

# REFLEXION

REVIEW

ECONOMIC  
COMMISSION FOR  
LATIN AMERICA AND  
THE CARIBBEAN



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# CEPAL

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# CEPAL REVIEW

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The *cepal Review* was founded in 1976, along with the corresponding Spanish version, *Revista de la cepal*, and is published three times a year by the United Nations Economic Commission for Latin America and the Caribbean, which has its headquarters in Santiago, Chile. The *Review*, however, has full editorial independence and follows the usual academic procedures and criteria, including the review of articles by independent external referees. The purpose of the *Review* is to contribute to the discussion of socio-economic development issues in the region by offering analytical and policy approaches and articles by economists and other social scientists working both within and outside the United Nations. The *Review* is distributed to universities, research institutes and other international organizations, as well as to individual subscribers.

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A subscription to the *cepal Review* in Spanish costs US\$ 30 for one year (three issues) and US\$ 50 for two years. A subscription to the English version costs US\$ 35 or US\$ 60, respectively. The price of a single issue in either Spanish or English is US\$ 15, including postage and handling.

The complete text of the *Review* can also be downloaded free of charge from the ECLAC web site ([www.cepal.org](http://www.cepal.org)).



*This publication, entitled the cepal Review, is covered in the Social Sciences Citation Index (ssci), published by Thomson Reuters, and in the Journal of Economic Literature (jel), published by the American Economic Association*

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United Nations publication  
ISSN 0251-2920  
ISBN 978-92-1-221064-3  
e-ISBN 978- 92-1-055725-2  
LC/G.2536-P

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Printed in Santiago, Chile

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**Explanatory notes**

The following symbols are used in tables in the *Review*:

... Three dots indicate that data are not available or are not separately reported.

(–) A dash indicates that the amount is nil or negligible.

A blank space in a table means that the item in question is not applicable.

(-) A minus sign indicates a deficit or decrease, unless otherwise specified.

(.) A point is used to indicate decimals.

(/) A slash indicates a crop year or fiscal year; e.g., 2006/2007.

(-) Use of a hyphen between years (e.g., 2006-2007) indicates reference to the complete period considered, including the beginning and end years.

The word “tons” means metric tons and the word “dollars” means United States dollars, unless otherwise stated. References to annual rates of growth or variation signify compound annual rates. Individual figures and percentages in tables do not necessarily add up to the corresponding totals because of rounding.

# Ten theses concerning social conflict in Latin America

*Fernando Calderón*

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**ABSTRACT**

Conflict in the countries of Latin America presents common features: platforms of exclusion and chronic inequalities that are under challenge from citizens; complex struggles relating these inequalities with their number and intensity; a combination of social protests that are manifested both at the national level and at the general cultural level; practical rationalities in the tensions arising from social reproduction<sup>1</sup> that coexist with demands for greater institutional efficiency and effectiveness and with systemic cultural conflicts. Other common factors are States that are omnipresent in all spheres of conflict but have only a limited ability to process them, and societies with fragmented conflicts; new public spaces where tensions are represented in a contradictory way, and conflicts that have been moving on to information and communication networks, with multiplier effects in the new environments where power is increasingly exercised. There is increased social complexity related to political systems and States with limited management capabilities. The situations and scenarios in prospect are diverse and options remain open.

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**KEYWORDS**

Social conflict, social issues, cultural issues, social conditions, income distribution, social integration, equality, government decentralization, mass media, Latin America

**JEL CLASSIFICATION**

O15, O54, Y90

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<sup>1</sup> This means that actors are driven mainly by a logic of concrete results that help to meet their social reproduction needs. Ideological narratives are circumstantial to the political situations experienced.



# I

## The context

The world today is at a critical juncture, since a number of different crises are coming to a head at the same time, as are transformations and choices of a financial, multicultural, environmental and political nature. What is unprecedented is the way changes with multiple characteristics are now manifesting themselves in full force.

Certain features of globalization are undergoing a process of transcendental change, and this is coinciding with a far-reaching recomposition of economic power and the sources of the planet's economic growth. A new multilateralism is taking root. The new emerging economies are adopting "heterodox" models of capitalism or the market economy, associated with political orientations whose ideological discourses are divergent: practical reformism, popular nationalism,<sup>2</sup> "neo-developmental indigenism" and conservative modernization (Calderón, 2008).

In Latin America, the economy has grown, poverty has been reduced and progress has been made with some distributive effects (ECLAC, 2010a; UNDP, 2009). The region has displayed remarkable political and managerial capabilities in dealing with the global crisis. In addition, growth projections there are quite favourable (Aranibar, Vázquez and Garzón, 2011).

However, productive transformation and the switch to a knowledge economy do not seem to be occurring as dynamically as is required if progress is to be made with the region's grave problems of poverty and inequality. Social inclusion and innovation are an equation that has yet to be solved. Similarly, a number of indicators of political legitimacy have improved; nonetheless, too little progress has been made towards a democracy of citizens (UNDP, 2004).

The problem is to know how to progress in this direction. What political capabilities are required? How can growth, redistribution and environmental sustainability be skilfully combined? How can the

political cycle the region is going through be associated with a cycle of transformations in its economic and production structures? How can cultural pluralism and institutions continue to be constructed in a manner suited to innovative economic change? A central issue in all these processes is social conflict and the ways this can be dealt with from a perspective that treats democracy as institutionalized conflict. This is the area the present study covers. The theses that will now be presented need to be viewed from a threefold perspective: historically, conceptually and as part of the process of global change.

In most of the region's countries, the common, central and historical feature of the contemporary conflict dynamic is the early appearance of the State as a social actor, something that not only reflects these societies' tendency towards social and political conflict but that has actively shaped the systems of economic interests and political actors which define the dynamic of conflict.

In the first cycle of populism experienced by the region, conflicts turned upon and were directed towards the formation of an autonomous nation-State, industrialization and the development of an inclusive modernization process underpinned by a solid culture of popular nationalism (Touraine, 1988).<sup>3</sup>

Under the dictatorships, the conflicts which social actors generated were in essence purely defensive actions, since authoritarian regimes "resolved" any manifestation of conflict by repression. Struggles and demands for human rights and political democratization developed with increasing force in this context (Ansaldi, 1986).

Democratization gave rise to new fields of conflict and to the revitalization of social movements or the emergence of new ones, or both. All this is analysed in the series of national studies entitled *Los movimientos sociales ante la crisis* (Calderón, 1986). In this study, a first field of conflict identified was the defence of workers' status. A second field were demands for urban quality of life, collective consumption and decentralization. A third field were rural conflicts over land, the market and ethnic recognition. Human rights and the quest for

□ The author is grateful for the assistance of Lorenza Fontana, María Isabel Nava and Huascar Pacheco in the preparation of this document, to PAPEP-United Nations Development Programme (UNDP) and to the UNIR Foundation in Bolivia for allowing the use of findings from the report *Los conflictos sociales en América Latina*, which was coordinated by the author.

<sup>2</sup> The people are identified with the nation and the State. See Calderón (2008).

<sup>3</sup> A culture of popular nationalism is one that seeks political hegemony, centralization of development and democracy in the State, mass mobilization and charismatic leadership.

equitable gender relationships were another significant field of conflict in this period.

Following structural reforms, conflict turned on the defence of living conditions and the discontent created by the reification of the market. In the late 1990s, in what was a historic turning point in terms of both democracy and development, a new type of conflict emerged, one that was more socially complex and multifaceted, with both conflicts and actors proliferating. Most prominent in this context were conflicts turning on multiculturalism and positions relating to new forms of quality of life, citizenship and dignity (PAPEP-UNDP, 2011).

Conceptually, the region's conflicts can be said to link demands for real freedom and cultural freedom. By the former is meant a set of demands whose objective is to meet the needs of a decent life so that people can then go on to build capacities and choose the type of life they wish to lead, in accordance with their own values and aspirations. By the second is meant recognition of the identities and rights of individuals and cultural communities, in connection with the right to adopt and change identities (Sen, 1999; UNDP, 2004).

In the conceptual approach of this article, constructivist policy is taken to be the best way of processing conflicts.<sup>4</sup> Political constructivism comes to terms with socioeconomic realities and power gambits in the effort to strengthen democracy, and sets out from the recognition of a sociocultural plurality out of which a common order has to be created, without losing sight of the fact that this order is the outcome of a process of conflict. Conflict is not synonymous with war; rather, the institutionalized conflict inherent in diversity and interculturality is the precondition for democracy and peace. According to this approach, politics and social actors are being constantly made and remade in conflict that is sustained by unequal power relationships which are also real and historical. Consequently, actors are shaped in politics, where everyone is subject to power relationships. This text synthesizes a normative view of politics as value-oriented politics. As Gianni Vattimo would have it, we do not agree when we have the truth; rather, we find the truth when we agree (Vattimo, 2006).

<sup>4</sup> The basis for political constructivism is the political ability of actors to create an order with an integral role for conflict based on interaction and mutual recognition between those who are different or opposed, something that entails an appreciation of the freedom and identity of the other. Constructivist policy can be understood as the art of the best possible. Policymaking entails the exchange of reciprocal recognitions (PAPEP-UNDP, 2011, chapter 1). Methodologically, to explain this type of action it is essential to determine the structural and institutional bases on which action rests and the effects of the socialization with which actors are associated (Boudon and Bourricaud, 1982, p. 308).

This paper does not argue for or against any particular type of society. What it argues for, primarily, is an institutionalized political way of accommodating differences so that shared goals can be constructed without denying the existence either of power or of conflict and disagreement in all sorts of areas. Here, politics becomes not an instrument of negotiation but an exercise in understanding the memory and freedom of the other.

From this perspective, the argument is that a society which produces conflict and change that is constructively processed through institutions will be more fertile in democracy and development, whereas if the society produces conflicts and its institutions are poor at processing these, the results in terms of democracy and development will be problematic, as they will be if the society is poor at producing conflict and change and its institutions are strong but are unable to process conflicts democratically. In situations where society, the State and institutions are all weak, as will be seen later on, informal systems of intermediation and oversight are what will prevail in the reproduction of the social order. For Latin America, the classic thinking of Marcel Mauss is still important.

In summary, how do conflicts affect democracy and development opportunities? This is exactly the question the present article sets out to answer.

Methodologically, the conflicts identified and interpreted in this study have been taken from the narratives developed by 54 periodicals in 17 countries of the region over a year. These publications represent different ideological positions, have substantial markets for information and often form part of complex global and local networks relying on the use and development of the new information and communication technologies (ICTs). This being so, it is very important to emphasize that the empirical basis for this study are the conflicts reported on by the periodicals selected. Although these and other media helped to shape public opinion about these events, a larger number of conflicts went unreported. This is obviously a serious limitation for studies of this kind, which in any event often confuse reporting with reality. However, consistency tests were carried out using other statistical sources covering national and sectoral cases, and similar qualitative trends were found. Nonetheless, it must be realized that the information is inadequate. What were mainly studied here were conflicts in the public communication space, on the basis of the written press.

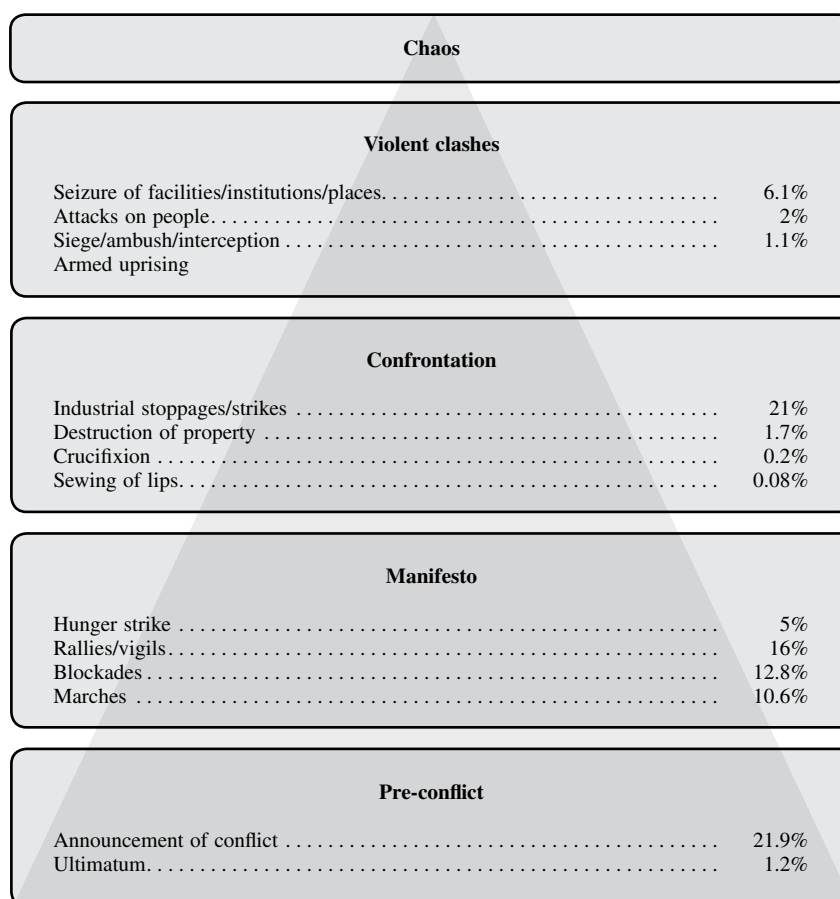
Quantitatively, Latin America is confirmed as a region with a substantial level of conflict. Yet the study

was conducted in a period when the continent was emerging from the global crisis and there was relative sociopolitical stability. It was a time when the “box” where intense radicalism and widespread conflict appear was empty. There were no serious crises of governance in the region, other than the coup in Honduras. The analysis detected 2,318 conflicts and 4,724 conflict episodes between October 2009 and September 2010. Broadly speaking, the countries with the largest number

of conflicts were Argentina, Peru and the Plurinational State of Bolivia, with a total of over 200. The countries with the fewest conflicts in the region were Chile, Costa Rica and El Salvador, averaging 58. The countries where conflicts were most radical were the Bolivarian Republic of Venezuela, Chile and the Dominican Republic, while they were least radical in Costa Rica, Panama and Peru. Figure 1 shows the degree of radicalization; and this is where Pandora’s box opens.

FIGURE 1

### Radicalization pyramid



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

## II The theses

The theses that will now be presented highlight the most frequent characteristics, common features and shared challenges facing the different Latin American societies.

### Thesis 1

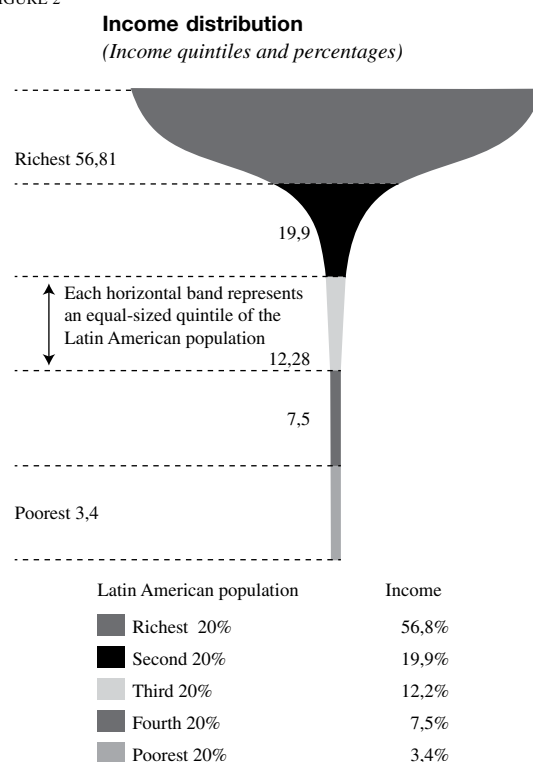
The characteristics of Latin America’s complex inequality are bound up not only with significant levels of social differentiation and high levels of wealth and income concentration, but also citizens’ discontent with and questioning of these levels of inequality. This is why inequality underlies most of the social protests and conflicts in the region.

Latin America has been enjoying a favourable economic environment, buttressed by a sound macroeconomy, high growth and a degree of redistribution through social policies; inequality remains a structural problem in the region, however. The UNDP *Regional Human Development Report for Latin America and the Caribbean 2010* mentions three characteristic features of inequality in Latin America and the Caribbean: it is high, persistent, and reproduced in a context of low socioeconomic mobility. The report also emphasizes that the region’s countries are among the world’s most unequal in household per capita income terms: 10 of the world’s 15 most unequal countries are Latin American. Thus, the Gini income coefficient for Latin America and the Caribbean is “65% higher than in high-income countries, 36% higher than the income inequality observed in East Asian countries, and 18% higher than the level reported for sub-Saharan Africa” (UNDP, 2010, p. 37).

Figure 2 shows the high levels of concentration in the region’s income distribution, with the richest 20% of the population receiving 56.81% of all income and the poorest 20% just 3.4%. According to *Forbes* magazine, the richest in Latin America received US\$ 332 billion between them, 17 times as much as the gross domestic product (GDP) of the Plurinational State of Bolivia and 19 times as much as the GDP of Paraguay (*Forbes*, 2011).

Citizens perceive these levels of inequality as unfair and there is a standing demand for change, which explains the strength of social conflicts even in situations where major progress has been made in reducing the poverty Latin America has suffered from (see

FIGURE 2



Source: prepared by the author on the basis of data from the Economic Commission for Latin America and the Caribbean (ECLAC), “CEPALSTAT. Latin America and The Caribbean Statistics”, 2009.

figure 3).<sup>5</sup> According to data from *Informe Latinobarómetro 2010*, 79% of Latin Americans consider that income is distributed unfairly.

### Thesis 2

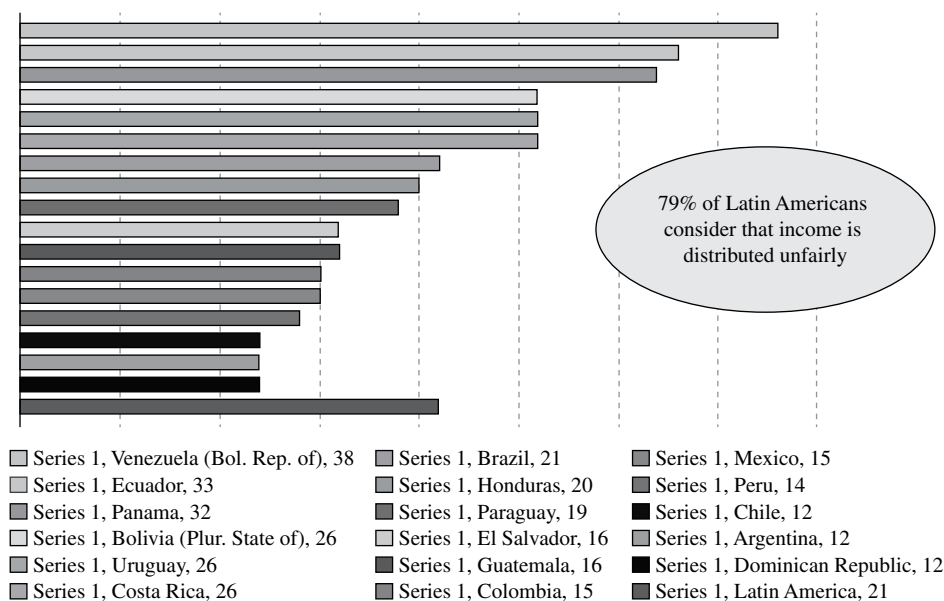
The public media space is increasingly where social conflicts are given expression and narratives about them constructed. This is bound up with the massive expansion and proliferation of the new ICTs. Actors in conflicts need the communications media and these need conflicts in a media logic of conflict and power.

<sup>5</sup> According to the *Social Panorama of Latin America*, the number of poor people fell by 5% in 2010, in a resumption of the regional poverty reduction trend that began in 2003 (ECLAC, 2010c).

FIGURE 3

**Perceptions of wealth distribution in Latin America, 2010**  
(Percentages)

Proportions answering “Very fair” and “Fair” to the question: “How fair do you think the distribution of income is in (country)?”



Source: Latinobarómetro Corporation, *Informe Latinobarómetro 2010*, Santiago, Chile [online] <http://www.latinobarometro.org/latino/LATDatos.jsp>.

The media are a source of power, institutions and firms that construct meanings and public imaginaries about conflict, socializing individuals. Just as the media need conflicts, conflicts need the media, which are public spaces where power relations are reflected, created and fought over and where conflicts between contending actors are recognized. The media are not neutral, but nor are they mechanical instruments of power; they are where political and social interests are expressed and where different journalistic approaches meet. They are also businesses. Their characteristics will depend on the market and on the interplay of interests and pressures among actors.

The concentration of media ownership is reflected in the types of Latin American media conglomerates. Three types or sizes of media conglomerates have been found to coexist in the region. The first, which may be termed “large”, own businesses covering the four key communications platforms of the global market (print media, audiovisual media, web platforms and mobile multimedia) to differing degrees at the regional level; the term can also apply to those that do not have a presence

in all four segments but own a large section of the media considered locally important in one or another of them. The second group or category, termed “medium-sized”, are corporations which do not own media outlets outside their own country but operate in three or four of the communication platforms mentioned in their local market. Lastly, there is the “small” group, consisting mainly of publishers that have an ever-increasing ability to offer products on different platforms for different audiences but own no more than a couple of print publications, do not have complex distribution platforms and do not participate in major information and communication networks at the regional or global level. Table 1 exemplifies the features of the groups mentioned.

In the media/society dialectic, it is not only that there is a complementary relationship between the media and those involved in conflict. From a constructivist perspective, the media construct reality, helping to delineate narratives and imaginaries that ultimately have repercussions in the real world, i.e., in the political system, the decision-making process and the agencies of social actors.

TABLE 1

## Types of media conglomerate

“Large” media group	
Publication	Multimedia group
<i>El País</i> (Uruguay)	Grupo de Diarios América (GDA)
<i>O Globo</i> (Brazil)	Organizações Globo/Grupo de Diarios América (GDA)
<i>El Mercurio</i> (Chile)	Grupo de Diarios América (GDA)
<i>La Tercera</i> (Chile)	Grupo Copesa S.A./Consortio Periodístico de Chile
<i>Reforma</i> (Mexico)	Grupo Reforma
<i>La Prensa</i> (Argentina)	Multimedios La Capital
“Medium-sized” media group	
Publication	Multimedia group
<i>El Tiempo</i> (Colombia)	Grupo Planeta
<i>El Comercio</i> (Peru)	Grupo de Diarios América (GDA)
<i>El Periódico</i> (Guatemala)	Media Development Loan Fund (MDLF)
<i>El Universal</i> (Mexico)	Grupo de Diarios América (GDA)
<i>El Panamá América</i> (Panama)	Grupo Epasa
<i>El Nacional</i> (Dominican Republic)	Grupo Corripio
<i>El Colombiano</i> (Colombia)	Periódicos Asociados Latinoamericanos
<i>Ultimas Noticias</i> (Venezuela)	Cadena Capriles
<i>La Nación</i> (Costa Rica)	Grupo de Diarios América (GDA)
<i>La Prensa Gráfica</i> (El Salvador)	Grupo Dutriz
<i>Diario Libre</i> (Dominican Republic)	Omnimedia Grupo Multimedia/Periódicos asociados latinoamericanos
<i>La Nación</i> (Paraguay)	Grupo Nación de Comunicaciones
<i>La República</i> (Uruguay)	Grupo ICK
<i>El Espectador</i> (Colombia)	Grupo Bavaria
<i>La Prensa</i> (Honduras)	Grupo Organización Publicitaria Sociedad Anónima (OPSA)
<i>La Jornada</i> (Mexico)	—
<i>El Día</i> (Dominican Republic)	Grupo Corripio
<i>Jornal de Brasília</i> (Brazil)	Grupo Jornal de Brasília
<i>O Estado de São Paulo</i> (Brazil)	Grupo Estado
<i>El Deber</i> (Plurinational State of Bolivia)	Grupo Líder
<i>Los Tiempos</i> (Plurinational State of Bolivia)	Grupo Líder
<i>La Razón</i> (Plurinational State of Bolivia)	Grupo Líder
<i>El Heraldo</i> (Honduras)	Grupo Organización Publicitaria S.A. (OPSA)
<i>La Nación</i> (Argentina)	La Nación S.A.
“Small” media group	
Publication	Multimedia group
<i>ABC Color</i> (Paraguay)	Editorial Azeta S.A.
<i>El Universo</i> (Ecuador)	Grupo El Universo
<i>El Universal</i> (Bolivarian Republic of Venezuela)	Periódicos Asociados Latinoamericanos
<i>El Diario de Hoy</i> (El Salvador)	América Interactiva
<i>La Tribuna</i> (Honduras)	Carlos Roberto Flores Facussé
<i>El Mercurio</i> (Ecuador)	Grupo Merchán
<i>Diario Expreso</i> (Peru)	Expreso S.A.
<i>Prensa Libre</i> (Guatemala)	Casa Editorial Prensa Libre S.A.
<i>La Nación</i> (Chile)	Empresa Periodística La Nación S.A./Chilean State
<i>Correo</i> (Peru)	Empresa Periodística Nacional S.A. (EPENSA)
<i>Crónica</i> (Paraguay)	Grupo Nacional de Comunicaciones
<i>Expreso</i> (Ecuador)	Grupo Gráficos Nacionales S.A. (Granasa)
<i>La República</i> (Costa Rica)	República Media Group (RMG)
<i>El Mundo</i> (El Salvador)	Grupo Mundo Multimedia
<i>La Hora</i> (Guatemala)	Familia Marroquín
<i>La Prensa</i> (Panama)	Corporación La Prensa S.A. (Corprensa)
<i>Página 12</i> (Argentina)	Editorial La Página S.A.
<i>Jornal do Brasil</i> (Brazil)	Nelson Tanure/Editora Jornal do Brasil

Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

**Thesis 3**

Conflicts have complex rationalities and differing intensities. Their frequency is not the same as their radicalism, and both are unequally related to levels of institutional legitimacy and social divides. Thus, the greater the social divides and the lower the level of institutional legitimacy, the more conflicts there are. Likewise, the more support there is for the institutional political regime, the fewer the conflicts that reach the point of violent clashes.

One of the patterns of social conflict in the region encountered by the present study was the asynchrony of conflict, i.e., there are conflicts with differing directions, intensities and meanings relating to basic living standards with demands (mainly directed at the State) for effective

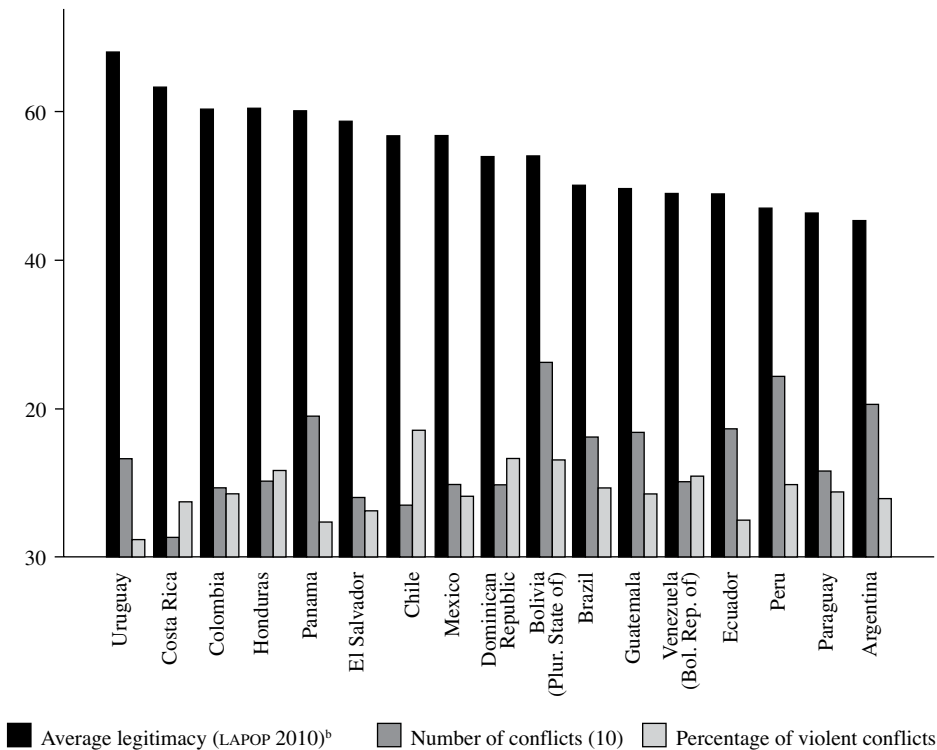
and legitimate institutional management and strategies for change in the dynamics of intercultural relations. At the same time, one of the central findings of the study is how complex the asynchrony of conflict is, since, as already mentioned, the deeper the divides in society and the weaker the legitimacy of the institutional regime, the greater the number of conflicts (see figure 4).

Again, the relationship between the radicalism of conflicts, institutional legitimacy, social divides and the number of conflicts is very important, but more complex. As noted earlier, the level of support for the institutional regime will determine whether or not conflicts reach the stage of violent clashes (see figure 5).

The relationship between social divides and radicalization is not linear but U-shaped: countries with intermediate divides have fewer cases of violence and

FIGURE 4

**Relationship between support for the institutional regime and number of conflicts/ average radicalization, 2010<sup>a</sup>**

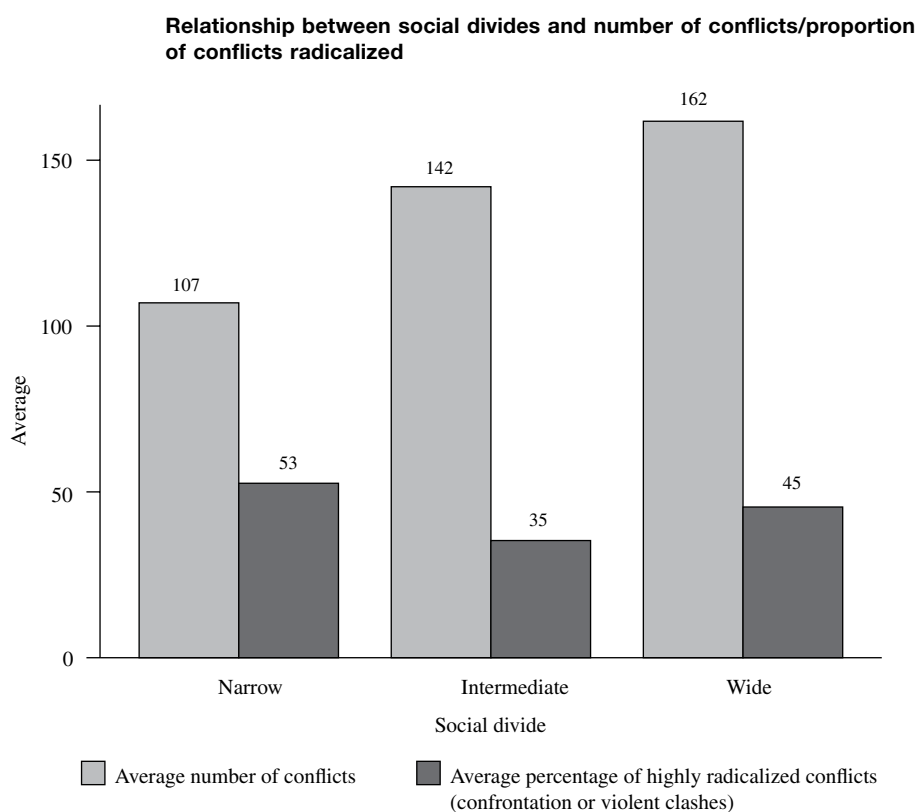


Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

<sup>a</sup> There is no significant or major correlation between levels of institutional legitimacy and conflict radicalization; a reading of the chart indicates that there is no obvious relationship between legitimacy and conflict intensity in the region. On the other hand, there does seem to be a relationship between the number of conflicts and the level of institutional legitimacy: countries with lower levels of institutional legitimacy would appear to have a greater propensity to social conflict, although this relationship is not conclusive and is only marginally significant in statistical terms.

<sup>b</sup> LAPOP 2010: Latin American Public Opinion Project for 2010.

FIGURE 5



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

clashes than countries with wide divides and countries with narrow divides. This appears to be due to the different forms of interaction between society, the State and conflicts, the ability to process these and, in general, a country's history and political culture. There is some good news here for the region, since there is now an "empty box" favourable to democracy and development: social conflict in the Latin American countries is neither very intense nor highly radicalized.

#### Thesis 4

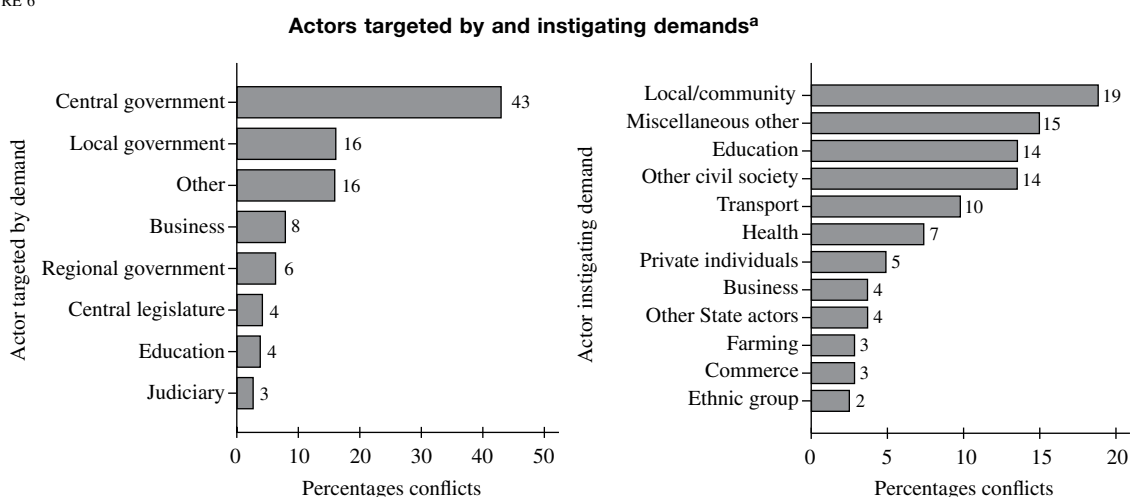
The State is a central actor in the interplay of power and conflict, but it has only a limited capacity to manage

them and resolve them in a way that contributes to social cohesion and extends democracy. The result is a paradox, with States catalysing social demands but lacking the capacity to manage them.

On the one hand, as figure 6 reveals, the main target of demands in Latin America is the State, accounting for 70% of cases. In other words, the State is the focus for social discontent in efforts to get demands met or attain objectives. On the other hand, society is undergoing a progressive fragmentation of collective actors and their identities, something that is reflected in a tendency for demands to proliferate outside of the traditional institutionalized frameworks of conflicts.



FIGURE 6



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

<sup>a</sup> The main actors in conflicts are local/community actors (19%) and miscellaneous other (15%), including circumstantial actors, irregular groups and groups associated with sectoral production and collective activities such as hydrocarbons, finance, mining, coordinating committees, unions, associations, trade bodies and education (14%).

### III

## Fragmentation

A contrasting tendency can be seen among actors instigating demands in the region: the prevailing fragmentation of those engaging in conflict. The most important actors are local organizations (19%), and it is also significant that 5% of conflicts are driven by circumstantial actors,<sup>6</sup> i.e., groupings of individuals

who are fighting for specific one-off demands and needs and whose organization breaks up once these concrete issues have been resolved. It is in this sector that the trend towards spontaneous collective action is most in evidence, embodying in terms of conflict that “liquid modernity” spoken of by Bauman (1999 and 2005). All this suggests the hypothesis that the prevailing situation is one of institutionally weak States and polycentric societies.

<sup>6</sup> These are collective actors who appear at the time of the conflict and then vanish.

## IV

### Centrality

For all the centrality of demands targeting States, situations vary greatly. There are countries with a greater State capacity (Uruguay) and thus a greater capacity for processing conflicts, and countries with lesser capabilities, such as the Plurinational State of Bolivia, Peru and Ecuador.

From a general perspective, the State is perceived almost everywhere in the region as the only actor capable of solving macrostructural problems and their local manifestations. There is a tendency towards centralization of social demands which confirms a historical pattern in the region whereby the State has played and continues to play a leading role. Conflicts are not distributed in a balanced way across the different social spaces, and demands most commonly take on a political connotation. As already pointed out by Calderón and Dos Santos (1987, p. 15), in Latin America “the lack of constitutional technologies capable of institutionalizing conflict management” compounds “the socially exclusive tendencies of order”.

This leaves the paradox of a weak State as the main focal point for powerful social demands: appeals are still to a State machinery that is usually inadequate and unable to provide negotiated institutional responses, being trapped by the inefficiencies of its bureaucracy, the ineffectiveness of its legal system, the lack of credibility of its governments and chronic problems of corruption and patronage. At the same time, the process of centralization in the collective imaginary reaches the highest levels, where the central government is the State, indeed the president is the State, in a historical and cultural evolution where personality-driven rule has almost never ceased to play a central role in Latin American politics.

Lastly, it is necessary to stress the importance of the normative and institutional framework when it comes to understanding the dynamics of social conflict. This can play a very important role in channelling tensions and keeping potential outbreaks of violence under control, organizing social demands, providing actors with forums for recognition and expression and promoting dialogue-based political forms of decision-making. What is considered here is the value of democracy as a system that sets political ground rules capable of processing conflicts (Lechner, 1986). This being so, there seems

to be no substitute for the institutional dimension when it comes to social change, and nor can demands for social citizenship or participation in decision-making be lastingly satisfied unless institutional limitations have been overcome (Calderón and Dos Santos, 1987, p. 17). Furthermore, manifest and deep-rooted dysfunctions in institutional systems lie at the root of specific crises of conflict, while at the same time they complicate the handling of social tensions of different kinds (both tensions over social reproduction and those relating to culture and political ideology).

#### Thesis 5

There is a tendency for conflicts to become decentralized and for local experiences with democratic conflict processing to emerge. This tendency leads to the development of a new politics centring on constructive relationships between actors and municipal measures that are characterized by legitimacy and effectiveness, possess civic agency in processes and results and ultimately construct a citizenship democracy on a local scale.

Despite the prevailing logic of centralism, or decentralization without deconcentration of resources, there are current and historical tendencies for conflicts to be decentralized down to the territorial, municipal or regional level of the State. As figure 6 illustrates, 16% of all conflicts recorded in the study period involved demands directed at the local State and 6% demands directed at regional governments.

In some important cases, this trend has been associated with the emergence of sociocultural and political actors seeking to extend a constructivist policy. As can be seen from table 2, the cases of the cities of Porto Alegre, Rosario, Bogotá, La Paz and Villa El Salvador, among others, are remarkable examples of public policies being applied to the processing of social conflicts in favour of a pluralistic and substantive democracy better able to cope with the problems of inequality and development.

These experiences and others like them show that it is possible to find and perhaps disseminate examples where the attempt has been made to turn conflicts, or some part of them, into agreements that are transformed into goals and concrete results.

TABLE 2

## Paradigmatic decentralization processes in Latin America

Country	City	Process
Brazil	Porto Alegre	Decentralization and local democratization
Bolivia (Plu. St. of)	La Paz	Decentralization and popular participation
Argentina	Rosario	Decentralization and local democratization
Uruguay	Montevideo	Participatory decentralization
Peru	Villa El Salvador	Participatory Development Planning and Budgeting System
Colombia	Bogotá	Administrative decentralization

Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

### Thesis 6

In a combined but unequal logic, there are three fields of conflict associated with social reproduction, institutional logic and the cultural dynamic. Social reproduction is organized by a practical logic and is an end in itself, as it constitutes an ethical touchstone for politics and culture: human dignity.

With the idea of obtaining a regional overview of collective action orientations, the study identifies three major fields of conflict in Latin America, encompassing the different demands that give rise to collective action: (i) social reproduction demands, (ii) institutional demands and (iii) cultural demands. The three fields partially differ in their rationale: (1) social reproduction conflicts mainly include demands for the satisfaction of the basic social welfare needs that are the minimum for a decent life, making possible the reproduction of individuals and human groups, and their logic is essentially practical; (2) institutional conflicts pursue greater effectiveness and legitimacy for State institutions; (3) the goal of cultural conflicts is to change the way people live (and they are thus strategic conflicts, as will be seen).

Figure 7 shows the percentage of each field of conflict by country and by subregion. It can be seen that social reproduction conflicts are the most numerous in the great majority of the countries, the exceptions being Colombia, the Dominican Republic, Guatemala, Panama and the Plurinational State of Bolivia, where institutional conflicts outweigh them. Colombia and Mexico are the countries with the greatest number of cultural conflicts.

Social reproduction means the ability of a society to reproduce itself and change over time, and concerns both basic reproduction thresholds (food, health, education, employment, etc.) and extended thresholds relating to quality of life in general and to the concepts of well-being and a decent life as a condition for true freedom

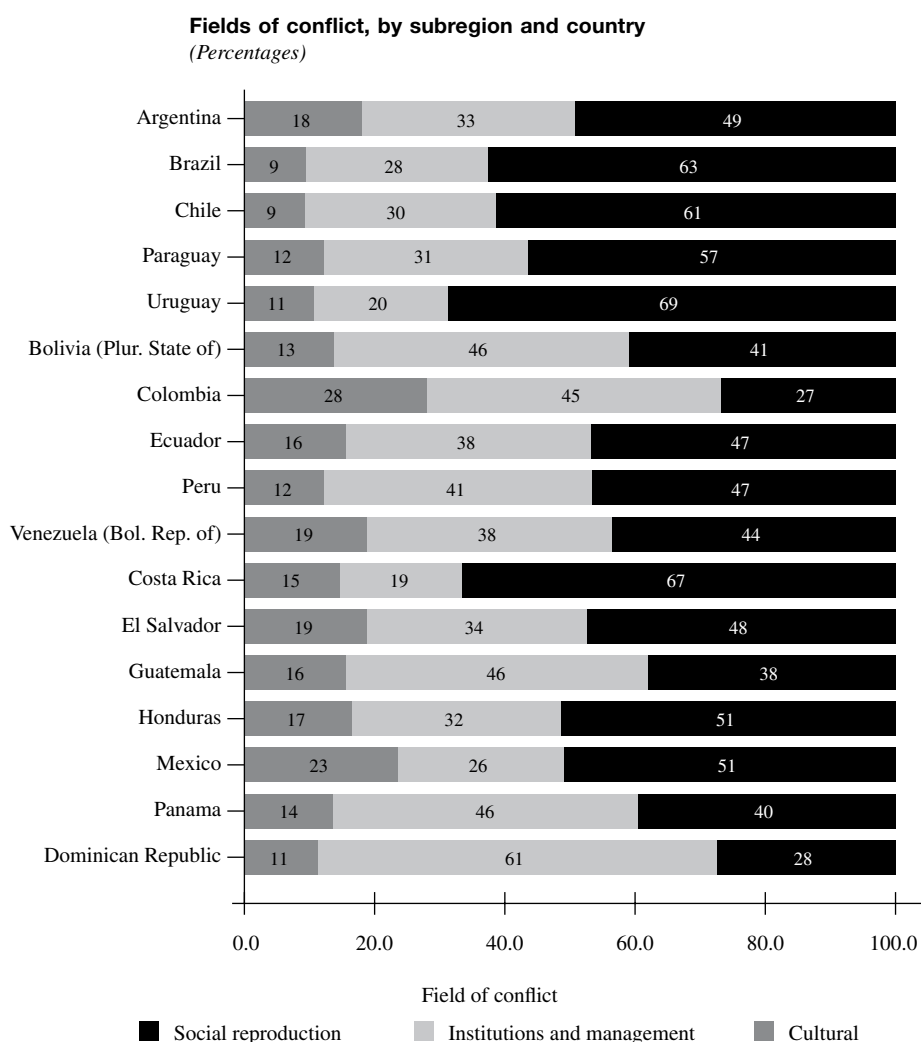
(Sen, 1999). It is in this field of conflict that the practical logic of social mobilization is becoming plainer to see. People take to the streets to ask for improvements in their living conditions and demand certain guarantees in the reproduction process, whether for better pay and employment conditions or assistance with health and education issues, or against economic measures that are perceived as destabilizing to the status quo.

Most social reproduction conflicts arise over socioeconomic issues, especially those involving employment and wages and collective consumption, but also as a rejection of certain political or social measures perceived as threatening the labour market status quo, and in support of norms that could improve the current situation, or over matters relating to land ownership and usage (see figure 8). Over half of all social reproduction conflicts are rooted in employment/wage demands (59.20 %). The relative importance of labour conflicts, in particular, reveals the strategic role work plays in the lives of our societies, in terms of both participation in employment and the quality of social life.

Furthermore, the data on social reproduction conflicts back up the structural data, in the sense that collective action seems to be consistent with the real socioeconomic problems perceived in the region. Social reproduction conflicts represent 47.3% of all conflicts in Latin America, and their relative importance is greater still if it is considered that these conflicts are the most numerous in 12 of the region's 17 countries, while in nine of them employment/pay issues and the economic situation are at the root of over 50% of conflicts.

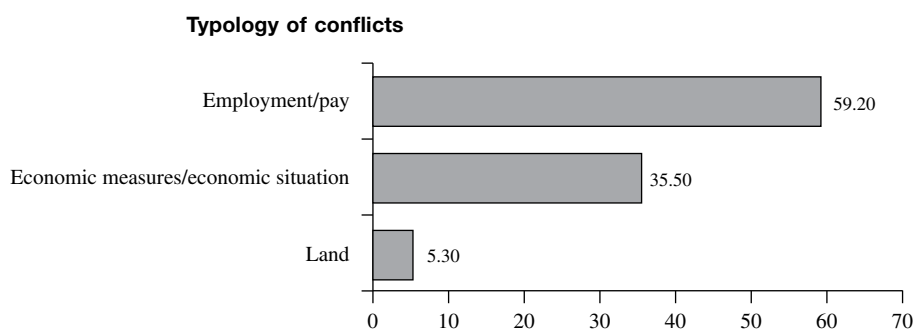
At the subregional level, the Andean countries and Central America have similar levels of conflict over social reproduction, which accounts for some 42% of all conflicts in these areas, while the number of conflicts in the Southern Cone is larger (58.7%) (see figure 9).

FIGURE 7



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

FIGURE 8



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

In this field, conflicts that tend to acquire a significant level of radicalization are those relating to land (53%) and employment/pay (49%), and protests against economic measures (42%) (see figure 10).

The data on averages confirm that the most radicalized conflicts are those over land. Although there are fewer such conflicts, they present a greater tendency to violence than do other types. This suggests that, first, there is a lack of institutional spaces for dealing with these demands and, second, these conflicts tend to combine with other factors, such as the issue of identities in the case of ethnic groups, or local economic and political interests, which increases their centrifugal ideological charge. Furthermore, the agrarian question is still a pending issue on the reform agenda of many Latin American countries, and the social consequences of a “neo-feudal” *latifundista* system with strong roots in the region continue to make themselves felt.

### Thesis 7

Institutional conflicts arise from dissatisfaction with the effectiveness and efficiency of institutions. A feature seen across the region is the strength of a “para-institutional” cultural of conflict.

Institutional conflict is a result of the inconsistency between people’s demands and the inability of State policies and institutions to meet these.

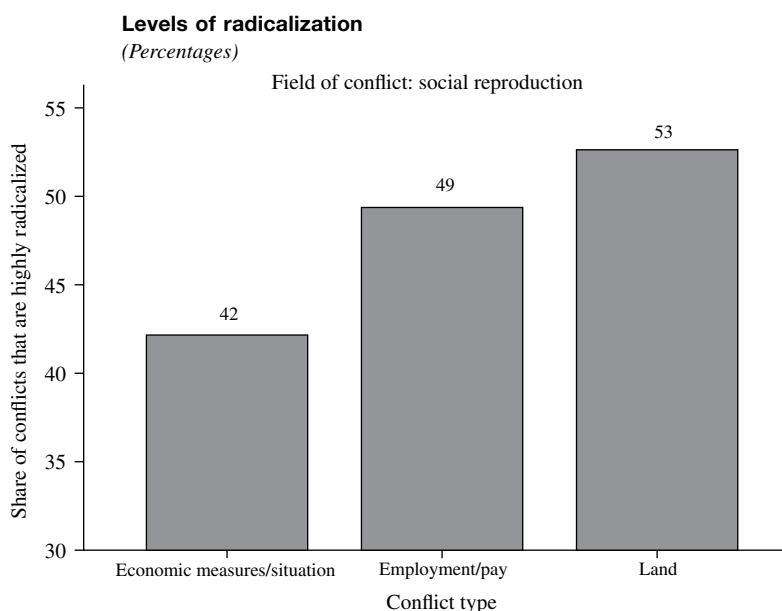
FIGURE 9

### Social reproduction conflicts (Percentages)



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

FIGURE 10



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

In particular, there is an emerging type of conflict that is more focused on criticizing the functioning of institutions or the State than the system as such, although in some cases criticism of the system is a general background to the positions taken.

The rationale for conflicts in this category is the need to improve institutions, understood in their more practical aspects as administrative management, public service provision, legal and judicial problems and the legitimacy of the public authorities. Struggles arise over both the lack of institutional structures and demands for the institutionalization of social actors.

Many of the conflicts characterizing Latin America derive from the weak application of norms and the inefficiencies of the State rather than from a lack of norms and institutions. In this way, the State is a major generator of conflict.

Institutional conflict is the second most important area in quantitative terms, representing 37.7% of all conflicts, and includes demands motivated mainly by failings in administrative management (35%) and the provision of public services (30.2%) (see figure 11). The former encompass demands motivated by observations or disagreements regarding the way institutional management is conducted, whether in the public or the private sphere, while the latter include any conflict caused by the lack of or shortcomings in public works (roads, schools, hospitals, etc.) in a particular area, and by inadequate State provision of basic services.

As regards the distribution of institutional conflicts in subregions, the Andean countries are where the

most such conflicts are to be found (41.2% of the total), especially Colombia and the Plurinational State of Bolivia. Institutional issues account for 41% of all conflicts in Central America, the Dominican Republic and Mexico. Two groups of countries stand out in this subregion: on the one hand, Panama, Guatemala and the Dominican Republic, where institutional conflicts are the most important class; and on the other, Honduras, El Salvador, Mexico and Costa Rica, with medium/low levels of institutional conflict. Lastly, 28.7% of conflicts in the Southern Cone are institutional, with medium levels in most countries (the exception is Uruguay, where just 20% of conflicts are of this type) (see figure 12).

The conflicts that most often tend to become highly radicalized are those relating to problems with administrative boundaries (56%), questioning or acknowledgement of authority (49%), administrative management (41%), breach of agreements (53%), public service provision (40%) and legal situation/measures (28%) (see figure 13). Radicalization is greater on average in the case of conflicts resulting from breaches of agreements and lower in the case of struggles relating to administrative boundaries and legal measures. The number of institutional conflicts and conflicts over issues of administrative management that become highly radicalized reveals the existence of structural causes that are at the base of the chronic weakness of institutional and governance mechanisms.

Latin America is characterized by the importance of a “para-institutional” dimension to conflict in many contexts. There is a grammar of relationships between

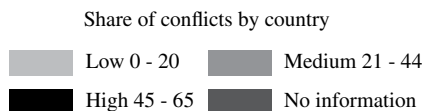
FIGURE 11



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

FIGURE 12

**Institutional conflicts**  
(Percentages)



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

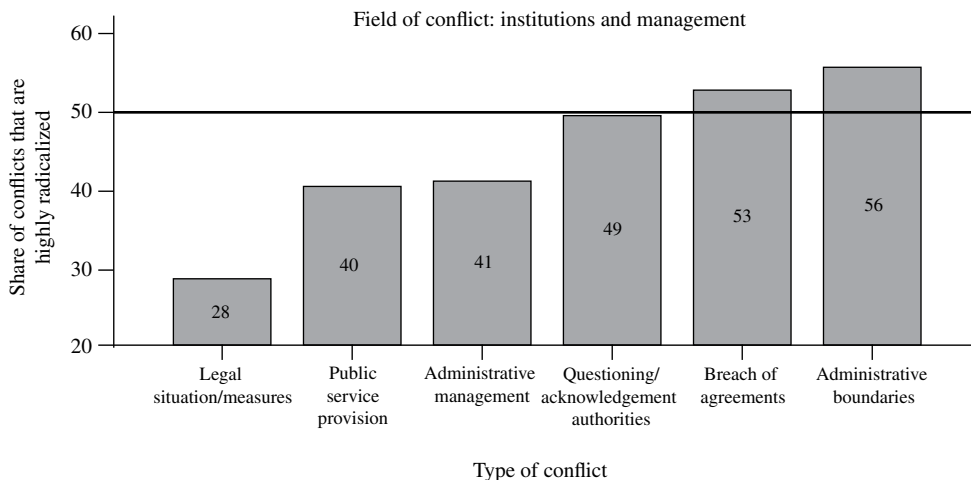
the State and social groups that shifts between the formal and the informal. These are syncretic systems that retain “pre-capitalist” and “pre-democratic” organizational and cultural features, combined with modern institutions. Thus, personal networks and informal hierarchies, embodied in systems of patronage and favouritism, operate as everyday mechanisms for regulating social relations between individuals and with formal institutions. It is precisely in this “para-institutional” sphere that social actors in conflict operate.<sup>7</sup>

Lastly, irrespective of political orientation and with some case-by-case variations, Latin America has a structural problem with the processing of conflicts, which has tended to worsen because of the political inability of institutions and the State to deal with demands and identify the needs and issues of most urgent concern to the population. The type of governance that results tends to be weak and unstable.

<sup>7</sup> Donzelot defines the Brazilian “art of negotiation” as a particular way of resolving conflicts through informal arbitration and negotiating mechanisms, in a practice that combines loose interpretation of legal principles, mutually agreed transgression of norms and the production of an informal legality with its own localized jurisdiction, free of the juridical and bureaucratic encumbrances of the State, all of which dislocates and subverts the supposed centrality and uniqueness of formal law as the organizing rule of life in society (Donzelot, 1994).

FIGURE 13

**Levels of radicalization**  
(Percentages)



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

## Thesis 8

Cultural conflicts are undertaken in pursuit of new forms of social accommodation and have systemic and global effects, but are more fragmented than other types of social conflict. They are largely strategic conflicts.

As we have seen, the Latin America region has chronic institutional weaknesses and exceptionally high levels of socioeconomic inequality, and is consequently fertile ground for the reproduction of what are likewise strong mechanisms of cultural inequality.

It is upon this fabric of complex inequality that the new needs and demands on the multifaceted cultural mobilization agenda of Latin America are coming together, with ideological and political conflicts and those relating to citizen security at the forefront.

Although cultural conflicts in all their variants are less numerous than conflicts in other fields, they have very strong systemic repercussions, owing to the role culture is playing in the new globalized context of Latin America. In terms of their impact on globalization, governance and democracy, then, these are strategic conflicts.

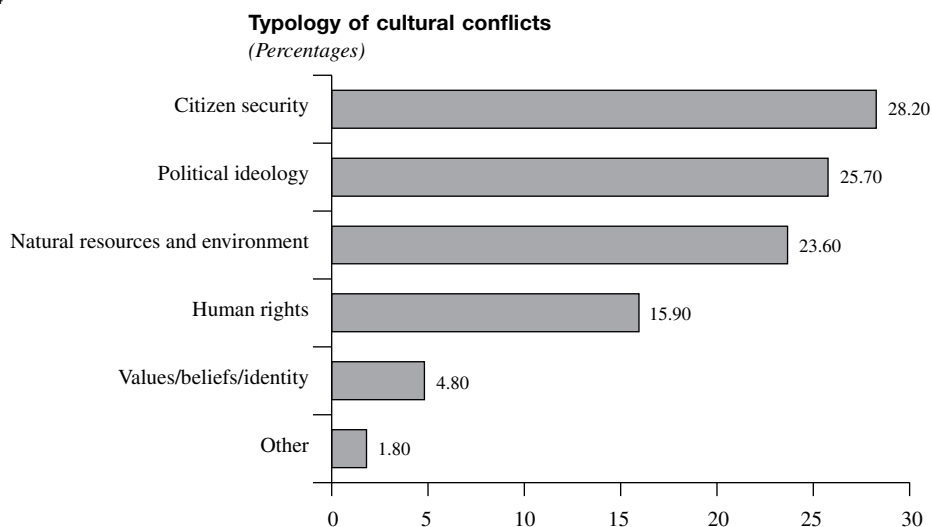
This field includes those conflicts whose roots lie in culture on a broad definition, with a strong accent on everyday life, subjectivities and multiple identities, and the culture industry and market. These conflicts are relatively few in number by comparison with the other fields (they represent 15% of all conflicts); however, they are a crucial category for understanding today's

social dynamics and the grammar of conflict in its new manifestations.

Cultural demands are usually about recognizing or strengthening the identities of individuals and actors and attaining a certain quality of life, focusing in the abstract on third generation rights and the concept of cultural citizenship. These conflicts express the need to affirm a type of socialization, both subjective and collectivist, in which social relationships and acceptable conditions of security are redefined.

Citizen security demands generate just over 28% of cultural conflicts. These are usually protests about a lack of protection against crime. The second most common type of demands are those relating to struggles over political ideology (about 25.7%, totalling 89 conflicts). These are struggles between factions (usually political parties, internal groups within them or the like) over opposing ideological visions that have taken on a confrontational character. Some 24% of cultural conflicts are triggered by problems with natural resource use and deteriorating environmental quality as a result of specific actions taken by public or private agencies, or both (see figure 14). These demands may be conducted more within environmentalist parameters or from an instrumental perspective of control over natural resources, as the case may be. The success of these movements could be due in part to their ability to tie in the particular with the universal, stressing the current development pattern and some globalized values that are hard to question, such as protection of the global ecosystem.

FIGURE 14



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.



At the subregional level, cultural conflicts are 16.3% of the total in the Central America, Dominican Republic and Mexico subregion, 15.5% in the Andean countries and 12.6% in the Southern Cone. Some of the countries with the most conflicts are to be found in the northern Andes: the Bolivarian Republic of Venezuela and Colombia. The pattern in the Southern Cone is generally around the average, with two tendencies: Argentina on the one hand, with the largest number of cultural conflicts in absolute terms, and Brazil and Chile on the other. In Central and North America, lastly, El Salvador and Mexico stand out for their high levels of conflict, something that can be accounted for partly by their ethnic diversity, but most especially by the high levels of insecurity and human rights violations in those countries (see figure 15).

Conflicts over political ideology are the most likely to become radicalized in percentage terms (34%), followed by those relating to citizen security (32%), struggles over environmental issues (26%), human rights disputes (20%) and, lastly, those concerning values, beliefs and identities (13%) (see figure 16). As regards the averages for radicalization of cultural conflicts, struggles over political ideology or citizen security tend to be the most violent. The figure for the other conflicts category is 17%.

Generally speaking, political and ideological radicalization seems to be a factor that seriously affects governance and democratic coexistence, owing to the risk of degeneration into violent clashes and confrontation. Given this, it seems essential for agreements to be reached in pursuit of political and ideological accommodation in shared democratic spaces.

In the area of cultural conflicts, lastly, young people appear to play a fundamental role as subjects of mobilization and producers of new social demands. The tendency towards mobilization has also been heightened because of the extent to which young people's expectations have been frustrated, owing to the negative socioeconomic situation of the previous period, institutional mistrust and rapid incorporation into "information" culture. This frustration is one of the drivers of conflicts, together with a perception of insecurity and exclusion as factors intrinsic to daily life, the breakdown of imaginaries and strains between the collective and individual levels. The young are a crucial section of society, embodying great potential for change and new thinking, and at the same time a Pandora's box with the potential to cause chaos if their demands, expectations and frustrations are not successfully channelled. Thus, young people are like conflicts: potentially dangerous, but also renewers of the social order. Women are also crucial actors in

FIGURE 15



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

cultural conflicts. Although gender tensions receive little expression and recognition in the public media space, they do have potential for cultural and strategic change in modern societies, most particularly because of the new thinking women can bring to politics and society as promoters of change and justice.

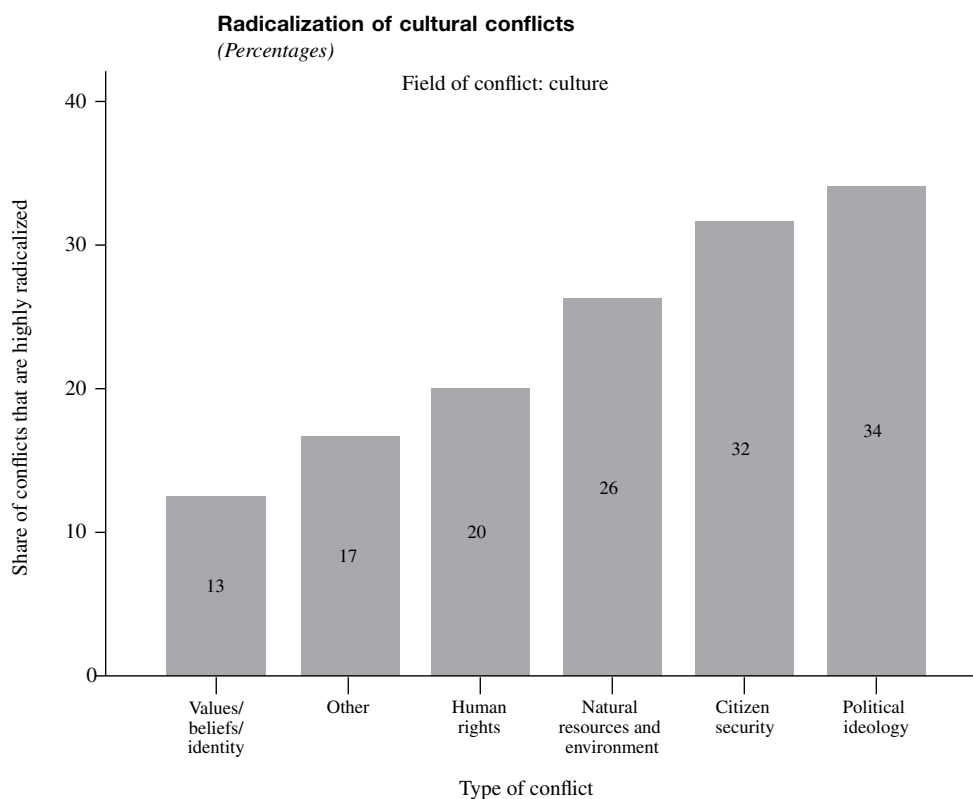
### Thesis 9

There is a growing tendency for traditional and new conflicts and actors to move on to information and communication networks.

The region is part of a new global system constituted by real-time networks of communication flows. These new forms of communication, knowledge and lifestyles that society has now incorporated have given rise to what Castells calls the "network society" (Castells, 1997).

The web has become the place where the new forms of conflict and power are expressed and developed. The culture of "technosociability" is changing not only the daily lives of individuals and communities, but politics as well. As for social conflicts, media politics plays an

FIGURE 16



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

important role, as holding a protest or march without the presence of the media, whether vertical (television, radio and newspapers) or horizontal (the Internet and mobile phones) means that the demands expressed have little impact and are less likely to be met.

The new ways of communicating have led to intensive use of ICTs in the public space. This space is understood as the “meeting point” where ideas and values are shaped, transmitted, supported and combated (Castells, 2009). ICTs allows actors to interact more nimbly, flexibly and spontaneously and to participate more actively in politics. The ease of access and low usage costs of both the Internet and mobile phones increase the scope for collective action.<sup>8</sup> Participating in a forum, a blog or a group within a social network is more easily achievable than other forms of political participation. Nonetheless, the information society reproduces the structural social

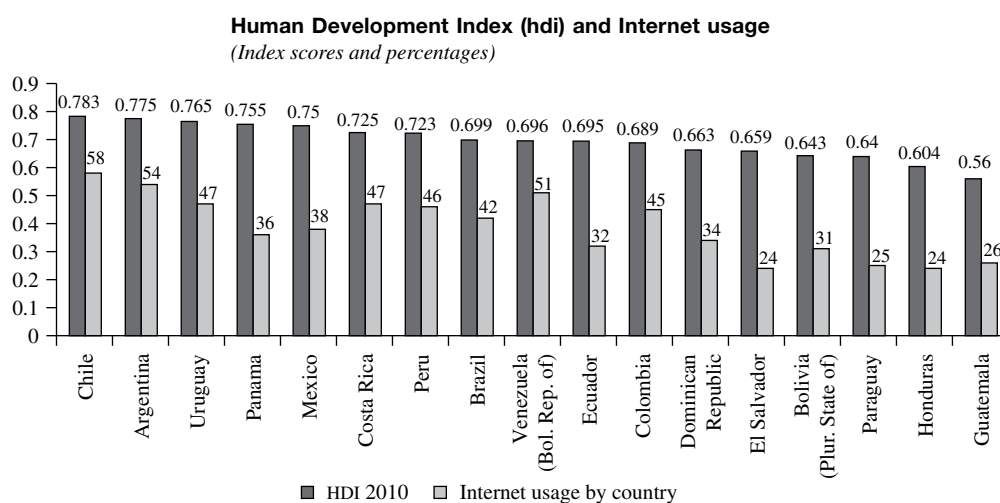
divides of Latin American society. And if the region’s countries continue with an “informationalist” logic without making the switch to the model which characterizes the information society, the economic capacity to integrate the population into an inclusive development process will not be attained (Calderón, 2003).

As can be seen in figure 17, there is a direct relationship between the Human Development Index (HDI) and the percentage of Internet usage. According to the data, countries such as Argentina and Chile rank highest for both indicators, while Paraguay, Honduras and Guatemala are at the other extreme.

These data can be interpreted as showing the existence of a feedback loop between the two variables. In other words, access to ICTs and the Internet in particular could be seen as a factor that directly and indirectly benefits development indices, since they are tools that can improve people’s levels of social and political information and participation, as well as their basic living conditions in terms of nutrition, health and education; although they can also be tools for domination. Accordingly, “technology is a tool for

<sup>8</sup> Many of the region’s countries doubled Internet usage in the period from 2002 to 2010 (*Informe Latinobarómetro*, 2010) and about 80% of Latin Americans own and use a mobile phone (International Telecommunications Union, ITU).

FIGURE 17



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

growth and development” (UNDP, 2001, pp. 29-30). Latin America is faced with a major challenge: narrowing the digital divide and participating fully in the growth model that is developing around the new technologies.

One important step towards this is to provide access to the new technology for the whole of society, especially the young, and structurally reform the education system so that ICTs are adopted there (Calderón, 2003).

## V

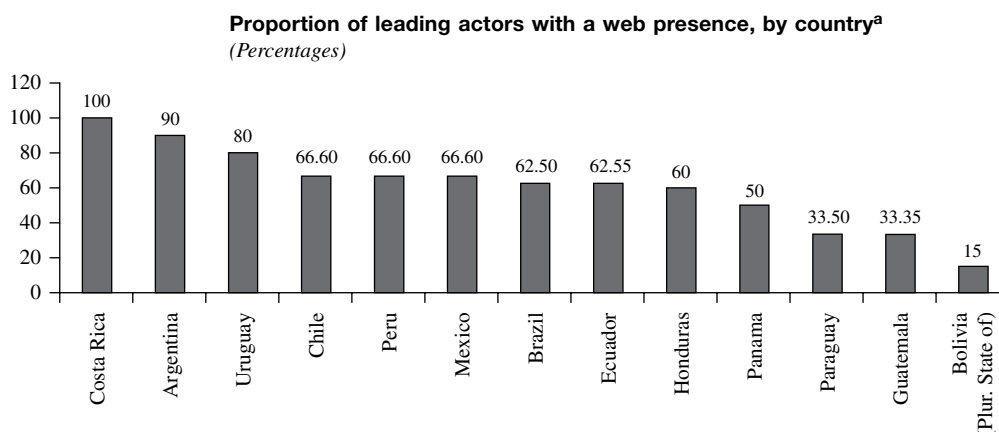
### Actors on the web

#### (a) Traditional actors

Many traditional sociocultural actors and movements in Latin America use web pages to position themselves within their countries or internationally. They use this medium to disseminate their values and ideas, thereby increasing their prospects of promoting political or cultural change and influencing opinion. Furthermore, using ICTs, and particularly the Internet, enables movements to interact and coordinate activities both internally and with other networks and organizations, thus socializing experiences.

Figure 18 shows that the development level and the percentage of Internet take-up both affect the number of actors with a presence on the web. On the one hand, countries such as Costa Rica, Argentina, Uruguay and Chile present high HDI scores and greater Internet usage, with a large percentage of actors represented on the web. At the other extreme are Paraguay, Guatemala and the Plurinational State of Bolivia, the region’s least developed countries and those with the lowest Internet usage, where only a very small percentage of social actors have web pages, blogs or social networks to disseminate their demands.

FIGURE 18



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

<sup>a</sup> Only actors with more than five conflict episodes in a particular conflict over the study period were considered.

## (b) Spontaneous actors<sup>9</sup>

These emerge from the web, since whenever any widespread demand or discontent arises, it is transmitted spontaneously by thousands of people in a relatively short time through social networks, blogs, forums, chain e-mails or text messages. In the event of conflict, citizens can use these instruments to organize and spread information. De Ugarte (2010) calls this “cyberactivism”, meaning a strategy for changing the public agenda by disseminating a particular message and encouraging its spread by word of mouth, which is multiplied by personal electronic communication and publishing techniques. There have been cases in recent years where the public agenda has been successfully changed in this way. Cyberactivism

has two phases: a deliberative phase, when blogs and forums are used to start the debate, and a mobilization phase, when e-mails and mobile text messages are used to get people out on to the streets.

One consequence of globalization has been the enhancement of individual capabilities, with spontaneity, determined political activism and self-organization coming to the fore (Beck and Beck-Gernsheim, 2002); as a result, it has become indispensable to redefine collective projects on the web. “The issue is the way individual action is the outcome of a collective commitment, and collective action can be viewed from the standpoint of individual agency” (UNDP, 2009).

## Thesis 10

A constructivist policy creates or improves a democratic society and is a powerful resource for coping with conflicts and adverse social climates. National situations are diverse and are inseparable from the social climate being experienced and the country’s political and institutional capacity for conflict processing.

The argument of this thesis is essentially hypothetical and prospective in character. It raises two questions. What conditions or what social climate affect the dynamic of conflicts? And is there the political and institutional capacity to process them?

By social climate is meant all the objective and subjective conditions in which conflicts arise, especially those connected with the equity, institutional structures and multiculturalism characterizing a particular country.

<sup>9</sup> Examples of spontaneous actors in Latin America are: (i) the student protestors known as the “penguins” in Chile, (ii) the InternetNecesario movement on Twitter in Mexico and (iii) “Un millón de voces contra las FARC” (“A million voices against FARC”) in Colombia. Case (i) occurred in 2006, with the demands of Chilean students for improved education quality. The success of the “penguin movement” was possible because of the way the students were organized, using ICTs to coordinate throughout the conflict. Case (ii) arose in 2009 on the Twitter social network in Mexico and reflected the discontent of thousands of users at the approval by the Chamber of Deputies of an increase of 3% in the cost of telecommunications from 2010. The reaction of users was immediate: “The Internet is not a luxury,” they claimed on Twitter, the result being a cyberprotest that lasted from 10 p.m. on 19 October to 5 a.m. on 20 October. Case (iii) was an action that took place on the Facebook social network in January 2008 in Colombia, with the goal of organizing a massive countrywide march against violence. There were eventually 300,000 adherents (Neumayer and Raffl, 2008) and its repercussions extended beyond the social network to the media and the real-world public space.

By conflict processing capacity is meant the capacity to move towards an equilibrium characterized by a legitimate State with wide-ranging and effective institutional instruments and spaces for processing conflicts in a positive way, together with an active society characterized by strong citizen participation in public life and a dynamic of creative collective action.

In other words, the need is for societies with actors who do not just protest but interact with other actors and the State, projecting themselves as thoughtful, autonomous subjects of development and democracy.

In general terms, Latin American States deal with an average of 11 new conflicts a month, the countries where there are the most conflicts being the Plurinational State of Bolivia, Peru and Argentina, with over 200 in total. The countries with the fewest conflicts in the region are Costa Rica, Chile and El Salvador, with an average of 59.

The data reveal the existence of a Latin American society with a significant capacity for social action, but also with major asymmetries in mobilization capabilities. While the Plurinational State of Bolivia stands at one extreme with an average of 21.8 new conflicts a month, Costa Rica is at the other with an average of 2.3 conflicts a month (the ratio between the two averages is 9 to 1). This is all without classifying specific social movements and struggles.

It is not only a society's capacity to mobilize or act collectively that has to be analysed, however. There is also the matter of the political and social capacity for processing conflicts when they do arise, whether numerous or not, and the set of collective imaginaries regarding conflict that are established in that society. Thus, a society and political environment capable of treating conflict as an opportunity to alter certain conditions rather than as something harmful or a hindrance to development will have a greater capacity to process conflict and to progress democratically. Similarly, a society that mobilizes but treats mobilization and conflict as an opportunity to seek and generate agreements (or the conditions for agreements) and not as a way of imposing a vision or an agenda is a society with conflict processing capacity.

Where society is concerned, then, the ability to process conflict is, first, the capacity it has for acting collectively, for mobilizing and protesting; and second, the ability to endow these processes with legitimacy through both the socialization of information and participation by the actors themselves in accordance with a constructivist logic. On the part of the State, the ability to process conflicts means both the capacity of institutions and parties for managing them and the way

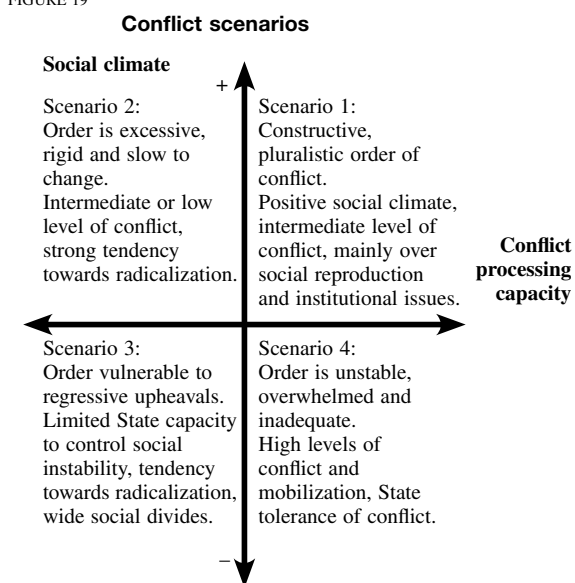
the State usually approaches them. Thus, there are States that are able to manage conflicts through the medium of solid institutions and States that use informal methods to manage conflicts.

Setting out from these variables, four dynamic scenarios were identified (see figure 19):

- i. Countries where social tensions are generally low and the tendency is towards a constructive, pluralistic order of conflict (scenario 1).
- ii. Countries that have a rigid or disproportionate institutional order and that tend to deal repressively with conflict or deny it (scenario 2).
- iii. Countries which are highly vulnerable to upheavals and where the predisposition to deal constructively with conflict is severely limited (scenario 3).
- iv. Countries which have an unstable order because their conflict processing capacity is weak and which have difficulty dealing with widespread social discontent (scenario 4).

These scenarios were used to construct a dynamic typology of the situation and prospects of the different countries, showing both countries with a considerable capacity for processing conflicts and a climate of social well-being (such as Costa Rica and Uruguay) and others with serious problems in their social climate and stark difficulties when it comes to processing conflicts (such as Honduras and Guatemala). In all cases, scenarios of

FIGURE 19



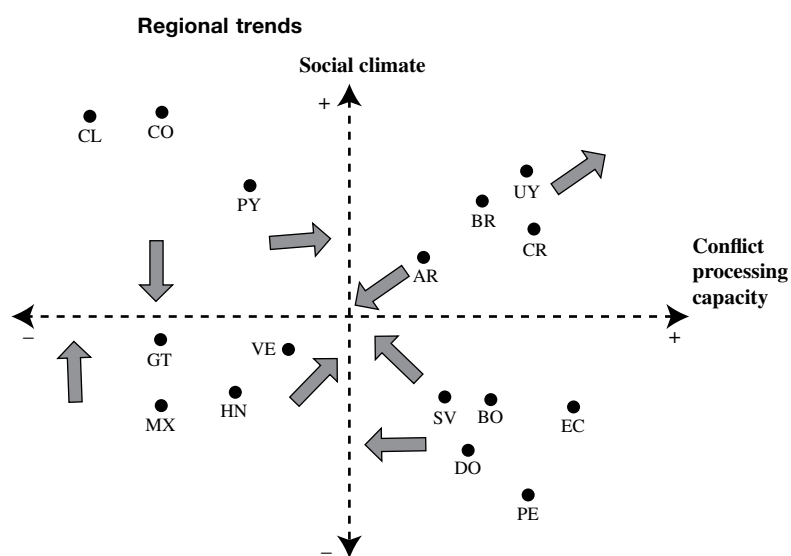
Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

improvement in the two variables at stake were identified. Figure 20 illustrates the situations and likely historical trajectories in the region.

To conclude and sum up, the countries of Latin America share common features where conflict is concerned: platforms of exclusion and chronic inequalities that citizens mostly question, complex conflicts that relate these inequalities to the number of conflicts and their intensity, a combination of social protests manifested both at the social and national level and on the cultural/global level, practical rationalities in conflicts over social reproduction, side by side with demands for greater institutional effectiveness and efficiency and cultural

conflicts of a systemic character. Other features include States that are omnipresent in all spheres of conflict, but with severe limitations when it comes to processing them, and societies whose conflicts are increasingly fragmented, new public spaces associated with communication systems where conflicts are represented in contradictory ways, and conflicts that are tending increasingly to move on to information and communication networks with multiplier effects in the new environments of power. In short, there is increased social complexity associated with political systems and States whose ability to manage it is limited. The situations and scenarios in prospect are diverse and options remain open.

FIGURE 20



Source: Political Analysis and Prospective Scenarios Project-United Nations Development Programme (PAPEP-UNDP), *Los conflictos sociales en América Latina*, La Paz, 2011.

(Original: Spanish)

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# Social stratification and mobility in Guatemala

*Guillermo Díaz*

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**ABSTRACT**

This article deals with two vital components of a country's social structure: social stratification and social mobility. It examines the social structure of Guatemala, adapting for this purpose two approaches to social class that are often used in studies dealing with the issue. The aim is to delineate the Guatemalan social pyramid, showing not so much classes as rough strata based on employment data. Statistical analysis of data from a living conditions survey is used to provide information about social mobility with a view to illustrating educational and occupational mobility in the country. The results indicate a pyramid-shaped social structure and low educational and occupational mobility when children are compared with their parents. They also show that mobility opportunities differ between the sexes and between ethnic groups.

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**KEYWORDS**

Social class, social mobility, measurement, education, employment, equality of opportunity, indigenous peoples, women, Guatemala

**JEL CLASSIFICATION**

J6, N0, O5

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# I

## Introduction

Little work has been done in Guatemala on the combined analysis of social stratification and social mobility, and there are few published studies on stratification in Guatemalan society. There are even fewer studies on social mobility in the country, and those that do exist have dealt with educational mobility. The aim of the present article is to look at the subject in a way that encompasses both issues, which are closely related.

Social stratification in Guatemala is approached by analysing the occupational structure. In today's society, occupation is the main determinant of well-being, i.e., it is the factor that decides people's life chances. Occupation also represents one of the main roles individuals play in society and influences not only their lifestyles, but their social standing as well. A practical reason for using occupation to construct social classes is the availability of information, which is deployed here to construct the class structure of Guatemala on the basis of the two schemata most widely used at present, those of Wright (1997) and of Erikson and Goldthorpe (1993), with the aim of furnishing knowledge about the composition of social classes in Guatemala at the outset of the present century.

There have been major changes in the economic and social structure of Guatemala in the last two decades. Economically, there is the country's increased participation in the world economy as a result of free trade agreements

(FTAs) and inflows of foreign investment, rising international emigration and the strong role of remittances, and the increasing share of services in the production structure. Social developments have included poverty reduction, improving education levels and the rise of the middle strata. Changes like those described have been creating the conditions for a more favourable distribution of access to greater well-being for individuals; in other words, they have favoured greater social mobility. To ascertain the scale of this phenomenon, the present study carries out estimates of educational and occupational mobility and of differences in mobility by sex, age and ethnic group.

The results indicate that Guatemala has a very hierarchical social structure (with a small social elite and an incipient middle class, both urban) and a low level of educational and occupational mobility. Educational mobility is greater among men than women, and in the non-indigenous ethnic group than in the indigenous one. In the case of occupational mobility, the opposite applies. People aged 40 and under have greater educational and occupational mobility than those over 40.

This paper is organized as follows. Section II discusses social stratification and the way Guatemalan social classes are constructed. Section III deals with social mobility and its quantification. Section IV examines the structure and mobility of social classes, and section V offers conclusions.

# II

## Social stratification

### 1. Social class

Sociological theory dealing with social class is extensive, with a multiplicity of approaches and studies covering a whole variety of subjects. Indeed, the subject of social class was among those given most attention by sociologists throughout much of the second half of the last century, and it remains the focus of attention and debate at the beginning of the present one, especially in advanced

societies, where discussion turns on whether social classes still exist there. Numerous theories have been formulated to define social classes and account for their existence, prominent among them being Marxist theory, also known as conflict theory, and functionalist theory.

In the framework of Marxist theory, Lenin (1919) offered the following concepts: "Classes are large groups of people differing from each other [...] by their relation [...] to the means of production, by their role in the

social organisation of labour, and, consequently, by the dimensions of the share of social wealth of which they dispose and the mode of acquiring it.”

The famous phrase “the whole history of mankind [...] has been a history of class struggles” (Marx and Engels, 1910) summarizes the central idea of the theory of social class delineated by Marx. This had not been fully articulated in writing by the time of his death, but the author did leave behind him the fundamental pillar of the sociological tradition of class conflict theory. In the Communist Manifesto, Marx argues that in capitalist society there are two antagonistic classes in conflict with each other, the bourgeoisie, which owns the means of production, and the proletariat, which lacks means of production.

Marx’s ideas were reinterpreted by Dahrendorf (1959) in the light of the changes experienced in industrial society in the last century. That author argues that, in industrial society, shareholders have no direct contact with the firms they own, as there is a “division of the twofold function of the employer-capitalist into two separate functions, that of the capitalist and that of the manager who, while legally just an employee, actually controls the process of production”. He also maintained that this new form of production created a new form of stratification. First, there was the functional production hierarchy comprised of managers, which was totally different from that of the firm’s owners. Second, there were changes affecting social standing in the working class owing to the appearance of skilled workers, whose education or training gave them a special position and differentiated them from unskilled workers. Also, and contrary to what Marx claimed, there was a broadening of the new middle class.

According to Dahrendorf (1959), class conflict was changed by the separation of company ownership and control, and by social mobility. Furthermore, he considered that in a democratic system the dominated class took the form of a variety of interest groups competing with one another or acting together, while the dominant class was differentiated from the dominated one by the existence of the bureaucracy. The action of the bureaucracy came between dominators and dominated, so that the exercise of power was broken down into multiple processes. On the basis of this consideration, the author held that the Marxist definition of classes based on private property needed to be replaced by one based on participation in authority or in domination (Dahrendorf, 1959). For that author, consequently, class conflict was ultimately rooted in the way authority or power was distributed in associations of domination (Dahrendorf, 1959).

Another influential author within the tradition of Marxist conflict theory is Touraine (1977), who sets out from the idea that society not only reproduces itself and adapts to a particular environment, but is actually self-producing, a phenomenon he terms historicity. The production of society is made possible by knowledge, accumulation and the ethical model. This last term defines the reflection society carries out upon itself, which helps to define the field of social relations, in the sense of establishing whether these are relations of production, distribution or consumption. Touraine sets out from what he calls the double dialectic of social classes, represented by the clash of interests between two classes that are also acting on the construction of society. The dominant ruling class controls the cultural model and uses it to exercise its power, while the discontented dominated class adopts a defensive position towards the cultural model. In Touraine’s perspective, social classes are the contending actors that construct history.

The crux of Marxist theory is the class struggle, which, as may be seen from the arguments of the authors mentioned above, can centre on the struggle for ownership of the means of production, authority and control over the production process or the construction of history. However, Veblen (1915) rejected this class conflict approach and argued that relations between the classes were imitative. According to Veblen’s theory, the lower class does not seek the destruction of the higher class, but accepts its unequal status and tries to imitate the social behaviour of that class.

In contemporary sociological theory, there is a widespread view that social classes are not defined solely by their relationship with the ownership of the means of production, as Marx posited. González-Anleo (1981) considers that the primordial characteristic of individuals sharing the same social class is not their relationship to the means of production but the function they play in the production process. Belmeni (1996) uses a definition that incorporates both the elements mentioned, arguing that a social class is a set of individuals who differ among themselves in terms of ownership and the role they play in the social organization of the production process. This definition is considered helpful for the purposes of this study as a way of understanding the social stratification mechanism in Guatemala, where ownership of material goods and position in the production process are the main markers of class.

One of the main criticisms of the Marxist analysis of social class is the emphasis it places on the division of society into two antagonistic classes, as this makes it difficult to place the intermediate class, which has

a substantial presence in industrial societies. Wright (1997) has developed a theory that seeks to overcome the constraints involved in placing the middle class. The three main situations in the class relations of capitalism are: the bourgeoisie, which owns the means of production and the output produced by the workforce; the proletariat, which lacks means of production; and the petty bourgeoisie, which owns means of production and the product of its own labour. To these three main class situations, Wright adds a further three contradictory class locations: managers and supervisors, who exercise control in practice over the means of production and the workforce; semi-autonomous workers, who lack means of production but control their own labour; and small employers. Figure 1 illustrates the relationship between these class locations.

This first class analysis schema of Wright’s was criticized by the theorists, leading the author himself to conclude that it was unsuited to the analysis of class in capitalism (Crompton, 1998). Wright proposed a new framework of class analysis, going on the theory of exploitation and class put forward by John Roemer (1989), who argued that ownership of the means of production did not necessarily prevent exploitation.

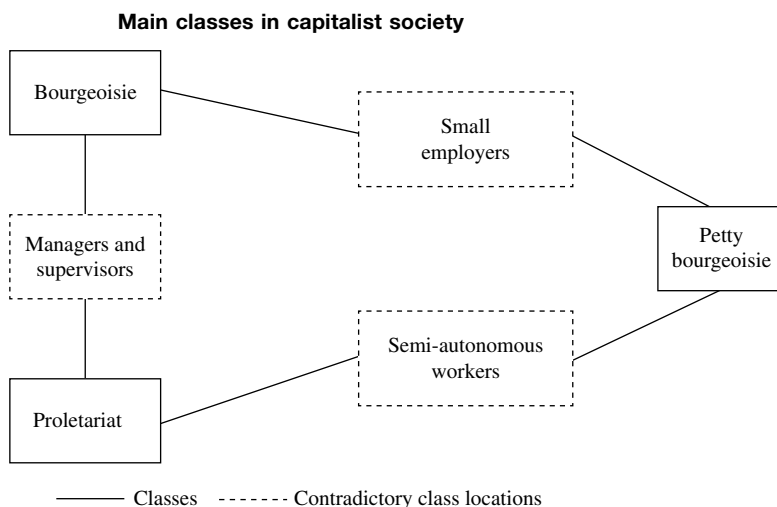
This author considered that, in the capitalist production system, capitalists not only owned the means of production and recruited workers to exploit these, but also “dominated” workers in the production process. This is crucial to an understanding of Wright’s theory, as he treats authority as a dimension of class relations in capitalism. In this system, it is managers and supervisors delegated by the owners who exercise

control over the means of production. This immediately poses the problem of whether they should be considered capitalists or workers. Wright calls this situation a “contradictory class location”, referring to the duality of these actors within the capitalist production system. However, he notes that managers and supervisors are distinguished from workers by sharing in the distribution of the economic surplus, and calls this a “privileged appropriation location within exploitation relations”.

The second important dimension in Wright’s analysis of class within capitalism is expertise, which constitutes an axis of class differentiation among workers. Expertise brings to light strata within an inequality structure rather than a position in the class structure (Wright, 1997, p. 16). With this argument, the author sets out to differentiate himself from the service class approach of Goldthorpe who, in Wright’s view, fails to take account of the problem of exploitation and antagonistic interests in his analysis and does not deal with authority in terms of domination. Another crucial difference between the two authors, as noted by Crompton (1998), is that Wright distinguishes between class and occupation, the latter being defined by technical relations of production while the former is defined by social relations of production.

Wright’s theory sought to deal with the contradictory position of managers and supervisors in the Marxist class model, as already noted, by creating the concept of the “contradictory class location”, on the basis of which the author developed an elaborated class typology by grouping classes into a positioning matrix, illustrated in table 1.

FIGURE 1



Source: E. Wright, *Class Counts*, Cambridge, Cambridge University Press, 1997.

Wright (1997) divides positions within this class structure into two: the first is the “direct class location”, determined by people’s relationship to the process of exploitation through the work they do, and the second is the “mediated class location”, which is related to family ties.

This schema is shown in table 2, but expanded from the perspective of the interplay of forms of appropriation and domination depending on whether capitalist relations or small commodity relations apply, i.e., whether relations involve more (+) or less (-) appropriation and domination or some intermediate level (+/-).

An important aspect of this author’s theory is that he identifies class relations with the unequal distribution of rights over the means of production. On the basis of this conception, he defines the class structure as the sum total of the class relations in a given unit of analysis; it is thus possible to speak of the class structure of a firm, a city or a country (Wright, 1999, p. 7). The importance of this concept in the author’s analysis is that the class

structure means the structure of social relations for individuals (or families, in certain cases) determining their class interests; the class structure can also be said to define the set of empty places or positions occupied by individuals or families (Wright, 1985, p. 10). A final element which the author adds to his analysis is the temporary character of class positions, which opens up the possibility of examining intragenerational social mobility. Likewise, another important element, especially where this study is concerned, is that the class structure provides a way of describing social changes over time.

Weberian theory distinguishes three dimensions in society: the economic order, represented by social class; the social order, represented by status; and the political order, represented by party. Each of these has its own stratification criterion: income and property, in the economic dimension; prestige and honour, in the social dimension; and power, in the political dimension. According to Frankel (1971), Weber identified status as an alternative to the concept of class. Status is connected

TABLE 1

**Wright’s elaborated class typology**

		Relation to means of production				
		Owner	Employees			
Number of employees	Many	Capitalists	Expert managers	Skilled managers	Non-skilled managers	Managers
	Few	Small employers	Expert supervisors	Skilled supervisors	Non-skilled supervisors	Supervisors
	None	Petty bourgeoisie	Experts	Skilled workers	Non-skilled workers	Non-management
			Expert	Skilled	Non-skilled	
			Relation to scarce skills			
						Relation to authority

Source: E. Wright, *Class Counts*, Cambridge, Cambridge University Press, 1997.

TABLE 2

**Class relations by forms of appropriation and domination**

Class	Capitalist relations		Small commodity relations	
	Appropriation	Domination	Appropriation	Domination
Bourgeoisie	+	+		
Top managers	+/-	+/-		
Lower supervisors	-	+/-		
Workers	-	-		
Petty bourgeois			+	+
Semi-autonomous employees	-	-	-	+
Small employers	+	+	+	+

Source: E. Wright, *Class Counts*, Cambridge, Cambridge University Press, 1997.

to lifestyle. According to Giddens (1973), lifestyle is the way the members of a particular group with the same status express their desire to differentiate themselves from the others.

Following Weber's argument with regard to power and status, Goldthorpe proposes a class schema based on occupation and the status associated with this, allowing him to group occupational categories of individuals with similar income levels and working conditions (Atria, 2004). Likewise, Erikson and Goldthorpe's schema takes the individual's position in the production process into account, which allows the element of authority to be incorporated. A basic schema of three class positions is developed: employers, (own-account) workers and employees. In a later version, Erikson and Goldthorpe (1993) kept the three major classes but expanded to 11 the number of social class categories, combining criteria of ownership and control of means of production, more or less autonomous service provision and manual work with different skill levels. Table 3 illustrates the expanded version.

## 2. The construction of social classes

In constructing social classes, it needs to be considered that "society is a product of man" (Berger, 1969, p. 3), although "individuals produce society [...] as historically located actors, and not under conditions of their own choosing" (Giddens, 1976, p. 160). These words are meant as a reminder that any schema for building a class structure will be conditioned by the historical and social context of whoever develops it.

Some authors set out from the idea of social class as a form of social interaction. This is the perspective

of the work done in Spain by Mora (2002) in studying the production relations of employees at two firms in Catalonia, and it is also the approach of the Cambridge Social Interaction and Stratification (CAMSIS) scale. The basis for the former is that human beings produce in society. As Marx (1891) puts it:

"In the process of production, human beings work not only upon nature, but also upon one another. They produce only by working together in a specified manner and reciprocally exchanging their activities. In order to produce, they enter into definite connections and relations to one another, and only within these social connections and relations does their influence upon nature operate—i.e., does production take place."

In consequence, Mora (2002, p. 12) argues that "social classes are, first and foremost, forms of social interaction".

The theoretical basis for the CAMSIS approach is the concept of "selective association". Thus, people with a similar social position as members of a social class are considered to have a tendency to interact more with individuals from that class, mainly when it comes to establishing relations of friendship and marriage. This approach is a departure from the traditional one, in which the class structure is defined first and then the way its members interact is studied. Accordingly, it is "close to the interactional approaches and the concept of social distance developed by Bourdieu. Actors who share similar positions within the social system also share similar experiences, including relations of friendship, affinity and marriage, as well as cultural patterns" (Francés, 2009).

Other authors consider that "occupation plays a role as an intermediate variable in the operationalization of

TABLE 3

**Erikson and Goldthorpe's typology of classes**

Service classes	I	Higher-grade professionals, administrators and officials, managers in large industrial establishments, large proprietors
	II	Lower-grade professionals, administrators and officials, higher-grade technicians, managers in small and medium-sized industrial establishments, supervisors of non-manual workers, employees
Intermediate classes	III a	Executive employees
	III b	Service workers
	IV a	Small proprietors and self-employed workers with employees
	IV b	Small proprietors and self-employed workers with no employees
	V	Lower-grade technicians, supervisors of manual workers
Working classes	VI	Skilled industrial manual workers
	VII a	Unskilled industrial manual workers
	VII b	Agricultural manual workers

Source: R. Erikson and J.H. Goldthorpe, *The Constant Flux: a Study of Class Mobility in Industrial Societies*, Oxford, Clarendon Press, 1993.

the different models of social stratification” (González, 1991, p. 35) and consequently construct the class structure on the basis of the occupational structure. Even in social interaction models such as CAMSIS, occupation is used as a measure of stratification. After all, “occupation is generally a good and economical indicator of position in social space” (Bourdieu, 1987, p. 4).

A third approach relies on asking subjects where they are situated in the class structure, something that is questioned by many authors, including Goldthorpe and Lockwood, who consider such studies to be of very little sociological value (cited in Bourdieu and others, 1986, p. 256). Bourdieu (1987, p. 2) takes issue with this stance when he says:

“In reality, agents are both classified and classifiers. But they classify according to (or depending on) their position within classifications. To sum up what I mean by this, I can comment briefly on the notion of point of view: the point of view is a perspective, a partial, subjective vision (subjectivist moment); but it is at the same time a view, a perspective, taken from a point, from a determinate position in an objective social space (objectivist moment).”

To this may be added, paraphrasing Lenoir (in Champagne and others, 1989), that the object of class sociology is not to draw boundaries between classes in order to define them but, in this case, to describe how individuals perceive themselves in their situation as members of a particular social class.

A number of studies on social stratification have been published in Latin America. The social stratification of Buenos Aires was studied by Jorrot (1997), using the

approaches of Wright and Goldthorpe. León and Martínez (2001) addressed the subject of social stratification in Chile at the end of the last century from the perspective of socio-occupational categories, using data from the 1995 employment survey. The structure of some Latin American countries was described by Portes and Hoffman (2003), who defined social classes by employing the criteria of control of the means of production, control of others’ labour and control of scarce intellectual resources. In Central America, Rodríguez (2002) made use of data on the working population gathered by the 2000 census in Costa Rica to develop a class model adapted from the one proposed by Wright, which has been the most used. In Guatemala, Pérez and others (2003) used data from an income and expenditure survey to develop a stratification index based on income, education and household living conditions.

The present study presents two structures for social class in Guatemala, following the schemata of Wright and of Erikson and Goldthorpe already presented (the composition of each class in each schema is described in the annexes). In the first case, the class structure is also developed for the different regions making up the country, with the object of contrasting the class structure of urban areas, represented by the capital and adjoining municipalities, with that of rural areas, constituted by the rest of the country.

The data used to produce the class structure are from the 2006 National Living Conditions Survey (ENCOVI) (INE, 2007). A sample of almost 27,000 people over 18 was selected from the database, on the basis of occupation and ownership of factors of production.

## III

### Social mobility

#### Quantifying social mobility

Social mobility is defined as any transition by an individual from one social position to another (Solares, 1989). Another way of looking at social mobility is as the ability of an individual or stratum to improve their position significantly (Miller, 1968, cited in Cachón, 2001, p. 217). Generally speaking, most authors, such as Bendix and Lipset (1972) and Mayer (1976), understand social mobility as the process whereby people move from one social stratum to another.

Mobility may be horizontal or vertical. Horizontal mobility occurs when an individual moves from one position to a different but equal one, while vertical mobility means the transition from one social stratum to another. This movement may be upward or downward. Sorokin (1956) considers that both individual and group social mobility can occur, and that this may happen in the economic, occupational, political or some other field.

An individual’s social mobility can take place across generations, more specifically from parents to children, in the form of a change of occupation, social

class or some other variable, and it can also take place over the lifetime of the individual, in which case it is intragenerational mobility. Mention should also be made of the difference between absolute mobility and relative mobility. The former alludes to the absolute number, usually expressed in relative terms, of people from one social class who move to another, i.e., it concerns a change in the distribution of the population between the different social classes. Relative mobility means the likelihood of people moving from their social class of origin to a different class (Sorokin, 1956).

There are a variety of theories to explain the causes of social mobility. One of the most popular is the so-called liberal theory, which maintains that there is a close connection between industrialization and social mobility. Liberal theory states that there is greater equality of opportunities for social mobility in industrial than in non-industrial societies. Economic development, and the growth of the service sector in particular, generates the conditions for an increase in technical and professional occupations (Echeverría, 1999).

In sociology there are numerous approaches, both quantitative and qualitative, for quantifying and studying social mobility in a given society. Barber (1964) illustrates the use of occupational transition matrices relating parents' situation to that of their children in different studies. Cachón (2001) describes the form and content of the transition matrix and the analysis that can be based on it. Figure 2 provides a graphic representation of the transition or mobility matrix.

The variable  $t_0$  denotes the starting categories and  $t_1$  the final categories. In both cases, the categories, their number and their order are the same. The initial categories often relate to the occupation, education or social class of the parent, while the final categories use the same variables for the children.

Figure 3 illustrates how the matrix is interpreted. The variable identified by the letter "a" shows the total number of individuals. The rectangle identified by the letter "b" shows the total number of individuals in the category of origin, and the one identified by the letter "c" shows the total number of individuals in the destination category. The name of each category is represented by the letters "A" for the parents and "Z" for the children. The letter "n" indicates the row and column vector, the total for which is on the right, while "N" indicates the total value of the different rows and columns. The diagonal containing the letter "d" shows the total number of individuals remaining in the position of origin, while the triangle with the letter "e<sub>1</sub>" identifies upward mobility and that containing the letter "e<sub>2</sub>" identifies downward mobility.

According to Cachón (2001), the basic matrix can be used to construct three matrices with proportional distributions. The first matrix, known as the rotation matrix, shows the proportion of individuals who were in a category of origin at a given time and in a destination category at another time. The second matrix is the relative distribution matrix for the rows, and is called the transition matrix, while the third matrix is the relative distribution matrix for the columns.

FIGURE 2

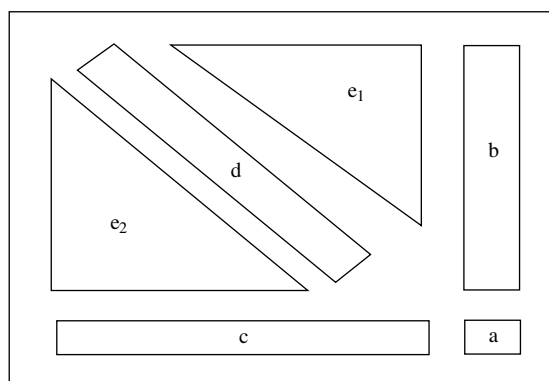
**Transition matrix**

$t_0 \backslash t_1$	$Z_1$	$Z_2$	·	·	·	·	$Z_k$	Marginal totals A
$A_1$	$n_{11}$	$n_{12}$	·	·	·	·	$n_{1k}$	$n_1$
$A_2$	$n_{21}$	$n_{22}$	·	·	·	·	$n_{2k}$	$n_2$
·	·	·	·	·	·	·	·	·
·	·	·	·	·	·	·	·	·
$A_k$	$n_{k1}$	$n_{k2}$	·	·	·	·	$n_{kk}$	$n_k$
Marginal totals Z	n1	n2	·	·	·	·	nk	N

Source: L. Cachón, *¿Movilidad social o trayectoria de clase?*, Madrid, Centro de Investigaciones Sociológicas, 2001.

FIGURE 3

Composition of the transition matrix



Source: L. Cachón, *¿Movilidad social o trayectoria de clase?*, Madrid, Centro de Investigaciones Sociológicas, 2001.

The matrix can be used to calculate indices like the following, suggested by Cachón (2001):

- I. Gross stability index:  $GSI = \sum_{i=1}^k n_{ii}$
- II. Gross mobility index:  $GMI = \frac{N - \sum_{i,j=1}^k n_{ij}}{N}$
- III. Upward mobility index:  $GMI = \frac{\sum_{i,j=1}^k n_{ij}}{N}$ , when  $j > i$
- IV. Downward mobility index:  $GMI = \frac{\sum_{i,j=1}^k n_{ij}}{N}$ , when  $j < i$

The relative distribution matrices for the rows and that for the columns can be used to obtain the indices of upward mobility (inflow) and downward mobility (outflow). Table 4 shows the case of a dichotomous manual/non-manual occupation matrix (Cachón, 2001).

TABLE 4

Matrix of relative distribution of occupations

		Child	
		Manual	Non-manual
Parent	Manual	a	c
	Non-manual	b	d

Source: L. Cachón, *¿Movilidad social o trayectoria de clase?*, Madrid, Centro de Investigaciones Sociológicas, 2001.

The stability vectors correspond to the letters “a” and “d” and the mobility vectors to the letters “b” and “c”, the first being downward mobility and the second upward mobility.

- I. Downward inflow mobility matrix:  $I = \frac{b}{a+b} * 100$
- II. Upward inflow mobility matrix:  $II = \frac{c}{c+d} * 100$
- III. Downward outflow mobility matrix:  $III = \frac{b}{a+c} * 100$
- IV. Upward outflow mobility matrix:  $IV = \frac{b}{a+c} * 100$

The mobility index proposed as part of the Shorrocks (1978) index can also be obtained from the transition matrices:

$$M(P) = [n - Trace(P)]/n-1$$

where:

$$0 \leq M(P) \leq 1$$

$n$  = number of ranges

$Trace(P)$  = sum of the diagonal elements of the matrix

An index value of 1 (one) denotes total or perfect mobility, while a value of 0 (zero) means that there is no mobility, implying a closed society.



Another way of obtaining a mobility index is by calculating regressions. Solon (1992) used this statistical technique to measure intergenerational income mobility in the United States. This regression was adapted by Mediavilla (2004) to measure educational mobility in Brazil, as follows:

$$E_{c,i} = \beta E_{p,i} + \varepsilon$$

where the terms  $E_{c,i}$  and  $E_{p,i}$  represent the education levels of children and parents, respectively, measured in logarithms and as deviations from the respective means.  $\beta$  indicates the degree of intergenerational educational persistence. Consequently,  $1 - \beta$  expresses the degree of educational mobility between generations.

## IV

### Social class and social mobility

#### 1. The social class structure

Following Wright's schema, the class structure reveals that the country's social elite, comprising the dominant class, is small and constitutes just 5% of the population, as shown in table 5. The "employers" class fraction, which includes those employing one or more workers, makes up the bulk of the dominant class and represents 3.1% of the whole population. The "executive" class fraction, comprising administrators, managers and executive staff in private-sector firms and public institutions, represents 1.8% of Guatemalan society.

The middle class is only now developing in the country and accounts for just 9.2%, meaning that just under 1 in 10 Guatemalans is a member of this social class, composed in virtually equal proportions of university-educated professionals, both employed and self-employed, technical workers and clerical workers with secondary education.

The working class, termed the lower class in the functionalist approach, forms the broad base of the Guatemalan social pyramid, comprising just over four fifths of the population (85.9%). The "skilled workers" class fraction is a minority within the working class, representing a quarter of this or 19.3% of the population. This class fraction is mainly composed of artisans and workers with some level of skills. The "non-skilled workers" class segment forms the great bulk of the population: 66.5%, or two out of every three Guatemalans. Half the country's population is poor, according to ENCOVI data for 2006 (INE, 2007).

The analysis of the class structure by regions of the country, which is presented in table 6, reveals that the dominant class mainly resides in region 1, the department of Guatemala, which includes the capital. The "employers" and "executives" class fractions

TABLE 5

Social class structure in Guatemala, 2006.  
Wright's schema

Social class	Number	Percentage
<b>Dominant class</b>	<b>1 332</b>	<b>5.0</b>
Employers	843	3.1
Executives	489	1.8
<b>Middle class</b>	<b>2 470</b>	<b>9.2</b>
Professionals	1 162	4.3
Technical and clerical workers	1 308	4.9
<b>Working class</b>	<b>23 089</b>	<b>85.9</b>
Skilled workers	5 195	19.3
Non-skilled workers	17 894	66.5
<i>Total</i>	<i>26 891</i>	<i>100.0</i>

Source: prepared by the author on the basis of National Institute of Statistics (INE), 2006 National Living Conditions Survey (ENCOVI), Guatemala City, 2007.

are urban, particularly the latter. The North region is where the dominant class is least present, particularly the "executives" fraction. The middle class is an urban social phenomenon and accounts for almost a fifth of the population in the department of Guatemala, double the national average. The middle class is also observed to live mainly in the Centre region, which includes departments close to the capital, the centre of economic and political power in the country.

The working class has the largest presence in all five of the country's regions, with the East region having the largest concentration of this class and the Guatemala department the smallest. The working class represents two thirds of the population in the latter, whereas in the other regions it represents about four fifths. The "skilled workers" class fraction has the largest presence in the Guatemala and Centre regions. The "non-skilled

TABLE 6

**Percentage structure of social classes in Guatemala, by geographical region, 2006.**  
**Wright's schema**  
*(Percentages)*

Social class	Guatemala	North	Centre	East	West
<b>Dominant class</b>	<b>11.0</b>	<b>3.2</b>	<b>5.5</b>	<b>5.6</b>	<b>6.0</b>
Employers	6.3	2.1	3.9	3.9	3.5
Executives	4.8	1.1	1.6	1.7	2.6
<b>Middle class</b>	<b>22.5</b>	<b>9.4</b>	<b>12.9</b>	<b>9.3</b>	<b>9.3</b>
Professionals	7.0	5.6	5.6	4.6	5.2
Technical and clerical workers	15.5	3.8	7.3	4.8	4.1
<b>Working class</b>	<b>66.5</b>	<b>87.2</b>	<b>81.6</b>	<b>85.0</b>	<b>84.7</b>
Skilled workers	29.1	14.5	25.4	17.8	19.9
Non-skilled workers	37.3	72.8	56.2	67.3	64.8
<i>Total</i>	<i>100.0</i>	<i>99.8</i>	<i>100.0</i>	<i>100.0</i>	<i>100.0</i>

Source: prepared by the author on the basis of National Institute of Statistics (INE), 2006 National Living Conditions Survey (ENCOVI), Guatemala City, 2007.

workers" fraction is most strongly represented in the North region, dominated by a poor indigenous majority.

It is useful to compare the class structure described here with that presented in other studies for certain countries or cities of Latin America, since while the methodological criteria are not the same, they are similar in their theoretical underpinnings. The purpose of the comparison is to be able to envisage the situation of Guatemala in relation to other Latin American societies. The idea is rather to highlight similarities in class structures than to carry out a statistical comparison.

Because of their geographical proximity and historical and social similarities, the comparison will be made first with Costa Rica, El Salvador and Mexico. According to the study by Portes and Hoffman (2003), around the beginning of this century the dominant class in Costa Rica (which includes capitalists, executives and professionals) represented 7.3% of the working population, as against figures of 5.0% for El Salvador and 5.7% for Mexico. The dominant class was in the minority in all three countries, as in Guatemala, while the petty bourgeoisie, composed for the purposes of this study by own-account professionals, represented between 10% and 12%, or almost double the Guatemalan figure. The working class, called the proletariat in the Portes and Hoffman study, represented between 82% and 83%, which is similar to the percentage obtained in the present study (82%). It should be noted that the authors cited made a distinction in their research between the formal and informal sectors, on the basis of employment conditions. The informal sector represents the majority in all three countries. The data used for stratification

did not allow this division to be made in the present study, although it would have provided further data for understanding and interpreting the pyramid of urban society in Guatemala.

León and Martínez (2001) developed a class structure for Chilean society in 1995, and two facts are worth highlighting about it: first, the employers class was also small (3.3%), and second, the middle class was about a third of the population. In Guatemala, on the other hand, the middle class constituted only a little over a tenth of the population. In both countries, the class structure stands upon a broad base of workers and is still a long way from being onion- or diamond-shaped, with a large middle class, as it characteristically is in more advanced societies. The same may be said of the class structure in Buenos Aires, according to the study by Jorrot (1997).

In accordance with Erikson and Goldthorpe's schema, the class structure is developed following the system put forward by Rivas (2008), which is presented in the annex, but modified in respect of the self-employed, whom it was thought better to include in the non-skilled worker class. Table 7 shows the structure developed for Guatemala, from which it can be seen that the service class, which is characterized by being composed of professionals and employees with executive functions, represents almost a tenth of the Guatemalan population, while the intermediate class, whose distinctive feature is that it has some degree of authority, but under the direction of others, represents about a fifth. Small agricultural proprietors are 12.8% of this class, something that highlights their importance in the Guatemalan

TABLE 7

**Social class structure in Guatemala, 2006.  
Erikson and Goldthorpe's schema**

Social class	Number	Percentage
<b>Service class</b>	<b>2 984</b>	<b>11.1</b>
<b>Intermediate class</b>	<b>4 959</b>	<b>18.4</b>
Routine non-manual workers	1 168	4.3
Smallholders	3 438	12.8
Petty bourgeoisie	353	1.3
<b>Working class</b>	<b>18 948</b>	<b>70.5</b>
Skilled manual workers	3 203	11.9
Unskilled manual workers	6 327	23.5
Self-employed workers	9 418	35.0
<i>Total</i>	<i>26 891</i>	<i>100.0</i>

Source: prepared by the author on the basis of National Institute of Statistics (INE), 2006 National Living Conditions Survey (ENCOVI), Guatemala City, 2006.

social structure, particularly in rural areas, where it is common for people to describe themselves as farmers rather than as campesinos, because they cultivate their own small plots.

With this schema, the base of the social pyramid is also constituted by the working class, mainly consisting of self-employed workers (35.0%) and unskilled manual workers (23.5%).

There are few studies of social class in Latin America based on Erikson and Goldthorpe's schema. One of the best-known is that carried out by Jorrot (1997) in the city of Buenos Aires, Argentina, which revealed the existence of a pyramid-shaped class structure with a service class representing 19.7% of the population at the top and a working class constituting 41.7% of the population at the base. Another study is the one applied in Chile by Torche and Wormald (2004). This also yielded a pyramid shape, with a service class representing 15% of the population. These data ought to be used for reference purposes rather than taken as a strict comparison, given the differences in social and economic structure between Guatemala and these countries.

Class relations in Guatemala can be summed up as relations of subordination and exclusion. Following Touraine (1977), it may be said that the dominant class has been controlling the country's economic, political, social, cultural and any other resources in order to wield power and ensure the reproduction of a social, political and economic system favourable to its interests. These domination relationships were challenged by armed movements in some periods of the country's history. The most recent ended with the signing of the Agreement on a Firm and Lasting Peace in 1996, which brought almost four decades of armed conflict to a close. The

class dispute in Guatemala is being waged politically on the electoral stage by the conquest of government and economically in the distribution of the wealth generated. The two most visible forms of this conflict are the setting of minimum wage and tax rates.

## 2. Educational and occupational mobility

Social mobility is estimated in its aspects of educational mobility and occupational mobility. The data used in both cases were obtained from the 2006 ENCOVI (INE, 2007). That survey gathers data on the education level and occupation of almost 34,000 individuals living throughout the country.

The variables selected from ENCOVI were age, kinship, education level of household head, education level of respondent, sex, age and ethnic group. The next step was to select only persons aged over 25, and this yielded a sample of 20,360 observations. The average years of education of parents and children were calculated for this sample, the figures being 2.5 and 3.6 years, respectively. The deviation from the mean was then calculated for both parents and children. Following Solon (1992), these data were used to estimate a regression in which children's education is determined by their parents':

$$E_{c,i} = \beta E_{p,i} + \varepsilon$$

The terms  $E_{c,i}$  and  $E_{p,i}$  represent the education level of children and parents, respectively, measured in logarithms and as deviations from the respective means. The  $\beta$  indicates the degree of educational persistence across generations. Consequently,  $1 - \beta$  expresses the degree of educational mobility between generations.

First an overall estimate of mobility was carried out. Gender, ethnic and age cohorts were then taken. Two age cohorts were used: 26 to 40, and over 40.

The results obtained in the different regressions, which are summarized in table 8, indicate that the parents' education determines the education level of the children by between 13% and 23%. The degree of determination is lowest among indigenous people and highest among women. For the "age" variable, the results indicate that the best fit is in the over-40 cohort.

The country-level results reveal that educational mobility is low, with a figure of 0.55. Males present slightly greater educational mobility than females: 0.57, as against 0.53. Similarly, the data reveal inequality of educational mobility between the indigenous and non-indigenous ethnic groups. Educational mobility is slightly lower in the former group (0.50) than in the non-indigenous group (0.52). The data for the "age" cohort

TABLE 8

**Intergenerational educational mobility  
among over-25s, as of 2006**

Variable	Beta*	Mobility	R <sup>2</sup>
Country	0.45	0.55	0.25
Male	0.43	0.57	0.23
Female	0.47	0.53	0.27
Non-indigenous	0.43	0.57	0.24
Indigenous	0.50	0.50	0.28
Over 40	0.47	0.53	0.27
40 and under	0.41	0.59	0.23

Source: prepared by the author on the basis of National Institute of Statistics (INE), 2006 National Living Conditions Survey (ENCOVI), Guatemala City, 2007.

\* Significant at 5%.

indicate that mobility is greater among those aged under 41 than among those aged 41 and over.

By ethnic group, the results shown in table 9 indicate that the Chuj and Ixil groups have the lowest level of educational mobility, while the Achí and Poqoman groups have the highest. These groups, along with the Poqomchí, Mam, Xinka, Q'eqchí, Tz'utujil and Kaqchikel ethnic groups, register educational mobility above the average for the country.

The data from the transition matrix for parents' and children's education were used to calculate the immobility, upward mobility and downward mobility indices, as described in the theory section. The calculations reveal a low level of upward mobility in Guatemala (42.5%) and likewise of downward mobility (5.8%); immobility is the difference. Upward educational mobility is greater among males than among females: 50.5% against 35.5%. By ethnic group, the non-indigenous population shows greater upward educational mobility than the indigenous population: 47.6% against 33.6%. Going by the "age" cohort, people aged 40 and under are more likely to have upward educational mobility than people over this age: 51.0% against 35.5%.

The transition matrix for males in table 10 shows retention rates greater than the averages for the population. The matrix also shows that the likelihood of a son of uneducated parents being able to study at university is low (1%). A son of parents with primary education has eight times as great a chance of studying at university as a son of uneducated parents. At the other extreme, the likelihood of a son of university-educated parents being illiterate is nil, and the likelihood of such a person going no further than primary education is low (3%).

In the transition matrix for females, contained in table 11, there is a higher retention rate in the "illiterate"

TABLE 9

**Adults over 25 by indigenous ethnic group**

Ethnic group	Beta*	Mobility	R <sup>2</sup>	Number of observations
Chuj	0.87	0.13	0.10	53
Ixil	0.84	0.16	0.17	156
Ch'orti	0.54	0.46	0.13	150
K'iche	0.51	0.49	0.14	2 246
Poqomchí	0.50	0.50	0.09	139
Mam	0.47	0.53	0.12	809
Xinka	0.46	0.54	0.12	105
Q'eqchí	0.45	0.55	0.07	920
Tz'utujil	0.45	0.55	0.11	243
Kaqchikel	0.44	0.56	0.13	1 694
Achí	0.40	0.60	0.06	357
Poqoman	0.35	0.65	0.06	39

Source: prepared by the author on the basis of National Institute of Statistics (INE), 2006 National Living Conditions Survey (ENCOVI), Guatemala City, 2007.

\* Significant at 5%.

TABLE 10

**Matrix of intergenerational educational  
mobility, sons over 25, 2006**  
(Percentages)

Parent/son	Illiterate	Primary	Secondary	Higher	Total
Illiterate	<b>42.3</b>	49.5	7.4	0.8	100.0
Primary	9.2	<b>54.2</b>	28.9	7.7	100.0
Secondary	0.8	10.3	<b>52.4</b>	36.5	100.0
Higher	0.0	2.6	34.0	<b>63.2</b>	100.0

Source: prepared by the author on the basis of National Institute of Statistics (INE), 2006 National Living Conditions Survey (ENCOVI), Guatemala City, 2007.

TABLE 11

**Matrix of intergenerational educational  
mobility, daughters over 25, 2006**  
(Percentages)

Parent/daughter	Illiterate	Primary	Secondary	Higher	Total
Illiterate	<b>60.4</b>	34.7	4.4	0.5	100.0
Primary	19.4	<b>52.4</b>	23.3	4.9	100.0
Secondary	3.5	15.5	<b>55.0</b>	26.0	100.0
Higher	1.7	3.5	51.3	<b>43.5</b>	100.0

Source: prepared by the author on the basis of National Institute of Statistics (INE), 2006 National Living Conditions Survey (ENCOVI), Guatemala City, 2007.

box than for men, and a lower retention rate for higher education. This reveals the existence of patterns of female marginalization and exclusion where education is concerned, something that impacts a number of social dimensions of their activities as human beings, since it

limits their prospects of finding employment, participating in the political sphere and owning material goods in the economic sphere.

A comparative analysis of the educational transition matrices for males and females reflects the unequal distribution of educational opportunities that affects women. Consequently, from a gender perspective it can be seen that Guatemalan women are subordinate to men where education is concerned. According to Parkin (1979), it may be said that this exclusion is not accidental but is intentionally inflicted by the male sex for the purpose of creating a privileged social position for themselves as a social group at women's expense. As long as women are excluded from education, the pattern of subordination to men is reproduced, to put it in the terms used by Bourdieu (2000).

To quantify occupational mobility, use was made of a sample of just over 2,200 people aged over 25, obtained from the 2006 ENCOVI (INE, 2007). The occupational data presented by the survey were reclassified in the case of some occupations in the "skilled manual" and "unskilled manual" categories. Table 12 shows the frequency distribution of parents and children for each occupation.

The table 12 data show that children's occupations are highly dependent on their parents' in the case of unskilled manual occupations. In that of skilled manual occupations, parental occupation is also a strong determinant of the child's occupation. The immobility index value is 0.74, reflecting the high degree to which children's occupations are inherited from their parents, particularly in the case of unskilled manual occupations. The upward mobility index value is low (0.16), but higher than the downward mobility value (0.09). The Shorrocks index reveals that intergenerational occupational mobility is low, with a value of 0.45. This index has a higher value for women than for men: 0.67 and 0.48, respectively. Furthermore, it shows that the indigenous ethnic group, with an index value of 0.69, has greater occupational mobility than the non-indigenous group, whose index value is 0.58. It also reveals that the occupational mobility of people aged 40 and under is almost twice that of those above this age: 0.83 against 0.46.

The transition matrix, illustrated in table 13, indicates the degree to which parents' occupations are reproduced in their children. In unskilled manual occupations, such reproduction occurs in almost four out of every five cases. In skilled manual occupations, the reproduction

TABLE 12

**Matrix of intergenerational occupational mobility. Frequency distribution. Children over 25, 2006**

Occupation of parent/child	Unskilled manual	Skilled manual	Technical and clerical workers	Professionals	Executives	Total
Unskilled manual	1 244	158	58	60	25	1 545
Skilled manual	81	231	24	24	6	366
Technical and clerical workers	6	5	36	5	2	54
Professionals	7	3	12	35	2	59
Executives	45	24	8	16	89	182
<i>Total</i>	<i>1 383</i>	<i>421</i>	<i>138</i>	<i>140</i>	<i>124</i>	<i>2 206</i>

Source: prepared by the author on the basis of National Institute of Statistics (INE), 2006 National Living Conditions Survey (ENCOVI), Guatemala City, 2007.

TABLE 13

**Matrix of intergenerational occupational mobility. Children over 25, 2006 (Percentages)**

Occupation of parent/child	Unskilled manual	Skilled manual	Technical and clerical	Professionals	Executives	Total
Unskilled manual	<b>80.5</b>	10.2	3.8	3.9	1.6	100.0
Skilled manual	22.1	<b>63.1</b>	6.6	6.6	1.6	100.0
Technical and clerical	11.1	9.3	<b>66.7</b>	9.3	3.6	100.0
Professionals	11.9	5.1	20.3	<b>59.3</b>	3.4	100.0
Executives	24.7	13.2	4.4	8.8	<b>48.9</b>	100.0

Source: prepared by the author on the basis of National Institute of Statistics (INE), National Living Conditions Survey (ENCOVI-2006), Guatemala City, 2007.

rate is a substantial 63%. Much the same happens with low-skilled non-manual occupations (technical and clerical workers), where the reproduction rate is close to 67%. The rate for professionals and executives is also considerable.

The transition matrix reveals that the children of parents with manual occupations, both skilled and unskilled, have only a small likelihood (just under 2%) of becoming executives. The children of parents with skilled non-manual occupations have almost the same prospects of becoming executives, with a likelihood of between 3.7% and 3.4%.

To enhance the analysis of the connection between parents' and children's education and occupations, a path analysis was carried out. Two regressions were calculated for this purpose. The first regression has the child's education as a dependent variable and the parent's education and occupation as independent variables.

The parent's education and occupation variables have a large influence (27.5%) in determining the child's education. The model indicates that for each extra year of education the parent has, the child's education increases by 0.40 years. This figure is similar to the one obtained in a study done in Chile in 2001 (0.428) and greater than the one calculated by a study conducted in the United

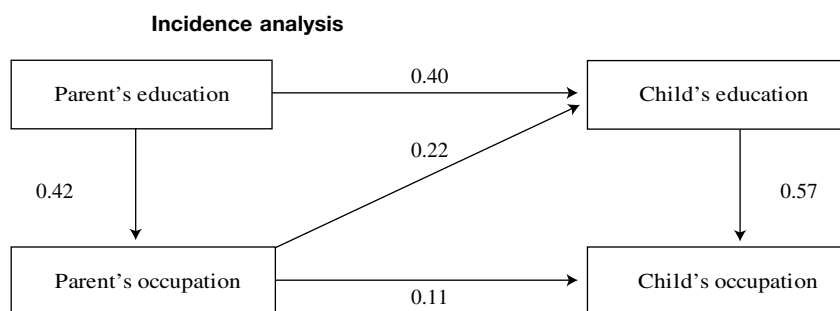
States in 1994 (0.341), which means that this last society is more open than the first two (Torche and Wormald, 2004). The incidence of the parent's occupation on the child's education is also substantial, although only half as great as the influence of the parent's education.

The second regression calculated has the child's occupation as its dependent variable and the parent's education, parent's occupation and child's education as explanatory variables. The findings indicate that the latter two variables accounted for children's occupation to the extent of 39% in 2006. The regression calculated indicates that the child's education has a greater incidence on the child's occupation than the parent's education does. Figure 4 summarizes the relationships.

The incidence analysis provides an opportunity to ascertain the direct and indirect effect of each pair of related variables, as summarized in table 14.

Decomposing the total effect of the parent's education on the child's education indicates that the direct effect bulks largest, with each extra year of education for the parent being associated with an increase of 0.40 years of education for the child. The direct effect of the parent's occupation on the child's education can also be seen to be large, at 0.22, as can the indirect effect, at 0.17. It is striking that after the parent's education,

FIGURE 4



Source: prepared by the author.

TABLE 14

**Decomposition of effects for each pair of related variables**

Effect of the first variable on the second	Total effect	Direct effect	Indirect effect	Spurious effect
Parent's education on parent's occupation	0.42	0.42		
Parent's education on child's education	0.49	0.4	0.09	
Parent's occupation on child's education	0.39	0.22	0.17	
Parent's occupation on child's occupation	0.33	0.11	0.01	0.21
Child's education on child's occupation	0.62	0.57		0.05

Source: prepared by the author.

the parent's occupation has a substantial direct effect on the child's education, equivalent to just over half the total effect (0.22 as compared to 0.39). This reveals mechanisms of intergenerational transmission of cultural capital endowment from parents to children. Where occupation is concerned, the direct effect of the parent's occupation on the child's is substantial and accounts

for a third of the total effect (0.11 out of 0.33). When the effect of education on occupation is compared, it transpires that the direct effect is greater in the case of the child than in that of the parent, which indicates a significant intergenerational social change where the function of education in employment prospects is concerned.

## V

### Conclusions

The class structure elaborated in this paper is an approximation of the social structure of Guatemala, which should be seen more in terms of strata than of classes. The social structure stands upon a broad base constituted by the working class and is still far from being onion- or diamond-shaped, with the large middle class that characterizes the most advanced societies. The dominant class mainly consists of employers, with only a small presence of executive employees in this class. The Guatemalan middle class is still small, is urban in character and is composed in almost equal proportions of university-educated professionals and administrative employees with secondary education. The working class mainly consists of unskilled workers, which is indicative of how few opportunities for social mobility there are in the country.

In Guatemala, children's education is determined to a considerable extent by that of their parents, with little educational mobility. Males have greater educational mobility than females. Similarly, the educational mobility of the non-indigenous ethnic group is greater than that of the indigenous group. In the latter case, the Chuj and Ixil groups have the least educational mobility and the Poqoman and Achí groups the most. The rate of reproduction of parents' educational level by their

children is considerable, with children reproducing their parents' educational level in just over half of all cases.

The likelihood of a son of uneducated parents studying at university is low. A son of parents with primary education is eight times as likely to study at university as a son of uneducated parents. At the other extreme, the likelihood of a child of university-educated parents being illiterate is nil, and the likelihood of such a child attaining only primary education is low.

There is little occupational mobility in Guatemala. Women have greater occupational mobility than men, and the same can be said of the indigenous ethnic group relative to the non-indigenous group and of people under 41 relative to those aged 41 and over. In skilled manual occupations, the parent's occupation is an important determinant of the child's. The immobility index has a high value, especially for unskilled manual occupations.

The incidence analysis indicates that parents' education and occupation have a substantial effect on their children's education, indicating the inheritance of cultural capital from parents to children. The effect of education on occupation is greater in the child's case than the parent's, which reveals a major change where the function of education in determining employment opportunities is concerned.

*(Original: Spanish)*

## ANNEX

TABLE A-1

**Occupational categories under the one-digit isco-88 and employment situations forming each social class, on the basis of Wright's schema**

	Class	Occupation	Employment situation
1	Employers	All	Employees
2	Managers	1	Wage worker Own-account worker Unpaid family member
3	Professionals	2	Wage worker Own-account worker Unpaid family member
4	Technicians and clerks	3 and 4	Wage worker Own-account worker Unpaid family member
5	Skilled workers	7 and 8	Wage worker Own-account worker Unpaid family member
6	Non-skilled workers	5, 6 and 9	Wage worker Own-account worker Unpaid family member

Source: prepared by the author.

isco: International Standard Classification of Occupations.

TABLE A-2

**Occupational categories under the two-digit isco-88 and employment situations forming each social class, on the basis of Erikson and Goldthorpe's schema**

	Class	Occupation	Employment situation
1	Service class	21 22 23 24 11 12 13 31 32	All
2	Routine non-manual workers	41 42 52	Wage worker Domestic service worker Unpaid family member Wage worker Domestic service worker
3	Petty bourgeois	33 34 51 52 71 72 73 74 81 82 83 91 92 93	Employer
4	Self-employed workers	33 34 51 52 71 72 73 74 81 82 83 91 95 93 41 42	Own-account worker Unpaid family member Own-account worker
5	Smallholders	61 62	Own-account worker Employer Unpaid family member
6	Lower-grade technicians and armed forces	01 02 33 34	All Wage worker Domestic service worker
7	Skilled manual workers	72 73 74 81 82 83 51	Wage worker Domestic service worker
8	Unskilled manual workers and agricultural labourers	71 91 93 61 62 92	Wage worker Domestic service worker

Source: R. Rivas, "Dos enfoques clásicos para el estudio de la estratificación social y de las clases sociales", *Espacio abierto*, vol. 17, No. 3, Maracaibo, 2008.

isco: International Standard Classification of Occupations.



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# Capabilities and gender: a sum or system of inequalities? The case of Chile

*Virginia Guzmán, Emmanuelle Barozet, Eduardo Candia, Bernardita Ihnen and Bettina Leiva*

**ABSTRACT**

Setting out from the broad capability approach put forward by Amartya Sen and working with data from the 2009 National Social Stratification Survey (enes), this article explores the influence of sex on differences in the personal capabilities deemed important for attaining outcomes that determine people's levels of well-being or deprivation. In terms of capabilities, it investigates individuals' ability to exercise material, cultural, social and political control over their lives and surroundings, distinguishing between the situation of men and women. Following the construction of individual capability measures, the hypothesis of female disadvantage was tested by the adjustment of multivariate models incorporating relevant controls. The findings suggest that there are non-negligible differences in capabilities between women and men in Chile.

**KEYWORDS**

Human development, gender research, women, capability development, gender equality, measurement, social surveys, statistical methodology, Chile

**JEL CLASSIFICATION**

D63, J16

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# I

## Introduction

The existence of inequalities<sup>1</sup> between men and women to the detriment of the latter, and the factors influencing the gender inequality observable in different fields, have been demonstrated by a large body of research carried out since the 1970s by research centres, universities and international organizations. In Chile, this work has been done by State bodies that have included the Women's Studies Centre (CEM), the National Women's Service (SERNAM) and the Research Department of the Labour Inspectorate, while the Gender Affairs Division of the Economic Commission for Latin America and the Caribbean (ECLAC) and the United Nations Development Programme (UNDP) have studied the issue at the Latin American level.<sup>2</sup> The purpose of this article is to go a step further and analyse the consequences of gender inequalities for the development of individual capabilities and functionings that are part of what determine people's autonomy in making choices about their individual and social well-being.

To this end, the article will set out from the concepts of capabilities and functionings developed by

Amartya Sen (1985), which serve not only to consider a hypothetically equitable distribution of goods in a given society, but also to progress towards a better understanding of differences between individuals when it comes to exercising the freedom to be and to act, and to secure access to available goods. Thus, Sen moves away from the abstract universalism of the "subject" to study concrete, historically situated individuals, in this case women and men whose access to goods is differentiated by their position within social relationships in the different spheres of society. The earlier work done in the studies of Nancy Fraser (1985 and 1989) and Fraser and others (1994) on the dimensions of gender injustice also provides a way past the conception of inequalities as originating only in the distribution of goods, without considering other dimensions that are present in the generation of inequalities in social recognition associated with status hierarchies and parity of participation in social and political decision-making.

The aim for Chile, then, is to construct four capabilities —material capability, cultural capability, social capability and political capability— that will be taken as a reference framework for comparing the individual measurements of men and women. From the data processing point of view, use was made of regression models that served to reveal differences in capabilities between men and women, controlling for the effect of relevant sociodemographic variables and other capabilities. To measure capabilities in the case of Chile, the study uses primary data from the National Social Stratification Survey (ENES) of the Anillos soc12 project.<sup>3</sup> This survey has unquestionable advantages because of its national

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□ This article has been written within the framework of the Anillo soc12 project, which forms part of the Desigualdades project ([www.desigualdades.cl](http://www.desigualdades.cl)) and is financed by the National Commission for Scientific and Technological Research (CONICYT). The authors are grateful for the comments of Vicente Espinoza, Soledad Herrera, Javier Núñez and a *cepal Review* referee.

<sup>1</sup> "A social inequality is the result of an unequal distribution, in the mathematical sense of the expression, of a society's resources among its members" (Bihl and Pfefferkorn, 2008, p. 9). The term "social inequality" obviously requires considerable clarification in respect of the type of variables that will be considered in defining the different aspects of this inequality. These dimensions may be treated separately or in combination.

<sup>2</sup> For an exposition of these subjects, there is a large literature dealing with the different spheres of inequality, such as economic participation (Contreras, Puentes and Bravo, 2005; Contreras and Plaza, 2010), education (Larrañaga, 2001; Contreras, 2004; Guerrero, Provoste and Valdés, 2006a and 2006b; MINEDUC, 2007), horizontal and vertical segregation in the labour market (Todaro and Yáñez, 2004; Acosta, Perticará and Ramos, 2005), employment quality (Leiva, 2000; Acosta, Perticará and Ramos, 2005), incomes (Le Foulon and Beyer, 2002; Berstein and Tokman, 2005; Perticará and Bueno, 2009), career characteristics (Guzmán and Mauro, 2004), access to pensions (Bertranou and Arenas, 2003; Bertranou, 2005), the distribution of time between productive and reproductive work (Todaro and Yáñez, 2004; Dussailant, 2009), social participation (Osborne, 2005; Lombardo, 2008; UNDP, 2010) and political participation and representation (Valdés, 2000; Altman, 2004; Ríos, 2008; UNDP, 2010).

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<sup>3</sup> The reflections set forth in this article form part of a larger field of research into equalities and inequalities in Chile conducted by a multidisciplinary and multi-institutional team whose goal is to carry out comparative study and measurement of emerging trends in social stratification in Chile ([www.desigualdades.cl](http://www.desigualdades.cl)). This programme of research examines the varied dimensions of inequalities, not only those deriving from traditionally recognized dimensions such as occupation, income and education level, but also those relating to social recognition and the involvement of individuals and groups in collective issues and decision-making. Also broached is the socio-historically constructed character of inequalities that place individuals and groups in differentiated power positions in the different systems of social relations structuring society, which include class, gender, ethnic, spatial and generational systems.

and regional coverage and representativeness, because it is applied individually to men and women while at the same time recording the households they belong to, and because it includes what are emerging variables in the study of social stratification relating to social, cultural, cognitive and political capital.

Two hypotheses are put forward in this paper: (i) women have fewer capabilities than men on average, even when relevant predictors of capabilities are controlled for, and (ii) in determining capabilities, the sex variable interacts with other explanatory variables that affect without nullifying its influence on the differences in capabilities identified between men and women.

## II

### Background

#### 1. A social gender system

Gender theory posits the existence of a social system based on the regular reproduction, with greater or lesser alterations, of recurrent patterns that organize relations between men and women at the symbolic, normative and practical level in different social and institutional settings. The gender system is characterized by great temporal and spatial reach, as it encompasses all interactions between men and women in the family, the market, politics and culture, and by its origins in the very constitution of modern societies (Valcárcel, 1991; Astelarra, 2003). Because it encompasses almost all social spaces, and because of its wide time horizon, the social gender system has a great capacity to affect other social systems, and can also be influenced by them. From a socio-historical perspective, the social gender system, as it is now known, has its roots in the beginnings of modern societies: it can be seen in the radical separation of the sexes in the hegemonic discourses of the imaginary institution of modernity, in the sexual division of labour, in gender hierarchies, in the private-public dichotomy, and in the inclusion and exclusion criteria of the structure of rights that regulate citizens.

In this context, the thinking about “gender justice” developed by Fraser (1985 and 1989) and Fraser and others (1994) distinguishes different dimensions that are fairly independent of one another: the economic dimension of redistribution, the cultural dimension of recognition and the political dimension of representation, which they integrate into the more general idea of

This article is structured as follows. Section II reviews the capabilities approach as proposed by Sen, emphasizing the multidimensional element entailed by inequality and paying special attention to the advances brought by studies of women in the sphere of capabilities. Section III moves from the theory to the measurement of capabilities. Section IV presents the data used to develop the model of analysis and construct the four capabilities that sum up a large amount of information on the situation of women in Chile; it also discusses the way these relate to the capabilities framework discussed earlier. Section V sets out the conclusions of the analysis in the light of the foregoing discussions.

“justice as participatory parity”. In the first case, people can be impeded from full participation because of the characteristics of economic structures that deny them the resources they need to interact with others as peers (distributive injustice). They may also be prevented from participating on equal terms because of the existence of institutionalized hierarchies of cultural value that deny them the appropriate status, in which case they are suffering from status inequality or misrecognition. The third dimension, which is the political one, concerns the jurisdiction of the State and the rules that organize political contestation. Politics, in this sense, provides the stage on which people’s struggles for distribution and recognition are waged.

#### 2. The capability approach: from distributive justice to the philosophy of development

A number of approaches have been developed to account for inequalities in the distribution of material and symbolic goods in societies. Among the most characteristic, mention should be made of Rawls (1971), an exponent of the classic conception of social justice which abstracts individuals from their environment, and Kymlicka (1991), who is closer to Sen in considering the influence of the cultural background of societies on the distribution of goods. Since 1980, Sen has offered a conceptual and methodological approach for dealing with the issue of development and inequalities, which he does by analysing the singularity of individuals and the radical differences between them when it comes to

exercising the freedom to be and act and to gain access to the goods available in a society.

To understand how individuals can exercise their freedom, Sen distinguishes capability from functioning (Sen, 1977, 1979, 1985). Capability is the freedom individuals have to do or be, and to live a good life on the basis of their autonomous decisions and their own values: “Capability is thus a kind of freedom: the substantive freedom to achieve alternative functioning combinations (or, less formally put, the freedom to achieve various lifestyles)” (Sen, 2001, p. 75). The concept of capability refers to those “substantive freedoms” of individuals that allow them to develop whatever functions they believe to be of value.<sup>4</sup> Functionings concern the degree to which people have been able to develop and exercise the capabilities considered essential to human development. Capabilities and functionings thus play a central role in determining individuals’ levels of well-being and autonomy.

All in all, Sen’s conception is an attempt to apprehend the singularity of each individual as a situated self, in his or her concrete circumstances, which means enriching the idea of equality with that of diversity and thereby counteracting the risks of standardization resulting from the abstraction of the idea of the “subject” or a homogenizing or excessively universalist view of human beings. Thus, for Sen, while two persons may have the same bundle of primary goods, they might have different freedoms to pursue their respective conceptions of what is good. Similarly, even if two individuals have the same income level, a great deal of inequality may subsist as regards their ability to achieve what they value.<sup>5</sup>

### 3. The capability approach applied to the analysis of gender inequalities

Gender is one of the fields where inequality is hardest to evaluate, for while there is abundant evidence, in both developed and developing countries, that women are worse placed than men in a number of dimensions, it is not easy to determine what the best indicator of this

inequality is. In Sen’s approach, not all inequalities are negative, but some of their forms are damaging: “If those elements that do not derive from personal effort (gender, race, household origin) are the ones that account for inequality, then inequality is not acceptable. But if inequality is the result of people’s effort, controlling for the other dimensions, then that inequality is acceptable” (Gamero Requena, 2006, p. 89). In this equation, gender is one of the variables that most seem to influence inequality of access to resources and the exercise of freedom, ranking among the unacceptable inequalities. A great many authors have taken up the challenge laid down by Sen (Anand, Hunter and Smith, 2005) and sought to produce a more or less fixed, more or less local or universalist list of capabilities that answer to the situations men and women actually experience. There is a great deal of debate about the validity of compiling such lists, since Sen himself has emphasized the need to be flexible and always to compile such lists for a specific context, place and space, thereby avoiding theoretical or a priori listings. Indeed, this very flexibility of Sen’s contribution, and its degree of internal pluralism, are undoubtedly among the things that have allowed researchers to apply the theory productively.

On this basis, Nussbaum (1995, 2000, 2003 and 2005) and Robeyns (2003 and 2006) have drawn on Sen’s theory to analyse differences in capabilities between men and women, thus building on the many efforts that have been made to complete, operationalize or specify the list of capabilities. Alert to the output of feminist theory, these authors have recognized that gender hierarchies, the private-public dichotomy and the inclusion and exclusion criteria of the structure of the rights that go to form citizenship have resulted in women being disadvantaged in public participation, in systems of political representation and in the possession of rights. They are confined primarily to the domestic world, where biological and social reproduction practices are also situated, and their experiences and problems are not usually considered proper subjects for collective decision-making, requiring mediation by the position of their partners (Goldthorpe, 1983). Thus, their prime responsibility for care tasks continually subjects them to the decisions and needs of others, diminishing their freedom. A social order structured around this sexual division of labour and representations of the female and the male deprives women of opportunities to develop their capabilities, something that is reflected in the different functionings of men’s and women’s capabilities.

One of the most thorough attempts to fix a universal list of capabilities is that undertaken by Nussbaum, who

<sup>4</sup> See Clark (2005) for a summary of critiques of the concept and its extended applications.

<sup>5</sup> For example, not all individuals will choose to apply their capabilities in the same way even if they have the same resources and capabilities, and will therefore not have the same functionings. The setting individuals live in and the limitations this imposes, and their own decisions—their capacity for agency, i.e., in Sen’s language, the capacity of “someone who acts and brings about change, and whose achievements can be judged in terms of her own values and objectives” (Sen, 2001, p. 19)—also bring major variations in the exercise of freedom.

has drawn up a list of 10 separate but closely related components that ought to be assured if a person is to be able to exercise freedom and attain well-being: (i) life; (ii) physical health; (iii) physical wholeness; (iv) senses, imagination and thoughts; (v) emotions; (vi) practical reason; (vii) affiliation; (viii) relationship with other species; (ix) recreation; (x) political and material control over their own environment (Nussbaum, 1995, 2000, 2003 and 2005). In the context of the same discussion, Robeyns, also working on the basis of Sen's theory, proposes eight components for studying capabilities: (i) life and physical health; (ii) mental well-being, bodily

integrity and safety; (iii) social relations; (iv) political empowerment; (v) education and knowledge; (vi) domestic work and non-market care; (vii) shelter and environment; (viii) mobility (Robeyns, 2003 and 2006). The contributions of these two authors are currently considered the most advanced in this field, but there is a fundamental difference between them. Nussbaum, true to the moral philosophy tradition, sought to draw up a list that could be valid in more than one context, while Robeyns has systematically sought to apply the list in accordance with the characteristics of specific countries, without seeking to "export" it to other situations.

### III

## Capabilities and functionings: from theory to measurement

A great deal has been written about the difficulties involved not only in defining capabilities in accordance with the type of analysis intended, but especially in measuring them. The empirical measurement of capabilities has been the subject of wide-ranging debate since the 1980s (Anand, Hunter and Smith, 2005), synthesized by the United Nations in the form of the human development index (HDI). Measurement has been carried out in a variety of countries by dint of adaptations and innovations in the measures (Martinetti, 2000). One of the cruxes of the debate is the data available, which are often secondary and thus somewhat removed from the original approach (Anand, Hunter and Smith, 2005; Robeyns, 2006). Furthermore, most of the empirical applications of the capability approach have been carried out in countries of the North, especially the United States and Europe (Alkire, 2002; Burchardt and Zaidi, 2003; Van Hees, 2004; Kuklys, 2005; Layte, Nolan and Whelan, 2000; Qizilbash, 1996; Schokkaert and Van Ootegem, 1990, among others). There have been few empirical applications or measurements of capabilities in countries of the South (Clark and Qizilbash, 2005, on South Africa) or in the developing countries (Majumdar and Subramanian, 2001, for India).

One of the greatest difficulties in empirical work, which has also been an issue for this study, is to distinguish between capabilities and functionings, since with real data this theoretical distinction becomes more tenuous (Anand, Hunter and Smith, 2005). With much of the data used in this field, including those used in this paper, both

capabilities and functionings have been approached by means of questions, either about what people do (e.g., whether they vote or not, their education level) or about their opportunities (to continue studying, travel, etc.).

Setting out from Sen's capability concept, its adaptations to gender theory and the analysis of Fraser's four dimensions of gender injustice, this paper elaborates capabilities that are meant to be sensitive enough to capture the factors generating inequality between men and women and affecting women's freedom to develop their capabilities and bring about various improvements. Thus, four categories of capabilities are defined to compare men and women individually: material capability, social capability, cultural capability and political capability.

By the concept of material capability is meant here the individual ability to obtain resources autonomously and to use systems of social security to cope with situations of material vulnerability and risk resulting from ageing and health problems.

The concept of social capability refers to social resources that individuals can mobilize to increase their well-being (by accessing material and symbolic resources, for example) or deal with negative eventualities.

The concept of cultural capability alludes to the resources available to subjects to enable them to understand their environment and reflect critically on their lives and on society.

Lastly, political capability means people's ability to participate in and influence the political decisions that affect their own lives and the whole community.

Thus defined, capabilities provide people with the resources they need to consolidate their material independence, develop a critical understanding of reality, build social trust and relationships and, lastly, participate in collective political and institutional

decision-making. They are thus factors in the degrees of autonomy and security people have when it comes to taking decisions about their individual and collective welfare and anticipating situations of future vulnerability in four major areas of life.

## IV

### Data, construction of tools and methods

#### 1. The 2009 National Social Stratification Survey (enes)

This study uses data from the National Social Stratification Survey (ENES) of the Desigualdades project to measure social mobility and stratification using both traditional variables and others that are not available from the instruments normally used to study social stratification in Chile, such as household surveys (National Socioeconomic Survey (CASEN)). ENES was applied between May and August 2009<sup>6</sup> to a sample of 6,153 individuals (3,141 women) in 3,365 households. The sample is representative of the Chilean population aged 18 and over,<sup>7</sup> as it has a random design with stratified (by region and zone)<sup>8</sup> three-stage cluster sampling, involving the selection of blocks, households and individuals, with an estimated error for individuals nationally of 1.3%, considering maximum variance and a confidence level of 95%. In each household, sociodemographic information was obtained for the whole household and each of its members. Up to three household members over 18 were interviewed, including the main earner, the main earner's partner (if any) and another or other eligible subject(s) chosen at random. Interviews were conducted in person by a professional interviewer. The instrument comprises 12 modules that collect information on social and territorial identification, religion and travel, work, assets, education, social mobility, social capital, political position and participation, values, and personal and family situation. A subset of 5,443 ENES observations was used for this study, as individuals declaring themselves retired or disabled were not eligible for the analysis.

<sup>6</sup> Survey conducted in the field by Statcom Estadísticos Consultores Ltda.

<sup>7</sup> Universe of 11,965,900 people as of June 2008, according to National Institute of Statistics (INE) population projections.

<sup>8</sup> There are 45 strata: 15 regions and 3 zones (urban centres, other urban, rural). The design excludes Easter Island and Juan Fernández.

#### 2. Concepts and measurements

On the basis of the empirical and theoretical material presented and a selection of variables included in ENES, indices were constructed to measure four specific capabilities: material capability, cultural capability, social capability and political capability. These indices combine a large amount of individual information, including conditions, practices or behaviours, and attitudes, making it possible to reduce the dimensionality of the problem and construct more parsimonious models. Their conceptual definition will now be summarized and details of their construction presented.

Returning first to the concept of "material capability",<sup>9</sup> it should be recalled that this refers to individuals' ability<sup>10</sup> to obtain resources autonomously and use systems of social security to cope with situations of material vulnerability and risk resulting from ageing and health problems. This is an important concept for those of working age not declaring themselves retired, a group represented by 5,443 observations in the sample and by the subset of observations that will be used in the analyses which follow. Material capability is measured by a three-category ordinal index distinguishing between individuals with low material capability (32%), who are not employed and have no assets,<sup>11</sup> those with medium

<sup>9</sup> To return to a point discussed earlier, material capability is the only measure which deals not with an attainment but with an outcome.

<sup>10</sup> This is not to deny that there are people who acquire a substantial financial capital because of their household situation irrespective of their individual capabilities, as may happen in the case of a housewife married to someone with a high income. Thus, it is possible to obtain a substantial material capability without formal work or assets through a marital relationship, children or the extended family. However, the decision to work with individual capabilities focuses the analysis on what is obtained autonomously without transitivity vis-à-vis other people and can therefore withstand changes in a person's family situation or ties to others.

<sup>11</sup> Such as a partnership in a business, ownership of rental properties, cattle, machinery, etc.

material capability (29%), who have a job or asset but no social security,<sup>12</sup> and those with high material capability (39%), who have a job or assets and social security as well. It should be emphasized that this measurement is independent of the household's income level or living standards. Thus, two people with different incomes may fall into the same material capability category, as will be seen further on. The advantage of this for the purposes of the present study is that it can be used to describe women's material autonomy, irrespective of their employment position and of the living standards of the household they belong to, thus helping to resolve one of the problems in measuring inequality as it affects women.

The concept of "cultural capability", in turn, refers to the resources subjects have available to them for understanding their environment and reflecting critically on their lives. It is measured by an index that combines, first, the years of education and knowledge of a foreign language dimensions (low, medium and high), with a weighting of 0.3 apiece in the overall scale, and second, the frequency of travel abroad and the number of courses undertaken outside of formal education or for training purposes, with these dimensions having a weighting of 0.2 apiece.

The concept of "social capability" refers to social resources individuals can mobilize to increase their well-being (e.g., access to material and symbolic resources) or to cope with negative eventualities, as shown by network theory (Granovetter, 1973; Porras and Espinoza, 2005). It is measured by an index that combines: the diversity of personal networks, given by the number of acquaintances an individual reports from a set of 12 different occupations; associative participation, given by active participation in at least one association; and two attitudes: community engagement and interpersonal

trust, variables that are latent or not directly observable and that consequently require special treatment.<sup>13</sup>

What is considered for the "political capability" concept, lastly, is people's ability to participate in and influence the political decisions affecting their lives. This is measured by an index combining: registration on the electoral roll declared by the respondent; level of political knowledge, given by the number of correct answers to basic questions about politics;<sup>14</sup> and attitudes: trust in political institutions, tendency to discuss and seek information about politics and willingness to engage in political activities, the measures for which were constructed by the same method as was used for the latent variables of the social capability index.

Table 1 shows the descriptive statistics<sup>15</sup> for the capability measures constructed.

<sup>13</sup> These attitudes were measured using scales defined by exploratory factor analysis (FA), i.e., with groups of items that were clearly allocated by a theoretically interpretable factor. For this model, use was made of a set of 10 items whose purpose was to ascertain the frequency of activities carried out for the benefit of the community and the degree of trust in different people, all with quasi-metric response scales. To obtain this measurement model, AF with principal components extraction and oblique rotation (*oblimin*) was used, on the theoretical assumption that all the resulting factors ought to be correlated. In addition, mean imputation was carried out for items with missing information to minimize sample loss by list. A solution was obtained with two factors that could be interpreted as community engagement and trust, respectively. The community engagement scale grouped six items with factor weights of between 0.60 and 0.75 and presented a Cronbach's alpha of 0.75, indicating that the scale had an adequate level of internal consistency or reliability. The interpersonal trust scale grouped four items with factor weights of between 0.67 and 0.85 and had a Cronbach's alpha of 0.79. The regression method was then used to obtain factor scores assigning a summary measure of each attitude to each observation on a continuous scale. To construct the final social capability measure, its four dimensions were combined with equal weightings (i.e., 0.25 each) into an index theoretically ranging from 0 to 100. This index presents a mean of 29 points with a standard deviation of 17, for 5,443 valid observations.

<sup>14</sup> Specifically: correctly identifying the election mechanism for the regional government and governors, and identifying the names of authorities (mayor, governor and interior minister).

<sup>15</sup> Sample weighting (standard expansion factor) has been used in all calculations to ensure that the statistics are representative of the universe studied.

<sup>12</sup> For present purposes, having social security means paying into a pension system and having access to a health system.

TABLE 1

## Descriptive statistics for the capability measures

	Number of observations	Minimum	Maximum	Mean	Standard deviation
Cultural capability	5 428	0	79.43	21.08	13.54
Political capability	5 443	2.31	94.5	32.75	14.98
Social capability	5 209	0.65	97.23	28.7	16.85

Source: National Social Stratification Survey (ENES), 2009.



### 3. Models and control variables

To ascertain the effect of sex on the capability measures constructed, use was made of analytical techniques appropriate to their measurement levels, with adjustments in successive models that took each of the capabilities as dependent variables.

A multcategory logit model was used to study the relationship of sex to material capability; what was estimated in this case was the relationship between the likelihood of response of an ordinal dependent variable and a set of categorical and continuous explanatory variables. The response variable was the logarithm of the odds of an alternative in relation to a reference category. The exponent of the additive parameters of the model predictors was taken to obtain multiplicative parameters, which can be interpreted as the geometrical mean of the increase ( $\beta_i > 1$ ) or decrease ( $\beta_i < 1$ ) in the odds of a category of the dependent variable in relation to the reference category (for example, odds of material capability below the mean), controlling for all the other model factors. The further these parameters are from 1, the stronger the effects (with 0 as the lower limit), while parameters close to 1 indicate an absence of effect (Billiet, 1995). Because the response variable has three categories for each continuous predictor, two parameters are estimated, and for each categorical predictor twice the number of categories minus 1.

The relationship between sex and cultural, social and political capability was studied with three respective models. The technique used was linear regression (ordinary least squares). In this type of model, the parameters ( $\beta$  in

tables 6, 7 and 8 below) are interpreted as the change in outcome (capability in this case) related to a change of one unit in a predictor, controlling for all the other model factors. When a predictor is categorical, its parameter is interpreted as a change in the outcome associated with a category by contrast with a reference category. The standardized  $\beta$ 's can be used to compare the size of the effect across independent variables. In this case, possible interactions between sex and other predictors were tested using a method of reverse elimination of effects.

Together with sex, included as the dummy variable *female* (51.4%), the following were included as independent variables in the adjusted models (both logit and regression) on the basis of theoretical considerations: *age last birthday*; *children < 18*,<sup>16</sup> indicating whether the respondent has children who are minors (51.1%); *rural*, indicating whether the respondent lives in a rural area (13.1%); *socioeconomic level*, which is the household's score based on the availability of goods and education level of the main earner,<sup>17</sup> indicative of living standards. To explain each specific capability, furthermore, all the other capabilities were included as predictors. This made it possible to determine the net effect of sex on each capability, controlling for a set of sociodemographic variables and other capabilities assumed to be relevant. Table 2 summarizes the statistics of these variables.

<sup>16</sup> The fact of having children under 18 is important, as one of the fundamental hypotheses of studies in the field is that this particularly affects women's capabilities and autonomy.

<sup>17</sup> According to the matrix of the International Marketing Association (IMA).

TABLE 2

Summary statistics for the variables used

	Number of observations	Mean	Standard deviation	Minimum	Maximum
Female	5 443	0.51	0.50	0	1
Q84: Age last birthday	5 443	39.51	14.45	18	93
Children < 18	5 443	0.51	0.50	0	1
Socioeconomic level 2008 (score)	5 230	354.02	243.76	0	1 000
Rural	5 443	0.13	0.34	0	1

Source: National Social Stratification Survey (ENES), 2009.

# V

## Findings

### 1. Differences observed

A straightforward review of the sex differences observed in the capability measures constructed suggests that women are in a situation of disadvantage in every one of them. To start with, women evince a significantly lesser

material capability than men. In this case, the size of the sex effect as measured by the Gamma statistic can be considered large, as indicated in table 3.

Secondly, as indicated below, the cultural, social and political capability of women is observed to be significantly lower than men's on average; the size of the effect is small, however.

There will now be an analysis of the extent to which these observed differences are maintained when the sex-capabilities relationship is modelled, controlling for a number of factors that are assumed to be relevant. In adjusting these models (logit and linear regressions), the calculation of standard errors associated with the parameters of the predictors took account of the stratified cluster sample design used to select ENES participants.

TABLE 3

**Material capability, by gender**  
(Percentages)

Material capability	Male	Female	Number of observations
Low	18.3	45.3	1 750
Medium	28.9	28.2	1 552
High	52.8	26.5	2 137
<i>Total</i>	<i>100.0</i>	<i>100.0</i>	<i>5 439</i>

Source: National Social Stratification Survey (ENES), 2009.

$\chi^2 = 545.52$ ;  $df = 2$ , \* $p < 0.000$ ; Gamma =  $-0.49$ .

### 2. Net effects

Table 5 presents the material capability model.

TABLE 4

**Differences between men and women in average cultural, social and political capabilities<sup>a</sup>**

	Male average	Female average	t-statistic	Degrees of freedom (df)	Significance (bilateral)	Pearson's correlation coefficient ( <i>r</i> )
Cultural capability <sup>b</sup>	23.9	20.4	9.32	4 814.9	0.00	0.13
Social capability <sup>b</sup>	30.4	27.1	7.45	5 371.2	0.00	0.10
Political capability <sup>b</sup>	33.8	31.7	5.10	5 338.0	0.00	0.07

Source: National Social Stratification Survey (ENES), 2009.

<sup>a</sup> Equality of variance is not assumed.

<sup>b</sup> Does not meet the normality assumption. The non-parametric test yielded similar results.

TABLE 5

**Material capability model**  
(Multiplicative parameters)

Predictor	Below average capability	Above average capability	Chi-square (degrees of freedom)
(Constant)	0.710	2.347**	72.15** (2)
Female (reference: male)	2.851***	0.524***	510.82** (2)
Age in years	0.986**	0.991	21.24** (2)
Children < 18 (reference: none)	0.545***	1.260	124.04** (2)
Socioeconomic level	1.000	1.001***	46.23** (2)
Rural area (reference: urban area)	1.034	0.682	15.60** (2)
Cultural capability	0.988	1.012*	36.65** (2)
Social capability	0.985**	0.990**	38.17** (2)
Political capability	0.996	1.010**	20.87** (2)

Source: National Social Stratification Survey (ENES), 2009.

Cox and Snell's pseudo  $R^2 = 0.188$ , Nagelkerke's pseudo  $R^2 = 0.212$ ; \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .

These findings reveal that the female variable presents the greatest correlation even after controlling for the effects of the other variables. The effect is significant, operates in the expected direction (i.e., to women's disadvantage) and can be considered moderate. According to the parameters, women are on average three times as likely as men to be in the low material capability category as opposed to the medium one, and half as likely to belong to the high material capability category as opposed to the medium one. Having children under 18 is the second most important variable in the model. This situation almost doubles the likelihood (1/0.55) of having medium versus low material capability, while living in a rural area reduces by a third the likelihood of having high as opposed to medium capability (1/0.68). The remaining predictors, particularly socioeconomic level and other capabilities, present weak relationships with material capability, i.e., the parameters are very close to 1, although they are statistically significant on occasion.<sup>18</sup>

Table 6 presents the cultural capability model.

In the cultural capability model, it is observed that when the other variables are controlled for, the fact of being female reduces cultural capability by an average of 0.7 points; however, this parameter is not statistically significant ( $p = 0.23$ ). In this model, the

most important of the explanatory variables significantly related to cultural capability prove to be socioeconomic level, with a positive correlation, age, which presents a non-linear negative relationship, and social capability, with a positive association. No evidence was found for major interactions between the fact of being female and other predictors.

Table 7 shows the social capability model.

Here it is observed that when the rest of the explanatory variables are controlled for, women's social capability is just over a point lower, but as in the previous case this effect is not statistically significant ( $p = 0.18$ ). In this model, the most important effects are those of cultural and political capabilities, as the standardized coefficients suggest. Again, no evidence was found of major interactions between the fact of being female and other predictors.

Table 8 presents the political capability model.

In this model, by contrast with what was seen in the explanation for cultural and social capabilities, being female has a negative and statistically significant effect ( $p = 0.023$ ), i.e., on average women score over a point less than men on the political capability index. When the standardized coefficients are compared, it is seen that age is the most important predictor in this model, followed by socioeconomic level and social capability. Confirming previous observations, no significant interactions were found between sex and other explanatory variables.

To sum up, this exercise has partially confirmed the hypotheses of the present study about the relationship between gender and capabilities. The relationship between being female and a lesser material capability is shown to

<sup>18</sup> This happens when a high value is obtained for the Wald statistic used to test the contribution of each predictor. That statistic is calculated as the square of the ratio between the additive parameter of each predictor and its standard error, on the assumption that it follows a chi-square distribution (Garson, 2011).

TABLE 6

**Cultural capability model**

Predictor	$\beta$	Linearized standard error	Standardized $\beta$
(Constant)	22.73	0.83	
Female (reference: male)	-0.68	0.56	-0.02
Age in years	-0.25	0.02	-0.26***
Age <sup>2</sup>	0.00	0.00	0.05*
Children < 18 (reference: none)	-1.24	0.69	-0.05
Socioeconomic level	0.03	0.00	0.49***
Rural area (reference: urban area)	-1.47	0.56	-0.04**
Social capability	0.15	0.02	0.18***
Political capability	0.07	0.02	0.08**
Low material capability	-0.81	0.56	-0.03
High material capability (Reference: medium material capability)	1.51 22.73	0.61	0.05*

Source: National Social Stratification Survey (ENES), 2009.

$R^2 = 0.46$ ; \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .

TABLE 7

**Social capability model**

Predictor	$\beta$	Linearized standard error	Standardized $\beta$
(Constant)	31.28	1.06	
Female (reference: male)	-1.18	0.88	-0.04
Age in years	-0.05	0.04	-0.05
Children < 18 (reference: none)	-1.13	0.85	-0.03
Socioeconomic level	0.01	0.00	0.09**
Rural area (reference: urban area)	3.70	2.03	0.07
Cultural capability	0.33	0.04	0.27***
Political capability	0.25	0.04	0.22***
Low material capability	-3.51	1.00	-0.10***
High material capability (reference: medium material capability)	-2.45	0.94	-0.07**

Source: National Social Stratification Survey (ENES), 2009.

$R^2 = 0.19$ ; \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .

TABLE 8

**Political capability model**

Predictors	$\beta$	Linearized standard error	Standardized $\beta$
(Constant)	34.98	0.95	
Female (reference: male)	-1.40	0.61	-0.05*
Age in years	0.60	0.02	0.58***
Age <sup>2</sup>	-0.01	0.00	-0.19***
Children < 18 (reference: none)	-0.01	0.68	0.00
Socioeconomic level	0.01	0.00	0.17***
Rural area (reference: urban area)	0.21	1.57	0.00
Cultural capability	0.10	0.04	0.09**
Social capability	0.16	0.03	0.17***
Low material capability	0.36	0.89	0.01
High material capability (Reference: medium material capability)	1.17 34.98	0.89	0.04

Source: National Social Stratification Survey (ENES), 2009.

$R^2 = 0.38$ ; \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .

be an important effect even after controlling for significant sociodemographic variables and other capabilities. When this exercise is repeated with cultural and social capability, the correlation observed initially, while it retains its direction, tends to zero and is not statistically significant. Again, the negative effect of being female on political capability is reduced substantially when controls such as age, socioeconomic level, household characteristics and other capabilities are introduced into the model; nonetheless, it remains statistically significant. Thus, there is evidence for a net effect of sex on these capabilities to women's detriment, but it is weak compared to the magnitude of the significant parameters of variables such as age, household socioeconomic level and social and cultural capabilities. Lastly, and against expectations, no evidence was found of interactions between sex and other predictors of capabilities, i.e., the functioning of

the explanatory variables studied is apparently stable between men and women.

### 3. Discussion and conclusions

The findings bear out the core hypothesis of this study that women's capabilities are less developed than men's in the case of material and political capabilities, while the relationship between gender and cultural and social capabilities, although operating in the expected direction, is not sufficiently strong. These capabilities were measured using indices especially developed from the variables in the 2009 National Social Stratification Survey (ENES), which were applied within the framework of the Desigualdades project. Each of the indices combined a large amount of individual information, including conditions, practices or behaviours, and attitudes, and this made it possible to

produce a more complex picture of the way differences between women and men are expressed, while at the same time reducing the dimensionality of the problem by constructing more parsimonious models.

Women evince a significantly lower material capability than men, which, by definition, means a lesser ability to obtain resources autonomously and use systems of social security to deal with situations of material vulnerability and risk deriving from ageing and health problems. The relationship between being female and material capability proves important even after controlling for major independent variables and the influence of other capabilities. These findings, which show women to be overrepresented in the low and medium material capability categories, reveal the structuring role of the gender relationship entailed in the sexual division of labour, which assigns women almost exclusive responsibility for domestic and unpaid care work and men the responsibility of providing for the household. This places women in a situation of dependence on the incomes and probably the choices of others.

In the explanatory models for social, cultural and political capability, female disadvantage persists after controlling for a set of explanatory variables, albeit exceptionally to a significant degree, in sharp contrast with women's much lower material capability. There are possible explanations for this: measurement of material capability refers to women's and men's potential for autonomy irrespective of the functionings attained, by contrast with the situation for the other capabilities, where it was harder to differentiate capabilities from functionings. This finding also makes sense from the viewpoint of gender theory, which postulates that the separation of private and public spaces and the sexual division of labour constitute the structural basis of the gender order and are particularly stable and resistant to changes over time, such as the greater access to education and public spaces that women now enjoy.

The weak correlation between the fact of being female and cultural capability is consistent with the findings of the studies by ECLAC, the Women's Studies Centre and the National Institute of Statistics (INE), which are at one in showing that sex divides have narrowed most

significantly in the field of education over the past 20 years. In fact, women entering the labour market now have higher levels of education than men.

Measures of social capability —social resources that individuals can mobilize to increase their well-being or cope with negative eventualities— indicate a very slight disadvantage for women as compared with men. This finding could be due to the survey encompassing the forms of social life found in both rural and urban areas: community networks are more stable in the former, while in the case of the latter the most recent Human Development Report for Chile dealing with gender issues (UNDP, 2010) showed that women had expanded their social networks over the past 20 years as a result of individuation processes associated with the country's modernization.

It is interesting that political capability is the other capability for which women are at a significant disadvantage. Just as the sexual division of labour and the separation of production spheres account for women's lesser material capability, cultural representations of men's and women's capabilities and fields of action and the coexistence of a twofold political and family authority over women reveal the cultural roots underlying this difference. Representations assign the spheres of politics and national decision-making to men and spheres of a more social or family character to women. These representations are interiorized and shape men's and women's motivations and expectations in the field of politics. At the same time, from an institutional perspective, a number of studies have revealed the mechanisms used to discourage women from participating in politics. In short, the results taken together show how the development of capabilities is the outcome of complex systemic processes relating to women's and men's positions within the social relationships that configure the gender order. Some of the positions occupied by women and men are resistant to change, as they constitute the structural bases of the gender order; others are more subject to the effect of different variables and ongoing social transformation processes, such as modernization and the individuation processes associated with it.

*(Original: Spanish)*

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# Determinants of educational performance in Uruguay, 2003-2006

*Cecilia Oreiro and Juan Pablo Valenzuela*

## ABSTRACT

Students' performance at the lower secondary level in Uruguay is examined on the basis of the mathematics scores compiled by the Programme for International Student Assessment (pisa) for 2003 and 2006. An effort is made to analyse the differences in score distributions, to identify the variables influencing students' performance and to trace the trends over that period and weigh their significance. In order to do so, a production function for educational achievement is defined and a number of different decomposition methodologies are applied. The findings indicate that the small increase in scores between 2003 and 2006 is the net result of differing changes, most of which are primarily the result of an across-the-board increase in the school system's efficiency, especially in the case of public schools. However, this improvement is partially offset by reduced resource endowments and, in particular, unfavourable socioeconomic and cultural conditions in many of the students' households. Most of the changes that are analysed in this study are found to be of a redistributive nature.

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## KEYWORDS

Education, quality of education, measurement, evaluation, secondary education, public schools, private schools, Uruguay

## JEL CLASSIFICATION

D39, I24, O38

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# I

## Introduction

This study's objective is to analyse the status of basic secondary education in Uruguay and to identify the reasons for the differences observed between students' scores on the mathematics portion of the test administered by the Programme for International Student Assessment (PISA) in 2003 and 2006.

Since the year 2000, the PISA test has been administered to students aged 15 (regardless of what grade they are in) in the member countries of the Organisation for Economic Cooperation and Development (OECD) and in a number of partner countries. The results can be used to examine how students' performance varies depending on the grade that they are in, which provides an indicator of how much they learn as they move up from one grade to the next.

The study will look specifically at the mathematics test results because this was the main focus of the 2003 assessment, which is the only one that can be used as a comparison with the 2006 results. The objectives of this analysis are to establish whether significant differences exist between the PISA scores for 2003 and 2006, identify the factors (characteristics of the students, features of the schools or institutional variables) that account for differences between the scores for those two years, and determine whether such differences are attributable to

variations in the magnitude of those factors, in how "efficiently" they have been used, or both.

In line with Valenzuela and others (2009a), a number of different methods for decomposing score differentials are used, including those of Oaxaca (1973), Blinder (1973) and Juhn, Murphy and Pierce (1993). An analysis based on microsimulations of the type outlined by Bourguignon, Fournier and Gurgand (1998) is also undertaken.

The potential contribution of this study to the economic and social development of the Latin American countries lies in the possibility it offers to draw conclusions about the quality of the education system and its heterogeneity which will be useful in identifying avenues for improvement. The PISA test can be used as a tool for comparing progress in Latin America with the advances being made in the developed world and with those taking place in other countries of a similar level of development. In addition, the use of decomposition techniques that are not widely applied in the field of education paves the way for a methodological approach that can be highly useful in gaining a better understanding of trends in educational achievement and that can be replicated in other school systems in the region, as well as being used for comparisons across countries.

This article is structured as follows. Background information that provides a frame of reference for the study is given in section II, while the methodology used for the analysis is described in section III. Section IV reports on the results, which are then compared in section V. Section VI concludes.

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□ This study is based on a Master's thesis written for the School of Economics and Business of the University of Chile, January 2011. The authors are grateful for the valuable assistance received from Alejandro Sevilla.

# II

## Background

### 1. The social and economic context

Historically, Uruguay has had one of the lowest levels of inequality and one of the lowest poverty rates in Latin America. Until the mid-1990s, its per capita income was rising, income distribution was fairly stable, and

poverty was on the decline (Amarante and Perazzo, 2008). In the second half of that decade, income levels began to descend and income concentration increased slightly, while poverty levels began to rise. In 1999, the first signs of a recession began to appear, and by 2002 the country was in the midst of a deep economic crisis.

All the economic variables worsened, there was a steep drop in GDP and per capita income, income distribution became more unequal, and poverty rates climbed sharply.

As the crisis was brewing, international emigration increased to a striking level. The country's negative migration balance is estimated to have amounted to 100,000 people in 2000-2004 and to 26,000 between 2005 and 2006 (Pellegrino and Koolhaas, 2008). A majority of the Uruguayans who emigrated were between 20 and 29 years of age. Most were males with an above-average level of education. In addition, a large proportion of the emigrant population was composed of entire family groups.

The level of economic activity in the country began to rebound in 2003 and gathered steam in 2004-2006, which proved to be a period of rapid economic growth. This recovery was not mirrored in the trend in household income until late 2005, however, and it was not until 2006 that significant reductions were seen in indigence levels, the poverty rate and poverty intensity (UNDP, 2008).

## 2. Education in Uruguay

The compulsory basic education cycle in Uruguay is nine years in length: six years of primary education and three of basic secondary education. Both academic secondary schools (*liceos*) and vocational schools use the same curriculum. Academic secondary schools are run by the Secondary Education Council (CES), while technical schools are administered by the Council for Technical and Vocational Education (CETP). The second cycle of secondary education is also three years in length and leads to a diploma known as a "diversified baccalaureate" if the student has attended an academic secondary school, and to a degree known as a "technical baccalaureate" if the student has attended a vocational school. CETP also offers basic training and basic vocational instruction, in addition to advanced occupational training.

The economic recovery that came in the wake of the 2002 crisis was coupled with a slight rise in the private-school enrolment rate. This increased private schools' share of total enrolment at that level, but the traditional pattern, in which public schools have predominated, remained intact (Cardozo, 2008). This growth phase came to an end in 2004. Enrolment in secondary education fell in 2004 and 2005 and remained steady in 2006. The decline registered in 2004 reflected lower enrolment in public schools, whereas the number of students in vocational and private schools rose. In 2005, enrollment also fell in vocational schools but rose for the second year running in

private schools. Nonetheless, the overall rate was lower once again. The decrease in the total enrollment rate in 2003-2005 is attributable to a reduction in the number of students completing their primary education and to international emigration (ANEP, 2007a).

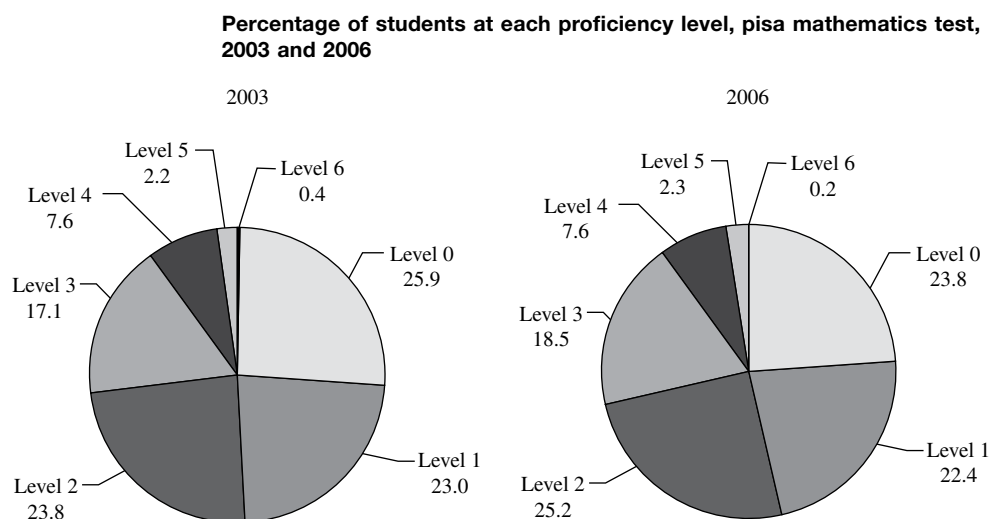
A comparison of the number of persons who should have been attending school with the number of persons who actually did attend yields a more accurate measurement of the extent of educational coverage in each sector. The secondary-school attendance rate for 15-year-olds in 2006 was 79.7%, which is a gain of five percentage points over the attendance rate in 2003. This increase is a reflection of an upturn in rural coverage, which climbed from 51.8% to 69.2% during that time period, while urban coverage (towns with a population of over 5,000) held steady (ANEP, 2007b).

Uruguay participated in the 2003 and 2006 PISA exams. Its students obtained some of the highest scores in Latin America, but performed considerably less well than students in OECD countries. Uruguay's performance was also one of the most uneven of all the participating countries —far more unequal than the OECD countries as a group and even, in 2006, more so than the other countries of the region (ANEP, 2004 and 2007b).

Between 2003 and 2006, Uruguay's average score on the PISA mathematics test rose from 422.2 to 426.8 score points (an increase of just 1.1%, which is not statistically significant). The question arises, however, as to whether this change in the average score from one period to the next might be the result of shifts in opposite directions in different social and institutional variables. The question as to whether given factors are generating movements in different directions and of different magnitudes will be explored by using methodologies that make it possible to decompose the effect of each relevant factor.

The PISA test results are also presented in an ordinal classification of academic performance. For the mathematics test, six proficiency levels are identified. Figure 1 shows the percentage of students at each of those levels in 2003 and 2006. As can be seen from the graph, 49% of Uruguayan students were below level 2 in 2003 (i.e. their level of proficiency is not sufficient to enable them to use mathematics in their daily lives). This means that they also run a high risk of being unable to participate fully in civic affairs or to gain entry to many of the occupations associated with an information- and knowledge-based society. Another 48.5% were at intermediate levels (2, 3 and 4), while only 2.6% were rated at the top two levels (5 and 6). These last two levels equate with highly developed mathematics skills relative

FIGURE 1



Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

to the students' age and identify the group of students for which the educational system has performed the best. A comparison of the students' performance on the 2006 and 2003 tests shows that the percentage of students at the lowest proficiency levels fell by 2.8%, while the percentage at the intermediate levels rose by 2.8%;

the percentage of students at the top levels remained virtually the same. This appears to signal an upward progression, but such a gradual one that, if this trend were to remain constant, it would take half a century before no Uruguayan student was scoring at the lowest levels of proficiency in mathematics.

### III

## Methodology

#### 1. General methodology

##### (a) Production function

The first step in determining the methodology to be used is to define a production function that relates each student's PISA score to a set of explanatory variables (socioeconomic variables relating to the student and his or her family, as well as school-related variables and institutional factors):

$$Y_i^t = X_i^t \beta^t + \varepsilon_i^t \quad (1)$$

where  $Y_i^t$  denotes the score achieved by student  $i$  in a given school at time  $t$ ;  $X_i^t$  represents the observable

characteristics of the student, the school and institutional factors;  $\beta^t$  corresponds to the estimated coefficients for the various control variables;<sup>1</sup> and  $\varepsilon_i^t$  is the error term, which is assumed to have a standard distribution with zero mean and a variance of  $\sigma_\varepsilon^t$  and to be independent of the exogenous variables of the model.

<sup>1</sup> Because of the way in which the PISA test results are expressed, the coefficients are estimated using five plausible values, which means that the regressions have to be estimated five different times, after which the mean for the estimates has to be calculated in order to arrive at the statistical value. The variance is adjusted for each estimate and for the whole distribution.

The variables that were selected for use in the statistical analysis are shown in table A.1 of the annex;<sup>2</sup> table A.2 lists the main descriptive statistics.

## 2. Imputation methodology

Given the large percentage of data that are missing for the PISA exam,<sup>3</sup> a way has to be found for dealing with the affected observations. Ammermüller (2004) states that the usual approach is to eliminate an observation from the regression if the value for any of the explanatory variables is missing. This greatly reduces the number of observations that can be used to arrive at estimates, however.<sup>4</sup> In addition, it generates a selection bias in the sample if the distribution of omitted values is not random.

In line with Valenzuela and others (2009a), the method used here consists of imputing the value of the median for a similar subgroup (i.e. a group having similar values for the different control variables), so that the observations for which data are imputed belong to fairly homogenous subgroups. The control groups used to define these subgroups are gradually reduced so as to eventually impute all the observations for which data are missing.<sup>5</sup>

When working with data that display a significant degree of variability, whether in the scores in each case or in the values that are imputed because data are missing, simply applying the mean values may result in the omission of the level of uncertainty of the measurement. This can distort the estimates of standard errors calculated for the parameters, which is particularly a problem in the case of effects that are near the significance limit. The calculation of standard errors thus includes the weightings for 80 balanced repeated replications (BRRS) in the database, with the Faye correction (0.5). These standard errors provide the degree of variation for any

statistic with respect to the population parameter, and the replications take account of the survey's complex design (which was conducted in two stages using a stratified sample).

## 3. Decomposition methodology

The methodological approach used here consists of a number of different techniques for decomposing differences in scores: Oaxaca (1973), Blinder (1973), Juhn, Murphy and Pierce (1993) and Bourguignon, Fournier and Gurgand (1998).

The first two methodologies have been applied by Valenzuela and others (2009b) and by Bellei and others (2009) to identify the reasons for the differences in the scores of Chilean students on the 2006 PISA mathematics and reading tests as compared to the scores of students in Poland, Spain and Uruguay. Valenzuela and others (2009a) also used microsimulations to identify explanatory factors for the improvement in 15-year-old Chilean students' scores on the PISA reading test between 2001 and 2006, as well as factors that could help to account for the increased inequality of those scores. These were the main methodological references used in this study.

### (a) *The Oaxaca (1973) and Blinder (1973) decompositions*

The decomposition method proposed by Oaxaca (1973) and Blinder (1973) provides a way to decompose differences in results for two groups of people or for two different years. This decomposition methodology involves three effects. One corresponds to the different results that individuals belonging to the same group may achieve as a consequence of their varying characteristics (the "characteristics effect"). Another corresponds to the differences in the level of efficiency with which the group's members make use of those characteristics (the "return effect"). And, finally, there is a combined "characteristics-return effect".

For the years being considered ( $t$  and  $t'$ ), given a variable for the mean mathematics scores ( $Y$ ) and a set of explanatory variables, the Oaxaca-Blinder approach makes it possible to estimate how much of the difference between mean scores is accounted for by differences in the explanatory variables for each year:

$$R = E(Y_t) - E(Y_{t'}) \quad (2)$$

where  $E(Y)$  represents the expected value for the PISA mathematics scores in a given year.

<sup>2</sup> The selection of variables was based on a number of prior national and international studies, including, in particular, those of Llambí and Perera (2008), Méndez and Zerpa (2009) and Hanushek and Woessmann (2010).

<sup>3</sup> For both tests, the missing data primarily concern the variables corresponding to the schools, with the largest gaps being 4% of the data missing in 2003 for the variable "Percentage of certified teachers" and 3.8% of the data missing in 2006 for the variable "Shortages of qualified mathematics teachers".

<sup>4</sup> Specifically, if the estimates were performed without correcting for the missing data, 461 observations would have to be eliminated from the 2003 sample and 377 would have to be removed from the 2006 sample (i.e. nearly 8% in each case).

<sup>5</sup> The effectiveness of this method, measured as the percentage of matches between the observed variable and the imputed variable for each iteration, works out to 60%, which surpasses the scores for the methodologies applied by Ammermüller (2004) and by Fuchs and Woessmann (2004).

Obtaining estimators by ordinary least squares (OLS) of  $\hat{\beta}_t$  and  $\hat{\beta}_t$  separately for the two samples ( $\hat{\beta}_t$  and  $\hat{\beta}_t$ ) and using  $\bar{X}_t$  and  $\bar{X}_t$  as estimators for  $E(X_t)$  and  $E(X_t)$ , the decomposition can be expressed as:

$$\hat{R} = \bar{Y}_t - \bar{Y}_t = (\bar{X}_t - \bar{X}_t) \hat{\beta}_t + \bar{X}_t (\hat{\beta}_t - \hat{\beta}_t) + (\bar{X}_t - \bar{X}_t) (\hat{\beta}_t - \hat{\beta}_t) \quad (3)$$

In this equation,  $\bar{Y}$  reflects the mean score on the mathematics text for each of the years in which the PISA exam was administered. The first term in the equation corresponds to the effect of the means of the control variables, which are the explanatory variables that have been incorporated into the production function (see equation No. 1), i.e. the variables for students, for schools and for institutional factors. The second term of equation No. 3 corresponds to the effect of differences in the coefficients associated with these observed variables (in other words, the productivity or effectiveness of these factors). The third term reflects the interaction between these two effects (i.e. the characteristics-return effect).

(b) *The Juhn, Murphy and Pierce (1993) decomposition*

Juhn, Murphy and Pierce (1993) applied the Oaxaca-Blinder (1973) methodology on a broader scale, developing a methodology for decomposing changes in the score distribution and for looking at their effects in the various parts of the distribution.

The first requirement of the proposed methodology is to obtain the residual  $\varepsilon_{it}$  as a function of two elements: the percentile in which individual  $i$  is located at time  $t$  in the residual distribution  $\theta_{it}$ , and the residual distribution function for the results in  $t$ ,  $F_t(\cdot)$ . Then, to define:

$$\varepsilon_{it} = F_t^{-1} \left[ \frac{\theta_{it}}{X_{it}} \right] \quad (4)$$

This makes it possible to estimate the score distribution for each year and to separate out the effects of changes in observable characteristics, returns and residuals; to this end, various estimations are performed for each year, and an initial estimation is performed for the regular form of results for each year:

$$R_{it}^{(1)} = \beta_t X_{it} + F_t^{-1} \left[ \frac{\theta_{it}}{X_{it}} \right] \quad (5)$$

A second estimation is then carried out for the results of year  $t$ , while referring to the returns and residuals for year  $t'$ :

$$R_{it}^{(2)} = \beta_t' X_{it} + F_t'^{-1} \left[ \frac{\theta_{it}}{X_{it}} \right] \quad (6)$$

Finally, the regular form for each year can be estimated, but this time with reference only to the residuals for the other year:

$$R_{it}^{(3)} = \beta_t X_{it} + F_t'^{-1} \left[ \frac{\theta_{it}}{X_{it}} \right] \quad (7)$$

This method makes it possible to decompose changes in the inequality of the results into three components: the “characteristics effect”:  $R_{it}^{(2)} - R_{it}^{(1)}$ , the “return effect”:  $R_{it}^{(2)} - R_{it}^{(1)}$  and the “characteristics-return effect”:  $(R_{it}^{(1)} - R_{it}^{(2)}) - (R_{it}^{(2)} - R_{it}^{(1)})$ . The remainder is a “residual effect” that measures variations in inequality that are not explained by any of the other three factors:  $(R_{it}^{(3)} - R_{it}^{(1)})$ .

(c) *Bourguignon, Fournier and Gurgand (1998) decomposition*

Other authors generalize the microsimulations method, using it to understand changes in the total distribution. This methodology was originally developed by Almeida dos Reis and Paes de Barros (1991) in order to analyse labour income inequality. Later, it was extended to the analysis of income inequality and poverty on the basis of total per capita household income. The first study to move in this direction was that of Bourguignon, Fournier and Gurgand (1998), who applied this methodology to decompose changes in household income inequality for Taiwan Province of China.

#### 4. Estimation of the production function and choice of school

The decomposition begins with the estimation of the production function (see equation 1). This function is estimated for each year and for each type of school (public and private) by OLS. The choice between these two types of schools for each student is also modeled using a logit estimation.

A word of caution about the risk of selection bias is called for here. A positive correlation between

the type of school and a student's level of educational achievement may be produced by a selection bias. This bias may be due to the fact that a family's choice of school is an endogenous decision taken as a function of its own characteristics. This possibility needs to be borne in mind when analysing the results.<sup>6</sup>

### 5. Counterfactuals for changes in student characteristics

With this methodology, calculating the characteristics effect entails finding the simulated result for individuals at time  $t$  if, all else remaining constant, characteristic  $k$  of vector  $X_{ki}^t$  has the distribution of time  $t'$ . In line with Valenzuela and others (2009a), different methodologies are used depending on the types of variables involved. In the case of dichotomous variables, we look at the unweighted percentage of cases in which the characteristic is displayed in period  $t'$ , and that datum is simulated in  $t$ . However, possession of the characteristic for period  $t'$  has to be linked to each individual in  $t$ . In order to determine the probability of each individual displaying the observed characteristics, we estimate a probit regression in  $t'$ , which gives us the probability in  $t$  that the characteristic is exhibited, in accordance with the other conditions of  $t'$ . Once these probabilities are placed in descending order, we then look for the cut-off point based on the observed percentage of individuals who have the characteristic in  $t'$ . The categorical variables are simulated by means of a multilogit estimation in  $t'$  and, once again, a probability of possession of the characteristic is assigned to each individual in  $t$ , after which the cut-off point is located on the basis of the observed percentage of individuals that exhibit that characteristic in  $t'$ .

In the case of the continuous variables, this approach involves looking at population groups constructed on the basis of the type of school and the size of the population centre.<sup>7</sup> Using these groups, we look at the minimum number of observations that match from one period to the next in a single group and then use this set of observations to construct quantiles for which the mean per group and quantile can be calculated. Then, using this mean for each year for the variable that is to be simulated, we construct a factor—the relationship

between the mean for year  $t'$  and the mean for year  $t$ —that is a multiple of the simulated variable for each subgroup in the population and quantile.

### 6. Counterfactuals for changes in returns

The microsimulation of educational attainments while introducing changes in the vector of returns (vector of coefficients for the effectiveness of inputs) involves determining the counterfactual results that a student would attain at time  $t$  if, *ceteris paribus*, the returns to those characteristics were to change (i.e. those corresponding to period  $t'$ ). To do so, we have to simulate the results obtained by students at time  $t$  while incorporating the estimated parameters for those returns for period  $t'$  ( $\hat{\beta}^{t'}$ ) while maintaining the same observable and unobservable characteristics and the structure of the school selection procedure for time  $t$ .

### 7. Counterfactuals for changes in school choice

The “choice effect” represents the change that occurs in the distribution of students' scores at time  $t$  if the structure of the selection procedure for period  $t'$  remains constant, with the other conditions corresponding to period  $t$  (i.e. the observable and unobservable characteristics and the returns to those characteristics) being given. In order to do this, we estimate a logit function for each year; a value of 1 (one) is assigned to the case in which a student is enrolled in a public school.

The simulation is for a different school choice and incorporates the estimated parameters ( $\hat{\lambda}_j^{t'}$ ) for period  $t'$ . The procedure for dealing with the error term for this equation consists of calculating a residual as the value of the observed decision (1 for enrolment in public schools and 0 for enrolment in private ones), minus the probability indicated by the logit estimation. A family is deemed to prefer public schools if the probability estimated by means of this simulation is equal to or greater than 0.5; if the value is lower than that, it is assumed that the family chooses a private school. Thus, a structure of school choice for individuals in period  $t$  can be simulated with parameters representing the structure of school choice that correspond to period  $t'$  while all others refer to period  $t$ .

In this simulation, the individuals in period  $t$  can choose a different type of school from the one they actually attend. After simulating the individuals' school choice in period  $t$ , the performance corresponding to the simulated situation is imputed to them. In those

<sup>6</sup> One possible way of dealing with the selection bias is to use the two-step Heckman adjustment. In order to use this method, however, the selection model would have to contain at least one exclusion variable, which was not possible in this study.

<sup>7</sup> In some instances, adjustments have to be made in order to make the simulation more precise, in which case other variables can be used for the population groups as well, such as grade or grade repetition.

cases in which the result of the simulation changes the choice of school, there is no estimated error term for the production function, so random terms are selected from a normal distribution for those residuals that correspond to the actually observed decisions regarding the type of school.

(a) *Complementary factors*

The complementary factors associated with the microsimulation include, first of all, the simulation of unobservable variables. Subgroups by type of institution and the size of the population centre are used for this purpose. One factor is calculated as the fraction corresponding to the standard deviation of the residual

for each year, by group, and this factor is then multiplied by the residuals for the year 2003 by subgroup. This procedure is used for the residuals of the two production functions, by type of institution.

Then, in order to adjust the factors of expansion, a fraction is calculated that reflects the ratio corresponding to the population represented by the sample in 2006 of a subgroup  $m$  (by type of school, size of the population centre, grade and, in the case of public schools, grade repetition), i.e. the sum of the factors of expansion for each subgroup relative to the population represented by the sample in 2003 for the same subgroup. The factor of expansion for each observation of subgroup  $m$  in 2003 is then multiplied by this fraction.

## IV Results

### 1. Results of the Oaxaca-Blinder (1973) decomposition

The Oaxaca-Blinder methodology makes it possible to disaggregate the total change in scores over the period 2003-2006 into changes in characteristics and changes in the returns to them. The total change occurring between those two years was 4.6 points and is primarily attributable to the “return effect”, which amounts to 11.2 points (see table 1). The magnitude of this effect is substantial, as well as being statistically significant, as it is quite similar to the improvement that would be brought about by one standard deviation increase in the socioeconomic and cultural level of the students’ households. This means that the characteristics’ efficiency in terms of educational attainment was greater in 2006 than in 2003. However, the characteristics effect is negative, which means that they were more disadvantageous in 2006 than they were in 2003. The characteristics-return effect is the least influential and is negative.

When the effects are separated out among the three groups of explanatory variables and the characteristics of the students, their schools and institutional aspects, these effects can be analysed in greater detail. The negative changes linked to the decline in characteristics mainly have to do with the student-related variables. The Index of Economic, Social and Cultural Status (ESCS), which is constructed by the PISA programme on the basis of variables relating to the family environment, reflects the

average 1.8-drop in score points, with its mean shifting from -0.35 to -0.51 during the period under study (see table A.2 in the annex). While this may seem to be a somewhat surprising development in the midst of an economic recovery, there are various possible explanations. One possibility is a shift in enrolment trends whereby more students in the upper socioeconomic stratum could be changing from public to private schools, which would tend to depress the ESCS mean for public schools. In addition, secondary-school coverage has increased, chiefly as a result of greater attendance rates in smaller towns. This means that a segment of the student body that used to leave school at an earlier age (and that is probably socioeconomically disadvantaged) is now staying in school, which could be the reason for the trend seen in the ESCS index during this period. Yet another reason for the ESCS trend could be the large-scale emigration from the country that took place during those years, since many of the emigrants came from the middle and upper-middle socioeconomic strata.

The change in the percentage of students in their third, fourth and fifth years of secondary school accounts for the 0.4, 0.5 and 0.7 reductions, respectively, in the corresponding means. Another factor that could be contributing to the drop in mean scores attributable to the characteristic effect is the increase in the percentage of students who have repeated one or more grades. The only variable that has had a positive (although not statistically significant) effect is the sex of the student.

TABLE 1

**Oaxaca-Blinder decomposition**

	Characteristics	Return	Characteristics-return
<b>Student-related variables</b>			
Sex (female=1)	0.01 (0.30)	-3.02 (2.24)	0.00 (0.11)
Third year	-0.40 (0.70)	-1.53 (1.28)	0.08 (0.15)
Fourth year	-0.49 (2.35)	-12.96 (9.09)	0.10 (0.52)
Fifth year	-0.69 (1.60)	-2.22* (1.33)	0.17 (0.40)
Behind grade	-0.10 (0.25)	-4.34 (4.11)	-0.17 (0.42)
ESCS	-1.78*** (0.57)	-0.84 (0.73)	-0.39 (0.33)
Subtotal: student-related variables	-3.46 (2.78)	-24.91* (14.74)	-0.21 (0.43)
<b>School-related variables</b>			
Peer effect (ESCS)	-3.04** (1.27)	-0.85 (2.69)	-0.39 (1.22)
School size	-0.83 (0.87)	-1.76 (6.99)	0.32 (1.24)
Student-teacher ratio	0.57 (0.60)	1.92 (10.11)	-0.21 (1.10)
Shortages of teaching materials	1.33 (1.10)	5.88 (10.51)	-0.67 (1.26)
Shortage of mathematics teachers	-0.64 (1.09)	-3.50 (7.39)	0.77 (1.64)
Percentage of certified teachers	1.54 (1.05)	-8.93 (8.38)	-1.19 (1.21)
Montevideo and its metropolitan area	-0.22 (0.30)	2.31 (3.08)	-0.10 (0.19)
Rural	0.02 (0.12)	0.72 (1.07)	-0.03 (0.16)
Subtotal: school-related variables	-1.27 (2.49)	-4.21 (18.23)	-1.50 (2.73)
<b>Institutional variables</b>			
Selectivity	-0.15 (0.32)	-0.21 (1.24)	0.03 (0.21)
Private	0.08 (0.17)	-2.76 (2.02)	-0.15 (0.29)
Subtotal: institutional variables	-0.07 (0.41)	-2.96 (2.14)	-0.13 (0.37)
Constant		43.31 (26.65)	
<i>Total</i>	<i>-4.79</i> <i>(4.49)</i>	<i>11.23***</i> <i>(3.22)</i>	<i>-1.84</i> <i>(2.77)</i>

Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

Levels of significance: \*10%, \*\*5%, \*\*\*1%

Standard errors are shown in parentheses.

Note: Values are expanded for the entire population.

ESCS: Index of Economic, Social and Cultural Status.



When looking at the school-related variables, we find that the decrease in the peer effect accounts for a three-point reduction in the characteristics effect, while the decrease in average school size accounts for only 0.8 points of this effect. The decline in the indicator for shortages of teaching materials and the increase in the percentage of certified teachers account for positive changes of 1.3 and 1.5 points, respectively. The total for school-related variables is negative but not statistically significant. Meanwhile, none of the institutional variables proves to be significant; the dummy variable for selectivity is negative, and attendance at private schools is positive.

As for the effects of changes in the efficiency of characteristics (the return effect), the 43.3-point increase in the constant can be accounted for by a recomposition of the cumulative effect of each additional year of schooling (whereby the attainment of students at lower achievement levels improves considerably) and by the broad increase in the school system's coverage of Uruguayan students overall. On the other hand, during this period the learning gap between students who have repeated one or more grades and those who have not done so widened and had a negative effect equivalent to 4.3 points.

As for the returns to school characteristics, the overall change is chiefly accounted for by the decline in effectiveness of the percentage of certified teachers and the shortage of mathematics teachers. Shortages of teaching materials, the student-teacher ratio and the dummy variables, by school location, are positive. The decrease in the return to institutional variables is mainly accounted for by the 2.8-point change in the returns to the choice of a private school.

Thus, the trend in the return effect of the constant reflects a narrower range in the levels of educational

attainment, which signals a major advance in educational equity for Uruguayan students. This indicates that the bulk of the improvement seen during this period has been shared by all of the country's students and especially those who attend public schools. This increase in equity has, however, been partially counterbalanced by the decrease in the return to attendance at private schools and the drop in returns to grade level.

The characteristics-return effect is negative but not significant and is mainly accounted for by the trend in this effect relative to the school-related variables.

## 2. Results of the Juhn, Murphy and Pierce (1993) decomposition

In analysing the different effects of the Juhn, Murphy and Pierce decomposition, table 2 shows the values for each of the effects that were included in the study, by decile and by the mean. The total change in the results is positive for the first eight score deciles and negative for the last two, with the greatest change being seen in the second, third and fourth deciles. The characteristics effect is negative for all the deciles of the score distribution, but its absolute magnitude is the greatest for the bottom decile. This result points to a regressive effect that is related to the magnitude of the given characteristics. The results obtained using the Oaxaca-Blinder methodology indicate that this effect is concentrated in variables at the individual level.

Table 2 shows that the total change in results is positive for the first eight score deciles and negative for the last two, with the biggest changes occurring in the second, third and fourth deciles. The characteristics effect is negative for all deciles of the score distribution, but its absolute magnitude is the greatest for the bottom

TABLE 2

**Juhn, Murphy and Pierce decomposition**

	Change: 2006-2003	Characteristics effect	Return effect	Residual effect	Characteristics-return effect
Mean	4.60	-6.62	11.23	1.92	-1.93
Decile 1	3.85	-13.24	16.48	3.49	-2.88
Decile 2	7.19	-8.59	15.04	2.98	-2.24
Decile 3	7.34	-6.94	13.40	2.72	-1.83
Decile 4	7.72	-5.74	12.54	2.95	-2.02
Decile 5	6.47	-6.13	11.05	2.63	-1.09
Decile 6	6.62	-4.55	10.72	2.20	-1.75
Decile 7	5.22	-4.48	10.18	1.78	-2.25
Decile 8	2.81	-5.48	8.56	1.33	-1.60
Decile 9	-0.16	-7.22	7.90	0.89	-1.72
Decile 10	-1.13	-3.77	6.48	-1.93	-1.90

Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

Note: Values expanded for the entire population.

decile. This means that there is a regressive impact which is linked to the magnitude of the characteristics in question. The results obtained using the Oaxaca-Blinder methodology indicate that this effect is concentrated in variables at the individual level.

As can be seen from figure 2, the return effect is invariably greater than the total change and is positive, although progressively less so. Table 2 also points to an increase in scores in all the deciles due to a more efficient use of the characteristics in question, with the higher averages being in the first two deciles; this indicates that the impact is progressive.

The residual effect is positive for the first nine deciles but negative for the last one, although it is small in magnitude in all cases. This effect reflects the change in the distribution of unobserved variables in terms of both their magnitude and their returns. The characteristics-return effect is negative in all cases and is greater in magnitude in the middle deciles of the distribution.

The results of the application of the Juhn, Murphy and Pierce decomposition are consistent with those obtained with the Oaxaca-Blinder decomposition. Most of the total difference between the 2003 and 2006 PISA scores is attributable to the positive effect of the change in the efficiency of factor use, while the magnitude of the characteristics effect is associated with a negative change that partially offsets the positive impact of the school system's increased efficiency. In other words,

the difference between the 2003 and 2006 scores is accounted for by a reduction in available resources and a more efficient use of those resources.

The increase in efficiency signals that the country is moving in the right direction. The reduction in characteristics poses a major challenge for Uruguay's school system, however, since it must find a way of improving the general conditions for students in the system. This is a matter of some urgency, since the gain in the effectiveness of the school system could have enabled underprivileged students to move up a level in terms of their performance on the mathematics test in slightly more than a decade; however, the deterioration in social and economic conditions for this segment of the population during that same decade has had the effect of lengthening the time needed to move up a level to three decades.

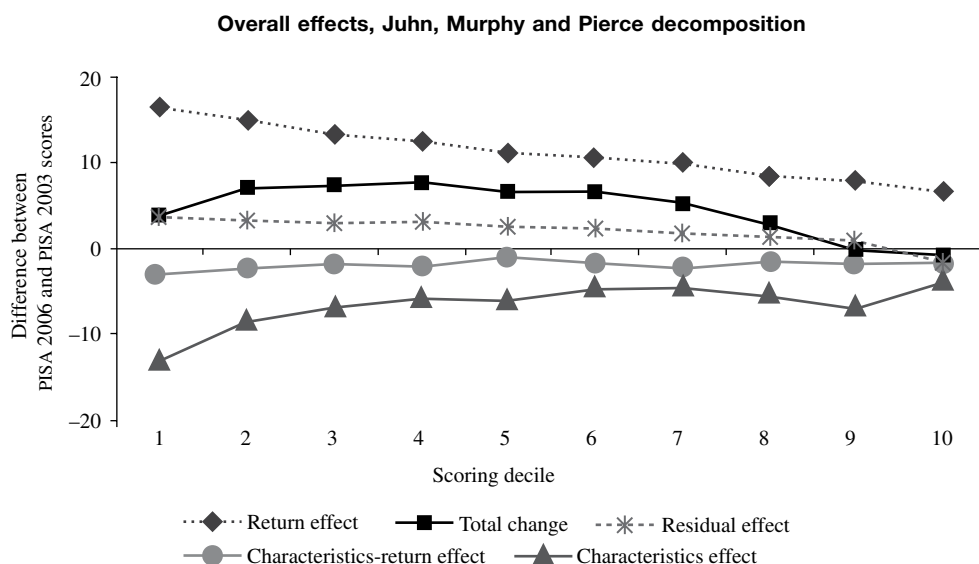
### 3. Results of the Bourguignon, Fournier and Gurgand (1998) decomposition

#### (a) Estimation of production functions

The first step in conducting the microsimulations is to estimate the production functions for the 2003 and 2006 PISA tests for each type of school (see table 3).

The  $R^2$  in the estimates indicates that it is possible to account for nearly 40% of the variance in scores in the estimations for public schools, whereas, in the case of

FIGURE 2



Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

TABLE 3

## Estimation of production functions for public and private schools, 2003-2006

	Public		Private	
	2003	2006	2003	2006
<b>Student-related variables</b>				
Sex (female=1)	-18.13*** (3.49)	-24.59*** (3.75)	-21.93*** (4.95)	-21.31*** (5.27)
Third year	41.89*** (4.31)	34.76*** (5.61)	110.40*** (39.16)	-3.49 (26.79)
Fourth year	110.00*** (9.45)	87.38*** (12.96)	123.80*** (33.57)	23.49 (37.79)
Fifth year	140.40*** (13.04)	106.50*** (14.68)	148.60*** (34.99)	44.73 (37.31)
Behind grade	-5.53 (8.55)	-21.56** (10.21)	-10.75 (21.50)	-26.65 (25.42)
ESCS	10.88*** (1.42)	12.80*** (1.81)	12.78*** (4.73)	16.15*** (3.85)
<b>School-related variables</b>				
Peer effect (ESCS)	14.50** (5.93)	15.79*** (5.51)	36.50** (18.21)	54.98*** (10.96)
School size	0.00 (0.01)	-0.01 (0.01)	0.01 (0.02)	0.01 (0.02)
Student-teacher ratio	-0.11 (0.31)	-0.14 (0.60)	-0.31 (1.26)	0.24 (0.91)
Shortages of teaching materials	-2.21 (2.50)	-1.39 (2.24)	-12.07 (8.63)	-7.01 (6.31)
Shortages of mathematics teachers	1.47 (2.17)	-0.61 (2.59)	4.62 (6.51)	1.28 (5.12)
Percentage of certified teachers	16.05 (13.99)	16.84 (11.84)	52.14* (27.11)	-18.33 (16.04)
Montevideo and its metropolitan area	12.02** (4.70)	14.14*** (4.93)	6.87 (13.17)	14.55 (14.64)
Rural	-9.62 (8.43)	-5.42 (8.55)	20.08 (24.84)	0.00 (0)
<b>Institutional variables</b>				
Selectivity	12.82 (10.32)	6.02 (8.34)	1.21 (12.18)	3.89 (10.87)
Constant	346.4*** (19.36)	390.9*** (21.09)	325.0*** (41.02)	432.9*** (45.19)
Observations	4 679	3 826	1 156	1 013
R <sup>2</sup>	0.39	0.38	0.17	0.24

Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

Levels of significance: \*10%, \*\*5%, \*\*\*1%

Standard errors are shown in parentheses.

Note: Values expanded for the entire population.

ESCS: Index of Economic, Social and Cultural Status.

private schools, the  $R^2$  is around 20%. This means that the explanatory value of the estimates is nearly twice as great for public schools as it is for private schools. This is probably because of the make-up of the student bodies in these two sectors and suggests that the proposed model

is a more accurate measurement of trends in scores in public institutions.

Most of the coefficients for variables at the student level are significant. The sex coefficient, which is negative and significant in all cases, declined in magnitude over

the period in question for public schools and rose slightly in the case of private schools. The magnitude of the coefficients for grade-related variables decreased during the period under study for both types of institutions. In the case of private schools, the magnitude and significance of the grade-related coefficients changed considerably between the two years in question, since part of the coefficient for 2006 is incorporated in the constant, which exhibits a difference between 2003 and 2006 of over 100 points; this signals an improvement for the control group.

Additional score points were achieved by persons who are a grade ahead in all cases. The additional inter-grade gain narrowed in public schools while, in private schools, the lead in scores that students in their fourth year of secondary school had over those in their third year was greater in 2006 than in 2003. The effect for those who were behind the grade associated with their age was negative in all cases, but this coefficient declined between the two years for students in both types of schools. The ESCS coefficients for both public and private schools rose.

Most of the school-related variables did not prove to be significant,<sup>8</sup> whereas the peer effect was not only positive and significant in all cases but also increased over the period under study, rising by nearly 50% in private schools and by around 9% in public schools. The ESCS coefficient at the individual level and the peer effect behaved very differently in public schools than they did in private schools. In the former, the peer effect was 1.3 times greater than the ESCS coefficient at the individual level, while in the latter, it was almost 3 times greater. These differences between the public and private sectors generate a greater incentive for increased segregation for private schools, since the maintenance of the entire student body at a given socioeconomic level will make it possible to obtain a “segregation premium”.

As for the size of the population centre, the dummy variable associated with Montevideo had a positive and increasing value during the period under study, while the dummy variable for rural areas was negative for public schools and positive for private ones. The institutional selectivity variable declined between 2003 and 2006

for public schools and did just the opposite in the case of private institutions.

Finally, the value of the constant was always positive and significant, and its coefficient rose in 2006 relative to its 2003 level.

(b) *Estimation of choice of type of school*

A logit function was estimated for each year, with a value of 1 corresponding to cases in which the student attends a public school. The results are shown in table 4.

The dummy variable for the sex of the student was negative but not significant as an explanatory variable for the probability of a student attending a public or private school. The effect of being behind grade level, on the other hand, was positive and significant in all cases for the probability of attending a public school and negative for the probability of attending a private one, while the ESCS coefficient was negative for the probability of attending a public educational institution.

The size of the school and the student-teacher ratio had almost no effect on the probability that a student

TABLE 4

**Logit estimation for choice of school type, 2003-2006**

	2003	2006
Sex (female=1)	-0.19 (0.15)	-0.09 (0.10)
Behind grade	1.53*** (0.36)	1.10*** (0.29)
ESCS	-1.36*** (0.11)	-1.44*** (0.10)
School size	0.00 (0.00)	0.00 (0.00)
Student-teacher ratio	0.07 (0.05)	0.08** (0.04)
Montevideo and its metropolitan area	-1.93*** (0.37)	-1.71*** (0.41)
Rural	0.41 (1.42)	
Constant	1.35** (0.68)	1.29** (0.55)
Observations	5 835	4 381
F statistic	32.95	50.18
Prob > F	0.00	0.00

Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), “PISA 2003” and “PISA 2006” [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

Levels of significance: \*10%, \*\*5%, \*\*\*1%

Standard errors are shown in parentheses.

Value 1= Public education.

Note: Values expanded for the entire population.

ESCS: Index of Economic, Social and Cultural Status.

Prob > F: p value associated with F statistic, used to test the null hypothesis that all of the model's coefficients are 0.

<sup>8</sup> Since some controls were used in the estimations that might have a non-linear effect, the possibility existed that the lack of statistical significance of some of them could be related to a linear specification. School size and grade size were therefore tested for non-linearity, but the results changed very little, with the exception of school size for 2006, where a downward trend is seen for schools with 800 students or more, which are in the minority in the sample.

would attend a public school. The variables related to the size of the population centre indicate that residence in Montevideo has a significant negative effect in terms of the probability of attending a public school, while residence in a rural area was not a significant factor in 2003.<sup>9</sup>

These findings indicate that students in public schools tend to come from poorer families, be less successful academically and live in smaller cities or towns.

#### 4. Results of the microsimulations

The main results of the microsimulations are summed up in table 5. The table provides information on the effects of changes both in the means and in the different score deciles as a result of the difference between the simulated distribution for each case and the observed distribution in 2003. Table A.3, in the annex, shows what the effects are when changes in the type of school are the only factor that is considered.

##### (a) *The characteristics effect*

The characteristics effect, as a whole, has the strongest positive impact of all in terms of explaining the reasons for the overall change in PISA mathematics scores between 2003 and 2006. On average, if schools had had the same individual resource endowments in

2003 that they had in 2006, their scores would have been 9.2 points higher (see table 5).

A word of caution is called for here with regard to the correct interpretation of this effect. The simulation of characteristics for 2006 entails using the unweighted percentage of cases in which a given characteristic is displayed, in the case of the dichotomous or categorical variables, or the unweighted mean, in the case of the continuous variables. In addition, in calculating the characteristics effect, the distribution measurements are computed using the sample weighting for 2003, which, as will be discussed in greater detail below, differs a great deal from the weighting for 2006, since the samples for those two years were designed very differently. An accurate interpretation of the trend in available resources during this period should therefore include not only the simulation of the characteristics (weighted by the factor of expansion for 2003), but also the weighting for the sample for the year corresponding to the simulation. It then becomes possible to see what happens when only the characteristics for 2006 are simulated and then to compare that result with the result of a simulation that includes the sample weightings for that year and that consequently provides a more accurate picture of the population which is being simulated.

The characteristics effect is greater for the bottom deciles and decreases in the upper deciles. This signals the presence of a redistributive effect, since lower-performing students benefit. If this effect is differentiated by type of school in the simulations for 2006 (see table A.3 in the annex), it turns out that the sharpest change is seen

<sup>9</sup> The corresponding coefficient for 2006 is unavailable because the sample for that year does not provide observations for private schools in rural areas.

TABLE 5

**Average microsimulation results and microsimulation results by scoring decile, 2003-2006**

	Mean	1	2	3	4	5	6	7	8	9	10
PISA mathematics test – 2003	422.20	257.03	318.07	355.44	384.22	410.99	435.48	460.99	489.39	523.25	587.56
PISA mathematics test – 2006	426.80	260.88	325.26	362.79	391.94	417.46	442.10	466.22	492.20	523.09	586.43
Total difference in PISA mathematics score (2006-2003)	4.60	3.85	7.19	7.34	7.72	6.47	6.62	5.22	2.81	-0.16	-1.13
Characteristics effect	9.24	13.07	17.87	15.48	13.40	10.77	8.50	5.23	2.98	2.43	2.85
Weight effect	-2.76	-4.31	-5.02	-3.91	-3.02	-3.06	-2.59	-2.04	-1.86	-1.06	-0.67
Characteristics+weight effect	-2.11	0.50	0.77	-0.11	-1.53	-2.66	-2.76	-4.37	-6.07	-4.31	-0.64
Price effect	7.69	13.24	12.15	10.37	9.21	7.44	6.91	6.12	4.67	3.90	2.67
Characteristics+weight+price effect	7.59	17.40	16.54	12.63	10.22	7.51	4.42	2.93	0.35	0.97	2.86
Choice effect	-0.05	-0.03	0.02	0.04	-0.03	-0.01	-0.03	-0.01	-0.02	-0.02	-0.29
Characteristics+weight+price+choice effect	5.91	9.90	10.11	7.61	7.22	6.22	5.60	4.08	2.74	2.39	3.20
Residual effect	0.00	2.58	1.62	1.09	1.07	0.68	0.28	0.05	-0.92	-2.03	-4.38
Characteristics+weight+price+choice+residual effect	5.93	13.53	11.63	8.44	7.89	6.50	5.90	4.21	2.00	0.65	-1.18

Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

Note: Values expanded for the entire population.

Choice effect: School selection effect.

in public schools (8.4 points) and that this accounts for virtually all of the characteristics effect, since private schools account for just 0.8 points.

Table A.4 (see the annex) provides a detailed look at the characteristics effect for each variable in the model and for the defined groups of variables, disaggregated by type of school. As can be seen from the table, the increase in educational resources is concentrated in the individual variables (7 points) and relates mainly to the number of students in their fourth year and to public schools, as well as being greater in the upper deciles of the distribution. The behind-grade variable also exhibits a positive although small effect. The dummy variable for the sex of the student, as well as the other grades and ESCS, points to a negative effect in the trend of scores on the PISA mathematics test.

The variables relating to educational institutions account for a positive change of 2.3 score points, with one of the most influential variables being the percentage of certified teachers (1.6 points). The associated peer effect shows a positive change of 0.2 points, while the ESCS has a negative but nearly negligible effect at the individual level. The student-teacher ratio, shortages of teaching materials and the dummy variable associated with Montevideo also have a positive effect, whereas school size, shortages of mathematics teachers and the dummy variable associated with rural zones exhibit a negative effect. The same is true of the institutional variable of selectiveness, which has a negative effect (see table A.4).

#### (b) *Weight effect*

When the individual weights in the 2003 sample are adjusted to reflect the 2006 population, the total change in PISA scores amounts to a 2.8-point decline (see table 5). This effect is explained chiefly by the change made in the sample design. In the case of Uruguay, a number of changes in the design of the different strata were made between the 2003 and 2006 tests. For the analysis of the 2003 test, 8 strata were used to define the sample design, whereas, for the 2006 test, 16 strata were used. There were also changes in the schools' response rate and in the number and types of schools that did not apply them or that did so incorrectly (ANEP, 2007b). In addition, as noted earlier, the attendance rates for the 2003 and 2006 tests differed, especially in the smaller towns. All of these factors generate variations in the sample weights that account for the size of the weight effect obtained in microsimulations.

The negative weight effect is greater in the first deciles of the distribution; this is accounted for primarily

by the change in the weighting of public schools (see table A.3 in the annex).

#### (c) *The characteristics-weight effect*

When the change in characteristics is combined with the change in weights (see the third simulation in table 5), the average effect diminishes, but retains the negative sign of the weight effect (-2.1 points). The change in this result, which is attributable to the inter-year variability of the sample weight and to the modification of the sample design, appears to be an accurate reflection of the trend in available resources during the period in question.

When this effect is analysed by decile, it can be seen that it has a positive sign for the first two deciles in the distribution but is negative for the other eight; consequently, the overall effect is highly redistributive. As is also true of the weight effect alone, the combination of these two effects is negative for public schools and positive for private ones.

#### (d) *Return effect*

The return effect is derived from the simulation of the 2006 coefficients in the 2003 score distribution. As shown in table A.5, the total effect of this component amounts to an increase of 7.7 points and is positive for all of the deciles of the distribution; the fact that it is stronger in the first few deciles indicates that it is redistributive. The sign of this effect reflects an increase in the efficiency of these characteristics in public schools, while it is negative for private schools (see table A.3).

Separate analyses of the return effect of each of the variables in the production function (see table A.5) show that the main factor is the greater effectiveness of the constant, which amounts to 53.4 points and signals a widespread improvement in student efficiency.

The combined effect of the variables at the individual, school and institutional levels is negative. This is consistent with the result obtained using the Oaxaca-Blinder decomposition. The increase in the efficiency of the peer effect (1.3 points) is notable, while the effectiveness of the ESCS at the individual level is lower. The bulk of the increase in the peer effect is accounted for by private schools, as the effectiveness of this factor in public schools declined.

Other variables at the school level that have a positive impact on the return effect are the student-teacher ratio, shortages of teaching materials and region-dependent variables. The size of the school, shortages of mathematics teachers and the percentage of teachers who are certified all have a negative effect. The institutional variable of academic selectivity also has a negative effect.

The overall effect of the variables at the student level is -36.5 points, with the public sector accounting for the majority of this value (-22.6 points). Of the variables at the individual level, the biggest change is generated by the dummy variable for the fourth year of secondary school (-22.5), which has a greater negative impact in the higher deciles of the distribution. All the other variables at the individual level have a negative, although smaller, return effect. The institutional variable of selectivity also has a negative effect.

(e) *The characteristics-return effect*

Figure 3 illustrates the combined effect of the change in characteristics and returns for all deciles in the distribution. As indicated by the graph, this effect is positive for the entire distribution and stronger for the lower deciles.

(f) *The characteristics-return-weight effect*

The fifth simulation in table 5 shows the combined effect of the simulation of characteristics, returns and weights. In this case, the mean effect is weaker than it is in the simulation of characteristics and returns alone (7.6 points). The combined effect is stronger for the lower deciles in the distribution, which, here again, indicates

that it is redistributive. When the change is analysed by type of school (see table A.3 in the annex), it is seen that it is greater for public schools.

(g) *The school choice effect*

The school choice effect is negative on average and very close to zero (0), as may be seen from table 5. It is nearly equal for all the deciles of the distribution.

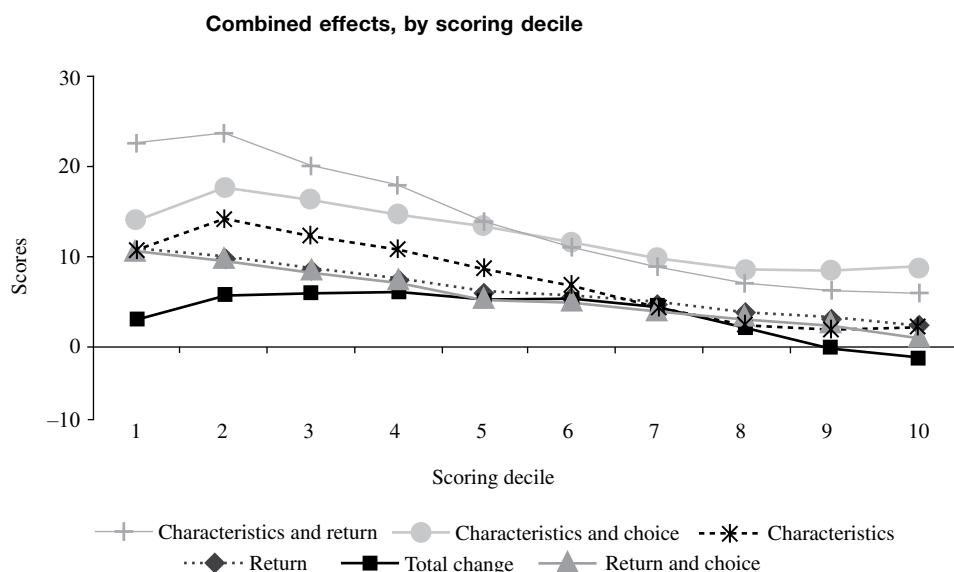
(h) *The characteristics-return-choice-weight effect*

When a combined simulation of characteristics, returns, school choice and weights is conducted, the mean effect falls to 5.9 points (see table 5), with the greatest decreases relative to the previous combined simulation being in the lower deciles of the distribution (see figure 4). In this case, the sign of this combined effect is positive for public schools and negative for private ones.

(i) *Residual effect*

The effect of simulating residuals for 2006 in the 2003 distribution is, on average, nil (see table 5), and this is true for both types of institutions (see table A.3 in the annex). The residual effect varies by decile, however, being positive in the first seven and negative in the last three.

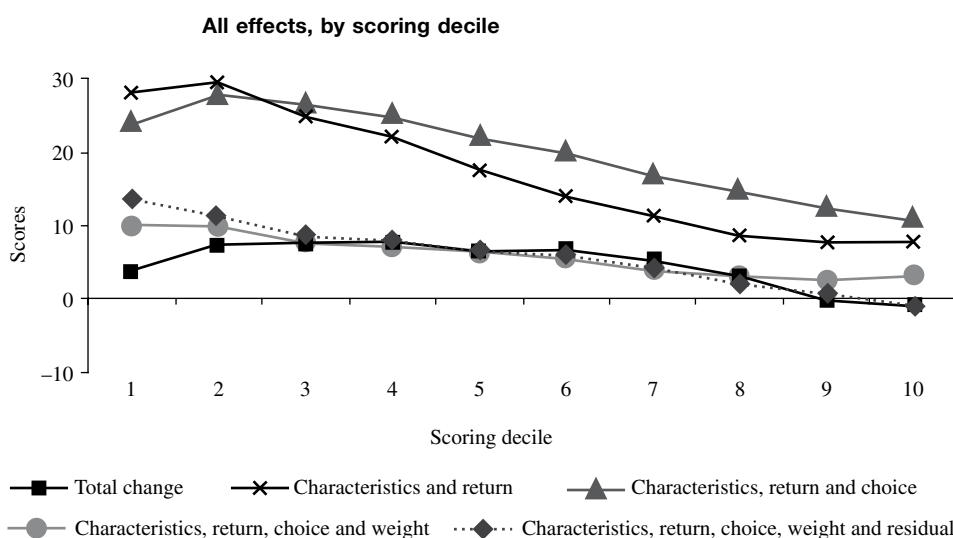
FIGURE 3



Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

Choice effect: School selection effect.

FIGURE 4



Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

Choice effect: School selection effect.

#### (j) Combined effects of the microsimulations

The overall effect of the microsimulations (see the final simulation in table 5) is a small change in the mean, with a slight decrease in inequality. The progressive nature of the overall change is accounted for by the result for public schools.<sup>10</sup> The results also show that scores improve only in those schools, since the trend is negative for private schools (see table A.3 in the annex). The main area of progress is the widespread improvement in the efficiency of resource use. This improvement is, however, offset by a reduction in available resources.

When unobservable variables are included in the first four simulations, it becomes possible to explain a great deal of the inequality seen in the trend in average scores. The overall effect is more positive in the lower deciles and turns negative in the last two. This result is in keeping with the progressive impact of the residual effect obtained using the methodology developed by Juhn, Murphy and Pierce.

The Gini inequality index, the Theil index and the entropy index, which are generally used to analyse trends

in income distribution, are then used to look at the trend in the size of the reduction in the inequality of the results. As can be seen from table A.6 in the annex, the trend in these three indicators reflects a small decline in levels of inequality in scores on the mathematics test. This reduction amounts to between 0.1% and 0.4% of these indicators and is mainly attributable to the progressive effect of the characteristics and price simulation and, in particular, to the change in public schools. The residual effect also has a progressive impact on the level of inequality, although a weaker one. The combined effect of all the simulations corresponds to a 0.8% decrease on the Gini index and one of 0.3% on the Theil and entropy indexes.

When all the simulations are combined, the mean effect amounts to 5.9 points (of 4.6, which is the observed change). The total adjustment is more precise for the last deciles in the distribution and is less so for the first decile (see figure 4). The 2006 sample design is more complex and results in a sample that provides a more exact reflection of the student population in the relevant age group; consequently, when the weights for that year are simulated in the 2003 sample (together with the characteristics, returns, school choice and residuals), they explain the changes seen in 90% of the distribution, thereby making it possible to clearly identify the main factors associated with the trend in each one of the deciles of the score distribution.

<sup>10</sup> If the combined effect of the microsimulations, by score decile, is calculated separately for the different types of schools, it turns out to be progressive for public schools and regressive for private schools. These results are in keeping with the total change seen in scores by type of institution.



## V

### A comparison of the results

These three methodologies yield mutually consistent results. They complement each other in terms of the degree of complexity of the analysis, and each has its own value-added.

The results obtained from the application of the Oaxaca-Blinder methodology indicate that the total score change is chiefly accounted for by a widespread increase in the efficiency with which the school system makes use of the available resources. The increase in the return to the constant is the main explanatory factor for this increase in efficiency. The fact that this increase was seen across the student population –and was especially marked in public schools– points to a more even distribution of educational outcomes. The improvement is primarily attributable to the economic recovery that occurred during the period under study. This positive effect is weakened somewhat by a lower level of efficiency in the most important variables at the student and school levels, however, especially in the returns to the different grade levels.

The defined characteristics were more disadvantageous in 2006 than in 2003, and most of this effect is concentrated in student-related variables. Although this marks a contrast with the economic recovery

of those years, it may be due to various factors, such as changes in enrolment or the demographic changes occurring in the country during that time.

The methodology developed by Juhn, Murphy and Pierce also makes it possible to draw conclusions about the influence exerted by the various effects on the different deciles of the distribution and indicates that there has been a progressive impact as a result of the return effect.

The microsimulations provide a way of gauging the extent of the differences existing between students in public and private schools, and they indicate that the change observed during the period under study was accounted for solely by students in State-run schools. The estimates also indicate just how sensitive the results are to changes in the composition of the samples. The characteristics effect is shown to be positive when the microsimulations are run, which differs from the results obtained with the other two decomposition techniques. When the simulation of the sample weighting is added in, however, the overall effect proves to be negative and of a similar strength as that calculated earlier using the Oaxaca-Blinder and the Juhn, Murphy and Pierce methodologies.

## VI

### Conclusions

This study provides information on the differences in the distribution of the PISA mathematics scores for 2003 and 2006 and identifies factors underlying those changes and the trend in their effects over the period under study. An analysis of the results obtained using three different methodologies leads to mutually consistent conclusions that support the statement that the country's outcomes, in terms of both equity and scores, are unsatisfactory.

A first conclusion is that, although the change seen between the results for the 2003 and 2006 tests is very small and has little impact in terms of an improvement in Uruguayan students' performance on the mathematics tests, there have been underlying changes in the defined characteristics and returns that offset one another, thereby

yielding a very small overall change. This bears out the study's initial hypothesis.

Secondly, the evidence suggests that the improvement in scores in 2006 relative to 2003 is attributable to an increase in the education system's ability to convert educational resources and characteristics into learning outcomes and, in particular, to a widespread efficiency gain in the use made of resources generated by the economic recovery of that period. This was especially marked in public schools, although it was partially offset by a decrease in the efficiency of grade-related factors at the individual level.

Thirdly, there was a reduction in resource endowments, particularly at the student level. This

decrease was especially notable in terms of socioeconomic and cultural characteristics and in the percentage of students at the higher grades (above all in the case of the more disadvantaged students). This indicates that the deterioration in the family- and school-related circumstances associated with students in the most vulnerable groups of the population has had the effect of making it take longer for these young people to move up from one step to the next on the scale used by the PISA test to measure proficiency in mathematics. If this had not been the case, this group was projected to have reached that objective in slightly more than a decade, whereas, with the emergence of these two groups of factors, it will take between 25 and 30 years to reach that goal.

Finally, the improvement in the scores on the PISA mathematics test had a redistributive effect and was concentrated among lower-performing students. This finding reflects a reduction in test-score dispersion and is accounted for by trends in the country's public schools.

Economic growth ought to be closely related to a substantive improvement in performance, but such a relationship is not evident in the scores obtained by Uruguayan students during this period. This indicates that the deterioration in social and economic conditions that occurred at the start of the decade brought about a structural decrease in educational opportunities for young students, while the benefits of the recovery will probably not become evident until the results of the 2012 PISA test are in. The methodologies used in this study offer a means of undertaking an in depth analysis into the challenges and situations faced by Uruguayan students and of identifying ways of enabling the country to meet its obligation to provide a satisfactory education to all of its citizens. The data lead to the conclusion that efforts should be focused on mobilizing educational resources and boosting efficiency at the individual level. Policies designed to provide more support for socioculturally

disadvantaged students are of critical importance in reducing the high rate of grade repetition and in seeking ways of providing higher returns to each additional year of schooling.

Despite the drop in the ESCS coefficient, the mean score for this period rose and, although the increase was slight overall, it was considerable in the lower-middle and middle strata. This would appear to indicate that, following the economic shock experienced by the country (which hit the vulnerable groups in society the hardest, not only in economic terms but also in terms of opportunities for social mobility, including those afforded by education) in 2003-2006, the potential retrogression triggered by the crisis appears to have been reversed. Nonetheless, formidable challenges remain to be overcome in order to improve the school system's overall effectiveness, particularly since the headway that was made in 2003-2006 could simply be due to the recovery rather than to increased effectiveness on the part of the school system. If this proves to have been the case, then we may not see further improvements in scores on future PISA tests, as occurred in 2009.

This study paves the way for the use of these methodologies to analyze the 2009 PISA scores as a means of delving more deeply into the underlying reasons for Uruguayan students' performance on this test. The incorporation of the more recent data will make it possible to analyse the trends of the last few years, which have been marked by economic growth and reforms aimed at improving the education imparted by the country's schools while also making it more equitable. This type of analysis could also be expanded to include comparisons of the results obtained by Uruguay with those of other countries at similar socioeconomic levels, such as Chile or Argentina, and with the scores of countries that have succeeded in making much greater gains, such as Poland.

*(Original: Spanish)*

## ANNEX

TABLE A.1

## Selected variables

Variable used	Comments
<b>Results variable</b>	
Mathematics score	2003-2006 PISA scores, 5 plausible values for performance on the mathematics test
<b>Student-related variables</b>	
Sex	Dummy variable for sex of student (omitted category: male)
Grade	Five dummy variables for a student's current grade: grade 7 (first year of secondary school), grade 8 (second year), grade 9 (third year), grade 10 (fourth year), grade 11 (fifth year) (omitted categories: any grade other than those grades)
Behind grade	Dummy variable that indicates whether the student has repeated a grade (omitted category: no repetition)
Index of Economic, Social and Cultural Status (ESCS)	Variable developed by OECD/PISA which takes into consideration the education and occupation of the parents and the types of products or goods in the home. Mean of 0 and standard deviation of 1 for the OECD-country average. A higher ranking on the index indicates a higher socioeconomic level
<b>School-related variables</b>	
Peer effect	Variable that measures the average ESCS rank for students in the same school
School size	Continuous variable that indicates the average number of students who are enrolled
Student-teacher ratio	Continuous variable that indicates the average student-teacher ratio
Shortages of teaching materials	Variable that indicates the extent to which the school's ability to educate its students is undermined by shortages of suitable teaching materials: Scale ranges from 1 to 4
Shortages of qualified mathematics teachers	Variable that indicates the extent to which the school's ability to educate its students is undermined by shortages of qualified mathematics teachers: Scale ranges from 1 to 4
Percentage of certified teachers	Variable that indicates the percentage of the schools' teachers who are certified: Scale ranges from 0 to 1
Size of population centre	Four dummy variables that indicate the location of the school: Montevideo and the surrounding metropolitan area, major cities elsewhere in the country, smaller cities, rural areas (omitted categories: does not live in that population centre)
<b>Institutional variables</b>	
Academic selectivity	Dummy variable that indicates whether or not a school applies selective criteria in reaching admissions decisions (based on the school selectivity index developed by OECD/PISA (omitted category: does not apply))
Public secondary school	Dummy variable that indicates whether or not the school is a public secondary school (general, military, rural or technical) (omitted category: does not correspond)
Private secondary school	Dummy variable that indicates whether or not the school is a private secondary school (omitted category: does not correspond)

Source: Authors' calculations.

TABLE A.2

## Descriptive statistics, 2003-2006

	Mean		Standard deviation		Range				Percentage	
	2003	2006	2003	2006	2003		2006		2003	2006
Score on mathematics test	422.20	426.80	95.22	93.37	108.93	734.41	102.58	732.04		
Student-related variables										
Sex (female=1)	0.51	0.51	0.50	0.50	0.0	1.0	0.0	1.0	416.30	420.49
First year	0.06	0.07	0.23	0.26	0.0	1.0	0.0	1.0	297.87	332.74
Second year	0.10	0.10	0.30	0.30	0.0	1.0	0.0	1.0	328.19	331.88
Third year	0.18	0.17	0.39	0.38	0.0	1.0	0.0	1.0	368.54	374.27
Fourth year	0.59	0.59	0.49	0.49	0.0	1.0	0.0	1.0	457.92	463.50
Fifth year	0.07	0.07	0.26	0.25	0.0	1.0	0.0	1.0	488.76	484.61
Behind grade	0.32	0.33	0.46	0.47	0.0	1.0	0.0	1.0	342.81	350.74
ESCS	-0.35	-0.51	1.05	1.18	-3.7	2.4	-4.3	2.8		
School-related variables										
Peer effect (ESCS)	-0.35	-0.51	0.63	0.77	-2.3	1.3	-2.7	1.6		
School size	531.12	435.16	335.86	248.90	9.0	2 535.0	30.0	1 275.0		
Student-teacher ratio	17.79	15.86	9.43	5.53	1.9	65.0	2.0	29.6		
Shortages of teaching materials	2.86	2.53	1.02	1.07	1.0	4.0	1.0	4.0		
Shortages of mathematics teachers	2.43	1.89	1.04	1.04	1.0	4.0	1.0	4.0		
Percentage of certified teachers	0.53	0.60	0.21	0.19	0.0	1.0	0.1	1.0		
Montevideo and its metropolitan area	0.48	0.46	0.50	0.50	0.0	1.0	0.0	1.0	440.64	443.31
Other major cities	0.32	0.32	0.47	0.47	0.0	1.0	0.0	1.0	412.65	412.72
Smaller cities	0.11	0.13	0.31	0.33	0.0	1.0	0.0	1.0	406.87	423.77
Population centres with fewer than 5,000 inhabitants	0.09	0.09	0.29	0.29	0.0	1.0	0.0	1.0	376.85	396.50
Institutional variables										
Selectivity	0.10	0.09	0.31	0.29	0.0	1.0	0.0	1.0	470.00	442.64
Public school	0.86	0.85	0.35	0.36	0.0	1.0	0.0	1.0	409.24	414.85
Private school	0.14	0.15	0.35	0.36	0.0	1.0	0.0	1.0	501.24	495.21

Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

Note: Values expanded for the entire population.

ESCS: Index of Economic, Social and Cultural Status.

TABLE A.3

## Results of microsimulations with changes in one type of school, 2003-2006

	Average total effect	Changes only in:	
		Public	Private
PISA mathematics test: 2003	422.20		
PISA mathematics test: 2006	426.80		
Total difference in PISA mathematics score	4.60		
Characteristics effect	9.24	8.45	0.80
Weight effect	-2.76	-3.99	1.22
Characteristics + weight effect	-2.11	-4.25	2.17
Price effect	7.69	8.83	-1.14
Characteristics + weight + price effect	7.59	6.67	1.08
Choice effect	-0.05	-0.05	-0.05
Characteristics + weight + price + choice effect	5.91	6.52	-0.90
Residual effect	0.00	0.00	0.00
Characteristics + weight + price + choice + residual effect	5.93	6.58	-0.93

Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

Note: Values expanded for the entire population.

TABLE A.4

## Results of the microsimulations of characteristics per scoring decile, 2003-2006

	Total effect and effect by decile (X)				Changes only in:	
	Total	2	5	9	Public	Private
PISA mathematics test – 2003	422.20	318.07	410.99	523.22		
PISA mathematics test – 2006	426.80	325.26	417.46	523.09		
Total difference in PISA mathematics score	4.60	7.19	6.47	-0.13		
Student-related variables	7.05	17.05	8.17	-1.18	6.85	0.20
Sex (female=1)	-1.82	2.23	-2.99	-4.05	-1.84	0.03
Third year	-1.99	-4.79	-2.46	-0.13	-2.13	0.14
Fourth year	11.94	7.00	7.92	18.74	11.60	0.34
Fifth year	-1.25	-1.05	-2.19	-1.46	-0.76	-0.49
Behind grade	0.33	1.95	0.06	-0.61	0.33	0.00
ESCS	-0.15	-0.83	-0.34	0.57	-0.34	0.19
School-related variables	2.29	-0.32	2.25	4.74	1.67	0.62
Peer effect (ESCS)	0.25	-1.20	0.01	1.72	-0.28	0.53
School size	-0.02	0.01	-0.10	-0.04	-0.01	-0.01
Student-teacher ratio	0.16	0.11	0.12	0.27	0.13	0.03
Shortages of teaching materials	1.00	0.18	0.75	1.78	0.76	0.24
Shortages of mathematics teachers	-0.91	-0.76	-0.98	-0.98	-0.87	-0.04
Percentage of certified teachers	1.63	1.98	1.64	1.39	1.70	-0.06
Montevideo and its metropolitan area	0.26	-0.42	0.42	1.00	0.26	0.00
Rural	-0.08	-0.14	-0.06	0.27	-0.01	-0.07
Institutional variables	-0.09	0.36	-0.25	0.14	-0.07	-0.02
Selectivity	-0.09	0.36	-0.25	0.14	-0.07	-0.02
Student-related and school-related variables	9.34	17.87	10.71	2.82	8.52	0.82
Student-related and institutional variables	6.96	17.04	8.16	-1.32	6.78	0.18
School-related and institutional variables	2.19	0.03	1.89	4.51	1.59	0.60
All variables	9.24	17.87	10.77	2.46	8.45	0.80

Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

Note: Values expanded for the entire population.

ESCS: Index of Economic, Social and Cultural Status.

TABLE A.5

## Results of microsimulations of coefficients per scoring decile, 2003-2006

	Total effect and effect by decile ( $\beta$ )				Changes only in:	
	Total	2	5	9	Public	Private
PISA mathematics test – 2003	422.20	318.07	410.99	523.25		
PISA mathematics test – 2006	426.80	325.26	417.46	523.09		
Total difference in PISA mathematics score	4.60	7.19	6.47	-0.16		
Student-related variables	-36.54	-29.29	-35.38	-43.09	-22.63	-13.91
Sex (female=1)	-2.80	-3.33	-3.17	-2.09	-2.85	0.04
Third year	-2.41	-3.67	-2.57	-1.60	-1.22	-1.19
Fourth year	-22.50	-11.91	-22.54	-32.44	-10.81	-11.69
Fifth year	-3.25	-1.04	-3.36	-5.61	-1.99	-1.26
Behind grade	-5.05	-11.62	-4.31	-0.47	-4.89	-0.16
ESCS	-0.52	-1.55	-0.88	0.66	-0.87	0.34

Table A.5 (concluded)

	Total effect and effect by decile ( $\beta$ )				Changes only in:	
	Total	2	5	9	Public	Private
School-related variables	-8.87	-6.77	-8.65	-10.89	-6.31	-2.56
Peer effect (ESCS)	1.29	-0.84	0.39	3.80	-0.58	1.87
School size	-4.25	-3.73	-4.65	-4.40	-4.24	-0.01
Student-teacher ratio	0.61	-0.42	0.08	1.96	-0.51	1.12
Shortages of teaching materials	3.27	2.47	3.00	4.09	2.15	1.11
Shortages of mathematics teachers	-5.32	-5.10	-5.32	-5.60	-4.64	-0.68
Percentage of certified teachers	-6.45	-1.50	-4.54	-11.42	0.34	-6.79
Montevideo and its metropolitan area	1.67	0.79	1.30	2.55	0.77	0.90
Rural	0.30	0.71	0.24	0.18	0.38	-0.07
Institutional variables	-0.26	-0.28	-0.37	-0.09	-0.39	0.13
Selectivity	-0.26	-0.28	-0.37	-0.09	-0.39	0.13
Constant	53.36	45.28	48.93	64.49	38.16	15.20
Student-related and school-related variables	-45.67	-37.30	-44.88	-53.33	-29.33	-16.34
Student-related and institutional variables	-36.80	-29.48	-35.74	-43.34	-23.02	-13.78
School-related and institutional variables	-9.13	-7.01	-8.99	-11.00	-6.70	-2.43
All variables	-45.67	-37.30	-44.88	-53.33	-29.33	-16.34
Variables and constant	7.69	12.15	7.44	3.90	8.83	-1.14

Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

Note: Values expanded for the entire population.

ESCS: Index of Economic, Social and Cultural Status.

TABLE A.6

## Effect of microsimulations on distribution indicators

	Changes in only one type of school			Changes in only one type of school			Changes in only one type of school		
	Gini <sup>a</sup>	Public	Private	Theil <sup>b</sup>	Public	Private	Entropy	Public	Private
Total difference in PISA mathematics score	-0.004	-0.003	0.001	-0.001	-0.001	0.000	-0.002	-0.001	0.000
Characteristics effect	-0.009	-0.009	0.039	-0.003	-0.003	0.014	-0.003	-0.003	0.013
Weight effect	0.003	0.004	0.039	0.001	0.002	0.013	0.001	0.002	0.013
Characteristics+weight effect	-0.001	-0.001	0.039	0.000	0.000	0.014	0.000	0.000	0.013
Price effect	-0.007	-0.005	0.038	-0.003	-0.002	0.013	-0.003	-0.002	0.013
Characteristics+weight+price effect	-0.010	-0.009	0.039	-0.004	-0.003	0.013	-0.003	-0.003	0.013
Choice effect	0.000	0.002	0.039	0.000	0.001	0.013	0.000	0.001	0.013
Characteristics+weight+price+choice effect	-0.005	-0.005	0.040	-0.002	-0.002	0.014	-0.002	-0.002	0.013
Residual effect	-0.002	0.000	0.038	-0.001	0.000	0.013	-0.001	0.000	0.013
Characteristics+weight+price+choice+residual effect	-0.008	-0.007	0.039	-0.003	-0.002	0.013	-0.003	-0.002	0.013

Source: Authors' calculations based on data from the Organisation for Economic Cooperation and Development (OECD), "PISA 2003" and "PISA 2006" [online] [http://www.pisa.oecd.org/document/51/0,3746,en\\_32252351\\_32235731\\_39732595\\_1\\_1\\_1\\_1,00.html](http://www.pisa.oecd.org/document/51/0,3746,en_32252351_32235731_39732595_1_1_1_1,00.html)

Note: The entropy index was calculated using  $\beta=2$ .

Choice effect: School selection effect.

<sup>a</sup> Gini coefficient.

<sup>b</sup> Theil index.

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# The socioeconomic cost of illicit drug consumption in Chile

*Matías Fernández H.*

## ABSTRACT

This article estimates the magnitude of monetary resources which Chile loses or forgoes owing to the trafficking and consumption of illicit drugs. On the basis of a “cost-of-illness” methodology, it is estimated that in 2006 drug consumption in Chile represented an economic burden of 266.744 billion pesos —or US\$ 503 million in current prices that year— equivalent to 0.45% of gross domestic product (gdp) and a per capita cost of 16,232 Chilean pesos or US\$ 31. The bulk of this sum is related to law enforcement for drug crime or other related offences (47%) and productivity losses reflected in the burden of disability-adjusted life years (46%).

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## KEYWORDS

Illicit drugs, consumption, drug trafficking, economic aspects, social aspects, costs, crime prevention, public health, productivity, measurement, statistical data, Chile

## JEL CLASSIFICATION

D62, J17, K42, H51

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# I

## Introduction

This article estimates the socioeconomic costs of drug trafficking and consumption in Chile in 2006—including the costs of prevention and health care, productivity losses and law enforcement—in order to allocate a monetary value to the negative externalities caused by illegal drugs in Chile.

A sound indicator of the socioeconomic costs of drug use and trafficking is needed in order to properly substantiate and justify public decisions and actions aimed at reducing the impacts of drugs. Single and others (2003) specify four purposes for this type of study:

- (i) economic estimates help argue for prioritizing drugs policies on the public agenda;
- (ii) high-quality estimates provide a standard against which intervention needs can be weighed. Without such a standard, there will be a tendency for advocates for each social problem to overbid;
- (iii) cost estimates help to target priority areas for action and identify failings in national reporting systems, and turn a spotlight on specific needs for improvement in national statistical systems; and
- (iv) the development of improved estimates provides baseline measures to determine the efficacy of drug policies and programmes.

### A. Background

Developing a good indicator of the socioeconomic costs of illicit drug consumption has become a priority and a challenge in the past decade, especially in developing countries with high consumption rates (Pacula and others, 2009). However, few countries have managed to develop quality estimates and the methodologies used vary widely. Studies conducted in the United States (Office of National Drug Control Policy, 2004), Canada (Rehm and others, 2006) and Australia (Collins and Lapsley, 2008) are probably the most advanced in the field, although estimates of a high standard have also been conducted in France (Kopp and Philippe, 2006), Spain (García-Altés, Ollé and Colom, 2002)

and England and Wales (Godfrey and others, 2002). In Latin America, the Inter-American Drug Abuse Control Commission (CICAD) of the Organization of American States (OAS) has spearheaded the “Program to Estimate the Human, Social and Economic Costs of Drugs in the Americas”, aiming to promote this kind of research in the region. This has yielded cost estimates for Argentina, Barbados, Chile, Costa Rica, El Salvador, Mexico, Peru and Uruguay. The findings of these studies are highly uneven, however, owing to over-use of secondary sources, failure to distinguish between costs related to alcohol and those related to illicit drugs—grouped in the category “psychoactive substances”—and the lack of proper estimates of indirect costs. Not all the studies have these problems to the same degree, but the estimates produced are not of the highest standard. The failure to distinguish between legal and illegal substances is a basic problem these studies share and one which—as we will argue—means that they fall short of international studies.

### B. What is a study of the socioeconomic costs of illicit drug use?

Studies of the socioeconomic costs of trafficking and use of illicit drugs are based on a “cost-of-illness” (COI) methodology, which compares a real scenario in which specific disease (in this case, trafficking and consumption of drugs) and its consequences exist, with a counterfactual scenario in which the disease does not exist (Kopp, 2001). This difference is quantified in monetary terms. What is being estimated is thus the magnitude of the costs to the country of illicit drug consumption, which would not exist in the absence of the “illness”.

Underlying this approach is the idea of opportunity cost, i.e. the cost incurred by investing resources in a particular activity (or an illness, in the COI approach), which could have been used for other available activities (Rehm and others, 2006). A COI study, then, quantifies the total reduction in the production of goods and services which can be attributed to the development of an illness (Kopp, 2001, page 26).

A COI estimate should not be confused with: (i) an avoidable cost study, (ii) a budgetary impact study, or (iii) a cost-benefit analysis. In the first place, unlike an avoidable cost study, a COI calculation does

□ This article forms part of the research conducted by the group Núcleo Científico Milenio de Investigación Socioeconómica en Uso y Abuso de Drogas, financed by the Ministry of Social Development (formerly MIDEPLAN). The author is grateful for assistance provided by Pilar Larroulet, Carlos Rodríguez and Eduardo Valenzuela.

not attempt to quantify the economic resources which could “really” be saved through effective programmes and public policy. Whereas an avoidable cost study attempts to calculate the difference between the actual situation and a hypothetical situation that assumes a feasible success rate for a given policy, a COI approach contrasts the actual situation with one in which illicit drug consumption does not exist now and never has (Segel, 2006). Second, COI calculations measure the impacts of the illness not on the public budget, but on society as a whole, including items which transcend related public spending. Lastly, unlike a cost-benefit analysis, COI estimations do not quantify the possible benefits associated with drug consumption. Whereas a cost-benefit analysis asks what would happen if the costs associated with a particular behaviour were to cease from today, a COI estimation compares the reality with a counterfactual scenario in which consumption had never started (Single and others, 2003, pp. 21 and 22). Even if a particular behaviour, like drug consumption, were to stop instantly, the consequences of past consumption would remain: they constitute “unavoidable” costs and are thus excluded from cost-benefit analysis (Single and others, 2003, p. 22). Conversely, COI studies can contribute to cost-benefit analysis.

### C. Limitations

Estimating the costs of illicit drug consumption, however useful, has many limitations and falls far short of capturing the true magnitude of the problem. The estimation results and methods show a quantification which is apparently precise but should be treated with caution. First, the accuracy of cost studies depends on information which even the developed countries are not producing comprehensively. Hence the frequent use of secondary data and proxy approaches to the problem, which make the findings somewhat uncertain even when they operate on reasonable, duly substantiated assumptions.

A second limitation is the lack of systemic studies on the indirect impacts of drug consumption on other cost-generating behaviours or diseases. In Chile there is an estimation of etiologic (or attributable) fractions<sup>1</sup> for drug-related crime (Valenzuela and Larroulet, 2010), and a very precarious estimation of disability-

adjusted life years (DALYS) where drugs are a risk factor in diseases other than addiction (School of Medicine, 2008). However, no etiologic fraction has been estimated for health (for evaluating the cost of treating diseases attributable partially to drug consumption) or for road traffic accidents.

Both points signal a major “external” limitation: despite our best efforts to generate a unified methodology for estimating COI for drug consumption —such as the notable work of Single and his colleagues at the Canadian Centre on Substance Abuse between 1994 and 2001— the research must ultimately settle for the information available in each country. The findings thus have differences that preclude comparisons (Pacula and others, 2009).

However, a methodology needs to be properly defined if it is to be used to conduct comparisons over time, and to evaluate at least how total costs and each cost item have evolved. The present estimate represents considerable progress in this respect: it has yielded quite accurate results for productivity losses and the costs of law enforcement for drug offences and drug-related crime, two of the most substantial items in total costs. The greatest failing, however, lies in the drastic underestimation of the direct costs of drug consumption on health and in the lack of any estimate at all of indirect health-related costs. Accordingly, the costs estimated need to be scaled up; they should serve as a starting point or floor level for future research that could remedy this shortfall.

The estimates should ideally have been based on a more recent period, since changes in consumption patterns or in the institutional context —such as the enforcement of the juvenile criminal responsibility act or the restructuring of the drug prevention agency— could have altered the total cost of drug consumption in Chile in the past few years. However, the information for an older period is often more consolidated than for recent periods. Moreover, many prestigious international estimates operate with a similar lag, with the exception of England and Wales (Godfrey and others, 2002), where the lag is just two years, and Australia (Collins and Lapsley, 2008), where it is three.

Notwithstanding their acknowledged shortcomings, the findings represent significant progress with respect to previous estimates by the National Drug Control Council (CONACE) (2005) and Olavarría (2009). This article owes much to the Olavarría study. In addition, the estimates for enforcement are far from comparable to international estimates published so far.

<sup>1</sup> An etiologic fraction is the proportion of cases in which an “illness” (involvement in crime, in this case) can be attributed to exposure to a given risk factor (consumption of drugs).

## II

### Basic methodological definitions

The definition of social costs used in CoI studies differs from that commonly used in economics: whereas social costs usually refer to the total sum of costs associated with a particular behaviour or decision, here social cost refers to what is often termed an “externality”, a concept which implies the total exclusion of private costs. The resources consumers spend in the drug market are not considered social costs. Social costs refer instead to the socioeconomic burden imposed “on” society as a whole by individual agents whose consumption decisions do not factor in these consequences (Single and others, 2003, p. 14). Private costs do not generate State interventions because: (i) they originate in an entirely voluntary determination by the individuals making the decision to assume these costs (OAS/CICAD, 2006, p. 18), and are offset by individual benefits of at least the same magnitude; and (ii) insofar as they do not affect third parties, what is beneficial for the individual is assumed to be beneficial for society overall. In addition, drug spending by one agent represents income for another. This differentiation is one of the key aspects in which this article differs from Olavarría (2009).

The estimate involves no great conceptual difficulties. Structurally, it has three steps (Single and others, 2003, p. 14; OAS/CICAD, 2006):

- Identification of the adverse impacts of drug abuse.
- Documentation and quantification of the degree of causality between the abuse and the adverse impacts.
- Assignment of costs to the adverse impacts.

The first step is, in principle, fairly well agreed upon. The only aspect on which agreement is lacking is whether to include or exclude intangible costs, i.e. the emotional and physical burden (addiction, premature mortality, or fear of crime and victimization), which may be borne by drug users themselves or by people around them (Pacula and others, 2009, p. 6). Although these costs could represent a large share of the total burden of drug consumption,<sup>2</sup> they are extremely hard to quantify (Kopp, 2001, p. 17; Segel, 2006, p. 4; Single and others, 2003, p. 27) and measures are far from standardized.

<sup>2</sup> Collins and Lapsley (2008) estimate that the intangible costs of drug consumption represent 45% of total socioeconomic costs in Australia in 2004 and 2005.

For these reasons, only Collins and Lapsley (2008) have incorporated them properly into the study of illicit drug costs. The instruments for this sort of analysis are not available in Chile.

The second step is more controversial. Initially, it distinguishes between direct and indirect costs: direct costs are those in which 100% causality can be established a priori (e.g. the direct costs incurred by treating addiction); indirect costs are those where imputation is partial and requires duly substantiated etiologic fractions to quantify the impact of the consumption of each drug on cost-generating behaviours or situations. In Chile, rigorous etiologic fractions for indirect costs are available only for law enforcement, i.e. the percentage of crime committed as a result of the use and trafficking of illicit drugs, and not only under their influence. Estimates, albeit less precise, also exist for indirect costs of drug consumption under the item of productivity losses, arising either from imprisonment or loss of healthy life years (DALYS).

However, there are no etiologic fractions to quantify the impacts of drug consumption on diseases other than addiction, which would help to determine what consumption costs the health system through derived and partially attributable illnesses. The lack of estimates for this item is probably the greatest defect of the calculations presented here. This article also excludes the cost of damage to property resulting from road traffic accidents, since no studies exist on etiologic fractions in this area. Unlike Olavarría (2009),<sup>3</sup> here we have preferred to maintain a conservative stance in the estimates.

With regard to the third and last step, fairly high quality information was available for most of the items in this work, and duly substantiated estimates in cases where no direct data exist. The sources and allocation methods are set forth for each item.

<sup>3</sup> Olavarría's procedure imputes to drugs the full cost generated by road traffic accidents where an illicit substance was detected. This is not adequately substantiated and overstates the measurement. As Longo and others (2000a and 2000b) show, the responsibility rate in road traffic accidents varies widely by type of drug and may even reflect an inverse correlation for drivers with low blood concentrations of tetrahydrocannabinol (THC).

**Cost structure**

The costs considered in the study were grouped into direct and indirect costs for four items:

- i. Prevention: includes campaigns, money provided for drug research and the entire budget of the National Drug Control Council (CONACE)<sup>4</sup> not corresponding to these areas or to rehabilitation.
- ii. Health: treatment in the public system for drug consumption. The private system and indirect costs are excluded owing to lack of information and of studies on etiologic fractions.
- iii. Productivity losses: the opportunity costs of DALYS attributable to mortality and morbidity resulting from drug addiction, the drug-attributable risk of other diseases, and imprisonment for crimes directly and indirectly related to drugs.
- iv. Enforcement: resources used to prosecute crime and infringements of the drugs law and crimes and infractions committed because of drugs (see table 1).

<sup>4</sup> In February 2011 CONACE was refounded as the National Service for Drug and Alcohol Consumption Prevention and Rehabilitation (SENDA).

TABLE 1

**Cost structure**

	Direct costs	Indirect costs
Prevention	CONACE Other institutions	–
Health (public)	Primary and hospital care CONACE partners Other institutions	(No etiologic fractions)
Productivity losses	Imprisonment for offences against drugs law Addiction-related mortality and morbidity	Imprisonment for partially attributable crimes Mortality and morbidity partially attributable to drug consumption (where drugs are a risk factor)
Enforcement (Each subitem for adults and juveniles separately)	Offences against drugs law: Police system Judicial system Penal system / SENAME Other institutions	Enforcement costs for partially attributable crimes: Police system Judicial system Penal system / SENAME

Source: prepared by the author.

CONACE: National Drug Control Council.  
SENAME: National Children’s Service.

## III

### Results

**A. General findings**

As illustrated in tables 2 and 3, in 2006 drug consumption in Chile represented an economic burden of at least 266.744 billion Chilean pesos (CLP) at that year’s prices (or 318.681 billion pesos in today’s terms, at 30 April 2011). This is equivalent to over US\$ 503 million (in average nominal terms for 2006), and represented 0.45%

of GDP that year, and a per capita cost of CLP 16,233 or US\$ 31 (see tables 2 and 3).

The largest portion of these costs (47%) was expended on law enforcement in relation to crimes committed either against the drugs law or because of drugs (to obtain them, in the case of addicts; under their influence, where the individual would not have committed the crime otherwise; or in the drugs market).

TABLE 2

**Estimated socioeconomic costs of drug consumption in Chile:  
total and by item, 2003 and 2006**

(Millions of nominal pesos, thousands of dollars and percentages)

	2003			2006		
	Millions of pesos	Thousands of dollars	Percentages	Millions of pesos	Thousands of dollars	Percentages
Prevention	9 103	13 166	11.6	13 070	24 647	4.9
Public health	12 625	18 260	16.0	5 093	9 605	1.9
Productivity losses	18 187	26 305	23.1	122 293	230 620	45.9
Enforcement	38 852	56 193	49.3	126 288	238 154	47.3
<i>Total</i>	<i>78 767</i>	<i>113 924</i>	<i>100</i>	<i>266 744</i>	<i>503 026</i>	<i>100</i>
<i>Nominal at 30 April 2011</i>	<i>101 503</i>	<i>220.4</i>	<i>100</i>	<i>318 681</i>	<i>692.0</i>	<i>100</i>

Source: prepared by the author on the basis of data for 2003 from the National Drug Control Council (CONACE), *Estudio de costos asociados al consumo y tráfico de SPA ilegales en Chile para el año 2003*, Santiago, Chile, 2005.

TABLE 3

**Estimates of socioeconomic cost of drug consumption: overall results, 2003 and 2006**

	2003	2006
Cost of drug consumption in millions of pesos	78 767	266 744
Percentage of GDP	0.15	0.45
Per capita cost in pesos	4 948	16 233
Per capita cost in dollars	7.2	30.6

Source: prepared by the author on the basis of data for 2003 from the National Drug Control Council (CONACE), *Estudio de costos asociados al consumo y tráfico de SPA ilegales en Chile para el año 2003*, Santiago, Chile, 2005.

GDP: gross domestic product.

The next largest cost is productivity losses, at 46% of the total. Together, these two items represent 93% of the total socioeconomic costs of drugs in Chile, although this proportion is over-estimated owing to the under-estimation of health costs, which inflates the relative proportion of the other items. Prevention costs represent 5% of the total, and public health costs, 2%.

The study for 2003 (CONACE, 2005) found a very different cost distribution: in this case, too, the largest share was represented by enforcement—an even larger percentage than we find—and the second largest by productivity losses (23%). The CONACE study heavily over-estimated for enforcement, because crimes were imputed to drug consumption merely by possession (no etiologic fractions were used), and heavily under-estimated for productivity losses owing to failings in the data sources used. This article corrects that failing by using a study by the School of Medicine (2008) on disease burden and attributable burden to arrive at a

more accurate estimate of the economic burden of drug addiction and drug consumption.

The third item, public health, represented 16% of total costs: the greater magnitude in this case reflects the fact that the estimates were conducted on the basis of secondary sources which yielded different results from the budgetary information on which the present work is based, as well as the inclusion of indirect costs on the basis of a study on drug consumption in emergency room patients “*Estudio de consumo de drogas en consultantes de los servicios de urgencia*” (CONACE/CIGES, 2001). However, the drug-attributable fractions in that study were estimated as a percentage of total admissions for external causes in which the presence of drugs was detected by a urine test. Again, this means attributing to drug use the whole set of incidents in which they are detected; for example, drugs were treated as the sole cause in all accidents in which they were found to be present. As we have argued, this procedure is highly questionable: if drugs explain 100% of the accident, it is then impossible to explain accidents in which no drugs were detected. The lack of any study that provides reliable etiologic fractions is the reason why this estimate does not include indirect costs under the public health item, notwithstanding that this means leaving out a particularly significant item.

Fourth and last, this article finds that prevention represents 11.6% of total costs, more than in the 2006 study. This is explained by the smaller volume of total costs, since the absolute value of this item rose considerably (from US\$ 13.2 million in 2003 to US\$ 24.7 million in 2006). But, since the sources and methodologies used differ significantly, this comparison is merely illustrative and does not reflect actual changes.

## B. Estimates of the socioeconomic costs of drug consumption by item

### 1. Prevention

As shown in table 4, in 2006 prevention costs amounted to CLP 13.07 billion, funded mostly from the budget of the National Drug Control Council (CONACE). What is now the National Service for Drug and Alcohol Prevention and Rehabilitation (SENDA, formerly CONACE) finances most of the work of drug consumption prevention in Chile. Its priority activity “SENDA Previene” (formerly a CONACE programme entitled “Previene”) receives an additional autonomous contribution from the municipal government for local implementation. CONACE also makes transfers to regional and subregional governments and —for research purposes— to the United Nations Development Programme (UNDP), the National Children’s Service (SENAME) and other community agencies, such as foundations, churches and private non-profit corporations. The largest cost —which is, however, indirectly linked to prevention— is “other CONACE costs”, which is the sum of all CONACE costs other than those listed above and of transfers for rehabilitation, including under public health costs. These other costs correspond mainly to the Council’s national level administrative costs. They are included under this item because the Council’s ultimate aim is prevention and in the absence of drug consumption (the counterfactual scenario), it would not exist at all. Lastly, the investigative branch of the Chilean police force, *Policía de Investigaciones de Chile* (PDI),

makes a small contribution through its Department of Antinarcotics Education and Public Safety for workshops on preventing drug consumption.

### 2. Public health

Public health usually represents a high portion of total costs in international COI studies. By contrast, here the costs to the public health system of the use and abuse of illicit drugs are grossly underestimated. Not only are indirect costs not counted —since there is no study on drug-attributable fractions for related diseases in Chile— but the direct costs are underestimated as well because of the lack of information on private health care and treatment for addiction.

Olavarría (2009) attempted to estimate private health costs attributable to drugs. He calculated the total number of treatments conducted in Chile using the expanded database of the CONACE study of the general population for 2006, assigning each treatment the corresponding public system value and subtracting from that sum the known total cost of treatments paid for out of public funds. It is thus assumed that the cost of private health treatment is given by subtracting known costs from the total costs estimated using the survey. Theoretically this exercise is reasonable, and since it does not separate drug and alcohol costs, the estimate is apparently plausible.

However, when, in this procedure, the drug-related costs are separated from alcohol-related costs, the results become so nonsensical that negative costs are found for certain types of treatment; for example, there are cases

TABLE 4

**Prevention costs, 2006**  
(Millions of pesos in nominal terms)

Prevention - CONACE	CONACE en su comuna: “Previene”	2 681
	CONACE transfers to regional governments	2 049
	CONACE transfers to provincial governments	96
	CONACE transfers to community organizations	702
	CONACE transfers to UNDP	21
	CONACE – SENAME agreement	149
	CONACE transfers to other agencies	710
	Other CONACE costs (not including rehabilitation)	5 965
Prevention – other institutions	PDI workshops	14
	Municipalities (independent contributions to Previene scheme)	683
<b>Total</b>		<b>13 070</b>

Source: prepared by the author on the basis of data for 2003 from the National Drug Control Council (CONACE), *Estudio de costos asociados al consumo y tráfico de SPA ilegales en Chile para el año 2003*, Santiago, Chile, 2005

CONACE: National Drug Control Council.

SENAME: National Children’s Service.

UNDP: United Nations Development Programme.

PDI: Chilean police force investigative branch.

in which the public system (known number) registers more treatments than the total estimated number arising from the survey (which should correspond, in Olavarría's strategy, to the sum of public and private treatments). This absurd finding highlights the risk of generalizing by extrapolating a very small number of cases to the national level, and provides conclusive grounds for excluding this item for lack of information.

In public health, Chile does not have direct sources of information on the costs of primary and hospital care attributable exclusively to illicit drugs; in the health system the two types of treatment—for drugs and alcohol—come under a single budget item. The costs linked to each of these two problems can, however, be estimated relatively accurately from the proportion of hospital bed occupancy for each, according to records of the Health Data and Statistics Department (DEIS) for 2006. Tables 5 and 6 show the data used to perform this calculation.

Although alcohol-related hospital stays represent 75.5% of total stays in relation to both substances, the duration of drug-attributable stays is considerably longer, with an average of 19.4 days per patient, far more than

the average 9.3 days stay in alcohol-attributable cases. Thus, the public system covered 69,683 days of hospital bed occupancy for alcohol and 47,441 for illicit drugs. These figures may be used to estimate costs: days of hospital bed occupancy for drugs represent 40.5% of the days of total occupancy for both alcohol and drugs and the same percentage of resources allocated for both items. Accordingly, we have assumed that 40.5% of the resources allocated to alcohol and drugs in hospital care corresponds to drugs and 59.5% to alcohol. Since the budgets show that total resources allocated to hospital treatment for alcohol and drugs was CLP 1.062 billion, 40.5% of that sum, i.e. CLP 430.4 million, was spent on drug-attributable cases.

In the absence of data on treatment in primary care facilities and psychiatric hospitals, we have assumed that the resources allocated to alcohol and drugs are distributed similarly to the proportions seen in the general hospital data. Estimates performed by Olavarría (2009) indicate that the costs for both alcohol- and drug-related treatment amount to CLP 2.195 billion, of which drug-attributable treatment would represent 40.5%, or CLP 889 million.

In addition, both the estimate for 2003 (CONACE, 2005) and the Olavarría study (2009) on alcohol and drugs in 2006 include treatment spending by non-governmental organizations (NGOs); the CONACE study includes only one organization, however, while Olavarría's work includes the amounts spent by nine NGOs, all in the Metropolitan Region, which responded to the author's request for information. Given that data on NGO treatment spending are not compiled systematically, this article has excluded them on the basis that a cost study must be based on a stable model that can be replicated over time; the random selection of these institutions makes it impossible to include them in a systematic and comparable study. A comprehensive register of NGOs working on drug rehabilitation with high quality data would be needed in order to overcome this problem.

Conversely, the costs of rehabilitation and detoxification treatment in prisons and SENAME centres are well documented and, probably as a result, constitute the main item in public health costs. It may be assumed that the costs of treatment in private centres are considerable, but there is no information in this respect (see table 7).

### 3. Productivity losses

Costs from productivity losses are often the largest item within the estimated socioeconomic costs of drugs. In the United States, they represented 71.2% of all socioeconomic costs attributed to drug consumption for

TABLE 5

#### Hospital stays and hospital bed occupancy days due to drugs and alcohol, 2006

	Alcohol	Drugs
Total stays	7 530	2 447
Total hospital bed occupancy days	69 683	47 441
Average hospital bed occupancy days	9.3	19.4
Percentage of total stays	0.5	0.1
Percentage of total hospital bed occupancy days	0.77	0.52

Source: prepared by the author on the basis of data on hospital stays from the Department of Health Statistics and Information (DEIS) of the Ministry of Health of Chile.

TABLE 6

#### Hospital stays and days of hospital bed occupancy due to drugs and alcohol as a percentage of total for alcohol + drugs, 2006

Drug-related stays as % of stays related to both alcohol and drugs	24.5
Alcohol-related stays as % of stays related to both alcohol and drugs	75.5
Drug-related hospital bed occupancy as % of occupancy related to both alcohol and drugs	40.5
Alcohol-related hospital bed occupancy as % of occupancy related to both alcohol and drugs	59.5

Source: prepared by the author on the basis of data on hospital stays from the Department of Health Statistics and Information (DEIS) of the Ministry of Health of Chile.

TABLE 7

**Public health costs linked to drug consumption and abuse, 2006**  
(Millions of nominal pesos)

	Subitem	Millions of pesos
Primary and hospital care	Treatment for psychoactive substances in primary health facilities	430
	Treatment in general and psychiatric hospitals	889
CONACE partners	FONASA - CONACE agreement	3 521
	CONACE - GENCHI agreement	232
Other institutions	Contributions from GENCHI	20
<i>Total</i>		<i>5 093</i>

Source: prepared by the author on the basis of data for 2003 from the National Drug Control Council (CONACE), *Estudio de costos asociados al consumo y tráfico de SPA ilegales en Chile para el año 2003*, Santiago, Chile, 2005, Olavarría y Asociados, 2009, and data from the Department of Health Statistics and Information (DEIS) of the Ministry of Health of Chile.

CONACE: National Drug Control Council.

FONASA: National Health Fund.

GENCHI: Gendarmería (prison guard service) of Chile.

2002 (Office of National Drug Control Policy, 2004). The present cost estimation works initially with two categories under this item: (i) costs for disability-adjusted life years (DALYs) through illness or premature death, and the costs for life years lost through imprisonment, and (ii) direct and indirect costs.

(a) *Productivity losses from incarceration: direct and indirect costs*

Costs from incarceration for offences against drug laws are obtained from the product of the average number of inmates imprisoned for infringements of drug law, the minimum monthly wage —CLP 131,250 in 2006— and a 12-month period. The assumption here is that the minimum wage is a more realistic alternative cost<sup>5</sup> for the adult prison population and the average income for the population generally.

Calculating the costs of imprisonment for crimes partly attributable to drugs is rather more difficult. First of all, Chile does not record precise information on the average number of inmates for each type of crime. The only information available is the distribution of crimes among the prison population. On the basis of that information, a good estimate may be obtained by comparing the proportion imprisoned for drug offences. Of the average numbers of inmates in closed prisons, in 2006 3,468 of a total of 38,007, i.e. 9.13%, were

imprisoned for drug offences. At the same time, the data available on inmates' crimes shows that of a total of 139,333 crimes, 12,487, or 8.96%, were drug-related.<sup>6</sup> Since the two percentages are almost identical, for the purposes of calculating the average number imprisoned each year for drug offences, we assume the percentage estimated on the basis of the prison population's total crimes to be equal to the average percentage imprisoned for those crimes each year. We always use a 12-month period, because the estimate of the average numbers imprisoned for each crime is precisely calculated and a productivity cost may be assigned for each of the 12 months. What is not known, however, is the duration of imprisonment of each individual by type of crime and imprisonment status (detained, on trial or convicted). The result of this estimate is shown in the column "average prisoners 2006" in table 8.

Secondly, estimates of productivity losses from crimes attributable to use, abuse and traffic of drugs which are not, however, typified as offences against the drugs law require an estimate of etiologic fractions which in Chile has recently been developed by Valenzuela and Larroulet (2010). In epidemiology, an etiologic or attributable fraction is a form of indirect quantification of morbidity and mortality due to a specified risk factor (Ridolfo and Stevenson, 2001, p. 2). In this case, the fraction corresponds to the proportion of various types of crime that may be attributed to the consumption of or addiction to different drugs.

<sup>5</sup> Olavarría (2009) uses another source and considers only convicted inmates. Here the figure for total inmates is used, because those charged, on trial and convicted all represent a cost directly associated with drug consumption.

<sup>6</sup> Crimes and not people: many inmates are in prison for more than one crime.



TABLE 8

**Costs in productivity losses from imprisonment: direct costs  
(drug law) and indirect costs (related crime), 2006**

	Average prisoners 2006 <sup>a</sup>	Attributable fraction <sup>b</sup>	Minimum wage <sup>c</sup> in pesos	Cost in millions of pesos
Imprisonment for offences against drugs law (direct cost)	3 468	1	131 250	5 462
Imprisonment for related crime (indirect costs)				
Theft	14 601	0.327	131 250	7 520
Violent theft	7 906	0.287	131 250	3 574
Sexual crime	1 447	0.079	131 250	180
Homicide	1 939	0.206	131 250	629
<i>Total</i>				<i>17 365</i>

Source: prepared by the author on the basis of:

<sup>a</sup> Ministry of Justice, *Compendio estadístico de la población atendida por Gendarmería de Chile*, Santiago, Chile, Gendarmería de Chile, Sub Departamento de Estadística y Control Penitenciario, 2006.

<sup>b</sup> E. Valenzuela and P. Larroulet, "La relación droga y delito: una estimación de la fracción atribuible", *Estudios públicos*, No. 119, Santiago, Chile, Centro de Estudios Públicos (CEP), 2010.

<sup>c</sup> Act No. 20.039 on the minimum monthly wage.

Valenzuela and Larroulet (2010) use the tripartite model by Goldstein (1985) to assess this link. In this model, the impact of drug consumption on the commission of crime occurs in three scenarios:

- i. A "psycho-pharmacological" connection is said to exist where crimes are committed under the influence of substances that increase excitability, irrationality or disposition to violence, including cases in which the victim is under the effects of a particular substance, on the understanding that a victim's vulnerability can constitute an opportunity to commit a crime.
- ii. A "compulsive economic" link is said to exist where the drug addict commits a crime in an attempt to obtain drugs or the means necessary to obtain them; and lastly,
- iii. A "systemic" link exists in those crimes that arise from the operation of drug production and exchange networks. Based on this conceptualization etiologic fractions are estimated for each type of crime and connection, on the basis of studies by SENAME on the committing population (SENAME, 2006) and by CONACE on the adult prison population in 2007 (CONACE, 2007).

Lastly, the minimum wage is used for the income factor rather than the average wage, on the basis that the minimum wage is a more realistic alternative cost in the case of the imprisoned population (see table 8).

(b) *Productivity losses from drug-attributable morbidity and mortality: disability adjusted life years (dalys)*

— *Study of disease burden and attributable burden in Chile*

Losses through morbidity and mortality are a particularly important item in international studies. For Chile, the Public Health Department of the School of Medicine at the Catholic University of Chile (School of Medicine, 2008) estimated DALYS as a "disease burden", i.e. specifically owing to an disease; and DALYS as a burden attributable to particular behaviours (17 risk factors) in other diseases.

Cause-specific DALYS correspond to the sum of years lost because of premature death from the specific cause, plus years of life lived with disability in cases affected by the specific cause. DALYS attributable specifically to drug addiction provide a gauge of the "direct" effect of drug consumption on future health loss. Here the opportunity cost of drug-attributable mortality and morbidity is key to the resulting estimate.

DALYS attributable to drug consumption, as an estimate of indirect costs, are obtained from an estimate of attributable burden which measures the incidence of 17 "risk factors" on the final damage (in DALYS). The attributable burden is the reduction that would be observed

in the actual burden if past levels of exposure had been similar to a given hypothetical distribution (School of Medicine, 2008, p. 79). The risk factor in this case is the use of illicit drugs, which represents by far the least significant risk factor of the 17 examined (0.0% of the total, School of Medicine, 2008). The study examines drug consumption as a risk factor in suicide, violence and road traffic accidents, and finds an attributable burden of 417 DALYS. There are sound reasons to suppose that this figure underestimates the burden, mainly because it was calculated using the prevalences reported by the CONACE study for the general population. The CONACE study was based on self-reporting,<sup>7</sup> which tends to underestimate the magnitude of the phenomenon and leaves out diseases that do not count as etiologic fractions for drugs in Chile, despite having been shown to be linked to drug consumption.

The economic burden in terms of productivity losses estimated as DALYS allows us to attribute a present value to potential future income. Since people value current benefits more highly than future ones, the discount rate applied must significantly influence the amount ultimately discounted. Generally speaking, the more uncertain the future, the higher the value individuals give to the present (Kopp, 2001, p. 19). There is no consensus on the selection of a discount rate (Single and others, 2003; Kopp, 2001) which, in general, “partly reflects the researcher’s opinion about how difficult a society will make it to live as a drug user. [...] The lower the selected rate, the higher the estimated social cost” (Kopp, 2001, p. 19). Usually a discount rate of 5% and 10% is suggested, however a 3% rate is most common (Segel, 2006, p. 30).

The study by the School of Medicine of the Catholic University of Chile uses a discount rate of 3%, which it states corresponds to the long-term investment growth rate and is widely used for evaluating social projects (School of Medicine, 2008, p. 33). This is a relatively low rate, as a result of which the derived costs may be slightly overestimated.

Lastly, the calculation of DALYS with respect to life expectancy for the different cohorts, rather than economically active life, could represent a problem for a cost estimate exercise which assigns a value to income forgone through failure to produce in working life. This difficulty is resolved by including a factor for valuation of the time lived at each age (School of Medicine, 2008, p. 32), in which a greater weighting is given to younger groups.

<sup>7</sup> Declaration of an interviewee on whether, for example, he or she has consumed drugs in the past 30 days.

— *Procedures for estimating drug-attributable mortality and morbidity costs (direct and indirect)*

The first important decision for estimating costs under this item is the amount to be assigned to each DALY. Here we opt for average income rather than the minimum wage, as in productivity losses from imprisonment, since the 2006 study on drug consumption in the general population in Chile finds that average income reported by drug addicts does not differ significantly from that reported by the rest of the population (and not only are the differences small, but they also favour the addicts). Average autonomous daily income is obtained from the National Socioeconomic Survey (CASEN) of 2006. The direct costs in productivity losses are obtained from the product of drug-addiction-specific DALYS, average autonomous daily income (CLP 11.114 billion in 2006), and 365 (days of the year). This calculation indicates that Chile’s productivity losses through mortality and morbidity directly attributable to drug addiction represented an economic burden of CLP 103 billion in 2006.

The same procedure was used for DALYS attributed to drug-related illnesses other than drug addiction (indirect cost). Since DALYS attributable to the risk factor of drug consumption are underestimated, the amount generated by the product of the elements is also underestimated. The economic burden of DALYS attributable to drug consumption as a risk factor for diseases other than addiction was CLP 1.907 billion at current 2006 prices. Overall, the economic burden of mortality and morbidity directly and indirectly attributable to illicit drugs appears to have been around CLP 105 billion (see table 9).

#### 4. Enforcement

Drug-attributable enforcement costs –corresponding to the item usually called “law enforcement”– represent the highest proportion of estimated costs in this article (46.6%). Usually, however, productivity losses represent the highest costs (here, 45.1%). There are two main reasons for this difference: one is that Chile has very solid information for calculating this item (especially for adults) and a sound attributable fractions study for calculating indirect costs, which has enabled a comprehensive estimate. By contrast, the etiologic fractions for productivity losses through loss of healthy life years (DALYS as a risk factor) are underestimated.

Calculation of the cost of enforcement for offences directly and indirectly related to drugs usually requires us to define a relevant and ideally equivalent activity on the basis of which to estimate the proportion of drug-linked

TABLE 9

**Direct and indirect costs of productivity losses due to drug-related premature morbidity and mortality, 2006**

	DALYS <sup>a</sup>	Average daily autonomous income <sup>b</sup> in pesos	Cost in millions of pesos
DALYS attributable to drug addition, specific cause	25 396	11 114	103 022
DALYS attributable illicit drug use, attributable burden (risk factor)	470	11 114	1 907
<i>Total</i>			<i>104 929</i>

Source: prepared by the author on the basis of:

<sup>a</sup> School of medicine, *Estudio de carga de enfermedad y carga atribuible 2007*, Santiago, Chile, Department of Public Health, Catholic University of Chile, 2008.

<sup>b</sup> National Socioeconomic Survey (CASEN), 2006.

DALYS: disability adjustment life years.

activities in an institution's total activities. This means assuming that equal resources are allocated to different activities. This assumption is broadly used (Pacula and others, 2009, p. 34), but highly implausible: investigation of a homicide mobilizes far more resources than a petty theft. In order to give each crime a differentiated weighting, a proxy was calculated for the relative difficulty of investigation of different crimes, based on the duration of the judicial processes in each case. As a substitute variable, this does not reflect the difficulty of investigation exactly or proportionally, since all crimes share a threshold level of bureaucratic time and there is always greater possibility in some cases of an alternative, abbreviated procedure or a more vigorous prosecution.

A weighting factor is calculated on the basis of a standardized average trial duration for each type of crime. A factor of less than 1 denotes below-average duration (and difficulty) and a factor of higher than one denotes the reverse. Table 10 shows the values of the weighting factors for crimes in question.

The crimes studied by Valenzuela and Larroulet (2010) are homicide, sexual crimes, violent theft and simple theft, which includes all sorts of non-violent robbery and petty theft. In order to estimate the relative difficulty of simple theft we calculate the weighted average (by frequency) for "non-violent robbery" (n=193,517) and "petty theft" (n=133,303), which gives 87.16 days, or a weighting factor of 0.828.

With this factor incorporated, we calculated the costs of enforcement for each institution for crimes against the drugs law and related offences. The nominal cost of this item exceeded CLP 126 billion in 2006, with 37.3% corresponding to direct costs (prosecution, trial and imprisonment for crimes against Act No. 20.000 on drugs and narcotics control), and the remaining 62.7% corresponding to other types of crimes committed partly as a result of drug consumption, abuse or trafficking

(this last item is less frequent: it refers to crimes, such as robbery or homicide, committed in the trafficking of drugs). This means that Chile lost over CLP 47 billion in 2006 in prosecuting drug crimes, and almost CLP 80 billion in enforcement for other types of crime attributable to drug consumption and trafficking. The police system assumed the largest share of these costs (42.6%), followed by the penitentiary system (37.1%) and the judicial system (19%). Other smaller institutions account for the remaining 1.3% of enforcement costs: the Medico-Legal Service, the Financial Analysis Unit, the National Customs Service and the Department of Maritime Territory and Merchant Navy (DIRECTEMAR)<sup>8</sup> (see table 11).

In turn, 14.7% of these costs (CLP 18.541 billion) are attributable to the prosecution and custody of juveniles for drug offences and other related crimes, while 85.3% (CLP 107.747 billion) was spent on prosecuting the same crimes in the adult population (see table 12).

(a) *Direct enforcement costs: adults*

For adults, the institutions involved in enforcement of drug offences and related crimes are the police, Carabineros de Chile, the detective branch, PDI (the police system), the courts, the Public Prosecutor's Office and the Public Defender's Office (judicial system), the prison guard service, Gendarmería de Chile (which, together with prison-building costs, form the penal system), and other smaller institutions. The combined economic burden for these institutions of prosecuting drug offences was over CLP 40 billion in 2006.

— Carabineros de Chile made 448,128 arrests (INE, 2008b). Of these, 9,870 were for drug offences.

The relative difficulty weighting for drug offences

<sup>8</sup> Information obtained from the study by Olavarría (2009).

TABLE 10

**Duration of trials and relative difficulty estimate (weighting) of crimes, 2006**

	Time taken (days)	Standardized value	Weighting factor
Theft	118	124.2	1.242
Non-violent theft	99	104.2	1.042
Petty theft	70	73.7	0.737
Homicide	297	312.6	3.126
Sexual crimes	234	246.3	2.463
Offences against drugs law	177	186.3	1.863
<i>General average</i>	95	100	1.000

Source: prepared by the author on the basis of information available from the Public Prosecutor's Office, *Boletín estadístico. Año 2006*, Santiago, Chile, Fiscalía Nacional.

TABLE 11

**Enforcement costs, by enforcement system and direct or indirect relation with consumption, 2006***(Millions of nominal pesos)*

	Direct	Indirect	Total	Percentage
Police system	22 155	31 650	53 805	42.6
Judicial system	8 248	15 797	24 045	19.0
Penitentiary and rehabilitation system (SENAME)	15 035	31 780	46 815	37.1
Others	1 624	-	1 624	1.3
<i>Total</i>	<i>47 062</i>	<i>79 227</i>	<i>126 289</i>	<i>100</i>
<i>(Percentage)</i>	<i>(37.3)</i>	<i>(62.7)</i>	<i>(100)</i>	

Source: prepared by the author.

SENAME: National Children's Service.

TABLE 12

**Enforcement costs, by enforcement system and prosecution for trafficking and consumption in juveniles and adults, 2006***(Millions of nominal pesos)*

	Minors	Adults	Total
Police system	7 427	46 377	53 805
Judicial system	199	23 846	24 045
Penitentiary and rehabilitation system (SENAME)	10 916	35 900	46 815
Others	-	1 624	1 624
<i>Total</i>	<i>18 541</i>	<i>107 747</i>	<i>126 288</i>
<i>(Percentage)</i>	<i>(14.7)</i>	<i>(85.3)</i>	<i>(100)</i>

Source: prepared by the author.

SENAME: National Children's Service.

is 1.863. The product of the percentage of related activities, the weighting factor and the institutional budget shows that in 2006 Carabineros de Chile spent CLP 13.169 billion on prosecuting drug crimes.

- The detective branch, PDI conducted a total of 179,955 investigations in 2006, of which 6,468 related to drugs (INE, 2008a, p. 101). Investigations of drug

offences as a proportion of total investigations, multiplied by the weighting factor and the institutional budget, indicate that PDI spent CLP 5.79 billion on investigating drug crimes in 2006.

- In 2006 1,013,833 crimes were registered in the Public Prosecutor's Office, of which 11,323 corresponded to offences against the drugs law. On the basis of the calculation used in the cases above, the Public Prosecutor's Office allocated CLP 1.62 billion to investigating drug offences in 2006.
- The Public Defender's Office took in a total of 212,095 crimes in 2006, of which 8,741 were drug offences. Accordingly, this Office spent CLP 2.281 billion on defending cases of drug crime that year.
- The judicial category includes the courts as well as the Administrative Corporation of the Judicial Branch (CAPJ) and the Judicial Academy. The information on crime for the calculation of costs was taken from the study by Olavarría (2009) who, in turn, used data from an official document prepared by CAPJ; drug offences represented 25,764 of a total of 2,193,142 recorded in the judicial system; the cost associated with drug crimes was CLP 4.253 billion.

- Gendarmería de Chile registered an average of 3,468 individuals imprisoned for drug offences in 2006 against a total of 38,007 on average that year. This corresponded to 9.13% of crimes committed by prisoners; this percentage is also assumed to apply to the proportion of resources used for drug-related imprisonment (no weighting factor is used here, since the effort and resources expended by the prison guard service do not vary by type of crime). Accordingly, in 2006 Gendarmería spent CLP 11.152 billion on drug-related imprisonment.
  - The cost of prison-building must be added to the previous calculations. According to the study by Olavarría (2009), the annual cost of prison-building should be measured by yearly depreciation. Olavarría assumes prisons to have a useful life of 50 years, so that prison-building costs for 2006 would be a fiftieth of the cost updated to 2006 of building the prisons in operation that year (Olavarría, 2009, p. 65). By multiplying annual depreciation by the proportion of inmates imprisoned for drug offences, it is found that Chile spent CLP 349 million on prison-building for incarcerating drug offenders. This figure does not coincide with that presented in the Olavarría study, because it counts both drug- and alcohol-related crimes and only prisoners who have been convicted, whereas the present study includes those convicted, on trial or charged for drug (but not alcohol) crime, since they are all held in facilities run by Gendarmería. As always, the estimates correspond to the annual average number of inmates per crime, not the total number of individuals for whom Gendarmería is responsible.
  - The drug-attributable costs carried by the Medico-Legal Service are estimated as spending represented on toxicology tests as a percentage of total laboratory tests (15%), which in turn represent 61% of the expenditure incurred by the Service. On this basis, the institution spent CLP 989 million on drug tests in 2006.
  - With regard to the Financial Analysis Unit of the Ministry of Finance, which investigates monetary laundering, there is no information on the percentage of suspicious transaction reports which are drug-related. It was therefore assumed the distribution is similar to that in the Public Prosecutor's Office, which gives an annual expenditure of CLP 132 million on investigating drug-related money laundering crime.
  - The National Customs Service spent CLP 344 million on drug-related enforcement in 2006; this figure comes from the budget of the Service's Drugs Control Department.
  - The Department of Maritime Territory and Merchant Navy (DIRECTEMAR) engages in a range of activities to investigate and combat drug trafficking; according to the information provided to Olavarría (2009), these represent 0.48% of the institution's total activities. On this basis, the Department spent CLP 157 million on this item in 2006 (see table 13).
- (b) *Direct enforcement costs: juveniles*
- With regard to juveniles, or under-age offenders, it is estimated that in 2006 Carabineros de Chile, the courts and the National Children's Service (SENAME) together spent CLP 6.822 billion on drug crime enforcement. However, the information for juveniles is imprecise, since before the juvenile penal responsibility act came into effect there were no proper information systems exclusively for under-age offenders.
- There is no precise information on the number of under-age offenders detained for drug-related offences in 2006; however, Carabineros de Chile is known to have detained 25,952 juveniles that year and information is also known on the profiles of law-breaking minors entering the "24 hours programme"<sup>9</sup> between 2001 and 2005. In order to estimate the number of crimes in 2006, it was assumed that detainments were distributed by crime in the same manner as in 2001-2005. It was thus deduced that 2,396 juveniles were detained in 2006 for drug consumption (the only drug-related crime which is categorized), which represents 0.53% of all detentions that year. After incorporating the weighting factor, we calculate that the Carabineros de Chile spent CLP 3.196 billion on detaining juveniles for drug consumption in 2006 (see table 14).
  - There is a large information gap with respect to juvenile offenders before the juvenile penal responsibility act came into effect in 2007. There are no public prosecution records for minors aged 14-17 declared competent to stand trial, because in that case they were tried as adults. Nor is there any information on the defence side. It is therefore not possible to estimate the costs for these institutions and only a very rough estimate can be ventured for

<sup>9</sup> Formally known as the 24-hour integrated safety programme for children and adolescents, the scheme's objective is to compile information on children and teenagers entering the police system and to connect them with the social protection and care network organized around municipalities with the objective of early crime prevention (Allende and Valenzuela, 2008).

TABLE 13

**Enforcement costs directly attributable to drug trafficking  
and consumption, adults, 2006**  
(Millions of nominal pesos)

		Total budget (millions of pesos) <sup>a</sup>	Related activities <sup>b</sup> (number)	Total activities <sup>b</sup> (number)	Difficulty weighting	Proportion of resources to drugs	Direct costs (millions of pesos)
Police system	Carabineros	320 931	9 870	448 128	1.863	4.10	13 169
	PDI	86 469	6 468	179 955	1.863	6.70	5 790
Judicial system	Public Prosecutor's Office	77 878	11 323	1 013 883	1.863	2.08	1 620
	Public Defender's Office	29 719	8 741	212 095	1.863	7.68	2 282
	Courts	194 337	25 764	2 193 142	1.863	2.19	4 253
Penal system	GENCHI	122 152	12 726	139 333	-	9.13	11 152
	Prison-building <sup>c</sup>	3 825	3 468	38 007	-	9.13	349
Others	MLS		22 757		-		989
	FAU	745			-	17.86	133
	Customs				-		345
	DIRECTEMAR	36 440	16 686	3 878 160	-	0.48	157
<i>Total</i>							40 239

Source: prepared by the author on the basis of data from: <sup>a</sup> M. Olavarría, *Estudio nacional sobre costos humanos, sociales y económicos de las drogas en Chile*, 2006, Santiago de Chile, Olavarría y Asociados, 2009; Olavarría (2009); <sup>b</sup> National Statistical Institute (INE), *Anuario de estadísticas policiales. Policía de Investigaciones de Chile*, Santiago, Chile, 2008; and *Carabineros. Informe anual 2006*, Santiago, Chile, 2008; INE (2008a y 2008b Public Prosecutor's Office, *Boletín estadístico. Año 2006*, Santiago, Chile, Fiscalía Nacional.); Public Prosecutor's Office (undated); Public Defender's Office, *Informe estadístico. Año 2006*, Santiago, Chile; Public Defender's Office (undated); Poder Judicial, *Memoria anual 2006*, Santiago, Chile, (2007); Ministry of Justice, *Compendio estadístico de la población atendida por Gendarmería de Chile*, Santiago, Chile, Gendarmería de Chile, Sub Departamento de Estadística y Control Penitenciario, 2006; <sup>c</sup> Annual depreciation.

FAU: Financial Analysis Unit.

MLS: Medico-Legal Service.

DIRECTEMAR: Department of Maritime Territory and Merchant Navy.

TABLE 14

**Enforcement costs directly attributable to drug trafficking  
and consumption, juveniles, 2006**  
(Millions of nominal pesos)

		Total budget (millions of pesos) <sup>a</sup>	Related activities <sup>b</sup> (number)	Total activities <sup>b</sup> (number)	Difficulty weighting	Proportion of resources to drugs	Direct costs (millions of pesos)
Police system	Police (Carabineros)	320 931	2 396	448 128	1.863	0.53	3 196
Judicial system	Judicial branch	194 337	563	2 193 142	1.863	0.03	93
SENAME		53 042	368	5 524	1	6.66	3 534
<i>Total</i>							6 823

Source: prepared by the author on the basis of information from:

SENAME: National Children's Service.

<sup>a</sup> M. Olavarría, *Estudio nacional sobre costos humanos, sociales y económicos de las drogas en Chile*, 2006, Santiago, Chile, Olavarría y Asociados, 2009; National Children's Service (SENAME), *Informe final de evaluación. Programa de Administración Directa*, Santiago, Chile, 2007; Olavarría (2009); SENAME (2007); informal communications from SENAME staff;

<sup>b</sup> National Institute of Statistics (INE), *Carabineros. Informe anual 2006*, Santiago, Chile, 2008; INE (2008b Carabineros de Chile/Government of Chile (2007), *Programa de Seguridad Integrada para Niños, Niñas y Adolescentes "24 Horas"*, Santiago, Chile).

the court system. Since the number of drug crimes (indeed all crimes) entered in 2006 is not known, an estimate is performed on the basis of trials citing a specific offence as a proportion of completed trials (crimes are not specified for unfinished trials). This gives a drastic underestimation of the resources allocated to judicial procedures, since it yields the conclusion that 503 juveniles entered the courts for drug offence in 2006, which—including the difficulty estimator— would mean that only 0.03% of the institution's resources, i.e. CLP 93 million per year, were spent on investigating juvenile drug crime. This underestimated figure is, however, offset by the magnitude of resources allocated by SENAME, a non-punitive—in principle—institution which also reports to the Ministry of Justice.

- With regard to crime, the role of SENAME consists more of rehabilitation than punishment. However, the Service is responsible for detaining or monitoring juvenile offenders who are imprisoned full or part time. Difficulties surround the estimation of costs for SENAME, too, since although the information on the juveniles in its care is public, reliable budgetary information is lacking for juvenile offenders, since there was no institutional division to this effect before the juvenile penal responsibility act. The budget information used is a reconstruction of different pieces of information provided by SENAME officials and the information submitted by SENAME for the final report on the direct administration programme

(SENAME, 2007). On this basis, we estimate that in 2006 SENAME spent CLP 3.534 billion on juveniles who committed drug-related crimes (see table 14).

(c) *Indirect enforcement costs: adults*

As noted earlier, one of the soundest aspects of this article is the estimate of indirect costs of drug enforcement based on the recent paper on attributable fractions by Valenzuela and Larroulet (2010) and on detailed information on drug-related crime from the various institutions involved.

As may be surmised from table 15, in 2006 the main institutions involved in prosecuting crime in Chile spent CLP 67.508 billion on enforcement for crimes committed by individuals over age 18 because of drugs, whether to obtain it (in the case of addicts), under its influence (when the crime would not have been committed otherwise) or in the drug market, following Goldstein's tripartite model.

The institutions spending the most on related crimes were Gendarmería (CLP 23.658 billion) and Carabineros de Chile (CLP 17.194 billion). They are followed by PDI (CLP 10.225 billion) and the Public Prosecutor's Office (CLP 9.403 billion). If these amounts are broken down by crime, simple theft is by far the most common crime committed because of drugs. It costs the institutions involved CLP 47.841 billion, i.e. 71% of costs for drug-related crime. Following at a considerable distance are violent theft (CLP 16.184 billion), sexual crime (CLP 2.142 billion) and homicide (CLP 1.341 billion).

TABLE 15

**Enforcement costs indirectly attributable to drug trafficking and consumption, adults, by type of crime, 2006**  
(Millions of nominal pesos)

		Simple theft	Violent theft	Sexual crimes	Homicides	Total
Judicial system	Public Prosecutor's Office	6 874	2 276	227	26	9 403
	Public Defender's Office	1 859	731	87	59	2 736
	Courts	2 414	949	113	77	3 552
Police system	Carabineros	14 637	2 353	120	83	17 194
	PDI	6 239	2 354	1 217	416	10 225
Penal system	Gendarmería	15 338	7 292	367	660	23 658
	Prison-building	480	228	12	21	741
<b>Total</b>		<b>47 841</b>	<b>16 184</b>	<b>2 142</b>	<b>1 341</b>	<b>67 508</b>

Source: prepared by the author on the basis of information from M. Olavarría, *Estudio nacional sobre costos humanos, sociales y económicos de las drogas en Chile, 2006*, Santiago, Chile, Olavarría y Asociados, 2009; National Institute of Statistics (INE), *Anuario de estadísticas policiales. Policía de Investigaciones de Chile*, Santiago, Chile, 2008; and *Carabineros. Informe anual 2006*, Santiago, Chile, 2008; Public Prosecutor's Office, *Boletín estadístico. Año 2006*, Santiago, Chile, Fiscalía Nacional.; Public Defender's Office, *Informe estadístico. Año 2006*, Santiago, Chile; Poder Judicial, *Memoria anual 2006*, Santiago, Chile, 2007; Public Prosecutor's Office, *Compendio estadístico de la población atendida por Gendarmería de Chile*, Santiago, Chile, Gendarmería de Chile, Sub Departamento de Estadística y Control Penitenciario, 2006; and E. Valenzuela y P. Larroulet, "La relación droga y delito: una estimación de la fracción atribuible", *Estudios públicos*, N° 119, Santiago, Chile, Centro de Estudios Públicos, 2010.

The calculation is the same as that used for the section on direct costs, except that in this case it includes attributable fractions.

(d) *Indirect enforcement costs: juveniles*

The estimation of indirect costs for juveniles uses the same strategies as those described for estimating the direct costs for this group, owing to gaps in the information available. Again, therefore, the cost of justice is heavily underestimated. The calculation applies an attributable fraction factor for each crime, which is specific to the juvenile population (Valenzuela and Larroulet, 2010).

Together, the institutions involved spent CLP 11.719 billion on enforcement for drug-related crimes. The

institution with the heaviest costs in this area was SENAME, with CLP 7.382 billion, followed by Carabineros de Chile, with CLP 4.231 billion and the judicial system with CLP 106 million, though this is a drastic underestimate.

By crime, simple theft is again the crime that imposes the highest costs on the enforcement system (CLP 6.362 billion, or 54%), although the lead is far shorter than is the case with adults. This is followed quite closely by drug-related theft with violence and intimidation (CLP 5.245 billion, or 45%), and at a greater distance by homicide (CLP 73 million) and sexual crime (CLP 38 million), which are statistically insignificant in this population (a combined 1% between the two) (see table 16).

TABLE 16

**Enforcement costs indirectly attributable to drug trafficking and consumption, juveniles, 2006**  
(Millions of nominal pesos)

		Socioeconomic cost, simple theft	Socioeconomic cost, violent theft	Socioeconomic cost, sexual crime	Socioeconomic cost, homicides	Cost indirectly attributable to PAS <sup>a</sup>
Judicial system	Courts	44	62	0.378	0.165	106
Police system	Carabineros	1 952	2 279	-	-	4 231
SENAME		4 366	2 904	38	73	7 382
<i>Total</i>		6 362	5 245	38	73	11 719

Source: prepared by the author on the basis of information from Poder Judicial, *Memoria anual 2006*, Santiago, Chile, 2007; Carabineros de Chile/Government of Chile (2007), *Programa de Seguridad Integrada para Niños, Niñas y Adolescentes "24 Horas"*, Santiago, Chile; National Institute of Statistics (INE, 2008b), *Carabineros. Informe anual 2006*, Santiago, Chile.

<sup>a</sup> Psycho-active substances.

## IV Conclusions

This article has attempted to demonstrate that the economic burden of drug consumption and trafficking in Chile in 2006 was at least CLP 266.744 billion in current prices that year, or CLP 207.531 billion in today's terms (30 April 2011). Much of that sum reflects productivity losses and enforcement costs, be it for drug offences directly or other crimes committed because of drugs. The losses directly attributable to drug consumption and trafficking are estimated at CLP 173.708 billion, and the indirect costs are estimated at CLP 93.036 billion (see table 17).

These results were obtained using the COI approach to evaluate the impacts of drug consumption and trafficking on society as a whole. This indicator of "negative

TABLE 17

**Total costs by item, direct and indirect, 2006**  
(Millions of nominal pesos)

	Direct	Indirect	Total
Prevention	13 070		13 070
Public health	5 093		5 093
Productivity losses	108 484	13 810	122 293
Enforcement (adults and juveniles)	47 062	79 227	126 288
<i>Total</i>	173 708	93 036	266 744
<i>Total adjusted to 30 April 2011</i>	207 531	111 151	318 681

Source: prepared by the author.



externality” may serve as a basis for decision-making and for gauging the effectiveness of programmes and public policies aimed at reducing drug consumption and trafficking and its harmful effects on society at large. A study of this sort also brings to light information which is not usually available to researchers and the general public, either because it is not published or because the various institutions categorize it in different ways.

The estimates given have failings which have been amply described. Insofar as they reflect information gaps, they highlight the need for specific studies in Chile to produce more accurate estimates that can quantify the problem more realistically. The main requirements in this regard are as follows:

- (i) Ideally, all State institutions should provide accurate and detailed information. This is particularly urgent in the case of the public health system, the judicial system and the prison guard service. The public health system should separate drug- and alcohol-related items in their reported budgets and make budgetary information available not only in reference to hospital care, but also for primary care, especially as regards the cost of treating drug-related diseases other than addiction. It would also be desirable to produce unified records for care and treatment in the private health system, in order to quantify the treatment given for addiction and other drug-related illnesses. The judicial system should provide more detailed information on its actions and respective budget, and Gendarmería should produce a clear record of crimes by judicial status, and a reliable profile of the individuals imprisoned by type of crime.
- (ii) A comprehensive register of ngos involved in work on illicit drugs in Chile would be highly useful, distinguishing autonomous budget fractions from government contributions.
- (iii) Chile should encourage the development of attributable fractions studies to help determine the

degree of relation between drug consumption and related behaviours or consequences, especially in the field of health. Work in Australia, Canada and the United States has shown that such studies provide extremely valuable information for public policy interventions, with a view to targeting interventions and resources on substances that generate the most adverse impacts in aggregate terms.

- (iv) More generally, Chile needs studies of this sort with unified criteria in order to evaluate the costs of tobacco and alcohol consumption, in order to compare their consequences and target and integrate interventions. A unified methodology, as in Australia and Canada, would enable comparison of the harmful effects of each substance and provide grounds for decisions on channelling prevention and rehabilitation resources. Although government agencies responsible for illegal drug matters afford great importance to drug consumption and its potential effects, these studies offer a means of assessing the burden that each drug represents for society in a more objective, substantiated manner. There is no reason, a priori, to assume that illegal drug prevention and rehabilitation merit more attention than legal drugs. It is possible that in Chile, for example, just as programmes tackle illegal drugs such as cocaine base paste, they should more broadly tackle alcohol, which is taxed less than tobacco and is allowed to be advertised, despite the fact that alcohol both directly and indirectly generates multiple forms of violence and a higher cost in dalys than tobacco.

The steps suggested would enable Chile to develop high-quality instruments for measuring the scale of problems associated with drug consumption and trafficking and for setting a solid baseline to support analysis of the costs and benefits of public policy interventions in this field.

*(Original: Spanish)*

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# The importance of the manufacturing sector for Brazilian economic development

*Carmem Aparecida Feijó and Marcos Tostes Lamônica*

**ABSTRACT**

This article, based on Kaldor's model of the stages of development, concludes that, despite having modernized thanks to the economic liberalization process, the evolution of Brazil's industrial structure has increased the share of low-technology goods in the production matrix. The trend appreciation of the real in the initial phase of economic liberalization was positive for modernizing Brazil's technology stock; but its continuation in recent years, when there has been ample international liquidity for emerging countries, threatens the development of the national manufacturing sector. This sector could suffer a technological setback, which, according to the principle of circular cumulative causation, diminishes its capacity to forge links with other sectors of activity, and accentuates the economy's long-term external dependency.

**KEYWORDS**

Industrial sector, manufactured products, consumer goods, capital goods, economic development, gross domestic product, industrial statistics, economic indicators, Brazil

**JEL CLASSIFICATION**

O11, O14, L16

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# I

## Introduction

The controversy surrounding the role played by the manufacturing sector in the development of the Brazilian economy has intensified recently, given the finding that the sector's share in gross domestic product (GDP) has been declining on a more or less sustained basis since the 1980s, and at a faster pace since the economic stabilization of the first half of the 1990s (Marquetti, 2002; Palma, 2005; Barros and Pereira, 2008; Bresser-Pereira, 2008; Nassif, 2008a; Oreiro and Feijó, 2010, among others). The controversy in particular concerns the effect of exchange-rate appreciation on potential industrial performance.

The appreciation of the real lasted throughout much of the 1990s and was interrupted by a change in the exchange-rate regime in January 1999. Since 2003 the Brazilian currency had been strengthening again, and the terms of trade have also been improving. Although exchange-rate appreciation benefits the productive sector by lowering the cost of imported inputs and capital goods, it also discourages exports. The repercussion on the productive structure depends on how those effects translate into higher productivity to offset the relative loss of competitiveness. Nonetheless, the effect of an over-valued exchange rate on the productive structure can only be positive if it contributes to structural change that expands the supply of products with a high income-elasticity of exports, and reduces dependency on products that have a low income-elasticity of imports. According to Thirlwall's law, if that occurred, long-term growth capacity would be increasing; in other words the external constraint on growth would be easing.

This article analyses the extent to which the declining share of the manufacturing sector in Brazil's GDP reflects a productive restructuring process that would enable the country to move closer to the technological frontier, or else a regression in the industrial structure that is likely to reduce future growth potential. According to the traditional economic-development approach, deeper productive specialization reflects the workings of the

market, so the economic liberalization that has occurred since the 1990s should have facilitated a modernization of the industrial structure, despite the preponderance of low-technology products. In contrast, the heterodox approach not only proposes a manufacturing development model based on industries of higher technological content, but it also views economic growth as determined by the momentum of an industry that is competitive in producing technology-intensive goods.

The analysis reported in this article is framed by the postulates put forward by Kaldor, who, while recognizing the importance of the manufacturing sector as a factor of economic development, showed that a more technologically sophisticated industrial structure involves more robust and complex intra- and inter-sectoral linkages, which increase potential growth. Application of the Kaldor postulates to the Brazilian case in the 1990s and first decade of the new century, supported by descriptive statistics, shows that despite the potential for modernization afforded by economic liberalization, the changing sector composition of industry reveals a process of specialization in the production of goods of low technological intensity. The appreciating trend of the Brazilian currency, following domestic-price stabilization, is identified as a key factor explaining the country's difficulty in furthering structural change to acquire a more advanced technological profile. This article contributes by showing that, over a period of two decades, the currency-appreciation trend may have had a positive influence in the initial phase of price stabilization, but that its persistence in a context of ample international liquidity puts the evolution of industry at risk.

Apart from this brief introduction, this article is divided into three sections. Section II describes Kaldor's theoretical framework, which analyses the special role played by the manufacturing sector in the economic-development process. Section III uses empirical arguments to characterize the changes that have occurred in Brazil's industrial structure; and section IV makes final comments.

## II

### Kaldor's structuralist analytical framework

Efforts to understand the economic development process of less developed countries first appeared on economists' research agenda in the 1940s and 1950s, when the structuralist thinking started to be articulated by the Economic Commission for Latin America and the Caribbean (ECLAC). Progress in the theoretical debate turned structuralist economic policy into the defender of the industrialization of non-industrialized countries, with a view to improving their economies' participation in trade flows. In practice, late industrialization gave countries on the periphery a highly heterogeneous and relatively undiversified productive structure, in contrast to the more homogeneous and highly diversified structure of the central economies.

Apart from displaying widely varying productive structures in terms of productivity and factor remuneration, the industrialization process based on import substitution in the peripheral economies faced chronic balance of payment problems before industrialization was fully completed.<sup>1</sup> In fact, it proved impossible to complete the process because of the external constraint on growth. Kaldor's work in the 1960s and 1970s describes how a comprehensive industrialization process ought to be adopted.

#### A. Kaldor and the four phases of economic development

According to Kaldor, the maturity of an economy depends on its having completed the industrial development process. Kaldor (1966) distinguishes four development phases in the industrialization process, and argues that the maturing of an "immature" economy is based on the growth of aggregate demand.<sup>2</sup> From this standpoint, the capital accumulation generated by the industrialization process is the key variable of economic development, since it speeds up technological change to the benefit of the entire economy — as reflected in lower unit costs

and higher-quality export products, enabling domestic producers to compete on foreign markets.

The application of the four-phase industrial development analytical framework makes it possible to evaluate economic development according to Kaldor's principles. The scheme recognizes that a country's industrialization process can occur cumulatively, which means that the production of consumer goods would precede the production of capital goods, which, in both cases and in their initial stages, would be export-oriented, in other words targeting external demand.

The first phase of development gives rise to a domestic industry producing consumer goods, as has been seen in the industrialization process in most countries, especially Latin American ones. This stage would reduce reliance on imports of this type of good; but the domestic production of machinery and equipment also begins in that phase, since the expansion of demand for consumer goods would stimulate an increase in the supply of certain types of machinery that domestic industry would be technological able to produce. Nonetheless, most of the capital goods used would continue to be imported, particularly those involving more advanced technology; but not all state-of-the-art technology would be exported by the more developed countries. Kaldor considered that the introduction and production of consumer goods is relatively swift and is exhausted when the import-substitution process for this type of goods is concluded.

To sustain rapid growth rates, the industrialization process has to enter a second phase, in which the consumer-goods-producing sector needs to start exporting its surpluses, thereby making it possible to sustain demand and expand specialization. Argyrous (1996) states that in the first two phases, it would be possible to create the conditions for the economy to specialize in the production of capital goods, which leads to the following phase.<sup>3</sup> At some point in the industrial development process, reliance on imported technology and capital could hold back output growth. But, at some stage of the industrialization process, the external constraint should presumably be eased, making

<sup>1</sup> For a more detailed historical assessment of this process in the region, see Bértola and Ocampo (2010), among others.

<sup>2</sup> An immature economy is characterized by a large supply of labour in low-productivity sectors, which can be absorbed by more productive sectors as the industrialization process spreads towards them. Countries would attain the maturity phase when productivity levels become aligned.

<sup>3</sup> Kaldor (1966) uses the term "specialization" to indicate that the sector competes on an equal footing in the international market in terms of productivity and technology endowment.

it possible to overcome reliance on foreign capital and technology. The third phase would begin when the country started to adopt measures to promote the substitution of capital-goods imports. Kaldor (1970) considered that large-scale investments in the capital goods sector would lead to greater productivity growth and would help raise competitiveness.

In the third phase, the country also needs to develop its own technology, which can be incorporated in domestic machinery and equipment, and consolidate the share of the capital-goods sector in the domestic productive structure. Among other things, measures to develop technological capacity should lead to the creation of new products making it possible to expand exports of more technologically intensive goods, which in turn would compensate for the import growth generated by higher incomes and the consequent increase in endogenous demand. The fourth phase, which completes the industrialization process, corresponds to the stage in which the country becomes a capital-goods exporter. In this phase, the capital-goods-producing sector would have achieved a technological maturity similar to that of the industrialized countries. Kaldor (1966) believed economic growth would increase significantly in this latter phase, driven by domestic and external demand for both consumer and capital goods.

Argyrous (1996) considers that success in exporting capital goods follows a lengthy cumulative development period driven by mass production in domestic industries using capital goods. Economic policies that restrict the production of capital goods could therefore obstruct the virtuous growth circle.

The thesis set forth in this article in relation to the Brazilian economy is that, although Brazil had already developed a complex industrial fabric in the period between the end of World War II and the mid-1980s, according to Kaldor's theory it had not progressed fast enough, basically because the final phases of development had not been completed (see section III.A).<sup>4</sup> a clear indicator of the incomplete nature of the process is the fact that the trade balance displays a structural deficit in more technology-intensive goods, which means that the country is a net importer of capital goods (see section III.B). Moreover, in the last few years since 2004, the domestic and international situations have not favoured the industrialization process (see section III.C), and Brazil has become one of the world's slowest growing emerging economies.

<sup>4</sup> For an evaluation of the major influence of Brazil's industrial sector on the growth rate of manufacturing industry and other sectors of the economy, see Nakabashi, Scatolin and da Cruz (2010).

Kaldor's theory of development phases can be complemented with the analysis made by Fajnzylber (2000, p. 871), according to which it is essential that an economy, including an industrialized one, has an "endogenous core of technological dynamism" to overcome the external vulnerability of growth. Several development authors agree with this idea. For example, Furtado (1984) argues that a developing economy with an incomplete industrialization process would have to resort to "creativity" to promote growth, in other words technological innovation. Furtado (1984, p. 27) also suggests that the lack of creativity in Brazil reflects the fact that its late industrialization occurred in the form of imitative development. Fajnzylber (1983, p. 286) argues that development of the capital-goods-producing sector would not be sufficient, and an "endogenous core of technical progress" would need to be created, technologically strengthened and articulated with the entire productive system to provide it with dynamism and achieve the productive excellence necessary to penetrate and remain in the international market.<sup>5</sup>

The development of this core would reflect the evolution of the economy in its third and fourth phases. On this path, technological progress becomes a key factor for increasing productivity growth and making the economy more competitive; but also to make it possible to expand exports based on the income generated by technology, which in turn would help mitigate the external constraint on growth. Consequently, and thus concluding the industrialization process, economies that are capable of developing and absorbing new technologies change the sectoral structure of industry and disseminate technical changes throughout (Cimoli and others, 2005, p. 12).

Kaldor's description of the industrialization process by stages is related to his thesis on role played by manufacturing industry in the economic growth process, known in the literature as "Kaldor's laws".<sup>6</sup>

<sup>5</sup> Fajnzylber (1983) considered that the lack of a well-developed capital goods producing sector, given the incomplete nature of industrialization in Latin America, was one of the basic causes of the chronic trade deficit of its economies, and had also prevented them from achieving levels of productive excellence.

<sup>6</sup> Kaldor did not present his postulates as economic "laws", but they are known as such in the history of economic thought. The author probably contributed to that himself by not questioning their definition as laws in the debate following their presentation. The fact that Kaldor did not explicitly define his postulates as "laws" has given rise to differences of interpretation as to their number, which varies between three (Targetti and Thirwall, 1989) and four (Targetti, 1992). This article adopts the latter position.

## B. Kaldor's laws and growth conceived as industrial development

Kaldor's analysis of development phases is complemented by "Kaldor's laws" explaining the dynamic of economic growth. In the 1960s and 1970s, Kaldor developed a set of theoretical proposals that depart from the neoclassical approach, in explaining countries' different growth dynamics in terms of factors related to aggregate demand. After formulating his growth theory based on capital accumulation and the distribution of income in the 1950s and early 1960s, Kaldor envisaged a growth model based on the principle of circular cumulative causation, which paid special attention to changes in the productive structure. In his opinion, aggregate demand levels across countries reflected differences in their productive structures, for which reason he saw the manufacturing sector as crucially important for economic growth, since that sector would enjoy increasing returns to scale, which would help increase productivity throughout the economy.

Kaldor (1966 and 1970) formulated a set of laws that used stylized facts to explain the dynamic of capitalist economies and, in particular, the differences between their growth rates.<sup>7</sup> Kaldor's laws postulate the following:

First law: There is a positive relation between growth and the aggregate output of the manufacturing sector, such that the higher the growth rate of that sector, the higher is the rate of growth of GDP. The industrial sector becomes the "engine of growth" given its dynamism and dissemination of innovations. The internal linkages within the manufacturing sector and its linkages with other sectors induces productivity growth both inside and outside. When industry has increasing returns, changes in the productive process are disseminated on a sustained and cumulative basis.

Second law: There is a positive relation between the rate of growth of productivity in the manufacturing sector, and growth of the respective output, owing to a causation relation whereby the higher the growth rate of that sector, the faster is also the rate of productivity increase. This law is known as the "Kaldor-Verdoorn law". An increase in output induced by an expansion of demand leads to productivity growth in sectors that

have dynamic economies of scale. This law explains why trading relations between the manufacturing sector and other sectors of the economy make it possible for the first law to be satisfied.

Third law: The higher the growth rate of exports, the greater is the increase in GDP. According to Kaldor, in the more advanced phases of economic development, GDP growth would be fuelled by increasing export demand. This idea assumes that the expansion of industrial activity would raise productivity in the manufacturing sector, which would enhance the competitiveness of exports and stimulate their growth. This, in turn, would lead to an increase in the economy's overall GDP. This development model would translate into a cumulative growth process based on increasing returns in the manufacturing sector. The cumulative causality relation reflects the existence of dynamic and increasing returns to scale in the industrial sector, stemming from the technical progress stimulated by the expansion of output. The existence of economies of scale raises industrial productivity, which generates greater income for firms and, hence, expands their investment capacity. Consequently, manufacturing growth would boost productivity and help to speed up technological change throughout the economy, thereby strengthening its competitiveness on the external market.

Fourth law: The long-term growth of the economy is not constrained by supply, but by demand; thus, in an open economy, the balance of payments is the main demand constraint on output growth. The sustainability of economic growth would depend on the country's capacity to maintain export competitiveness, which in turn would depend on productivity growth in the manufacturing sector (second law).<sup>8</sup> This means that output growth, ultimately conditioned by the trend of productivity and the economy's learning capacity, should occur when the balance of payments is in equilibrium. So growth rates of both industrial productivity and GDP are determined by the rate of growth of exports in relation to the income-elasticity of demand for imports (Thirlwall, 1983).

The balance of payments equilibrium condition shows how exports help to ease the constraint that this imposes through time. If, in the development process, the level of exports fails to increase as needed to cover

<sup>7</sup> Kaldor did not perform econometric tests using developing country data, but his arguments aroused great interest among several of his followers, which made it possible to expand his model and test it in other economic contexts.

<sup>8</sup> The third and fourth laws are closely related. These two laws were formulated by Kaldor (1970) and subsequently formalized by Dixon and Thirlwall (1975) and Thirlwall (1979).



the additional import expenses, aggregate demand would have to contract in the long run, and this would reduce employment and output. Accordingly, expanding exports is of strategic importance for the sustainability of growth. Nonetheless, according to the Kaldor-Thirlwall model, the effect of exports on GDP growth depends on each country's productive structure. If the economy has not attained a level of industrialization that enables it to exploit the benefits of cumulative causality, policy-makers should implement structural changes that lead towards that development model. Such measures should focus on industries with increasing returns to scale, particularly those producing goods of higher technological content and unit value, in other words industries that make use of a differentiated and science-based technology.<sup>9</sup>

<sup>9</sup> Prebisch (2000) argues that exports can make a major contribution to mitigating the external constraint on growth. Accordingly the Kaldor-Thirlwall model and Prebisch's centre-periphery model share an interest in the potential effects of balance of payments deficits for long-term growth. Although the first model is based on the developed economies and the second on developing economies, the analysis of the income-elasticity of demand for imports and exports and the

In short, Kaldor believes that the capital accumulation incorporated in modern technologies leads to the conception of a sustained process of industrial change and facilitates significant changes in the productive structure, which enables the economy to match that of the countries with the highest productivity levels. This author recognizes that capital accumulation has a double effect on labour productivity, which increases both because workers use better machinery and because of the learning-by-doing process. Consequently, developing economies should adopt a policy aimed at capital accumulation to speed up the industrialization process, since the development of a technologically advanced industrial sector is a fundamental basis for sustaining long-term growth.

effects these have on the growth path of the countries considered in both models produce converging conclusions. Mention should also be made of the vast Schumpeterian literature which corroborates Kaldor's postulates on the dynamic of increasing returns. See Dosi, Pavitt and Soete (1990); Dosi and Fabiani (1994), and Verspagen (1993), among others.

### III

## Brazil's industrial structure

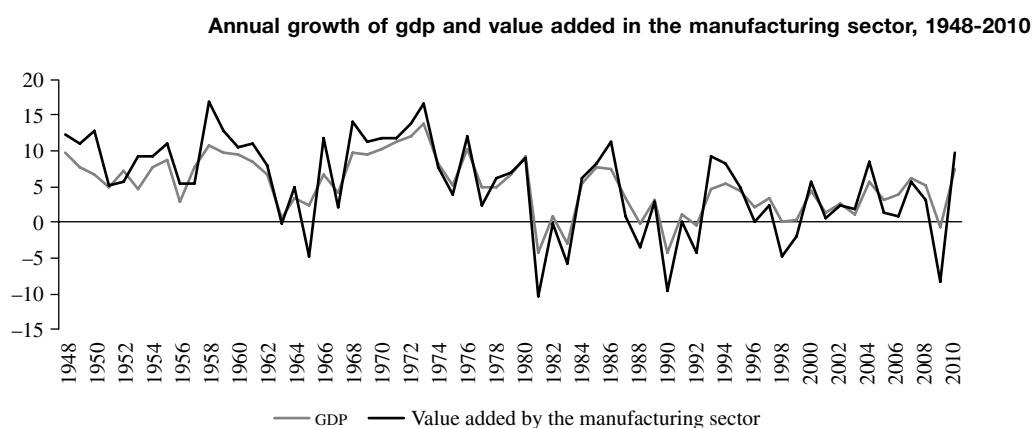
The acceleration of Brazil's industrialization process lasted from the end of World War II until the mid-1980s, with value added by the industrial sector growing from 20% of GDP in 1947 to 36% of GDP in 1985. From then on it started to decline, and by 2010 represented little over 15%. From the growth dynamic standpoint, there is a close correlation between the expansion of the manufacturing sector and GDP growth (see figure 1). Until 1980, industrial output grew faster than GDP in most years; but in the 30 years between the external debt crisis in the early 1980s and 2010, the growth of industrial value added only outpaced GDP on 10 occasions. Accordingly, the years in which the manufacturing sector grew fastest coincide with those of highest GDP growth. Figure 2 shows cumulative growth rates since 1970 and the relation between the expansion path in the industrial sector and the economy at large. Since 1980, in a changing international liquidity context, the manufacturing sector ceased to lead growth of the Brazilian economy.

Given the close correlation that exists between the growth of manufacturing industry and GDP growth,

industrial development cycles tend to move in harmony with the cycles of development in the Brazilian economy as a whole. The manufacturing sector expanded rapidly between 1950 and 1980, after which it started to slow. In the period 1981-2008, the industry growth path was affected by periods of high inflation between 1980 and 1994, international liquidity shortage in the 1980s, foreign exchange crises in the second half of the 1990s, and other events that diminished the dynamism of the sector. In this context, there was increasing uncertainty following the change of exchange-rate regime in January 1999, the energy crisis of 2001, the crisis of confidence caused by the election of the first left-wing president in 2002-2003, and the international financial crisis of the last quarter of 2008. Moreover in the 1980s there were changes in the way development policy was managed, specifically economic liberalization and market promoting reforms, which significantly changed the macroeconomic context of industrial development.

Following the adoption of the Target Plan in the 1950s, the government applied an industrial development

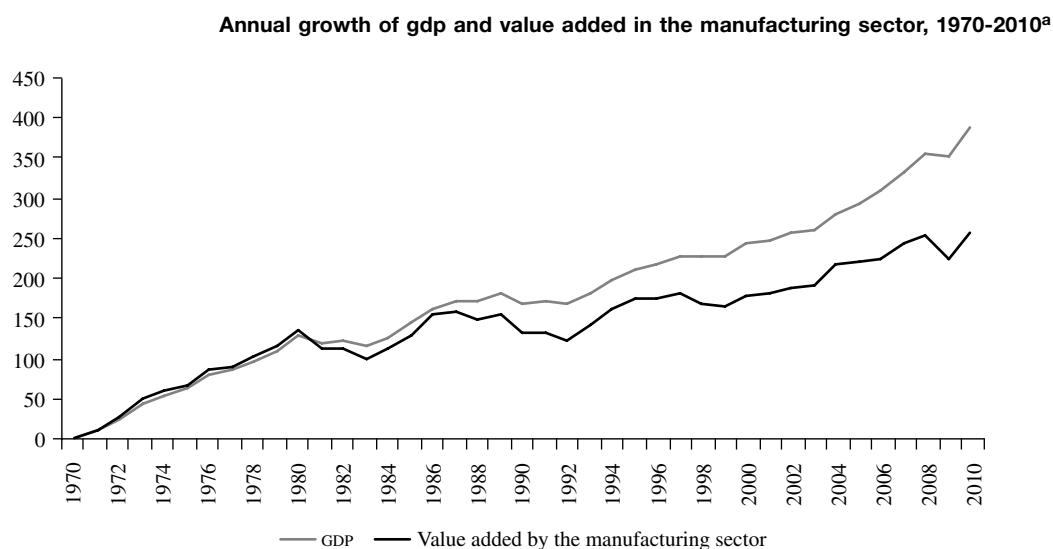
FIGURE 1



Source: National accounts and the economic and financial database (Ipeadata) of the Institute of Applied Economic Research (IPEA) of Brazil.

GDP: Gross domestic product.

FIGURE 2



Source: National accounts and the economic and financial database (Ipeadata) of the Institute of Applied Economic Research (IPEA) of Brazil.

<sup>a</sup> Base 1970=100.

GDP: Gross domestic product.

policy based on import substitution. In the 1970s, new steps were taken to develop an industrial sector that also produced goods and services based on scientific knowledge and with a differentiated technological base; but the external debt crisis, acceleration of inflation, and, no less important, growth of the public-sector deficit, conspired to interrupt this process. Once inflation had

been brought under control in 1994, and in an open macroeconomic context, those industrial sectors did not have an environment that enabled them to increase their share in industrial GDP, which remained unchanged. It can therefore be said that one of the explanatory factors for the reduction in the industrial growth rate since 1980 could be the change in productive structure, which involved a

relative loss of dynamism in industries producing more technologically sophisticated goods.

Figure 3 compares the growth trend of the capital-goods-producing sector, in which industries based on scientific knowledge and differentiated technology are concentrated, with the evolution of the manufacturing sector since 1975.<sup>10</sup> According to the Kaldor postulates, these industries are precisely those that would be in a position to increase the GDP growth rate, insofar as their growth outpaced that of the other industrial sectors. This property relates to the privileged position of the machinery- and equipment-producing sector in the industrial productive chain, since it has tight backward and forward linkages with the other economic sectors. After a rapid growth phase in the 1970s, this sector performed more sluggishly in the 1980s, before expanding by less than the industrial average owing to the economic liberalization of the 1990s. Since 2003, growth has been boosted again by the start of a new cycle of investments in the economy, although this was interrupted by the international financial crisis in late 2008.

<sup>10</sup> From that year on, monthly statistics have been published on the trend of industrial sectors, classified by final destination, compiled through the Monthly Survey of Industry - Physical Production, undertaken by the Brazilian Geographical and Statistical Institute (IBGE).

To provide a more in-depth analysis of the view that the composition of the Brazilian industrial sector has not evolved so as to ease the external constraint on growth, the following subsections review its behaviour since the 1970s in terms of three analytical elements: the changes that have occurred owing to the composition of the GDP of the manufacturing and extraction sectors, by degree of technological intensity; indicators of the evolution of the industrial sector in the different phases of development identified by Kaldor, based on the trade balances of the consumer durables and capital goods sectors; and, lastly, a review of industry after economic liberalization.

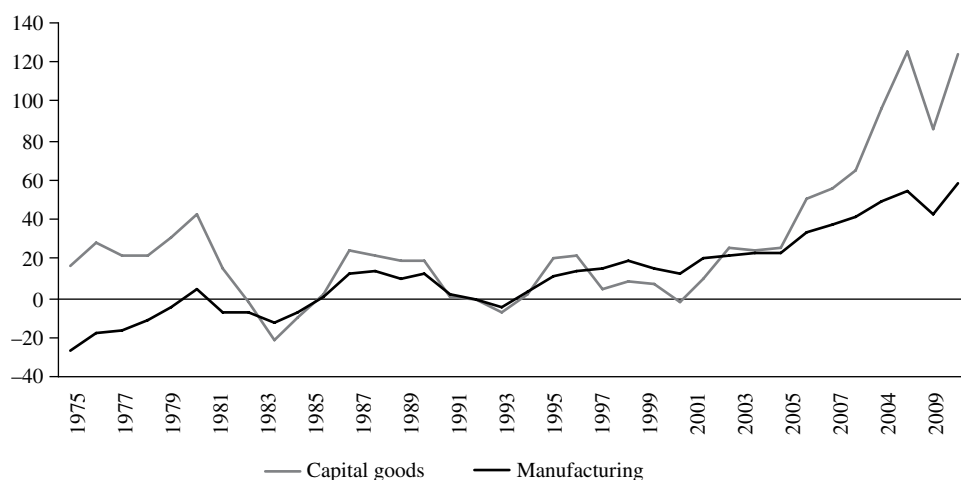
### A. Brazilian industry since the 1970s and phases of industrialization

The import-substitution process supported by development promoting policies should have been completed in the 1980s, when the share of the manufacturing sector surpassed 30%.<sup>11</sup> Table 1 shows the trend of the sector shares in economic activity, classified by type

<sup>11</sup> See the analyses of the stages of Brazil's industrial development discussed in Bacha and Bonelli (2005) and Lamonica and Feijó (2011), among others.

FIGURE 3

#### Growth in the physical output of the capital goods and manufacturing sectors, 1975-2010<sup>a</sup>



Source: Monthly Survey of Industry - Physical Production undertaken by the Brazilian Geographical and Statistical Institute (IBGE), historical series and new series.

<sup>a</sup> Base 1991=100.

TABLE 1

**Percentage share of value-added by manufacturing industry and mineral extraction,  
according to technological intensity, by sectors 1970, 1985, 1996 and 2007**

Industrial sectors by type of technology used	Percentage share				Variation (percentage points)
	1970	1985	1996	2007	1970-2007
Natural resource-based	32.6	34.0	32.6	41.0	8.4
Mineral, oil and gas extraction	2.9	4.7	1.6	4.0	1.1
Production of nonmetallic minerals and cement	3.4	3.0	2.5	1.7	-1.7
Metallurgy of non-ferrous minerals	1.4	1.9	1.2	1.8	0.4
Wood products	2.4	1.4	1.1	1.3	-1.1
Manufacture of paper and pulps for paper manufacture	0.1	1.6	0.7	0.6	0.4
Leather manufacture	0.5	0.5	0.3	0.2	-0.3
Food, beverages and tobacco	16.5	12.8	18.3	16.1	-0.4
Manufacture of alcohol and derivatives	2.0	3.0	1.5	0.8	-1.2
Manufacture of coke and oil refining	3.4	5.2	5.4	14.5	11.1
Labour-intensive	15.9	15.3	13.6	10.1	-5.8
Travel accessories and leather articles	0.1	0.1	0.1	0.1	0.0
Textiles	9.3	5.5	3.3	1.9	-7.4
Clothing, footwear and fabric articles	3.3	4.7	4.1	3.0	-0.3
Miscellaneous products	1.3	1.5	2.3	1.6	0.4
Manufacture of metal products (except machinery and equipment)	1.9	3.5	3.8	3.5	1.7
Scale-intensive	37.1	35.9	35.8	33.7	-3.4
Basic metallurgy	10.1	9.4	4.2	6.1	-4.0
Automobiles	6.3	4.7	8.1	8.5	2.3
Transport equipment (except aircraft)	1.7	0.8	0.6	1.3	-0.3
Rubber and plastic	3.8	3.8	4.1	3.3	-0.6
Manufacture of products and articles made of paper and paperboard	2.4	1.2	3.1	2.8	0.3
Manufacture of perfume articles	...	...	...	1.2	1.2
Chemical products	6.6	13.4	9.2	6.4	-0.2
Publishing, printing and reproduction of recordings	3.9	1.9	4.9	2.8	-1.1
Ceramic products for civil construction and miscellaneous uses	1.4	0.2	1.0	0.7	-0.6
Glass and glass products	0.9	0.6	0.6	0.5	-0.4
Sectors that apply differentiated technologies	9.9	10.9	13.0	10.5	0.6
Optical instruments, chronometers and watches	0.2	0.4	0.2	0.2	0.0
Equipment of medical and therapeutic use	0.2	0.4	0.3	0.4	0.1
Electrical and electronic appliances, communication apparatus and equipment	4.4	5.2	5.7	4.0	-0.4
Machinery and equipment	5.1	4.9	6.8	6.0	1.0
Scientific knowledge-based	4.5	3.9	5.0	4.6	0.1
Office equipment and computer hardware	0.4	0.9	0.5	0.6	0.3
Pharmaceutical (and veterinary) products	3.4	1.6	3.4	2.7	-0.7
Measurement, testing and control apparatus and instruments	0.1	0.1	0.3	0.3	0.1
Electrical energy distribution equipment	0.6	0.7	0.5	0.3	-0.3
Aircraft production and assembly	...	0.4	0.2	0.7	-
Machinery and apparatus for industrial robotization	...	0.2	0.1	0.1	-
<i>Total</i>	<i>100.0</i>	<i>100.0</i>	<i>100.0</i>	<i>100.0</i>	<i>-</i>

Source: Brazilian Geographical and Statistical Institute (IBGE), Industrial Census of 1970 and 1985 and Annual Industrial Survey of 1996 and 2007.

of technology used in the selected years.<sup>12</sup> The table shows that the productive structure obtained from the industrialization process was quite differentiated even in 1970; but there was very little representation of sectors based on differentiated technology and scientific knowledge. Two development programmes were implemented in the 1970s: the first National Development Plan, which lasted from 1968 to 1973; and the second National Development Plan from 1974 to 1979. These made it possible to consolidate the process of diversifying Brazil's industrial structure, but without the parallel creation of a technological innovation development core. The existence of a differentiated industry, specialized in medium- and low-technology sectors, lasted into the following decade, when the most important changes in the productive structure occurred in industries that make intensive use of natural resources and labour, and also in scale-intensive industries.

The contribution to value-added made by high- and medium-high technology sectors, which form part of the Brazilian industrial sector based on differentiated technologies and scientific knowledge, increased, because they required a larger contribution of capital and technology. In the first case (sectors based on differentiated technologies), their share of industrial value-added rose by 0.6% between 1970 and 2007, and their share of total value added was about 10%; whereas in the second case (sectors based on scientific knowledge), the contribution to value-added increased by just 0.1%, for a total contribution of around 5% in that period.

Given Brazil's comparative advantages and its continental size, it might be expected that the process of consolidating its industrial fabric would start in sectors specialized in basic industrial products. In fact, in 1970, sectors engaged in the intensive exploitation of natural resources already contributed over 30% of industrial value-added, whereas 16.5% of the total contribution came from the food, beverages and tobacco industries. This share had shrunk to 12.8% in 1985, although it increased again in 1996 and in 2007, to reach practically the same level as in 1970 (16.1%), thus becoming the most important industrial sector. Despite the relative stability of the percentage share of this activity, and

taking account of the years of extreme performance, the category of industries specialized in the exploitation of natural resources increased its share by 8.4% between 1970 and 2007. This increase was basically due to a higher share of activities such as oil drilling and refining, which accounted for 3.4% of total value-added in 1970, but only about 14.5% in 2007. The increasing importance of this sector has lasted since the end of the 1990s and reflects the start of a major change in Brazilian industry's participation in world trade.

Labour-intensive industries maintained a share of around 15% between 1970 and 1985, but this started to shrink from then onwards, so that by 2007 their contribution to total value-added was 10.1%. The most important change in this category occurred in the textile industry, whose share has been declining systematically. The contribution of garment-producing industries fluctuated between a high of 4.7% in 1985 and 3.0% in 2007, while the share of industries producing metal products in total value-added consolidated around 3.0% as from 1985.

The share of scale-intensive industries has also been declining, although their contribution of roughly 30% to industrial value-added suggests that the first and second phases of Kaldor's chronological sequence in the industrialization of Brazil's manufacturing sector are clearly consolidated. Sectors in this category provide inputs for producing intermediate goods, both consumer and capital goods (basic metallurgy, rubber and plastic, chemical products, ceramic products and glass and glass products), while also encompassing the consumer-goods sectors, and the production of vehicles, perfume products and publishing, printing and reproduction of recordings. The greatest changes have occurred in the basic metallurgy sector, whose share decreased from 1970 to 2007, and in the vehicle sector, whose share increased. The chemical products sector accounted for 13.4% of total industrial value-added in 1985, the largest share in that year. Since then, its contribution remained around 9% until 2000, but in 2007 it dropped to 6.4%, a similar proportion to 1970.

The shares of sectors based on differentiated technologies and scientific knowledge, which encompass the capital-goods producing sectors, have not changed much between 1970 and 2007. Nonetheless, the average contribution of these categories in the period analysed (almost 15% of industrial value-added) shows that Brazil's industrialization process has now entered the third phase, by virtue of the expansion and diversification of the productive structure and the large share of the capital-goods producing sector.

<sup>12</sup> The literature on the subject has used this classification widely. See Nassif (2008a), among others. The years were selected on the basis of the availability of official figures. In 1970 and 1985, industrial censuses were conducted, which since 1996 were replaced by the Annual Industrial Survey. Feijó and Carvalho (1999) analyse the availability of official statistics on Brazil's manufacturing sector in the 1990s.

In terms of the chronological sequence of the phases of industrial development, the spread of the industrialization process to more technology-intensive sectors would have been affected, even in the 1980s, by the depreciation of the currency and consequent increase in the cost of imported equipment, as well as by the heightened economic uncertainty stemming from the increase in inflation, among other factors. Currency depreciation and the rise in inflation were caused by greater external vulnerability, which was exacerbated by the Mexican crisis in 1982. In fact, the external debt crisis in the early 1980s interrupted the industrialization process, before the investments had had time to attain a sufficient volume to develop the endogenous core of national production envisaged by Fajnzylber (1983).

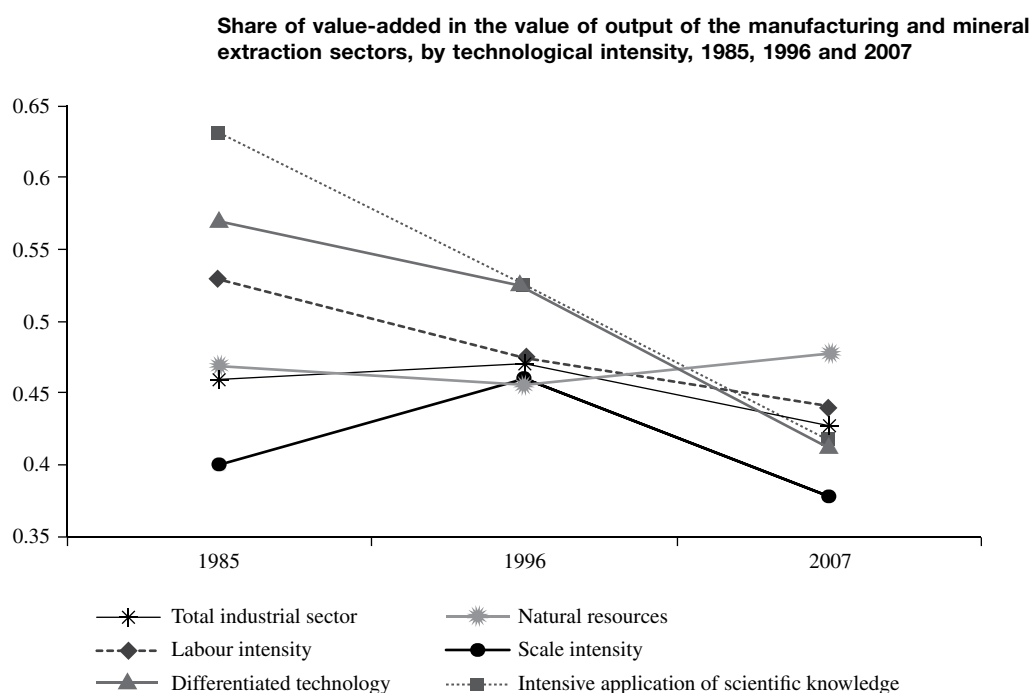
Although the industrialization process was interrupted before reaching its conclusion according to Kaldor's four-phase model, there were large trade surpluses in the first half of the 1980s, coinciding with the stage in which the Brazilian economy was subject to a major external constraint. Castro and Souza (2004) attribute these surpluses to the maturing of the structural changes generated by the second National Development Plan, which had been applied in the period 1974-1979.

In brief, comparing the situation in 1970 with that prevailing in 2007 shows that changes in the productive

structure were heavily circumscribed. The increase in the relative share of natural-resource-based sectors mirrors the growing importance of the oil industry, whereas the declining relative importance of labour-intensive sectors is caused by the decreasing share of the textile industry. The relative loss of importance of the scale-intensive segment reflects the declining importance of the basic metallurgy industry. The share of industrial categories based on differentiated technologies and scientific knowledge changes little between the first and last year considered in table 1. All of the above reveals the clear trend of the Brazilian industrial sector towards specialization in natural-resource-intensive activities. Given this propensity, Brazil's industrial structure has proven relatively rigid over the last four decades. Changes in the relative share of the different sectors were more intense between 1985 and 2007, which accentuated the concentration of industry in the production of natural-resource-intensive goods. According to the Kaldor industrial development model, Brazilian industry has not yet attained maturity.

To complement this latter comment, figure 4 uses another indicator to show how Brazilian industry needs to continue making progress to enter the maturity phase. Figure 4 shows the trend of aggregate content in relation to the value of output in the categories included

FIGURE 4



Source: Brazilian Geographical and Statistical Institute (IBGE), Industrial Census of 1985 and Annual Industrial Survey of 1996 and 2007.

in table 1, for three years: 1985, when a major stage of the import substitution process can be assumed to have ended; 1996, when the effects of the liberalization that began in the early 1980s had already started to appear in the industrial structure; and 2007, the year before the international financial crisis.<sup>13</sup> Given that the coefficient considered is declining in the industrial sector as a whole particularly in the post-economic liberalization period, it could be interpreted as showing that part of the demand that was previously met by domestic industry has now moved abroad. Several empirical studies highlight this effect as from the 1990s, which led to a deepening of the debate on the country's deindustrialization.<sup>14</sup>

Nonetheless, the industrial organization literature states that this coefficient really measures the degree of verticalization of the industrial sector; so a fall in the indicator would not necessarily mean a relative increase in the use of imported inputs, but, in contrast, could point to an intensification of industrial specialization. In the terms of this article, the question that arises is whether the strengthening of specialization in Brazilian industry which actually occurred, is occurring prematurely, given that the index of value-added of production started to decline throughout industry in 1996, in other words before it could reach maturity. Figure 4 shows that, between 1985 and 1986 the coefficient rose from 0.46 to 0.47 for industry as a whole, and then fell back to 0.43 in 2007. The category of industrial sectors that make intensive use of natural resources is the only one that shows a slight increase in aggregate content between 1985 and 2007 (from 0.47 to 0.48). All other categories record a loss in the capacity of domestic industry to add value to the manufacturing process — a loss that is more accentuated in the categories of sectors that make intensive use of scientific knowledge and differentiated technology, and in scale-intensive sectors.

#### **B. Balance of trade in consumer durable goods and capital goods: from consolidation of the industrial sector to the economic liberalization of the 1990s**

The changes that have occurred in a country's industrial structure can also be seen by analysing the international

trade flow. In terms of sectors that produce final goods, figure 5 shows the trend of the trade balances in consumer durables and capital goods for the period 1974-2010. Brazilian industry was a net exporter of consumer durables from 1977 until 1993, a period in which the economy was still highly protected by customs duties and other trade barriers. The closed nature of the Brazilian economy was also reflected in the technological backwardness of this sector compared to other late-industrializing countries, particularly the "Asian tigers". The trade liberalization of the early 1990s, together with currency appreciation, fuelled an increase in the volume of consumer goods imported, until the exchange-rate regime was altered in 1999. The volume of durable goods exports grew again from the start of the first decade of the new century until 2005, when exchange-rate appreciation caused a new contraction that turned the country into a net importer of consumer durables.

Implementation of the second National Development Plan in the 1970s made it possible to strengthen the capital-goods-producing sector, which was concentrated in the categories of activities based on the use of differentiated technologies and scientific knowledge, thereby making it possible to make progress in the third phase of the industrialization process. Nonetheless, for the sector to be able to mature, technological development is essential at the national level. Kaldor considers that economic growth and the alignment of a developing economy with the more developed economies requires mature industrial sectors with capacity to create and produce consumer goods locally for both the domestic and the external market. Trade statistics show that the Brazilian economy has not completed the fourth and final phase of industrial development and that, in most years since 1974, trade in capital goods has been in deficit. In the period 1974-1984, when the capital goods sector consolidated thanks to the application of the second National Development Plan, imports outweighed exports. From 1985 to 1990, there were surpluses, except in 1986 and 1987, reflecting the faster growth of GDP. Since 1991, by which time the economic liberalization process had already begun, net imports of capital goods again grew vigorously, partly because the intensification of domestic competition stimulated a renewal of Brazil's industrial fabric, which was facilitated by exchange-rate appreciation once inflation had been brought under control. In 2003, the country became a net exporter following a fall in the exchange rate, but in 2008 the trade balance started to reverse, and in 2010 it posted a record deficit of US\$ 13.64 billion.

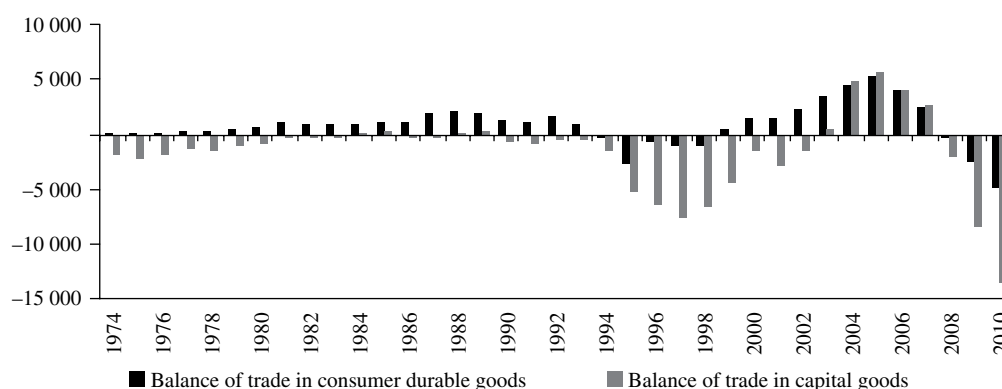
Comparing the figures shown in figure 5 with the information contained in table 1 shows that the

<sup>13</sup> The ratio between value-added and the value of output is calculated by dividing the value of industrial processing, used by the IBGE in industrial surveys of the last few years as a variable representing value-added, by the gross value of industrial output.

<sup>14</sup> On this point, see the studies performed by the Industrial Development Research Institute (IEDI). See also Feijó, Carvalho and Almeida (2005) and Oreiro and Feijó (2010), among others.

FIGURE 5

**Balance of trade in consumer durable and capital goods, 1974-2010**  
(F.O.B. in millions of dollars)



Source: prepared by the authors on the basis of data from the Centre for Foreign Trade Studies Foundation (FUNCEX), and the Economic and Financial Database (Ipeadata) of the Institute of Applied Economic Research (IPEA) of Brazil.

performance of the consumer-goods sector, which encompasses medium-high- and high- technology activities, remains insufficient to provide Brazilian industry with the dynamism it needs to become the engine of long-term economic growth—in other words, to reduce the external constraint on growth. An analysis of trade balances shows that changes in the productive structure over the years have not resulted in an effective increase in the share of the capital-goods sector, which requires further technological upgrading. Since the start of the economic liberalization process, installed industry has shown sufficient dynamism to modernize in terms of processes and the capital stock; but it has not found the momentum needed to make a technological leap that would enable it to start producing goods with a high technological content and high value-added. The absence of an active industrial policy in the economic liberalization stage clearly hampered this stage of the industrialization process.

In a specific study on the behaviour of capital goods imports, (Nassif, 2008b) shows that these were harmed by changes in the macroeconomic environment. The growth of Brazilian capital-goods imports between 1989 and 1998 not only reflects the initial effects of liberalization (1990-1994), but also those arising from a long period of currency overvaluation (1994-1998). In 1999-2006, machinery and equipment imports slackened as a result of the sharp exchange-rate depreciation that occurred between 1999 and 2003 and the low growth

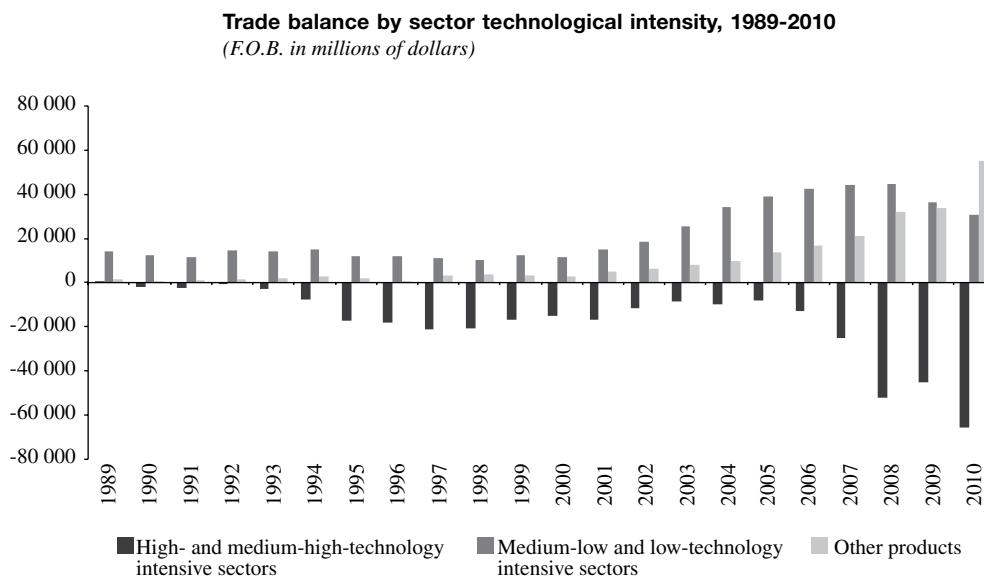
rates of the Brazilian economy in the same period (Nassif, 2008b, p. 255).<sup>15</sup>

Kaldor considered that the most dynamic sectors of the economy, which could therefore raise the quality of exports, were those producing high- and medium-high-technology goods. Figure 6 shows the trade balances of industrial products classified according to their technology intensity as from 1989, to demonstrate that economic liberalization and the consequent modernization of the industrial production process did not cause a reversal of the trade balance in goods of high- and medium-high-technology content. The persistent exchange-rate appreciation, which began with price stabilization in 1994 and, since 2004, the vigorous expansion of domestic demand, served to increase the deficit in this industrial category (high- and medium-high- technology goods) (see figure 7). While the over-valued exchange rate lowered the cost of imported capital goods, it has also made it harder to produce them domestically. Consequently, the deficit of the high- and medium-high-technology sector reflects the fact that Brazil is a net technology

<sup>15</sup> Nassif (2008b) notes that the sector is producing pumps, compressors and transmission parts; generators, transmission and electric motors; metallic structures and heavy boiler equipment, tanks and boilers. Meanwhile, machinery and tools that account for a larger share of capital goods exports have lost comparative advantage (Nassif, 2008b, p. 258), indicating a loss of efficiency among the traditional or developed sectors in Brazil.

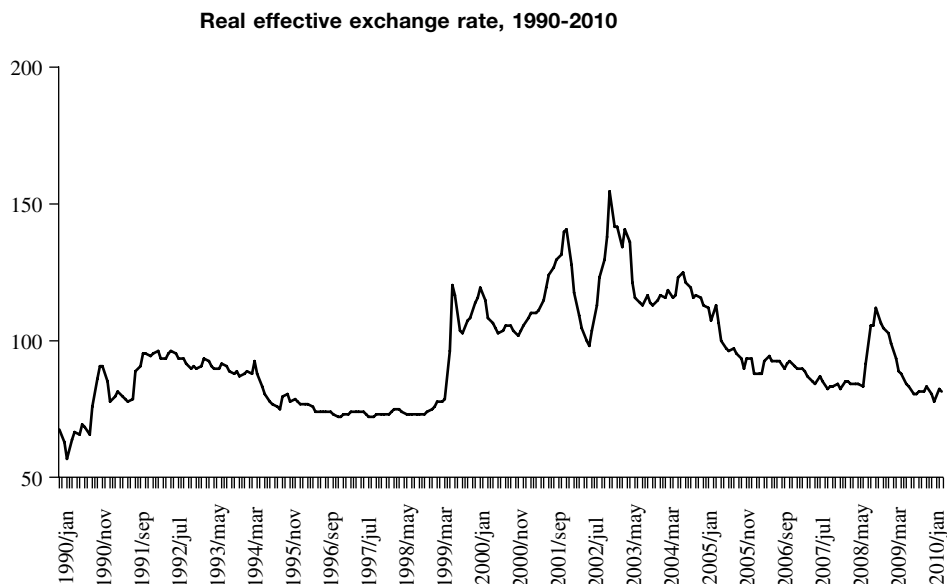


FIGURE 6



Source: prepared by the authors on the basis of data from the Industrial Development Research Institute (IEDI). (Deficit of US\$ 34.8 billion in the manufacturing sector) *US\$ bilhões de déficit nos bens da indústria de transformação*, Carta No. 451, 2011 [online] [www.iedi.org.br/cartas](http://www.iedi.org.br/cartas).

FIGURE 7



Source: Central Bank of Brazil.

importer. The technological backwardness that this represents for the country shows that, in the long term, it is specializing in the production of low-technology goods and commodities, of which it is a net exporter. Although the trade balance has not been in deficit over the last decade, in general commodity exports have largely covered the deficit that the manufacturing sector has been accumulating since 2007 (IEDI, 2011).

The growth of net commodity exports, together with an over-valued exchange rate, would not sustain long-term growth in view of the sector's scant contribution to rapid growth. Moreover, the maintenance of an appreciated exchange rate over a long period tends to cause a reallocation of resources that harms development and the domestic production of high- and medium-high-technology goods. Given the exchange-rate appreciation trend, the cost of importing industrial goods with higher technological content is less than the cost of producing them domestically. Thus, Brazil is moving in the opposite direction to that proposed by Kaldor and by structuralist theory as set out in the classic texts of Furtado and Fajnzylber, among others. Apart from the technical advances applied to the production of commodities, product or process innovations tend to come from abroad, which means that the "endogenous core of technical progress" would be oriented towards increasing the comparative advantages of the production and marketing of commodities, and that the income-elasticity of demand for imports would continue to exceed the income-elasticity of exports.

Accordingly, although the productive sectors had already consolidated the first and second phases of industrialization and embarked on the third phase, the conditions did not exist for Brazil to catch up the industrialized countries after economic liberalization. This alignment can only happen when industrial-sector specialization leads to higher value-added in production, greater technological content, and greater dynamism in terms of a larger spillover effect on other sectors of the economy. Among other things, this process could lead less structural heterogeneity and better functional distribution of income. The trend of the industrial sector over the last few years shows that major changes are occurring that could be decisive for its transformation.

### C. Recent industrial process and "Dutch disease"

An important factor for fulfilling the "Kaldor Laws" is the principle of circular cumulative causality. According to this principle, the increasing returns that start to appear

in the manufacturing sector, after a given stage in the technological development of the productive structure, can be expected to enhance the competitiveness of exports, which in turn would help increase aggregate output. The interpretation of the recent structural changes in Brazilian industry shows that as the development phases have remained incomplete, the advantages of circular cumulative causality possibly do not materialize. To catch up the more advanced economies and ensure that cumulative causality functions in a virtuous manner, other forces are needed apart from market incentives, such as industrial and technological policies to induce the necessary changes in the productive structure. Moreover, policies that encourage import substitution in high-technology goods are even more necessary when the exchange rate has been appreciating on a sustained basis, as has been the case in the Brazilian economy since price stabilization, and particularly since 2004.

Economic liberalization in a context of price stability and exchange-rate appreciation has had a positive influence on the industrial sector,<sup>16</sup> by stimulating changes in the allocation of productive resources towards modernization of production processes.<sup>17</sup> Nonetheless, modernization of the productive structure occurred despite the relatively low level of investment. Although the investment rate in the Brazilian economy was around 22% in the 1970s, it fell to around 17% between 1990 and 2010. The economic and financial liberalization of the early 1990s, together with market-oriented institutional reforms, provided a new macroeconomic scenario for private decisions, in which the competitive dynamic was stimulated.<sup>18</sup> Exchange-rate appreciation, together with the removal of tariff and nontariff barriers, made imported final products more competitive, thus generating a new pattern of competition with domestic production. This setting called for the modernization of productive processes and the introduction of new products, while exchange-rate appreciation also facilitated lower prices for imports and capital goods, thus contributing to the modernization of

<sup>16</sup> There is an extensive literature on the effects of economic liberalization for the industrial sector. See, Feijó (2003), Castro (2003) and Ferraz, Kupfer and Iooty (2004), among others.

<sup>17</sup> Industrial productivity remained unchanged from the mid-1980s, but improved in the first five years of the 1990s, thanks to trade liberalization. Nonetheless, there was a pronounced decline in employment in industrial sectors, since output expanded without a significant increase in the capital stock. See the analyses of the evolution of industrial productivity in Brazil contained in Bonelli (1996), Bacha and Bonelli (2005), Feijó and Carvalho (2002), and Nassif (2008a), among others. Nassif (2005) analyses the consequences of trade liberalization for the pattern of Brazil's of foreign trade.

<sup>18</sup> Erber (2010) reviews the changes that occurred in the macroeconomic scenario, specifically the emergence of a new development consensus.

production processes. Nonetheless, market forces alone were insufficient to induce a deeper structural change, which would have enabled the economy to make progress in industrialization according to the sequence set forth by Kaldor.

Over the last few years, what explains the structural shift in favour of greater productive specialization is the combination of an over-valued exchange rate, particularly since 2004, and an improvement in the terms of trade. Between 2004 and 2010, the real appreciated by about 60%, and the terms of trade rose by roughly 35%. The continuation of the appreciated exchange rate reduced the competitiveness of scale- and labour-intensive sectors, which resulted in a loss of share for those sectors within the productive structure. The terms-of-trade improvement favoured natural-resource-intensive sectors. Although the rise in commodity prices had a positive influence on economic growth, even in the context of an appreciated exchange rate, it accentuated the trend towards industrial specialization in those sectors. Table 1 shows that the period 1996-2007 saw progress in the productive structure of natural-resource-intensive sectors, among others, mineral extraction, oil refinery, and the food, beverages and tobacco, as well as scale-intensive sectors such as basic metallurgy.

In view of the above, the rise in the terms of trade could be leading to the economic predominance of natural-resource-exploiting sectors to the detriment of others, which would contribute to the contraction of the industrial sector. This effect is related to one of the forms of “Dutch disease”: expansion of the commodity sector and relative stagnation of the industrial goods sector.<sup>19</sup> Accordingly, persistent exchange-rate appreciation caused by an increase in net exports, compounded by increased demand for natural resources (mineral or agricultural commodities), could trigger a deindustrialization process unless policies are applied to counteract the negative effects of currency appreciation for industry, or if the policies applied for that purpose do not have much effect. The transmission mechanism for deindustrialization caused by “Dutch disease” would consist of a rise in the profitability of commodity exports and a fall in the profitability of other sectors. In the case of the current Brazilian economy, the exchange-rate appreciation trend shown in figure 7 would reduce the competitiveness of the

domestic industrial sector and strengthen the propensity towards stagnation in sectors based on differentiated technologies and scientific knowledge, while also causing a contraction of labour- and scale-intensive sectors, by raising foreign currency production costs in the stagnated sectors. The exchange-rate appreciation trend of the first decade of the new century has lasted on a sustained basis since mid-2004, and was only interrupted in the second half of 2008 owing to the worsening international financial crisis.

Nonetheless, the declining relative importance of industry for long-term growth should not only be attributed to the recent improved terms of trade. Monetary policy management, which maintains a high interest-rate spread that attracts foreign-currency inflows in excess of balance of payments financing needs, as shown by the surplus on the capital and financial accounts, is one of the factors fuelling currency appreciation, which undermines the competitiveness of the industrial sector in the case of Brazil.<sup>20</sup> Figure 8 shows the evolution of the balance of payments accounts as a proportion of GDP as from 1990. The trade balance has been positive since 2000, and it has contributed to positive current account balances since 2003. These turned negative from 2007 onwards, despite abundant inflows of external resources, which have generated an excessive accumulation of international reserves, representing 15% of GDP in 2009. In addition to the pressure exerted by rising terms of trade, monetary policy has magnified the potential effect of “Dutch disease” and prolonged the exchange-rate appreciation by maintaining the high interest-rate spread and attracting capital inflows.

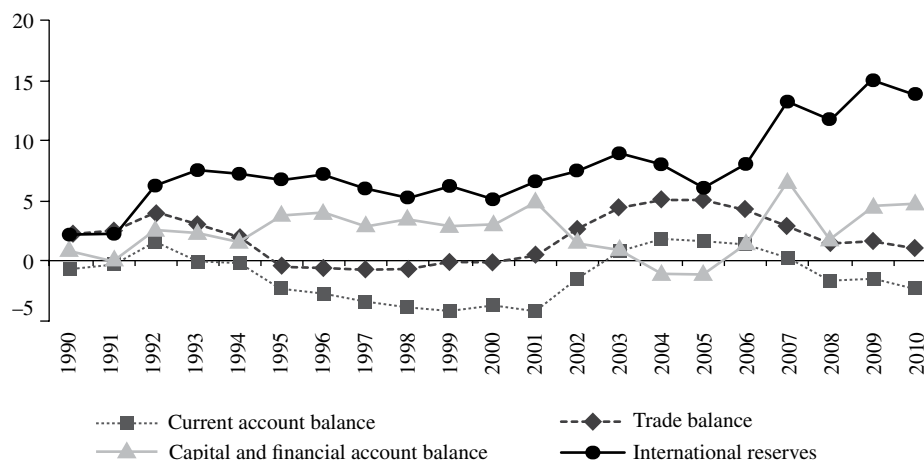
It could therefore be argued that, even in a context of rising terms of trade, the trend declining share of the Brazilian industrial sector cannot be defined as a classic case of “Dutch disease” reflecting “the curse of

<sup>19</sup> The term “Dutch disease” was originally coined to describe the decline of the manufacturing sector in the Netherlands, following the discovery of large gas reserves in the North Sea in the 1960s. Since then, the term has tended to be related to the “curse of natural resources”, although, strictly speaking, “Dutch disease” would be one manifestation of that curse.

<sup>20</sup> Kaldor (1965, pp. 49 and 50) analyses the negative effects for development of an overvalued exchange rate, and calls for an exchange-rate target to be set through economic policy. In the case of excessive appreciation, a medium and long-term target should be set. According to Kaldor, “the correct amount of devaluation [...] presupposes strongly deflationary internal policies while the process of structural adjustment is going on, as well as a succession of downward adjustments in the exchange rate and not a single, once-for-all adjustment. The reason for this is that the acquisition of new markets and the adaptation of the internal production structure in favour of “international goods” takes time, and the exchange rate that may ultimately be necessary to attain the “target”, whether this is stated in terms of a share in world trade or in terms of a strong balance of payments position sustained without import restrictions, would represent an “excessive adjustment” if adopted initially — excessive, in that the economy could not respond to the changing relative prices, which would, consequently, the largely nullified by inflation.”

FIGURE 8

**Balance of payments account balances and international reserves  
in relation to gdp, 1990- 2010**



Source: Central Bank of Brazil.

GDP: Gross domestic product.

natural resources". Moreover, the discovery of natural gas and petroleum in the pre-salt strata<sup>21</sup> in 2006 cannot be seen as a potential cause of "Dutch disease", since exploitation has not yet begun on a large scale. The relative deindustrialization of the Brazilian economy basically reflects the rising terms of trade for commodities, of which the country has abundant supply, and the exchange-rate appreciation trend sustained by a monetary policy that maintains a large interest-rate spread in a context of high international liquidity. The second factor is no less significant than the first.<sup>22</sup>

Following Kaldor's logic, the positive effects of the commodity export boom since 2003 should have been harnessed to finance investments to promote growth in the more technically advanced sectors, to regain the import-substitution process and make it possible to ease the external constraint on solid foundations. This would require investments to expand the faster

growing industrial sectors. Consequently, the increased import capacity should have been reversed, to expand possibilities for absorbing technological process through capital accumulation. As Salter pointed out many years ago (Salter, 1966, pp. 153 and 154), a high rate of investment is needed to change the productive structure rapidly and, depending on demand, generate increased output and higher productivity in sectors where faster technical progress is possible.

Pérez (2008) argues that the income generated by the commodity sector could finance a "jump to development". This would depend on sustained technological updating of natural resource-based activities, which would gradually improve the export profile through continuous innovation of products, activities and related processes; and it would create goods of high value-added based on the traditional commodity market. The success of a strategy of this type might largely depend on the coordination of a development-oriented economic policy, which leads to the creation of an "endogenous innovation nucleus" based on the favourable circumstances offered by the exploitation of natural resources in terms of generating demand.

The situation that has prevailed in Brazil over the last few years does not match that description. Cimoli and others (2005, pp. 32 and 33) note that the existence of abundant natural resources can sustain high growth rates for a time, without the need for major investment to create technology; but the availability of natural

<sup>21</sup> Geological strata formed before an extensive layer of salt, which can be more than 2,000 m thick.

<sup>22</sup> Generally speaking, the debate on Brazilian "de-industrialization" has focused more on rising commodity prices than the role of monetary policy. See, among others, Bresser-Pereira (2008). Nassif, Feijó and Araújo (2011) analyse the factors that explain the change recorded in Brazil since 1999, giving prime importance to the interest rate spread. It should also be remembered that the post-Keynesian literature states that capital flows in emerging economies tend to be procyclical. See Resende and Amado (2007).

resources alone cannot sustain long-term growth. There are two reasons for this:

- (i) Growth based on factor abundance does not promote structural change; and the increased productivity throughout the economy reproduces undesired situations of distributive inequality, poor job quality, and structural heterogeneity; and
- (ii) Growth is more vulnerable to changes in the international economy and the behaviour of external demand. This leads these authors to conclude that the economy is less vulnerable when the source of growth is income contributed by technology and knowledge production, which makes it possible to respond to changes in the competitive framework. In contrast, it is much harder for that to happen when the income source is highly dependent on an abundant resource, owing to the lack of technological capacity needed to adapt the economy to the new context.

According to the Kaldorian-structuralist literature on economic growth, therefore, in Brazil over the last 30 years the larger share of industrial sectors based on natural resources in the productive structure implies slower long-term GDP growth and greater vulnerability to external crises, particularly those involving a slump in external demand. This means that the long-term GDP growth rate, in a framework of balance of payments equilibrium, will be lower than what it could be, particularly compared to the rapid growth period in the context of development-oriented policies. If industrial sectors based on differentiated technologies and scientific knowledge grew at least as fast as natural-resource-based sectors and the agriculture and service sectors, they could give the Brazilian economy long-term growth rates above those achieved in the last decade, such as

those achieved in the period between the end of World War II and 1980. Clearly, the stimulus to rapid growth in industrial sectors based on differentiated technologies and scientific knowledge, and the expansion of their share in industrial GDP, would respond to an industrial policy oriented towards the development of an endogenous technology core—in other words State participation is the source of incentives for industrial development oriented towards an increase in the technological content of the goods and services produced in the country. The recommendation made by Ocampo and Vos (2008), for peripheral economies to expand the scope of policies to promote sustained growth, can be interpreted in the same way.

Brazil's current productive structure, and its reflection in the trade balance, are the outcome of the historical industrial and economic development process. According to Kaldor (1966 and 1970) and Fajnzylber (1983), if industry had diversified more intensively, the structure would remain incomplete owing to its relatively small share in industrial GDP and the recurrent trade deficit of the technology-intensive sectors. Moreover, the ongoing exploitation of Brazil's abundant natural resource endowment, in a context of rising terms of trade, has the corollary of exchange-rate appreciation that is magnified by the interest-rate spread, and industrial weakening that starts in technology-intensive sectors. According to the approach followed by Kaldor (1966 and 1970) and Fajnzylber (1983), "Dutch disease" will set a trap for the development process by restricting the growth of the more technologically intensive industrial sectors. In the case of Brazil, the trap could arise when the exploitation of oil and natural gas reserves from the pre-salt strata reaches its peak, which would turn the country into a large-scale exporter of those commodities.

## IV

### Final comments

Intensification of the current trend of Brazilian industry toward specialization in natural-resource-intensive sectors, together with a relative contraction of sectors that make intensive use of technology, especially those producing capital goods, will move Brazilian industry away from the maturation process posited by Kaldor. Moreover, following the interpretation of this author, not all possibilities for development of Brazilian

industry offered by the industrialization process have been exhausted.

In terms of Kaldor's development phases, the Brazilian productive structure faces the challenge of deepening phases three and four to reduce the external constraint on growth, particularly in relation to sectors based on differentiated technologies and scientific knowledge. Consequently, the main obstacle

to exploiting the country's long-term growth potential is not the declining share of industrial output in GDP, but the stagnation or shrinking share in industrial GDP of sectors that make very intensive use of technologies. According to Kaldor's cumulative causality mechanism, lack of progress in the industrialization process will lead to less favourable participation in trade flows, thereby lowering the Brazilian economy's long-term growth rate, which could become trapped in a vicious growth circle, rather than evolving in a virtuous circle.

The economic liberalization since the 1990s, together with exchange-rate appreciation have contributed to a structural change in industry. Although that change has helped modernize the industrial fabric, it has also discouraged exports and the creation and production of national technology, owing to the combined effect of a high real interest rate and exchange-rate appreciation. These would be the first symptoms of "Dutch disease".

The terms of trade increase that started in 2003 has had a positive effect on Brazilian GDP growth since then, even with a lower exchange rate and high real interest rates, which typically discourage exports and investments in high-technology goods. Accordingly, while significant variables such as the exchange rate and interest rates hinder sustained growth, this has been achieved in the current phase through rising prices in the commodities for which Brazil is one of the world's leading producers. It needs

to be asked whether this type of growth is sustainable in the long term. Kaldor's theory would suggest not.

As noted by Pérez (2008) and Rodrik (2010), unlike what happens with specialization, the diversification of industrial sectors is essential for sustained economic growth, since it allows for a wider range of productive activities and more balanced shares among the manufacturing sectors. In contrast, the perverse combination that has developed in Brazil between rising terms of trade, an appreciated exchange rate and high real interest rates has had the opposite effect of turning the Brazilian economy into a specialized, albeit modern, economy, and narrowing the range of industrial activities, in other words causing sector concentration. Holland and Porcile (2005, p. 61) argue that specialization in sectors with little or no technological intensity would reduce to capacity of less technologically developed economies, particularly developing countries such as Brazil, to diversify their productive structure on a competitive basis, in other words without the need for tariff protection or falling relative wages. Consequently, attaining the objectives of easing the external constraint and convergence in terms of productivity requires investments in technology that are reflected in the production of consumer goods and durable goods to supply both the domestic and external markets.

(Original: Portuguese)

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# Argentina: Dissemination of genetically modified cotton and its impact on the profitability of small-scale farmers in the Chaco province

*Valeria Arza, Laura Goldberg and Claudia Vázquez*

## ABSTRACT

This article analyses the adoption of genetically modified cotton by small-scale farmers in the Chaco region of Argentina. It uses the socio-technical configuration of the technology as a conceptual framework, which postulates the existence of a set of factors that significantly affect the way in which technologies operate. Based on this framework, the article describes the conditions under which small-scale farmers in the Chaco region adopt gm cotton; and it identifies the differences between them and large-scale farmers, on which most of the literature focuses. Qualitative methodologies are used to analyse the breaks and continuities in productive practices affecting the profitability of small-scale farmers since the introduction of gm cotton. It is found that the productive difficulties they face have remained essentially unchanged, and, in some cases, have become more accentuated.

## KEYWORDS

Cotton, crops, genetically modified organisms, small farms, productivity, income, economic conditions, Argentina

## JEL CLASSIFICATION

O13, O33, Q16

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# I

## Introduction

Since their launch in Argentina in 1996, genetically modified (GM) crops have spread very rapidly with adoption rates among the highest in the world. GM cotton was introduced in 1998, and by 2010 nearly all of the areas sown with this crop were cultivating transgenic varieties. Although the speed of its dissemination may reflect the benefits that GM technology brings to its users, this article finds that the benefits have not been equal for everyone: transgenic varieties were better suited to the production conditions of large-scale farmers.

The key contribution to profitability made by GM cotton stems from cost savings in labour and pesticides. However, small-scale farmers do not benefit from that saving as large-scale farmers do, because they do not hire labour or use pesticides to the same extent. Moreover, the main pest currently afflicting the region, the boll weevil, is not one of the insects controlled by available GM seeds. As will be argued in this article, the introduction of GM crops may have actually aggravated other socio-productive problems faced by small-scale farmers, related to their disadvantaged position in the marketing chain.

In fact, many small-scale farmers have abandoned cotton growing over the last few years, and some have even sold their land. Some provincial technical experts and workers believe cotton production is no longer viable for small-scale farmers in the Chaco. Although this situation may have started to develop before the introduction of GM technology, which is consistent with the expansion of the “productivist” paradigm that attempts to generate and exploit economies of scale (Vanloqueren and Baret, 2009),<sup>1</sup> this article propounds the view that the adoption of that technology has widened

the gap between large- and small-scale farmers, thereby fuelling the perception that small-scale cotton-growing is no longer viable.

Most studies of the effect of GM crops in Argentina view the technology as an artifact. In other words, they focus on the virtues of GM seeds and their associated technological package (Qaim and de Janvry, 2003 and 2005; Trigo and Cap, 2006; Trigo and others, 2002; Trigo, Falck-Zepeda and Falconi, 2010); and they evaluate the effectiveness of seeds that are insect-resistant and herbicide-tolerant (how much pesticide or labour they save) and the economic effects in terms of changes in yields and profitability.

Within this group, the specific literature on GM cotton in Argentina concludes that its adoption, particularly in the case of seeds resistant to *lepidoptera* insects, has increased yields thanks to better pest management (Qaim and de Janvry, 2005; Trigo and Cap, 2006). These studies do not consider small-scale farmers, but are based either on information from surveys of relatively large-scale farmers, or on aggregate modelling exercises for farmers as a whole. Moreover, as these studies attribute to the artifact all of the virtues that the technology can produce, there is no in-depth analysis of differences in the contexts in which it is adopted by different users. For example, it is assumed that GM seeds were generally adopted as part of a package including good agronomy practices, specific inputs and modern machinery. Nonetheless, while large-scale farmers generally gain access to the full technological package, smaller-scale farmers generally use an incomplete package that consists of uncertified and low-quality GM seeds, with haphazard herbicide use.

This article takes a broader view of the technologies, understanding them as “socio-technical configurations, rather than individual artifacts (seeds, machines, and other items). The socio-technical-configuration concept was developed in the fields of sociology and the economics of science and technology (Bijker, 1995; Klein and Kleinman, 2002; Kleinman, 1995; Pinch, 1996; Pinch and Bijker 1987; Rosen, 1993; Williams and Edge, 1996) and argue that technologies need to be understood in relation to the contexts in which they are produced, marketed and adopted.

Under this approach, the artifact itself is just one aspect of a socio-technical configuration, which also includes social, cultural, political and economic

□ This study received financial support from the International Development Research Centre (IDRC), Ottawa, Canada, and from the National Council for Scientific and Technical Research (CONICET), project PIP112-200801-02758, Argentina. The authors are grateful to staff at the Office of the Under-Secretariat for Rural Development and Family Farming of the Government of Chaco province, researchers and extension workers at the National Institute for Agricultural Technology (INTA) and representatives of the rural consortia in the localities visited, for all the assistance provided during the fieldwork. We are also grateful for comments received from an anonymous referee of the *cepal Review*.

<sup>1</sup> The productivist paradigm has been a significant element on the national agriculture agenda in Argentina since the 1970s. See for example, Becerra, Baldatti and Pedace (1997) and Gárgano (2011).

dimensions. With regard to these, this article focuses on the users' capacities and practices, and on their bargaining power in relation to other key players in the productive chain. The socio-technical approach argues that the artifact will "work" differently in different socio-technical configurations. This approach makes it possible to appreciate the flexibility of the technologies: when the social context changes, the technologies have different effects, consequences and meanings.

This article shows that the socio-technical configuration of GM cotton differs greatly between small- and large-scale farmers. Accordingly, although the existing literature concludes that the introduction of GM technology unequivocally increased the profitability of cotton production, this article puts that conclusion in a more relative light, and claims that in Chaco province the effects were not the same for all farmers. The study's main finding is that GM technology, in the case of cotton in Chaco province, has had different economic effects for large- and small-scale farmers, and has widened inequalities between them.

The empirical evidence reviewed here was obtained in participatory workshops with small-scale cotton farmers, held in July and September 2010 and in July 2011 in four cotton-growing localities in Chaco province (Pampa del Indio, Quitilipi, Villa Berthet and Sáenz Peña). About 20 people participated in each workshop, mainly small-scale farmers (cultivating less than 10 ha)

but also some medium-sized farmers (areas of up to 100 ha), together with intermediaries, extension workers from the National Institute of Agricultural Technology (INTA) and local officials. The workshops, lasting roughly a day and a half each, were organized using participatory methodologies and aimed to identify productive practices, problems and potential solutions. The information collected during the workshop was complemented by in-depth interviews<sup>2</sup> with INTA agents (8), government representatives (1), representatives of farmer co-operatives (2), leading members of farmers' organizations (2) and representatives of the seed industry (2).

This article is organized in three sections following this introduction. Section II focuses on the context in which GM cotton was adopted. It describes the historical evolution of cotton production and gives details of the main characteristics of the productive practices used by large- and small-scale farmers. Section III analyses the changes in productive practices that occurred following the dissemination of GM seeds, based on qualitative data obtained in the workshops. It firstly considers changes in yields, and then changes in profitability. Lastly, section IV sets out the conclusions and proposes policy guidelines.

<sup>2</sup> The figures refer to the number of interview sessions organized, rather than the number of people actually interviewed, because in some sessions several people were interviewed.

## II

### Cotton production in Argentina and the practices of small-scale farmers in Chaco

#### 1. Main characteristics of cotton production

Chaco province accounts for 60% of the total area in Argentina sown with cotton (see figure 1).<sup>3</sup> It is one of the country's poorest provinces: in 2009, the United Nations' human development index ranked it as Argentina's third poorest province. According to 2002 data (the latest national agricultural census with figures available) there were 18,000 cotton workers in the province, of whom

13,000 were family workers (Valenzuela and Scavo, 2009). As seen in table 1, a small proportion of large-scale farmers accounted for half of the total area sown with cotton, while most farmers (60%) were cultivating land plots smaller than 10 ha. Subsection 2 describes the chief characteristics of these two groups in detail.

Cotton production in Chaco began in the early twentieth century and has experienced major fluctuations through time, mainly reflecting changes in national policy and international prices. As tends to happen with commodities, production and price trends are correlated (see figure 2).

Since the late 1990s, the expansion of soya production has substantially displaced cotton-growing in

<sup>3</sup> On average for the period 1969-2010, the Chaco produced 62% of the country's total cotton output (Ministry of Agriculture, Argentina).

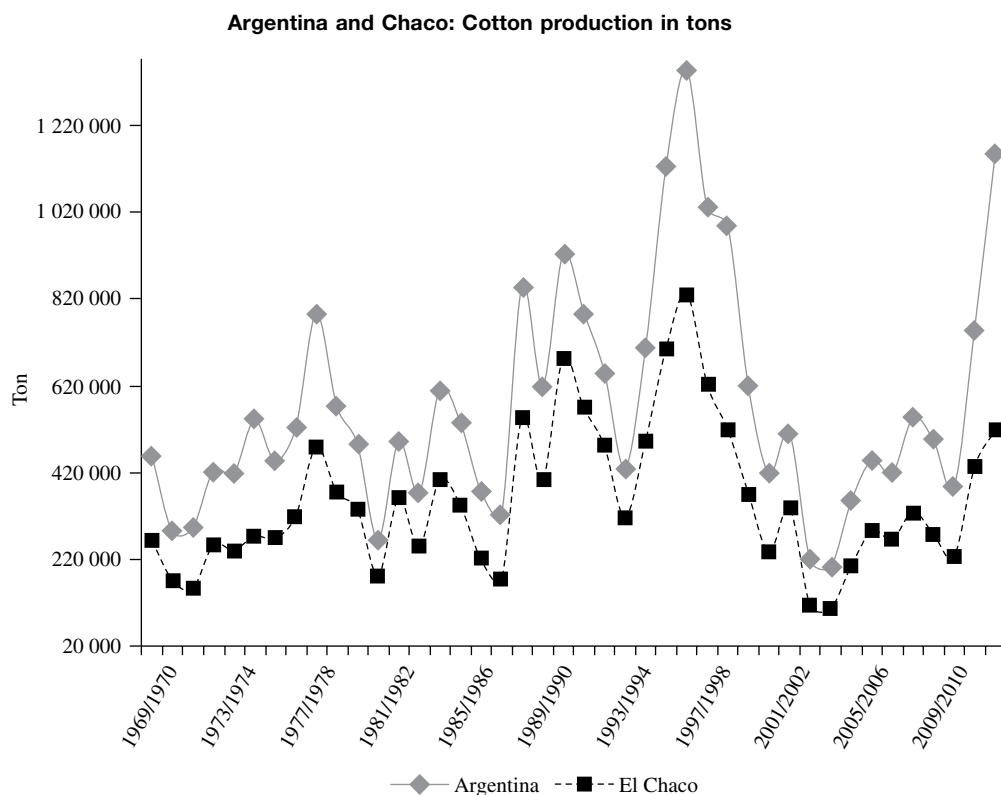
TABLE 1

## Chaco province: distribution of cotton farmers by size, 2002

Size	Area in hectares	Percentage of farmers	Area sown with cotton (percentage)
<i>Minifundista</i>	0.1 to 10	60	9
Small-medium	10 to 100	34	41
Large	Over 100	6	50

Source: National Institute of Statistics and Censuses (INDEC), National Agricultural Census 2002.

FIGURE 1



Source: prepared by the authors on the basis of the Integrated Agricultural Information System (SIIA) of the Ministry of Agriculture.

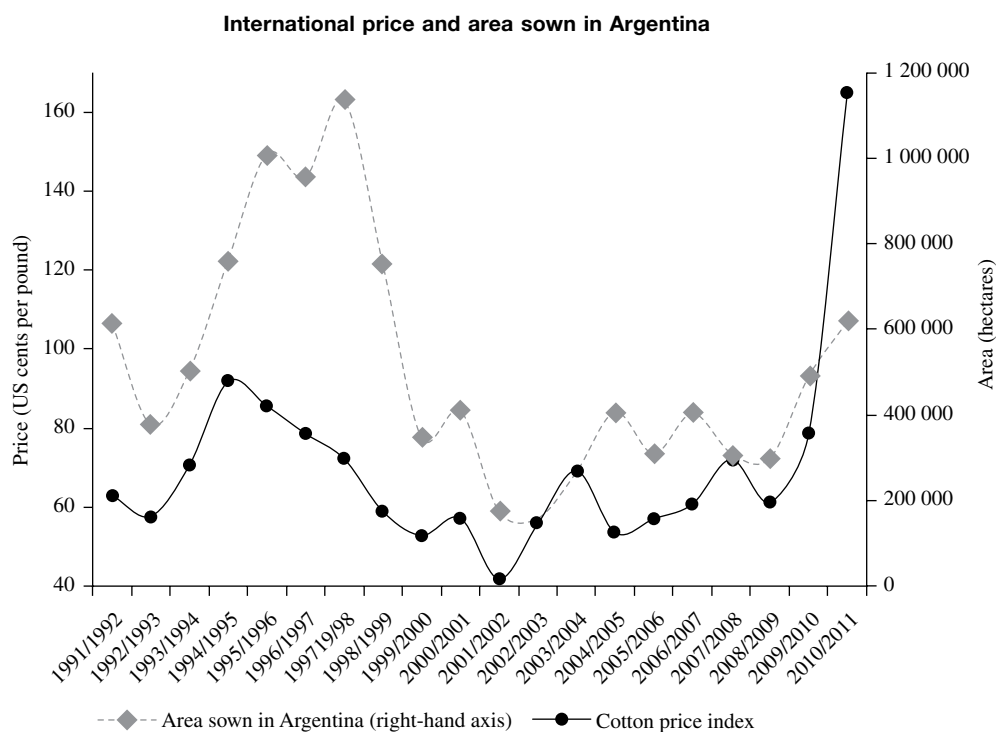
the province (see figure 3). With the economic recovery (particularly in the textile industry), cotton production revived as from 2003, but is still far below its historical levels (see figure 1).

Monsanto is the only firm to have introduced GM cotton seeds in Argentina, through its Genética Mandiyú joint-venture. This was created in 1997 between Monsanto, Delta & Pine (subsequently taken over by Monsanto) and CIAGRO, the leading input distributor in the north-east of Argentina. In 1998, Monsanto obtained approval from the Ministry of Agriculture to market a variety of Bt cotton (resistant to *lepidoptera* insects), and in 2001 to market an RR seed tolerant to glyphosate (a broad-

spectrum herbicide) whose genetic base comes from a variety originally developed by INTA (Guazuñcho). Lastly, in 2009, they obtained commercial approval for two varieties that stack the Bt and RR genes of Monsanto (this combination of genes is known as the “Bt/RR stacked event”). In other words, seeds were obtained that are simultaneously *lepidoptera* resistant and glyphosate tolerant. One of them was marketed in that year, and the second was introduced commercially in 2011.

The introduction of transgenic cotton seeds transformed the cotton-seed market. Until the 1990s, the entire cotton-cultivation area was sown with varieties developed by INTA. The use of GM seeds, particularly

FIGURE 2



Source: prepared by the authors on the basis of the Integrated Agricultural Information System (SIIA) of the Ministry of Agriculture, for the area sown, and *Cotlook Index "A"* (<http://www.cotlook.com/>) for the price index (the international source most widely used for the cotton fibre export market).

herbicide-tolerant varieties and the stacked event, spread very fast (see figure 4); and, given its autogamous property (which allows self-fertilization) the seed could be multiplied informally, without authorization from Genética Mandiyú or quality control by the National Seed Institute (INASE). Industry sources report that uncertified GM cotton seeds, known as “white bag” seeds, accounted for over 80% of GM seeds sown in 2009.<sup>4</sup>

## 2. Socio-technical configurations of cotton in the Chaco

Small-scale farmers live in extremely precarious conditions, reflecting both the lack of access to basic housing services, electricity and water, and insufficient income. Most small-scale cotton-producing families live in shacks,<sup>5</sup> in overcrowded conditions, and only some of them have very recently gained access to rural electrification. While they have no piped drinking water,

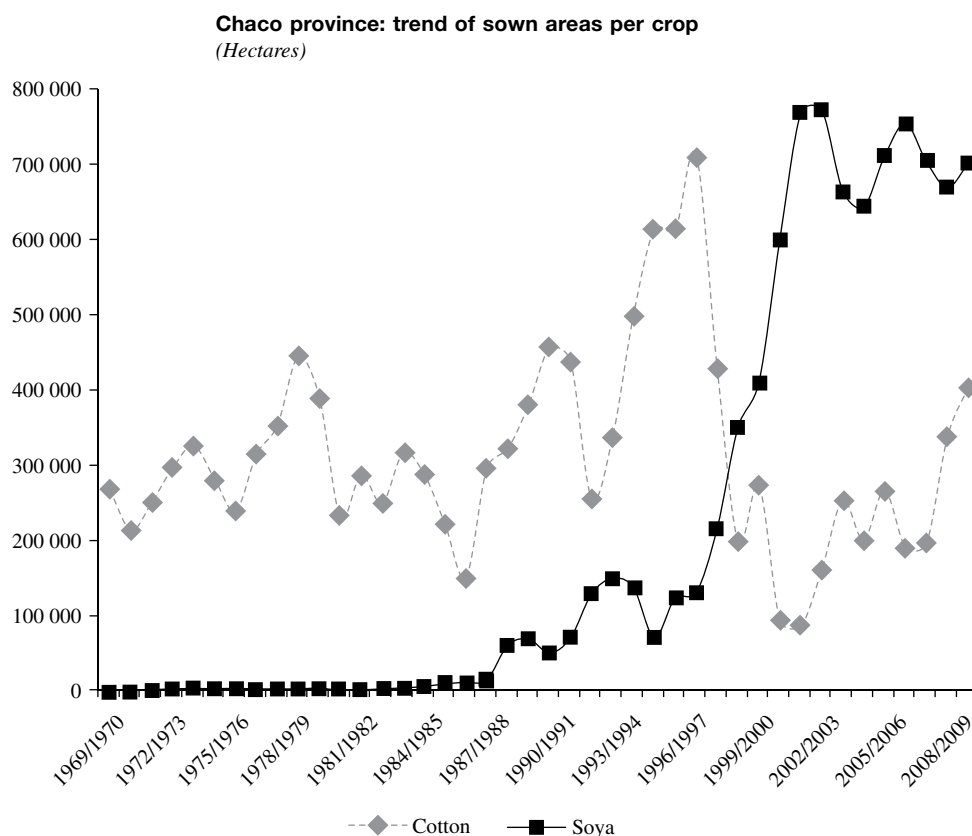
they often also do not have a water well on their land. They work the land for their own subsistence; they feed themselves from the crops they grow in their vegetable garden and the animals that they breed in their farmstead (“*chacra*”). They usually find it hard to sell any surplus produce, because the markets in the towns are mostly far away. The only crop grown commercially is cotton. They use the income obtained from cotton sales to purchase basic goods, such as clothing and school utensils for their children. In most cases, the land is worked exclusively by the family. They receive support from local public programmes that provide soil preparation services, along with seeds and fuel. In addition, farmers generally receive some form of public transfer, which accounts for a large proportion of total household income.<sup>6</sup> Formal credit is beyond their reach, and they use informal channels to purchase inputs on credit, paying a high interest rate. They also generally have fragile property rights over the

<sup>4</sup> Interview held with industry representatives.

<sup>5</sup> Very spartan rural dwellings with rough adobe walls, metal sheets, straw or similar products on the roof, and an earthen floor.

<sup>6</sup> Since 2009, the various national income transfer programmes supporting families with children has been unified under the Universal Child Allowance for Social Protection (AUH), which pays \$220 per month for each child under 18 years of age, for up to five children; and \$440 for each disabled child with no age limit.

FIGURE 3



Source: prepared by the authors on the basis of the Integrated Agricultural Information System (SIIA) of the Ministry of Agriculture.

land on which they work and live, which makes them even more vulnerable.

In this context, small-scale cotton farmers in the Chaco face a serious productive and profitability problems. Yields are low mainly because they are severely affected by the boll weevil, a pest that is not controlled by transgenic technology.<sup>7</sup> In addition, the soils they cultivate are degraded owing to deficient soil management practices (they do not practise crop rotation or use fertilizers). The technical assistance they receive is targeted on other crops and generally provided in the towns (in the form of informative meetings and other “office” activities) or else in demonstration fields, but not in the farmer’s own *chacra*.

The low profitability of small-scale farmers is not only due to low yields, but also to their position in the

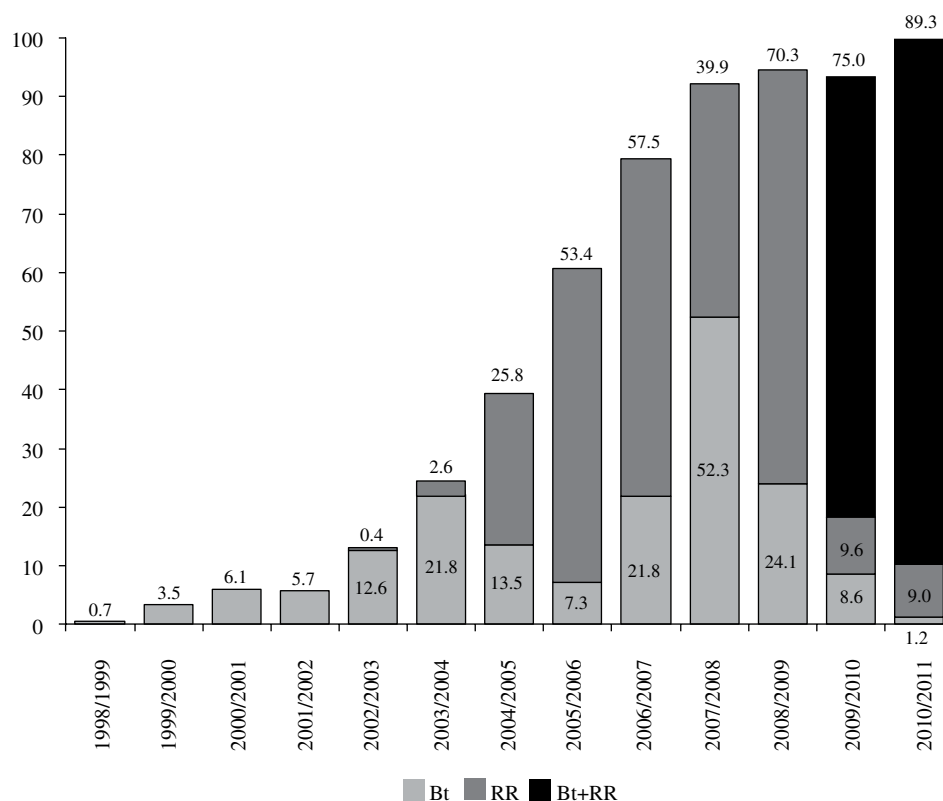
marketing chain. The harvested cotton is sold raw and they have to accept the price offered by the intermediaries that collect it from the *chacra*. There are three reasons for this: (i) they are in debt to this intermediary, who is often the same person that provides them with credit for inputs, charging a high rate of interest; (ii) they face transport difficulties in reaching other markets; and (iii) they cannot sell their output in markets where tax registration is required, because they are not legally registered.<sup>8</sup> This is compounded by the urgency of sale, because they need the income for family subsistence. In many cases, co-operatives operate as intermediaries, both as a buyers of the harvest and as suppliers of inputs,

<sup>7</sup> The boll weevil is a pest specific to the American continent, which feeds and reproduces in the cotton bolls, preventing flowering. Some scientific studies suggest that the spread of the pest could be related to the reduction in fumigation that occurred as a consequence of Bt (and Bt/RR) cotton (Grossi-de-Sa and others, 2007; CCIA, 2009).

<sup>8</sup> At the present time, to sell the harvest output directly to cooperatives or to entities that undertake the ginning process (see definition in footnote 9) requires tax registration, to be able to issue invoices. But small-scale farmers generally are not registered with the tax department, since it is very difficult for them to make regular contributions. Accordingly, they continue to sell raw cotton through informal channels to larger registered farmers or local warehouses, which then market it with the ginner.

FIGURE 4

**Argentina: trend of area sown with gm cotton**  
(Percentage of area sown with cotton)



Source: prepared by the authors on the basis of the Integrated Agricultural Information System (SIIA) of the Ministry of Agriculture, for the total area sown, and the Argentine Council for Biotechnology Information and Development (ArgenBio) for the adoption of GM cotton by type.

Bt: Cotton variety resistant to *lepidoptera* insects.

RR: Cotton variety tolerant to herbicide, whose germplasm comes from a variety originally developed by INTA.

particularly seeds, because these are usually recovered in the “ginning”<sup>9</sup> process and sold back to the farmer.<sup>10</sup> This practice reduces the germination power of the seed and increases uncertainty as to the identity of the different varieties.

Nonetheless, despite their precarious situation and low profitability, small-scale farmers are culturally attached to cotton. They were born and have grown up with cotton and have learned to cultivate it as their

parents did; it forms part of their identity. Moreover, for them, cotton functions as a currency in a way that other crops do not: they can pick small amounts and will always find a buyer for it, albeit at a modest price.

The situation for larger scale farmers is very different. They use modern machinery and hired labour. Generally, they combine cotton production with soybeans and in some cases with sunflower, maize or sorghum. Soybeans in particular may occupy a large part of the sown area. The smaller farmers in this group are family firms, but the large-scale farmers tend to be corporations (Arza and others, 2010) whose investors are normally not involved personally with rural life. In general, these farmers have their own gin and use state-of-the-art technologies, including the full technological package associated with GM seeds (see the description in box 1). This group is the main customer of Genética Mandiyú, although they also multiply their own seeds.

<sup>9</sup> Productive process to obtain cotton fibre from raw harvested cotton, separating the fibre from the seeds and other waste material extracted from the harvest. This is done with a ginning machine.

<sup>10</sup> Although the cooperatives were created to improve farmers' bargaining power *vis-à-vis* large-scale buyers of cotton fibre, and also to obtain better prices through joint purchases of key inputs such as diesel, the activity of these cooperatives is currently no different from that of other intermediaries.

BOX 1

**The full technological package**

To maximize the yields and the return from its adoption, gm seeds should be accompanied by specific practices and inputs. Although it is possible to adopt just some of its components, the full technological package includes the following: gm seeds purchased in the formal market; direct sowing in a narrow rows (0.48-0.5 m wide); herbicide and insecticides to be applied throughout the crop cycle; growth regulators; defoliant and mechanical harvesting using the stripper harvester adapted to the narrow row. Use of this package requires a minimum scale to justify mechanization and technical knowledge. Funds are also needed to purchase inputs. Small-scale cotton farmers, who cannot obtain formal credit and only have their own work and that of their family to rely on, continue to sow using the conventional system (1 m wide rows) and to harvest manually. The following table estimates the yield and profitability differential between farmers who use the full technological package and those who do not:

	Farmers who use the full technological package	Farmers who do not use the full technological package
Yields (tons/ha)	2.9	1
Price of raw cotton (AR\$/ton)	1 800	1 000
Cost of seeds (AR\$/ha)	630	80
Fibre percentage	25	30

*Source:* M.G. Elena, "Costo de producción por hectárea de algodón", National Institute for Agricultural Technology (INTA), 2010 [online] [http://inta.gob.ar/documentos/costo-de-produccion-por-hectarea-de-algodon-2009-10-para-surcos-estrechos-0-52m-1/...](http://inta.gob.ar/documentos/costo-de-produccion-por-hectarea-de-algodon-2009-10-para-surcos-estrechos-0-52m-1/) and workshops with farmers organized by the authors. Estimates for the 2009/2010 season.

AR\$: Argentine pesos.

Studies done by the inta Experimental Agriculture Station at Saenz Peña compare the margins obtained when different elements of the package are combined. Elena, Íbalo and Gesualdo (2006) estimate the additional benefit of sowing in a narrow row for direct sowing (sd) and conventional sowing (sc). The results show that sowing in a narrow row produces an additional benefit of \$ 818.37 and \$ 553.55 per hectare for sd and sc, respectively.

Similarly, Elena, Ybran and Lacelli (2008) analyse the costs of cotton production using different sowing and harvesting alternatives and different price scenarios. They conclude that sowing in a narrow row and using stripper harvesting has more competitive results than manual or picker harvesting and that, for the price scenario, the only profitable alternative is obtained by combining narrow row sowing and the stripper harvester.

### III

## Repercussions of the adoption of gm cotton by farmers in the Chaco

#### 1. The benefits of adopting gm seeds, according to the literature

One of the best-known studies on the impact of adopting GM cotton in Argentina is Qaim and de Janvry (2005), which is based on surveys of a sample of cotton farmers made during the 1999-2000 and 2000-2001 agricultural seasons. At that time, users of GM cotton seeds were still

few in number. The sample contains 290 observations, of which 125 correspond to farmers working areas larger than 90 ha, which then included 87 users of Bt cotton. The sample also contains observations for 173 farmers working less than 90 ha of land, none of whom were users of the technology. The authors estimate an econometric model to evaluate the extent to which the adoption of Bt cotton increased yields and reduced pesticide use

among users. They conclude that the number of pesticide applications and the amount applied both decrease significantly when Bt seeds are sown. In addition, the technology increases yields by 500 kg per hectare, on average. The authors find that the yield effects are greater than those reported for other countries that have adopted the technology, such as China or the United States. The explanation for this differential effect is that pest control was deficient in Argentina prior to the introduction of the GM seed: the amount of pesticide applied with the conventional seed was less than recommended, so the adoption of Bt cotton increased yields by more than it would have done if pest control had previously been greater.<sup>11</sup> For the same reason, and despite the fact that small-scale farmers had not adopted the Bt seed when the study was undertaken, the authors infer that the technology would be particularly effective for them,<sup>12</sup> because the pest control normally undertaken by this group is even more deficient.

Trigo and Cap (2006) also analyse the repercussions of GM cotton in productivity and profitability terms using data from the 2001-2002 season. This study draws on the estimates published by Elena (2001) that Bt cotton raises yields by 30%, to analyse the distribution of the benefits among farmers, the seed industry and the State. Based on averages, the authors conclude that 86% of the benefits are appropriated by the farmers and that the benefits received by the (single) seed firm are low, because 66% of the seed used is “white bag”.

Ten years after the research done by Qaim and de Janvry (2005) and by Trigo and Cap (2006), the situation regarding the adoption of GM cotton in the Chaco is clearly different. Firstly, there are new varieties: in addition to the Bt seed there is now RR seed and the “stacked event”, which are widely disseminated, mostly through informal channels. Secondly, conventional seeds have practically disappeared from the market, and it is assumed that the small amounts that do circulate are highly contaminated with transgenic material. Thirdly, boll weevil has spread and now poses the greatest threat to cotton production in the province.

Accordingly, and given that most large, medium and small-scale farmers sow GM cotton seeds, it is critically

important to analyse whether their adoption by small-scale farmers has had the expected effects in terms of yield and profitability.

That is the aim of this study. Based on the conceptual framework of the socio-technical configuration of the technology, it analyses productive practices in relation to the use of GM seeds. Section III subsection 2 focuses on productive practices related to yields, while section III subsection 3 focuses on profitability. Both subsections describe breaks and continuities arising as a result of the adoption of GM technology. As there are no statistics on yields and profitability with a size breakdown, information obtained through qualitative methodologies has been used. Without generalizing, comments made by farmers and other stakeholders at the participatory workshops and interviews are used to illustrate the main arguments.

## 2. Productive practices and yields

Nowadays, GM seed is widely disseminated among small-scale farmers. Nonetheless, the seeds available to them are of dubious quality, because in all cases they are “white bag” seeds obtained informally or distributed free by the local government.<sup>13</sup>

Apart from the generalized adoption of GM seeds, small-scale farmers have not acquired machinery or changed their sowing techniques. They even continue with the practice of mono-cropping, which causes increasing deterioration of soils.

To prepare the land, they generally rely on a neighbour with a tractor to provide the service in exchange for fuel that they receive free from the government.<sup>14</sup> If the municipality has a tractor, they use that service to prepare the land; but this is not always available because there are many farmers to share the single tractor that the municipality normally owns.<sup>15</sup>

Harvesting techniques have not changed as a result of adopting GM technology. Small-scale farmers continue to pick small amounts in each flowering, selling the raw

<sup>11</sup> Furthermore, the authors stress that this result could be underestimated, owing to the impossibility of controlling for germoplasm (genetic fund): the Bt varieties launched commercially were not specifically developed for Argentine soil, as were the conventional varieties developed by INTA and marketed until then. If this factor were controlled for, the effect attributable exclusively to the Bt gene could therefore be even be greater.

<sup>12</sup> This study classifies farmers in the sample as large-scale if they cultivate more than 90 ha.

<sup>13</sup> A few seasons ago, the provincial government, which historically had provided free conventional cotton seeds to small-scale farmers, delegated seed purchase to the municipalities, which obtain and distribute uncertified GM seeds.

<sup>14</sup> “We now have ‘diesel vouchers’, but we have to wait for someone with a tractor to stop working in their own field and see whether they will come to the *chacras* in exchange for those vouchers. Not everyone wants to come to the small *chacras* because it is more costly and there can be problems.” Small-scale farmer, Sáenz Peña.

<sup>15</sup> “Everything takes longer for us because the municipality is responsible for ploughing the land and as there are 30 associations, they are done at random, and never reach some associations. The municipality has one tractor and is about to buy another one.” Small-scale farmer, Sáenz Peña.



cotton immediately because they need money to purchase basic consumer goods.<sup>16</sup> Cotton continues to function as money for them, because in the province it can very easily be sold to warehouses or local intermediaries. Harvesting is done manually by the entire family.<sup>17</sup> Nonetheless, since the exodus of the youth population, many families do not have enough hands at harvest time, and they need to hire harvesters, which further erodes their already low profitability.

In terms of sowing techniques, small-scale farmers from all the localities visited stated that they had not changed the distance between rows (0.7- 1 m). When asked why they did not sow in narrow rows, farmers and INTA technical staff both explained that there were difficulties in obtaining the inputs and machinery needed to sow and harvest at that distance.<sup>18</sup> Apart from this constraint, the workshops also identified a common perception among small-scale farmers that the yields in narrow rows are lower because the plant grows less ("*carga menos*"),<sup>19</sup> despite consensus among the INTA technicians consulted that yields are higher.

This difference between farmers' perceptions and the technical opinion exemplifies a difficulty faced by technical assistance when working with small-scale farmers.<sup>20</sup> Moreover, it is likely that since the introduction of GM cotton, INTA technical assistance in this crop has

decreased and is being retargeted towards other productive activities that are considered priorities for the institution.

Several reasons could explain this change in priorities. Firstly, as from 2001, the INTA extension strategy was changed from technology transfer to "technological innovation" projects, which generally pursue social, environmental, and technological needs objectives simultaneously (Alemany, 2003). In practice, these extension projects have prioritized fruit, vegetables and livestock production, ahead of industrial crops, in accordance with the principles of food sovereignty.

Secondly, INTA agents are primarily concerned with soil conditions in the region, which require urgent attention including diversification of production. Small-scale farmers are reluctant to diversify beyond cotton and food for subsistence. According to INTA technicians, this reluctance worsens the quality of soils, which in turn lowers yields.<sup>21</sup> When asked about this, the small-scale farmers basically blamed the lack of markets to sell alternative productions, as well as extolling the virtues of cotton: it is not perishable, there is an easy market for it, and it is resistant to adverse weather conditions.<sup>22</sup>

Thirdly, it is worth stressing another aspect that affects the active role of INTA in the seeds market, relating to the privatization of knowledge. Prior to the introduction of GM crops in many developing countries, including Argentina, conventional breeding<sup>23</sup> was done largely by the farmers themselves and public research institutions. The diffusion of GM technology and subsequent strengthening of intellectual property rights imposed a clear limit on such practices (McIntyre and others, 2008).<sup>24</sup> As germoplasm development is a subject to economies of scale, and given that most firms producing GM seeds are global players that optimize their sales worldwide, these firms pursue active standardization strategies. Consequently, the diversity of varieties

<sup>16</sup> "As a family, the cotton we can pick in a week from Monday to Saturday is 2,000 or 3,000 kg; we have to sell it immediately because we need the money for our every day lives. What we pick we sell to meet our needs. We can't pick 20 tons, it's not the same as selling 2,000 kg." Small-scale farmer, Quitilipi.

<sup>17</sup> "We small-scale farmers have always worked with just the family. I would sow 2 ha. When I planted vegetables, I would say: with the help from my family today I harvested the 2 ha and this is money that one makes within the family. We don't need to pay more than what the family makes from its work and that's what we live on." Small-scale farmer, Sáenz Peña.

<sup>18</sup> "In a narrow row you need money for the technology. The defoliant ... you need size to be able to enter with the machines. They harvest by hand and at 52 years old you cannot harvest by hand". INTA agent, interviewed in September 2010.

<sup>19</sup> "With due respect to the people at INTA, the narrow row is debatable: the calculations need to be done carefully. I spoke to people that used both methods who say that you have to make the numbers very small and it isn't clear which is best. We talk of three tons per hectare, but with a yield of 20% to 22%, and I harvest with another machine or by hand and in a normal year it gives 37%, 38%, 40%. So I don't know. And for the ginning, this cotton stripper charges another \$100." Small-scale farmer and member of the cooperative, Quitilipi.

<sup>20</sup> "The government never looks out for the small farmer. No technician has ever come here to tell us what seed to use, never. The technicians are in Quitilipi, in Sáenz Peña, but no technician has ever come here to help us". Small-scale farmer, Quitilipi.

<sup>21</sup> "The people at INTA give a talk here, but don't go to the *chacra*. Large farmers have their paid technicians, they also have INTA, they have everything." Small-scale farmer, Quitilipi.

<sup>21</sup> "You have to consider the soil as well. This is yielding less because they have been producing cotton for 30 years. It needs crop rotation." INTA agent.

<sup>22</sup> "I defend cotton, I'll die with cotton, because there is nothing that is as resilient as cotton, to start in this zone. If I grow 10 ha of sunflower, soya or wheat, no way, to sell I have to produce miracles: I have to register in the National Commercial Agriculture Control Office (ONCCA) [...] for us this is impossible. And if you grow vegetables, who would you sell to? Where is the market? If 900 farmers grow half a hectare of pumpkin each, where do we go?" Small-scale farmer, Quitilipi.

<sup>23</sup> This refers to the conventional improvement of plants by exploiting genetic variation (either created deliberately or found in wild populations), selecting the most desirable individuals according to different agronomic characteristics.

<sup>24</sup> In Argentina, Rossi (2006) states that the intensive propagation of GM crops has meant the privatization of knowledge production and dissemination.

available in the market has been cut drastically, to the point where currently only three varieties are sown, and two of these come from imported gene pools.<sup>25</sup> Before the spread of transgenics, on the other hand, the cotton seed market was dominated by the conventional varieties developed by INTA. The institution not only undertook research for the development of technological options adapted to the region and improvements and product diversification, but it also assumed responsibility for multiplication and, sometimes, the seed marketing process. In fact, until the 1990s, INTA seed production was done by “co-operating associations” (*asociaciones cooperadoras*) of this institution or private seed farmers that signed agreements with it under the technological linkage agreements scheme. As GM technology spread, the seed firms ended (or did not renew) their agreements with INTA, and now there is only one co-operating association producing varieties in the institution’s fields, and a single seed firm that has applied for a permit to multiply INTA seeds for the 2011 season.<sup>26</sup>

In view of this, whereas in the past INTA emphasized the dissemination and correct use of its varieties, nowadays, although it remains the leading national institution undertaking cotton-specific research,<sup>27</sup> the varieties it develops are not sold on the market. Technical assistance on the GM varieties that are used is provided mainly by private technicians, who are hired by large-scale farmers. Genética Mandiyú also provides a “technical service” and “customer service” for its customers. Small-scale farmers who cannot afford to hire private technical services and are not customers of Genética Mandiyú because they obtained their seeds on the informal market, do not generally receive technical assistance.

In brief, apart from the widespread adoption of GM cotton seeds, small-scale farmers have not changed their sowing and harvesting techniques, the machines they use have not been updated, they do not generally receive technical assistance and have not diversified their production.

<sup>25</sup> For the 2011-2012 season, a new GM seed has been launched containing the “stacked event” on an old INTA variety (registered in 1996).

<sup>26</sup> Interviews with INTA agents.

<sup>27</sup> The various cotton technology research projects currently under way in INTA include a technological linkage agreement that the institution signed with the cotton-growing provinces in 2009. The aim is to generate knowledge and non-contaminating technologies for controlling boll weevil and developing integrated management. The project activities are implemented in five modules addressing the boll weevil problem, with participation from over 40 researchers and auxiliary workers from the institution. The modules range from conventional improvement of the cotton to bio-technological solutions; and there is a specific module devoted to studying intellectual property issues related to the research topic.

Not everything has stayed the same, however. Firstly, as noted above, boll weevil has become one of the key problems causing lower yields, particular for small-scale farmers who cannot afford to control the pest. The seriousness of the problem stems from the fact that it is very destructive pest given its high reproduction rate and lack of natural predators, and because it is not controlled by the Bt gene available in commercial seeds. Although there is a set of practices that to some extent reduce the incidence of the pest (concentrating the sowing period, shortening the plant growth cycle, destroying the stubble immediately after harvest and avoiding new shoots), these practices are not widespread among small-scale farmers. For them, the moment of sowing is determined by weather factors and by the availability of seeds; sowing in narrow rows to shorten the crop cycle requires machinery they cannot afford; immediate destruction of the stubble is not done because of a lack of fuel and because they can use it as fodder for livestock; they do not cut off new shoots because they can harvest them and obtain an extra income; and they do not apply the amount of insecticide needed to control the pest because of the cost.

Secondly, since starting to use seeds with the RR gene, most farmers have stopped hoeing<sup>28</sup> or hiring hoes. This is highly valued by nearly all farmers, particularly as is difficult to obtain hoes.<sup>29</sup>

Thirdly, linked to the previous point, the spread of wide-spectrum herbicides is one of the main changes in productive practices arising from the introduction of GM seeds.

Fourth, there were a number of references to the problem of the rural exodus, particularly among young people. The main reasons for this exodus are problems of infrastructure and lack of opportunities.<sup>30</sup> The exodus is causing a lack of labour which delays harvests and increases exposure to boll weevil.

In short, this subsection has shown that small-scale farmers tend to adopt an incomplete version of the GM technological package, as described in box 1. They do not incorporate elements that represent economies of

<sup>28</sup> Clearing the land to remove weeds.

<sup>29</sup> “At hoeing time, the farmer has no money at all, so it is difficult to obtain hoes; this is a problem.” Small-scale farmer, Villa Berthet.

<sup>30</sup> “Family labour has decreased... they cannot harvest that area on their own and there is no labour... that means that harvesting takes longer, instead of lasting 30 days.” INTA experimental station agent, September 2010.

“It also seems to me that the countryside is not providing conditions of life for young people to stay: electricity is expensive, scarce water, primary school to sixth grade, so what do you do...?” Small-scale farmer, Quitilipi.

scale (machinery), those requiring working capital (most inputs), or better sowing practices (narrow row); nor do they control pests adequately, particularly in the case of boll weevil. They also fail to halt the deterioration of soils through crop diversification, owing to a lack of markets for alternative products to cotton. Some aspects of management of the technology previously provided by INTA are now mostly supplied by private firms or by the GM seed producing firm, which small-scale farmers cannot afford. In general, the analysis of the productive practices implemented shows that small-scale cotton farmers have not been able to improve yields by adopting GM seeds, as the literature reports for larger scale farmers.

### 3. Bargaining power in the marketing chain and profitability

The profitability of cotton production is the outcome of the cost and income equation. As there are no quantitative data available to evaluate changes in these variables following the introduction of GM seeds, the analysis is necessarily confined to an analytical argument inferred from qualitative evidence. Those tools are used to analyse the impact of the dissemination of GM seeds on costs, incomes and bargaining power (which mediate between them) among small-scale farmers.

#### (a) *Costs*

The technological package includes new inputs (mainly herbicides, but also defoliant and growth regulators), while also reducing labour costs (particularly in the hoeing process, but also in pest control) and savings on pesticides that are no longer used. As noted above, the literature assesses the balance as positive.

Given the practices of small-scale farmers, however, it is not clear that average costs have also decreased for this group. Firstly, the seeds have become more expensive even on the informal market, and they also require new inputs such as herbicide.<sup>31</sup> Secondly, cotton production usually involves participation by the entire family, with workers being hired from outside only on exceptional basis.<sup>32</sup> In the absence of alternative opportunities to occupy the time of discontinued family tasks, it is not

<sup>31</sup> "Last year we ordered and bought a certain quantity of seeds, but in the end it was thrown away because people did not want to sow it because of the very high costs [...]. It's also very expensive! I'm not sure this technological package is suited to farmers working less than 50 ha." Government representative, Pampa del Indio.

<sup>32</sup> "Transgenic seeds are very expensive and sometimes we can't buy them. So we try using the conventional seeds, which at least don't involve so much expense; we do all the work within the family." Small-scale farmer, Pampa del Indio.

obvious that the technology produces an economic saving for this group.

Lastly, small-scale farmers generally do not apply pesticides with conventional seeds, so they do not perceive a cost reduction in this regard.

#### (b) *Incomes*

The income received by the farmer depends on yields and the price of harvested cotton. Section III discussed the impact of the use of GM seeds on yields and concluded that it was not clear that these variables had increased for small-scale farmers as a result of using that technology. The price of harvested cotton has not been boosted by the introduction of GM, because it is set on the international market.<sup>33</sup> Moreover, the small-scale farmer usually sells the harvested crop unprocessed, so the characteristics of the fibre, which tend to be better when picked manually than harvested mechanically, do not affect the price received.<sup>34</sup>

#### (c) *Bargaining power*

As noted above, small-scale farmers are trapped in the marketing chain, particularly by intermediaries that sell inputs to them on credit—which is paid back at high interest when the crop is sold.<sup>35</sup> In general, they cannot choose where they buy inputs, because they have no way to pay for them and no access to the credit market. They can also not choose whom they sell to, because they are in debt to the supplier who buys the harvested crop from them.<sup>36</sup>

It can be argued that the dissemination of GM cotton has weakened and reduced the bargaining power of small-scale farmers, since they now need more inputs than before (they depend on intermediaries more than before) and because informal markets have spread.

<sup>33</sup> If anything, the opposite is probably true, given the loss of variety and diversity caused by transgenics, which could have had a negative effect on fibre quality. Nowadays, most of the cotton produced comes from imported genetic funds, which are therefore not best suited to the region's agronomic and climatic conditions.

<sup>34</sup> The lack of payment for quality is important in the case of small-scale farmers that harvest manually. The fibre percentage of the total harvest is greater with manual harvesting (because there is less waste) than in mechanical harvesting. But by selling the cotton raw, the small-scale farmer no longer receives this differential. "Unfortunately, at the moment in our country quality is merely rhetoric; it is not paid for. Throughout our marketing system, if it can avoid paying for quality it won't pay." INTA agent interviewed in September 2010.

<sup>35</sup> "The poison [glyphosate] costs \$200, but they charge us \$600". Small-scale farmer, Quitilipi.

<sup>36</sup> "They buy from you at so much, like it or not...". Small-scale farmer, Quitilipi.

"The fact is that no matter the quality they pay you what they choose, we are their prisoners". Small-scale farmer, Quitilipi.

Although informal seed markets existed prior to the dissemination of GM seeds, small-scale farmers also had the option of buying seeds formally.<sup>37</sup> Moreover, interaction with local seed farmers enabled them to understand the agronomic characteristics of the seed and obtain their technical advice. Conventional seeds were mostly INTA varieties, and formal seed farmers, as noted above, worked closely with the institution, which not only had obtained the technology but also took responsibility for its dissemination. Consequently, small-scale farmers were probably better informed on the varieties available, which improved their bargaining position.

Since the introduction of GM technology, the INTA role in the seed system has weakened, and the size of the formal market (both in terms of the number of formal seed producers and in the proportion of formal sales) has shrunk significantly. Although initially only large-scale farmers bought GM seeds, as the informal market grew, small-scale farmers also started to adopt them.

Given this situation, in 2008 various participants in the cotton market signed a commitment to organize the seeds market (in other words, to control the multiplication of seeds and reduce the size of the informal market). Through this agreement, Genética Mandiyú authorized a number of stakeholders—typically cooperatives—to purchase the original seed, multiply it, and sell it formally,<sup>38</sup> paying for each sack obtained in the multiplication process,<sup>39</sup> while the firm retained the right to monitor and control the multiplication process. Since then, the Genética Mandiyú share of the seeds market has grown from 8% in 2008 to 16% in 2009.<sup>40</sup>

Nonetheless, although it is clear that informal markets undermine the bargaining power of small-scale farmers, by restricting their access to information and thus reducing their autonomy; it is also clear that not all attempts at formalization benefit them. The aims in formalizing the seed market can also harm the small-scale farmer if the price of access to the technology increases by too much, or if the intermediaries consolidate their

bargaining power in the chain by becoming “authorized” intermediaries.

In short, the introduction of GM seeds has made small-scale farmers more vulnerable as input purchasers; they have to obtain a larger variety of inputs and can only do so on the informal market. It is not yet clear how recent attempts to formalize the seed market will affect small-scale farmers. Some risks could decrease (those related to access to information), and, if seed quality improved, their yields could also increase. On the other hand, small-scale farmers will face higher costs and, given that the number of intermediaries could decline, their already-scarce bargaining power with input suppliers could deteriorate. The importance of asymmetric bargaining power to the detriment of small-scale farmers within the marketing chain is illustrated by the fact that one of this sector’s main demands is for a floor price to be set to improve their bargaining position.<sup>41</sup>

The situation of large-scale farmers is clearly different and, as has been discussed in the literature, the adoption of GM technology has brought them visible benefits. Firstly, it enables them to significantly save on labour costs, by improving the treatment of weeds, and also to economize on pesticides, which are no longer needed owing to the use of the Bt seed (Qaim and de Janvry, 2005)—although the spread of the boll weevil pest detracts from this claim. Secondly, introduction of the GM package has made it possible to extend the agricultural frontier, turning soybeans into a suitable crop for the region.

Overall, while GM technology has brought higher yields and profitability to large-scale farmers, the profitability gap between them and small-scale farmers has widened as the latter have not experienced significant improvements.

The larger profitability gap is illustrated by the pressure exerted on small-scale farmers to sell their land. Although there are no official figures on farm concentration trends (the most recent data come from the 2002 agricultural census), nor on the exodus from rural areas (the most recent information corresponds to the 2001 population census),<sup>42</sup> there is a widespread

<sup>37</sup> This refers to the possibility of buying from one of the various authorized multipliers of INTA varieties. With time, as GM seeds were disseminated, access to conventional seeds in the formal market came to depend on the location of the farmers, such that those closest to the INTA experimental fields had best access. (Interview with INTA agent).

<sup>38</sup> The provincial government finances cooperatives to purchase the original seed.

<sup>39</sup> According to information from Genética Mandiyú, the price of a sack of original seeds of the “stacked” event was about \$200. The payment was around \$45 per sack multiplied, including the de-linting service (the process in which the seed is cleaned, removing the linter or fluff and making it more effective for sowing) by Genética Mandiyú.

<sup>40</sup> Interview with industry representative.

<sup>41</sup> “If there is a minimum wage for the rural worker, why isn’t there a floor price for the farmer?” Small-scale farmer, Quitilipi. “The government should fight to guarantee prices.” Small-scale farmer, Quitilipi.

<sup>42</sup> The most recent data for the Chaco show that the number of farms decreased by 21% between 1988 and 2002. Moreover, while the rural population in the province amounted to 53% in 1970, it only represented 17% in 2001.

perception among small-scale farmers,<sup>43</sup> INTA agents and government representatives<sup>44</sup> that a phenomenon of this type is unfolding. Moreover, the issue of land sales and concentration has been reported by various farmers' organizations<sup>45</sup> and mentioned in academic studies.<sup>46</sup>

Lastly, the widening profitability gap may have consolidated a discourse claiming that cotton cannot be profitable for small-scale farmers. For example, the provincial government and certain INTA officials argue that small-scale farmers should abandon cotton production

<sup>43</sup> "There is no alternative, if there is no technology in 10 years we'll disappear, we'll no longer exist. Ten years ago there were 32,000 inhabitants: 17,000 in the countryside and 15,000 in the town. Now we are 42,000 inhabitants and have 31,000 in the town and 11,000 in the countryside [...] we are existing: Me, by being stubborn, because I like the cotton and I defend cotton." Small-scale farmer and cooperative representative, Quitilipi.

<sup>44</sup> "It used to be said that cotton was a 'social crop' because it employed a lot of labour, but not any more." Government representative, Pampa del Indio.

<sup>45</sup> Various social movements have expressed their concern about this situation, such as the Multisector Forum for Chaco Lands (*foroporlatierrachaco.blogspot.com/*). See the journalistic article by Aranda, 2011.

<sup>46</sup> The concentration of land in the hands of large-scale owners or corporations has been a key phenomenon since the 1990s (see, for example, Rossi, 2006 and Manzanal, 2009). See also the book by Valenzuela and Scavo (2009), which describes the resistance by small-scale farmers to the concentration that has resulted from the expansion of the agricultural business model in the Chaco. Other authors, in contrast, claim that concentration, although considerable, reflects a global process of intensification of production under the productivist paradigm (Trigo and Cap, 2006).

and turn to alternative crops (generally vegetables), which are less scale-dependent, better suited to degraded soil conditions, more related to food sovereignty, and potentially more profitable.<sup>47</sup>

Most small-scale farmers disagree with these views, however. As noted above, not only do they have a cultural link to cotton, but it is hard for them to find markets for alternative products, whereas with cotton there is at least an organized marketing chain. Accordingly, small-scale farmer organizations do not generally advocate abandoning the crop; their main claims relate to avoiding land sales and the rural exodus, and finding ways to increase their bargaining power to improve profitability, including setting a floor price.<sup>48</sup>

<sup>47</sup> "Cotton is no longer profitable for some of the farmers we spoke to. We need to see this group as food producers. Paradoxically, Chaco province imports 83% of the agricultural production it consumes, and the small-farmers, the most deprived and abandoned sector, are in the best position to produce food." Government representative, Pampa del Indio.

"I used to be a cotton fanatic, but now I doubt that it is useful for small-scale farmers. There may be more profitable alternatives such as vegetables." INTA experimental station agent, interviewed in September 2010.

"My conscience is clear if I create productive alternatives. If I go and tell my people: "Don't grow cotton" [...] but we are encouraging some people not to grow cotton because it is not in their interests! Because they don't have the right soil, because they don't have access to the machinery. It's not in the minifundista's interest." INTA experimental station agent.

<sup>48</sup> Interview with representatives of the Association of Small-Scale Farmers of the Chaco (apch) Pampa del Indio.

## IV Conclusions

While transgenic crops have expanded rapidly over the last decade, their benefits are not distributed uniformly among all farmers. This article has analysed the changes in yields and profitability caused by the adoption of GM cotton by small-scale farmers in Chaco province.

Throughout the article, it has been argued that the benefits of adopting the technology depend on multiple aspects that go beyond the virtues of the technological artifact itself, in this case GM seed. If the technology is seen as a socio-technical configuration, the expected benefits will depend on the context in which it is adopted, which needs to be analysed from different points of view.

Nonetheless, the literature describing the repercussions of GM cotton in Argentina has not

considered the different contexts in which GM seeds have been adopted. The existing evaluations tend to standardize the constraints faced and the behaviours of the different types of farmers; so they tend to generalize the conclusions to all types of farmers.

This article has analysed the socio-technical configuration of small-scale cotton growers in the Chaco, particularly in terms of productive practices that affect the yields and profitability of cotton production, with the aim of identifying continuities and breaks associated with the introduction of GM seeds.

The main argument developed in this article is that the constraints faced by small-scale farmers in improving their yields and profitability in cotton production remained

in place, and even were exacerbated, following the adoption of the GM technology. As the literature reports higher profitability for large-scale farmers as a result of adopting this technology, the profitability gap between large and small scale farmers must have widened.

A significant difference between these two types of farmers is that small farmers adopt an incomplete version of the technological package. As they do not have access to formal credit to finance working capital, and they produce on a small-scale, their production does not include all of the inputs of the package, and processes continue to be done manually.

Deficient pest management practices have serious consequences, since boll weevil, which is not controlled by the GM technology, has become a real threat to cotton growing in Argentina. Small-scale farmers are particularly affected by the pest, because usually they cannot afford to follow the recommended practices.

In short, the productive practices of small-scale farmers fall short of what is needed to obtain the best yields from GM seeds (because they do not adopt the full package). Besides, they now receive less technical assistance for cotton production than before. Consequently, it is not clear that their yields have increased as a result of adopting the technology.

Apart from yields, profitability also depends on relative input and production prices. The qualitative evidence suggests that costs have not fallen significantly for this group, because they did not hire labour or use pesticides (at least not systematically) before the introduction of GM seeds. In terms of the cotton price, as quality did not improve following the introduction of the new technology, it cannot be concluded that incomes are higher for this reason.

In any event, the real price faced by the small-scale farmer depends, largely, on its capacity to bargain within the production chain. As noted above, small-scale farmers have traditionally been trapped in this chain: they generally pay higher prices for their inputs and receive lower prices for their output. The analysis of this article shows that the dissemination of GM cotton has weakened the bargaining capacity of small-scale farmers: firstly, because they depend on more inputs than before; and secondly because the expansion of informal markets reduces the options available and worsens access to information (for example, only GM seeds of dubious identity are sold). With their bargaining power weakened, their chances of improving profitability are also reduced.

As the adoption of this technology did bring clear increases in profitability for large-scale farmers (as

reported in the existing literature), the profitability gap between them and small farmers must have widened.

This situation is illustrated by: (i) discourses circulating among policymakers that suggest small-scale farmers should abandon cotton production; (ii) the conclusions of several researchers regarding the increased concentration of land ownership; (iii) the widespread perception among farmers of the rural exodus phenomenon; and (iv) complaints made by peasant organizations of the pressures put on them to sell their land.

The question now is whether there are alternative ways to reduce this gap by improving the yields and profitability obtained by smaller farmers.

We believe the GM technologies have been widely accepted because they do not call into question the dominant agricultural paradigm, based on the intensification of production and increasing scale. Under this “productivist” paradigm, the profitability gap is likely to continue widening, and the sustainability of production by small-scale cotton farmers will remain at risk. Nonetheless, alternative paradigms have recently been supported by the international literature. In particular, the agro-ecological paradigm advocates conservation of natural resources such as water and soil and biodiversity (McIntyre and others, 2008; Vanloqueren and Baret, 2009); and a different accumulation strategy is proposed, based on autonomous input supply and sustainable resource management. Argentina has an example of agro-ecological cotton production (*Cooperativa Agroecológica del Litoral*, located in San Martín), but there are few farmers currently participating. For a farmer to switch to agro-ecological production, it needs to radically change productive practices and be willing to absorb economic losses during the transition period. These disadvantages could explain why agro-ecology has not been adopted by small-scale farmers as quickly as GM technology (which does not question the farmers’ habitual practices).

Policies to improve the situation of small-scale farmers can also be envisaged under the current production system. In fact, this article has identified several policies and strategies that are currently being implemented, which could improve their situation:

- The Chaco provincial government has recently set up “rural service consortia” with potential to empower small-scale farmer organizations. Although many of these are not yet fully functioning and they have not received the provincial funds promised to them, when this happens their members should be able to act collectively in the market, both in purchasing

inputs and in selling their output. This would increase their bargaining power in the marketing chain, which is one of the major obstacles to raising their profitability.

- The Agricultural Single Social Tax (*Monotributo Social Agropecuario*) policy creates a special national tax regime for small-scale farmers, enabling them to be legally registered at no cost. This tool has the potential to expand alternatives for selling the harvested crop, thereby improving the prices they can obtain. Nonetheless, the coverage of this system is still limited. Specific actions are needed to streamline administrative process and disseminate the initiative to expand coverage and build trust.
- INTA has developed a narrow-row harvester which, given its size, is suitable for small-scale farmers. Although this machine is not yet available in the Chaco, INTA has signed agreements with metallurgy firms to produce it for the national market.
- INTA is promoting and contributing to the organization of “free trade fairs”, where small-scale farmers can sell their produce for family consumption (for example, jellies, jams, and other items). The main advantage of these initiatives is that they eliminate intermediaries and promote crop diversification. Nonetheless, the number of participants in each fair is limited, which excludes a large number of farmers. Secondly, in many locations, the fair has little chance of generating sufficient demand, because the public mostly consists of small-scale farmers who self-supply. Consequently, this type of production needs to be incorporated into other marketing channels, such as the central markets of the main cities.
- Since 2009, an INTA research project, financed by cotton-producing provinces, has been attacking the problem of boll weevil on several fronts (ranging from biotechnology to conventional improvement,

and including bio-insecticides). As INTA is well aware of the situation of small-scale farmers, the results of this research could produce practical benefits for small-scale production.

Much still remains to be done to improve the profitability of small-scale cotton growers in the Chaco. The following paragraphs outline a number of policies that could be implemented without a radical change in the productive paradigm:

- Improve technical assistance for small-scale cotton growers. There are a number of production techniques that could be adapted to the requirements of small-scale farmers (for example direct sowing and narrow rows). INTA has experience of working with these groups and has a major role to play in the process.
- Create financial schemes for small-scale farmers. These should take account of the fragile property rights of this group and be designed for the acquisition of machinery and financing for working capital. In particular, such schemes could usefully be organized in conjunction with the development of consortia to allow collective borrowing.
- Guarantee access to good-quality GM seeds for small-scale farmers, either by exempting them from the payment of royalties, or else authorizing consortia or other farmer organizations to multiply seeds (in other words, broadening the scope of the existing agreement).
- Actively control expansion of the boll-weevil pest in zones that are not yet infested, and help small-scale farmers to control it. These activities should be promoted by the provincial government and by the National Food Health and Quality Service (SENASA), which for 10 years has been running a boll-weevil prevention and eradication programme, in coordination with neighbouring countries that are also affected (Brazil and Paraguay).

*(Original: Spanish)*

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# Infrastructure and economic growth in Peru

*Roberto Urrunaga and Carlos Aparicio*

**ABSTRACT**

This article reviews the literature analysing the importance of infrastructure for economic growth, and performs an econometric estimation to discover the relation between the two variables in the case of Peru. Different estimators are used with panel data from the 24 regions of Peru for the period 1980-2009. The econometric results confirm that public-service infrastructures (roads, electricity and telecommunications) are important in explaining temporary differences in regional output, in keeping with neoclassical exogenous growth theories. Evidence is also found of significant differences in the repercussions of the different infrastructures on per capita gdp in each region. Consequently, the policy authorities should streamline the development of projects that help to reduce the infrastructure disparities that hinder the development of Peru's regions.

**KEYWORDS**

Physical infrastructure, roads, electric energy, telecommunications, economic growth, regional development, gross domestic product, econometric models, Peru

**JEL CLASSIFICATION**

C33, H54, L90, O11, O18, O40, R11

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# I

## Introduction

As a fundamental input for private-sector activities, infrastructure is directly related to production and stimulates economic growth. Studies that summarize the main findings on this relation include Straub (2008a); González, Guasch and Serebrisky (2007), and Cárdenas, Gaviria and Meléndez (2005).

The key mechanism through which infrastructure affects output and economic growth involves raising the productivity of capital, and this effect will be more pronounced the greater the complementarity between infrastructure and the productive investment made by firms. According to Straub (2008a), other mechanisms include infrastructure maintenance activities, which increase along with the infrastructure itself; adjustment costs, which decrease as a result of the lower logistics costs generated by the new investments; higher labour productivity, resulting from workers with better information and communication technologies (ICT's) and better health and education conditions; and lower transport costs, owing to the exploitation of economies of scale and scope.

Studying the relation between infrastructure and productive growth is particularly interesting in the

Peruvian case, given the vigorous growth of its economy and major progress in terms of developing public service infrastructures. In this context, the main hypothesis of this article is that this infrastructure has a major repercussion on output and economic growth in Peru's regions. The article also considers whether there are significant differences in the contribution of infrastructure to the productive development of the regions of Peru. To this end, panel data are used containing information for Peru's 24 regions over the period 1980-2009, under different econometric estimators. Given the existing information shortcomings, the article works with data on road, telecommunication and electricity energy infrastructures.

The importance of undertaking this type of study stems from the fact that Peru and many other Latin American countries still face infrastructure problems that can limit their growth opportunities, so it is necessary to raise awareness among the authorities at the different government levels to speed up the pace of concession processes and public infrastructure investments.

This article is structured as follows. Following the introduction, section II reviews literature dealing with the relation between infrastructure and economic growth. Section III then discusses the relevant methodological issues. Section IV analyses the results obtained from the estimated models, and section V sets forth conclusions and recommendations.

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□ The authors are grateful to Carlos Cubas and Regina Ruiz for their help in producing this paper, and to an anonymous referee from *cepal Review* for comments made on a preliminary version. Any error or omission is the authors' exclusive responsibility.

# II

## Literature review

### 1. Theoretical framework

Table 1 summarizes the main studies that have addressed the relation between economic growth and infrastructure. There is consensus in viewing public infrastructure investment as an important component of economic growth. This was initially verified in practice by Aschauer (1989) and later corroborated by authors such as Easterly and Rebelo (1993); Canning (1999) and Calderón and

Servén (2004b), and also by Vásquez and Bendezú (2008) for the case of Peru. Nonetheless, the discussion does not seem to focus on the direction of the effect, but on its magnitude. Thus, for example, the literature review performed by Straub (2008a), found a negative effect in just 6.5% of the studies, all of which used an inappropriate infrastructure indicator (as will be shown below); in contrast, 37.5% of the studies obtained neutral results, whereas 55.8% of them produced positive coefficients.

The pioneering work of Aschauer (1989) is one of the main studies to have found empirical evidence of the positive effect of infrastructure on output. This author argues that the fall in the productivity of capital in the United States in the 1970s and 1980s reflected a reduction in public investment in infrastructure. In particular, the author identifies transport (roads, ports and airports), energy and sanitation infrastructures as those having greatest effects on productivity.

The first step in embarking on a discussion of the literature at the theoretical level is to propose a production function that explicitly includes the variables of interest—the public infrastructure stock—as done in Straub (2008a):

$$Y = A(\theta, F) \cdot F(K, L, I(N)) \quad (1)$$

where  $Y$  is aggregate output,  $A$  is the productivity term,  $K$  is the capital stock (excluding infrastructure),  $L$  is labour, and  $I(N)$  is a variable representing intermediate inputs in which public infrastructure ( $N$ ) is the key variable. The level of infrastructure is separated from  $K$ , where it is usually included, such that  $I(N)$  reflects the direct effect of  $N$ . By including infrastructure as an explanatory factor of  $A$  (the indirect effect of  $N$ ), it is assumed that infrastructure has an effect on total factor productivity. All other factors that might affect the productivity term are encompassed by the variable  $\theta$ .

Theoretically, it is preferable to model the direct effect of infrastructure through the services it provides  $I(N)$ , instead of including it in the production function directly. Firstly, as indicated by Romp and de Haan (2007), including the infrastructure variable directly would mean assuming that it has pure public good characteristics and provides services proportionate to the quantity of infrastructure, without rivalry or exclusion in consumption. In practice, public infrastructure does not produce anything itself; it simply provides services (such as transport and communications) which are incorporated within enterprise cost functions (Hulten, Bennathan and Srinivasan, 2006).

Secondly, Pritchett (1996) explains that infrastructure investments are generally not determined through market mechanisms, but tend to be influenced by the regulatory framework, which generally faces imperfect information problems (Laffont and Tirole, 1993). They are also generally susceptible to political interference (Guasch, Laffont and Straub, 2005), because in many cases they involve natural monopolies. This means that firms cannot take decisions on the cost of the quantity of infrastructure they use (Duggal, Saltzman and Klein, 1999; Hulten, Bennathan and Srinivasan, 2006).

Moreover, the indirect effect of infrastructure means assuming that its accumulation generates externalities that raise the general efficiency of the economy. Prud'homme (2005) argues that infrastructure has a similar effect to that of lowering tariffs, because it makes it possible to increase the size of the market, leading to greater specialization, more intensive competition, economies of scale, and a larger effective labour market. Duggal, Saltzman and Klein (1999) add that infrastructure also has an important network effect. An example of this is the quality of electricity supply, which makes it possible to use more sophisticated machinery (Hulten, Bennathan and Srinivasan, 2006).

Public infrastructure also differs from general capital in other ways. Firstly, infrastructure tends to come in large units, and fractions of it cannot provide any service; accordingly, an infrastructure work needs to be completed to be useful. In most cases this will imply large-scale investments and long waiting periods to receive services from the infrastructure in question.

In some cases, the relation between public infrastructure and the level and variation of output may be ambiguous, because certain infrastructure works are developed exclusively to improve the well-being of a given population group, prioritizing redistribution ahead of economic efficiency. Moreover, according to Barro and Sala-i-Martin (1990) and Glomm and Ravikumar (1994), infrastructure may become congested, so its repercussion on the economy will depend on the level of congestion at a given point in time. Nonetheless, if the increase in the infrastructure stock occurs when existing infrastructure is not congested, it will not generate major benefits, since it will not significantly improve the quality of the service. This could mean that in some cases it is better to invest in maintaining existing infrastructure rather than building a new one (Hulten, 1996).

The productivity of infrastructure investments will largely depend on other bottlenecks in the economy such as institutional quality (particularly contractual mechanisms), the level of competition (state enterprises, concessions, public-private partnerships, and others) and the project approval mechanism.

Another key point of discussion concerns the duration of the effects of new infrastructures, in other words whether the effects would be permanent or temporary. According to Straub (2008b), the former means assuming that the infrastructure generates sufficient externalities to induce constant returns to scale in aggregate terms, as in the endogenous growth case. Secondly, assuming the effects to be temporary means that any infrastructure investment will have a decreasing returns, for which

the neoclassical case of exogenous growth would be applicable, where public infrastructure affects output, but not the long-term growth rate.

According to Mankiw, Romer and Weil (1992), the empirical evidence shows that output variations are adequately explained by maintaining the assumption of decreasing returns to scale of capital. Accordingly, the possibility of analysing output differences based on a Solow model should not be ruled out (Solow, 1956).

Lastly, from a public-policy standpoint, it is interesting to discuss the possibility that an optimal point exists for the infrastructure stock, which could be found easily by equalling its marginal cost to its social benefits. Nonetheless, calculating the cost of infrastructure is a major challenge.

## 2. Techniques used

Although the theoretical relation between investment in different types of public infrastructure and the growth of gross domestic product (GDP) has been very clearly explained in numerous studies of the topic, difficulties arise when trying to express this theoretical relation in an econometric model. This is due mainly to three issues: (i) how to deal with the endogeneity that exists between infrastructure investment and economic growth; (ii) what infrastructure measure reflects its true effect on aggregate output, and then how to separate the effect of each type of infrastructure on output; and, lastly, (iii) what additional controls are needed to avoid confusing the effect of infrastructure with that of other variables linked to the country's economic and political environment.

Table 1 shows the results of the main studies reviewed in terms of the contribution made by infrastructure to economic growth. The earliest studies estimated a simple linear regression, based on a monetary indicator of infrastructure expenditure; and many authors believe this approach explains why both Aschauer (1989) and Munnell (1990) obtain such large elasticities for infrastructure. Later studies, such as Devarajan, Swaroop and Zou (1996) and García-Milà, McGuire and Porter (1996), obtain lower or even negative results, using a panel-data model with fixed effects that capture the unobserved differences between countries. Nonetheless, Canning (1999), Calderón and Servén (2004b) and Straub, Vellutini and Warlters (2008) obtain larger coefficients for infrastructure investment measured by a physical indicator. Other studies, such as those of Rivera and Toledo (2004) and Vásquez and Bendezú (2008), find a cointegration relation between the infrastructure variables

and economic growth, using the Johansen method; and these authors later attempt to find the short-term relation in an error-correction model (see table 1).

## 3. The endogeneity of the model

With regard to the first issue, most of the studies mention three main sources of endogeneity: the presence of unobserved fixed effects in models applied to many countries or regions; the existence of dual causality between output and infrastructure investment; and multiple problems related to omitted variables in the model and measurement error in the infrastructure variables.

Both Aschauer (1989), which uses regional information from United States, and Munnell (1990), which prepares a panel of various countries, find very high values for the elasticity output with respect to infrastructure (0.31 in the first case and 0.54 in the second). Gramlich (1994) points out that these results are not consistent with reality, since elasticities like those would imply a marginal return of 100%; in other words, the infrastructure would fully cover their costs in one year.

Later studies such as Holtz-Eakin (1994) and García-Milà, McGuire and Porter (1996), claim that these high results reflect the omission of a fixed effect that captures unobserved effects between the countries or regions analysed. These studies report considerably lower results than the first-generation studies. Straub (2008b) reviews 51 studies that apply panel data—25 of which include fixed effects—and finds on average that infrastructure has smaller effect on output in studies that applied fixed effects.

The second possible manifestation of endogeneity in these models is the presence of dual causality between the infrastructure investment variables and output, which could give an upward bias to the results, even where a fixed effect is explicitly included. The ideal is to be able to apply a test that indicates the direction of the causality unambiguously. Unfortunately, in most cases, this test cannot be done owing to the nature of the data, so an alternative solution needs to be found.

A first alternative is that adopted by Canning and Pedroni (2004), using panel data. These authors find that the long-term relation and short-term correction between infrastructure and output varies across countries. As they find that both variables are non-stationary but co-integrated, they can estimate an error-correction model without including a priori restrictions. Then, by introducing restrictions into the model, the direction of the causality can be determined.

TABLE I

## Summary of the main studies

Study	Evaluated countries	Sample	Infrastructure variable	Methodology	Elasticity
Aschauer (1989)	United States	1949-1985	Public expenditure on non-military capital	OLS	0.39
Munnell (1990)	United States	1947-1988	Public expenditure on infrastructure	OLS	0.34
Canning (1999)	57 developing countries	1960-1990	Telecommunications	Fixed effects panel	0.139
Easterly and Rebelo (1993)	28 developing countries	1970-1988	Expenditure on transport and telecommunications	OLS	0.16
Esfahani and Ramírez (2003)	75 countries	1965-1995	Telecommunications and energy	2-stage OLS	0.091 and 0.156
Vásquez and Bendezú (2008)	Peru	1940-2003	Roads	Cointegration	0.218
Rivera and Toledo (2004)	Chile	1975-2000	Sector investment in infrastructure	Cointegration	0.16
Sánchez-Robles (1998)	57 countries	1970-1985	Infrastructure index	OLS	0.009
	19 Latin American countries				0.012
Devarajan, Swaroop and Zou (1996)	43 developing countries	1970-1990	Expenditure on transport and telecommunications	Fixed effects panel	-0.025
Calderón and Servén (2004b)	101 countries	1960-2000	Infrastructure index	Fixed effects panel	0.0195
				GMM	0.0207
Straub, Vellutini and Warlters (2008)	92 emerging countries	1971-1995	Telecommunications, roads and energy	Fixed effects panel	0.028; 0.029 and 0.018
	40 low-income countries				0.03; -0.043 and 0.028
Duggal, Saltzman and Klein (1999)	United States	1960-1989	Public expenditure on roads and structures	OLS, non-linear specification	0.27
García-Milà, McGuire and Porter (1996)	United States (48 states)	1971-1983	Public expenditure on water, drainage, and express highways	Fixed effects panel	-0.058 and -0.029

Source: Prepared by the authors.

OLS: Ordinary least squares.

GMM: Generalized method of moments.

Rivera and Toledo (2004) and Vásquez and Bendezú (2008) follow this route in an attempt to identify the existence of a cointegration relation between the infrastructure variables ( $N$ ) and output ( $Y$ ). For this purpose, they firstly have to perform unit root tests to effectively rule out the presence of a trend component or structural break in the series. In both cases it was found that the variable had a unit root.

Another possible approach is to solve a simultaneous equations system that includes an equation explaining GDP and another that explains infrastructure. In this case, the problem would consist in identifying the functional form of the second equation, since the components that generate infrastructure investment may vary across countries.

Some authors have opted to solve endogeneity by taking the first differences of the components, to be

able to analyse the feedback effect of output growth on infrastructure investment, as done by González, Guasch and Serebrisky (2007) and Esfahani and Ramírez (2003). In the case of panel data, this differentiation also helps to eliminate the unobserved component corresponding to each of the  $n$  countries analysed. Nonetheless, this approach does not make it possible to test the long-term relation that exists between the two variables of interest, and ignores the possibility that the series may be cointegrated.

Aschauer (1989) and Calderón and Servén (2004b) use internal instruments such as lags in the explanatory variables of interest. This is preferable to the previous alternative, because it explicitly estimates the autoregressive process of the series. This produces robust coefficients: most research using this methodology obtained similar coefficients for infrastructure investment with respect to other types of capital investment; and their results are also consistent with the internal rates of return reported in many World Bank transport and telecommunications projects, as noted by Bandyopadhyay and Devarajan (1993). These models are estimated in parallel using ordinary least squares (OLS) and the generalized method of moments (GMM).

Sánchez-Robles (1998) and Alesina and Perotti (1993) apply a similar procedure using infrastructure variables measured at the start of the period and output variables measured at the end of the period. The solution represents a concept similar to internal instrumentalization, except that the choice of that instrumentalization is preferable since it imposes fewer a priori conditions on the instruments to be used.

In contrast, García-Milà, McGuire and Porter (1996) find that, in this type of research, using a squared panel makes it possible to save on the internal instrumentalization step. This observation is corroborated by Straub (2008b), who shows that in the case of panel data studies instrumentalization with lagged values of the explanatory variables themselves does not change the results of the model.

#### 4. Choice of infrastructure indicator and separation of effects

All of the studies reviewed included one of two types of infrastructure indicator: a monetary measure of the investment in public infrastructure, or a physical index of infrastructure related to the services it provides.

Indicators of the first type are normally used to measure investment in public capital. Nonetheless, this method does not necessarily encompass investments

in public infrastructure exclusively because it can also capture investments in State buildings and State-owned machinery. Another failing in the first type of indicator is that the private sector share in the provision of this type of infrastructure is increasingly important (telecommunications is a clear example in Peru), so the public-capital measure would be insufficient. Moreover, measuring the amount invested by private firms in public infrastructure could be difficult, because firms generally try to keep their cost structures as confidential as possible. Lastly, the investment cost is often not related to the quantity of infrastructure that is actually built.

The choice of a physical infrastructure seems a better alternative, but it is not problem-free. The empirical evidence conclusively shows that levels of investment in the different types of public infrastructure are highly correlated. This poses a dilemma: including each type of public infrastructure separately invalidates the OLS estimator by reducing its efficiency owing to the presence of multicollinearity; but summarizing the information in a single indicator makes it impossible to identify which type of public investment is the most productive.

In practice, most authors—including Calderón and Servén (2004b) and Sánchez-Robles (1998)—have decided to attempt both approaches, by estimating in parallel one equation that includes an aggregate index of infrastructure and others that include one type of public infrastructure at a time. The differences in the coefficients of the different types of public infrastructure indicate which of them is most productive. In both cases, the indices are prepared using variables from three sectors: transport (length of the road network within the country's total territory), electricity generation (electricity generating capacity in per capita terms) and telecommunications (number of telephone lines per capita); so an increase in any of these variables will raise the value of the index.

In the case of the infrastructure index, most authors follow Alesina and Perotti (1993), who designed an index of sociopolitical instability based on the principal components method. This method aims to summarize the information contributed by a set of highly correlated variables in a single variable (first principal component) that best explains the variance of all of the series together. For that purpose, it is important that all variables have the same direction,<sup>1</sup> to ensure a valid interpretation of the principal component. In this case, an increase in the value of the principal component implies an increase in

<sup>1</sup> The scale of measurement and magnitude would not be that important because the variables can easily be normalized.

general political instability (the specific manifestation of the political instability is irrelevant here).

Limao and Venables (2001) use a public-infrastructure index in a model that attempts to explain transport costs. To construct the index they use the following variables: kilometres of road, kilometres of paved road, kilometres of railway line (all three divided by the area of the country) and the number of telephone lines per person. The authors argue that the four variables listed are highly correlated, and it is impossible to identify the effect of each one on transport costs. They opt to use the linear average of the standardized infrastructure variables, which means assuming that the different types of public infrastructure are perfect substitutes for each other for a given transport service function. The authors decide not to use the principal components method, because the data emerging from the research is incomplete for many of the types of infrastructure analysed in different countries.

The study by Calderón and Servén (2004b) uses information from Latin America, so it is the only study in which an infrastructure index has been constructed for the Peruvian case in this context. It is also worth noting that none of the studies reviewed performed a regional analysis within a given country, except for Vásquez and Bendejú (2008), precisely for Peru.

Before discussing which additional variables are needed to avoid overestimating the effect of infrastructure owing to the omission of other relevant variables, there is the need to decide how to separate the direct and indirect effects of infrastructure on growth. There is not much literature that attempts to address this point directly. Most studies use a Cobb-Douglas function that does not make it possible to explain indirect effects in general. Growth accounting methods also are unable to distinguish such effects, because—as discussed above—it is not easy to attribute a price to infrastructure capital. As infrastructure is partially a public good, its contribution to output cannot be estimated on a partial basis.

Of the studies reviewed, the only one that models the contribution of infrastructure through its indirect effect is Duggal, Saltzman and Klein (1999). These authors use a non-linear model and include an infrastructure index as an additional factor of the Solow residual. They find

a positive infrastructure effect with a similar magnitude to that found by Aschauer (1989), and that this effect has a positive feedback with technological progress.

## 5. Choice of control variables

The final point in the methodological discussion concerns the role played by control variables for the correct specification of the model. There are two types of variables that make it possible to correct potential specification problems: dummy variables, which capture the presence of structural breaks, and variables related to the business cycle. This is necessary because often the effect of the parameters varies through time, or else they follow a given cycle. This is particularly relevant for regional or cross-sectional studies.

On the first point, Rivera and Toledo (2004) and Vásquez and Bendejú (2008) perform studies to detect the presence of a structural break in the cases of Chile and Peru, respectively. This reflects changes in the type of management of the entities responsible for undertaking public infrastructure investment in those countries, which occurred in the early 1990s.

Vásquez and Bendejú (2008) also include the fiscal cycle and the export cycle as additional control variables, which were calculated using the Hodrick-Prescott filter, to eliminate the trend of the fiscal and export series, respectively, to explain short-term GDP fluctuations correctly.

This procedure is also consistent with Canning (1999), which included a dummy variables series to control for the phase of the business cycle in which the economy was situated. Nonetheless, one should not confuse the variable used by Canning (1999) with the dummy variable used by Rivera and Toledo (2004) and Vásquez and Bendejú (2008) to correct for structural breaks. The variable used by Canning (1999) aims merely to reflect the phase of the business cycle, which is related to the fiscal and export cycle variables used by Vásquez and Bendejú (2008). Lastly, the dummy variables used by Rivera and Toledo (2004) and by Vásquez and Bendejú (2008) relate to changes in the type of management of public infrastructure works.



### III

## Methodological considerations

### 1. Models and estimation methods

The starting point is equation (1) shown in the previous section, which is used to break down the capital stock into three components: non-infrastructure physical capital (C), human capital (H) and public-service infrastructure  $I(N)$ . The new expression is thus:

$$Y_{it} = A_{it} \cdot H_{it}^{\beta} \cdot C_{it}^{\alpha} \cdot I(N)_{it}^{\gamma} \cdot L_{it}^{1-\alpha-\beta-\gamma} \cdot U_{it} \quad (2)$$

where the subscripts  $\alpha$ ,  $\beta$ ,  $\gamma$  and “ $1 - \alpha - \beta - \gamma$ ” reflect the individual factor shares in the production function: physical capital, human capital, public service infrastructure and labour, respectively. If the sum of the shares is 1, the production function has constant returns to scale; if it is less than 1, there are decreasing returns to scale, and if it totals more than 1, there are increasing returns.

Similarly, the subscripts  $i$  and  $t$  correspond to individual  $i$  (each Peruvian region) in time  $t$ . Lastly,  $U_{it}$  is the error term.

Taking logarithms of both sides of equation (2), gives the following expression (which is interpreted in per capita terms):

$$y_{it} = a_i + b_t + \beta h_{it} + \alpha c_{it} + \gamma I(N)_{it} + u_{it} \quad (3)$$

where the first two terms of the equation correspond to total factor productivity ( $A$ ), as indicated by Canning (1999):

$$A_{it} = \alpha_i + b_t \quad (4)$$

Thus,  $A_{it}$  comprises  $\alpha_i$ , which is the constant factor and specific for each region (unobservable heterogeneity), and  $b_t$ , which is productivity growth, common to all regions in period  $t$ .

Estimating panel data with fixed effects would allow each region to have its own level of total factor productivity without the need to calculate it. In fact, attempting to include productive improvement explicitly could generate measurement errors when estimating through the Solow (1956) residual in the conventional way.

Nonetheless, it is necessary to include  $h_{it}$ , which is the human capital indicator;  $c_{it}$ , the non-infrastructure physical capital stock, and  $n_{it}$ , which represents public service infrastructure. As this article aims to estimate the effect of three types of public-service infrastructure on per capita output, the term  $n_{it}$  (which stems from the assumed  $I(n)$  function) can be broken down into the following components:

$$n_{it} = e_{it} + t_{it} + r_{it} \quad (5)$$

where  $e_{it}$ ,  $t_{it}$  and  $r_{it}$  are indicators reflecting electricity, telecommunications, and road infrastructure respectively, for each region at each point in time. It was decided to use these infrastructures only, owing to information shortcomings for the other infrastructures both regionally and in terms of their characteristics. Firstly, there is no information on access to water and sanitation in a long series at the regional level. Secondly, the heavy centralization of port and airport activity in the country's capital means that the other regions have little port and airport activity, and it is insignificant in explaining regional output. Railroad infrastructure is also not very important in productive terms compared to roads and highways in the regions of Peru. Lastly, the weak penetration of broadband infrastructure and scant access to natural gas (these infrastructures have been developing for less than 10 years in Peru, and natural gas is only supplied in the capital) mean that they are not yet relevant in explaining differences in output at the regional level.

It should be noted that in this specification the  $I(n)$  function is assumed linear. This implies that there are no complementarities between the different types of infrastructure, which is not necessarily true for some infrastructures, such as telecommunications, that require the presence of electric energy to operate. Nonetheless, the linear relation is assumed since the aim is to analyse the contribution of each type of infrastructure to regional productive growth; and estimating another type of function could distort the results, since part of the repercussion of each infrastructure on output would be absorbed by other infrastructure.

Equation (3) is then transformed into expression (6), which is what this study estimates:

$$y_{it} = A_{it} + \beta h_{it} + \alpha c_{it} + \delta e_{it} + \lambda t_{it} + \sigma r_{it} + u_{it} \quad (6)$$

To capture potential differentiated repercussions of the different infrastructures on per capita output in the regions, dummy variables were constructed for each region, and interactions between these variables and the infrastructure variables in the model are added.

This model is interesting because it shows the temporary effect of infrastructure on economic activity. According to Straub (2008b) and Mankiw, Romer and Weil (1992), this type of model reflects neoclassical exogenous growth theory, where infrastructure affects output but not the long-term growth rate.

This specification uses the OLS estimator and the instrumental variables (IV) estimator through the GMM method, assuming a pooled model (estimated through the IV-GMM estimator). These estimators do not consider endogeneity between the variables and the unobservable heterogeneity that exists between regions; but it is worth including them to evaluate the robustness of the econometric results obtained. In addition, this model is estimated through the OLS estimator for a static panel data model, which does incorporate unobservable heterogeneity. In contrast, it is not estimated from the within-group estimator (of fixed effects), since this eliminates the model's unobservable heterogeneity. It is important to control for unobservable heterogeneity under this specification, because it captures the repercussions of productivity on output. For that reason, it is assumed that unobservable heterogeneity is not correlated with the explanatory variables.

To undertake a more complete analysis, models in differences were also estimated to identify the effect of the different infrastructures on regional economic growth.<sup>2</sup>

$$\Delta y_{it} = \Delta A_{it} + \zeta \Delta h_{it} + \eta \Delta c_{it} + \psi \Delta e_{it} + \omega \Delta t_{it} + \phi \Delta r_{it} + \Delta u_{it} \quad (7)$$

This model is estimated through OLS, IV-GMM, generalized least squares (GLS) (random effects) and the within-group estimator (fixed effects). The latter is justified because the model is estimated in difference form; accordingly, a model is estimated that does not consider the specific unobservable component of each

region, related to productivity. Moreover, estimating the model in differences eliminates potential unit roots related to the variables used in the specification.

It is important to note that by eliminating the productivity component in this specification, the main explanation for economic growth under the neoclassical exogenous growth models is lost. Thus, this model would be indirectly evaluating whether the long-term productive growth of the regions is endogenous<sup>3</sup> and whether infrastructure has a significant effect.

Dynamic panel models are also estimated with the lagged dependent variable as explanatory variable, estimated through both difference and system GMM:

$$\Delta y_{it} = \alpha \Delta y_{it-1} + A \Delta_{it} + \zeta \Delta h_{it} + \eta \Delta c_{it} + \psi \Delta e_{it} + \omega \Delta t_{it} + \phi \Delta r_{it} + \Delta u_{it} \quad (8)$$

The GMM in difference form applied to dynamic panel models makes it possible to control for potential endogeneity in the explanatory variables —since it instrumentalizes the variables based on the first and second lags of the variables used in the estimation— and to take account of potential persistence of the dependent variable (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998). This is important for evaluating an endogenous growth model.

Under this estimator, different sets of conditions are assumed for moments involving different levels and differences of the explanatory variables as additional instruments. This follows the recommendations made by Ashauer (1989) and Calderón and Servén (2004b) to use an internal instrumental variable process to estimate the relation between infrastructure and economic growth. The estimator under GMM is as follows:

$$\delta_{mgm} = (\Delta X' Z W_N Z' \Delta X)^{-1} \Delta X' Z W_N Z' \Delta Y \quad (9)$$

In this expression,  $Z$  is the matrix of instruments,  $X$  is the matrix of explanatory variables,  $Y$  is the dependent variable of the model, and  $W_N$  is the positive-defined weights matrix  $\left[ \frac{1}{N} \sum_{i=1}^N \left( Z_i' \Delta \hat{v}_i \Delta \hat{v}_i' Z_i \right) \right]^{-1}$ . This latter expression includes the  $\Delta \hat{v}_i$ , which are the estimates consisting of the first in differences of the residuals obtained from a prior consistent estimator. Accordingly,  $\delta_{mgm}$  is a two-stage estimator.

<sup>2</sup> As the variables are expressed in logarithms, estimating the model in differences means that the dependent variable becomes the growth of per capita regional output and the estimated coefficients would be the elasticities.

<sup>3</sup> Testing this hypothesis more effectively requires a change in the model's specification to eliminate the presence of decreasing returns to scale of factors of production.

According to Blundell and Bond (1998), the GMM model in first differences is biased and inaccurate in finite samples when the lagged variables of the series are weakly correlated with the subsequent first differences, so that the instruments for the equations in first difference form are weak. Accordingly, these authors impose additional restrictions on the model to obtain a larger number of moment conditions. Exploiting the additional moment conditions in some cases can generate a significant increase in efficiency and reduction of selection bias (Blundell and Bond, 1998). It is therefore also useful to estimate the model through the system GMM, which includes a larger number of instruments.

To evaluate the validity of the instruments based on the use of the GMM estimator (in difference and system form) the Sargan test is used—contrasting the specification used to test the validity of restrictions that over-identify the instrumental variables. The null hypothesis of this test is the lack of correlation between the instruments and the residuals in the first differences model.

Lastly, a serial-correlation test should also be performed (Arellano and Bond, 1991). Under the null hypothesis of the absence of serial correlation between the errors of the estimation, a significant negative correlation should be found in the residuals of the equation in first difference form and no second-order correlation in these residuals. The dynamic-panel specification used will only be valid if both conditions are simultaneously fulfilled.

## 2. Data and variables

The study considered data from the 24 regions of Peru in the period 1980-2009. Official information sources were used: National Institute of Statistics and Informatics (INEI), the Supervisory Agency for Private Investment in Telecommunications (OSIPTEL), the Ministry of Energy and Mines (MINEM) and the Ministry of Transport and Communications (MTC), although in some cases, the authors own assumptions and estimations were included to complete the data series.

According to the model, the infrastructure variables needed for the estimation are the number of telephone lines in service (fixed and mobile) as an indicator of telecommunications infrastructure; installed electric power as an indicator of the electricity sector; and an indicator of asphalt or paved roads, as a percentage of the total roads existing in each region.

For the estimations to reflect the true repercussion of infrastructure on output, the variables need to be adjusted for potential scale problems. For example, differences in population sizes between regions would justify a larger

number of telephone lines in more populated regions, without this meaning greater relative capacity to provide a service and, therefore, does not lead to a higher rate of growth or size of output. Similarly, a longer length of the road network in larger regions would not necessarily mean higher productivity of this indicator compared with other regions.

As a result, the gross output value series—which is used as a proxy for GDP—was divided by the population of the region. This is the dependent variable used regularly in this type of studies and has been included in logarithms. Similarly, the telecommunications and electricity indicators are expressed in per capita terms for each region.

The transport infrastructure indicator was constructed as the quotient between the logarithm of the length of asphalt or paved road divided by the region's area, to correct for scale, and the logarithm of the length of the total road network also corrected for scale. This is a relative capacity indicator that takes into account not only differences in area, but also the difference in the quality of the road network. This indicator is not used in other studies, which instead use the logarithm of asphalt or paved roads divided by the surface area of the country in question. This indicator was chosen given the low variation displayed by the level of roads (total and asphalt) in relation to the areas of the Peruvian regions over the last decade. One of the main limitations of this choice is that it does not make it possible to compare the coefficient related to this type of infrastructure with those of electricity and telecommunications.

The other variables used, for control purposes, are the economically active population (EAP) adjusted for human capital, and the non-infrastructure capital stock. The first variable can be estimated through the EAP with secondary, higher, or both levels of schooling, or else with average years of schooling, which is the most widely used measure in international studies. This article used EAP with secondary or higher level schooling, owing to the lack of official statistics on the average years of schooling of the EAP in each region. It is also used as an alternative indicator to the EAP in levels, if the EAP with secondary schooling is not significant under some specifications. Both indicators were standardized by dividing them between the population of the region.

In the case of the non-infrastructure capital stock, the proxy variable constructed by Vásquez and Bendejú (2008) for 1973 and 1993 was used, and their methodology was used in constructing this variable for 2007 on the basis of the Fourth National Census performed by INEI. The methodology proposed by these authors consists of

compiling the value of fixed assets of commercial and industrial firms (initial cost, revaluation and cumulative depreciation) at the regional level. The regional series for inter-census years was constructed according to the pattern of investment in each region.

Nonetheless, as this series includes private investment in electricity, telephony and roads (which could bias the results of the estimated model) these components were purged from it. For that purpose, a model was estimated through OLS, for which the dependent variable is estimated capital stock, and the explanatory variables are the three chosen infrastructure variables. The residual of that estimation is used as the proxy variable for non-infrastructure capital, after dividing it by the population and expressing it in logarithmic form.

For the estimated coefficients to be unbiased and efficient, the respective variables need to be stationary and not display any structural break. To detect these problems, the Levin, Lin and Chu (2002) and Im, Pesaran and Shin (2003) tests were performed, both developed in Cameron and Trivedi (2009). These tests use the null hypothesis that all panel data have a unit root. The Levin, Lin and Chu test assumes a single auto-regressive parameter for all panel data, in other words, a common unit root for all individuals (regions); so rejecting the null hypothesis could mean that some regions actually have series that display a unit root while other regions have the same series, but with stationary behaviour. The specification of the test for the existence of the individual intercept for each observation, but without trend, requires the number of periods to grow more quickly than that of the regions, so the ratio of regions to periods tends to zero, using augmented Dickey-Fuller tests for each region. Accordingly, rejecting the null hypothesis (at a 5% significance level) means accepting that in no case is there a common unit root for all individuals.

In addition, as recommended by Canning (1999), to test the average stationarity of the series, a more powerful test was used than the augmented Dickey-Fuller test, through the sequential procedure of Dolado, Jenkinson, and Sosvilla-Rivero (1990)<sup>4</sup> applied to each series for each individual (region). In this test of Im, Pesaran and Shin (2003) the Dickey-Fuller test was also used, but the t-statistics were averaged, so that the resultant t-statistic represents the average of independent stochastic trends<sup>5</sup>

of a distribution with an expected value and known variance for a non-stationary series. Although this test is also designed for panel data in which there are more time periods than individuals, it is found to be very powerful also in short panels (Canning, 1999).

The results of applying the tests are not decisive in rejecting the null hypothesis of non-stationarity with respect to all variables. This is logical in a context where some infrastructures, such as mobile telephony, have made significant progress over the last decade in the Peruvian regions. This would be one of the main limitations of the estimations. Nonetheless, as the models in level terms do not include the lagged dependent variable, this would not be a relevant constraint. Moreover, the models in differences eliminate the unit root, solving the problem directly.

### 3. Stylized facts of the Peruvian economy

The sustained economic growth achieved by the Peruvian economy over the last decade has been the highest in the region and one of the highest worldwide. This growth is mainly due to the market reforms implemented in the 1990s, and has allowed for a significant reduction in poverty in Peru.

Nonetheless, one of the main problems that persists in the Peruvian economy is that production and economic development is concentrated in Lima and in the main coastal regions. This reflects the fact that efforts to decentralize productive activity and promote development in the mountain and jungle regions have been insufficient. In 2009, Lima accounted for 47% of the country's gross production value, followed by Arequipa, La Libertad and Piura with 5.2%, 4.4% and 3.7%, respectively. One of the main challenges facing the Peruvian economy for the next decade is therefore to guarantee that productive development reaches the regions furthest from the capital.

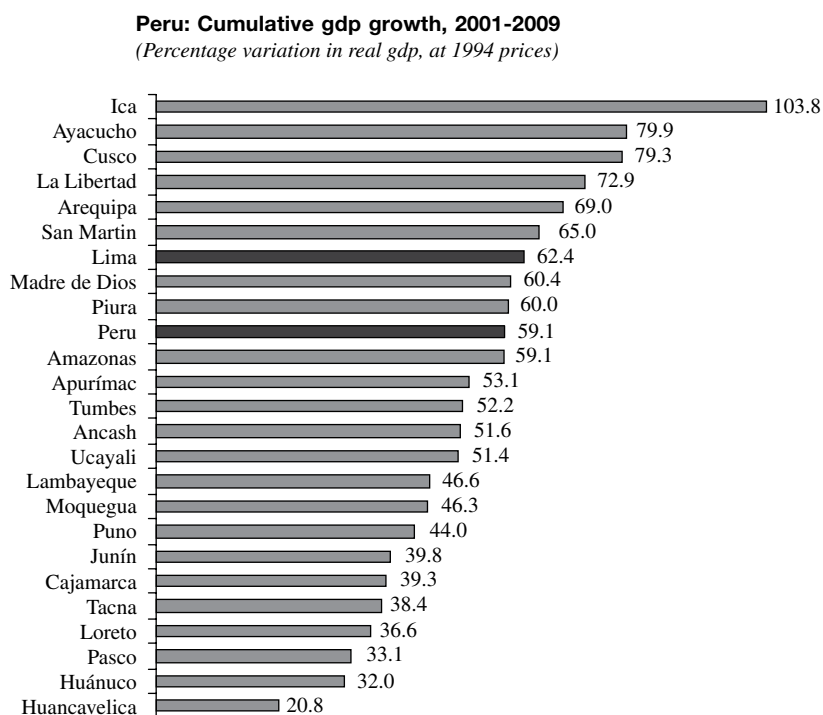
However, some regions have achieved sustained economic growth thanks to the development of productive activities such as agribusiness (for example Ica and Lambayeque, which have very good climatic conditions and agricultural yields that are higher than most countries in the world) and mining and hydrocarbons (in particular Cusco with the Camisea natural gas project). Thus, the economic growth experienced by the regions of Peru has been differentiated, resulting in large disparities in current per capita GDP between regions (see figure 1).

This differentiated economic development is closely correlated with the relative presence of public infrastructures in each region. Various regions display

<sup>4</sup> Taken from Canning (1999).

<sup>5</sup> In other words, it allows for the possibility that the panels do not have common unit roots.

FIGURE 1



Source: prepared by the authors on the basis of data from the National Institute of Statistics and Information (INEI).

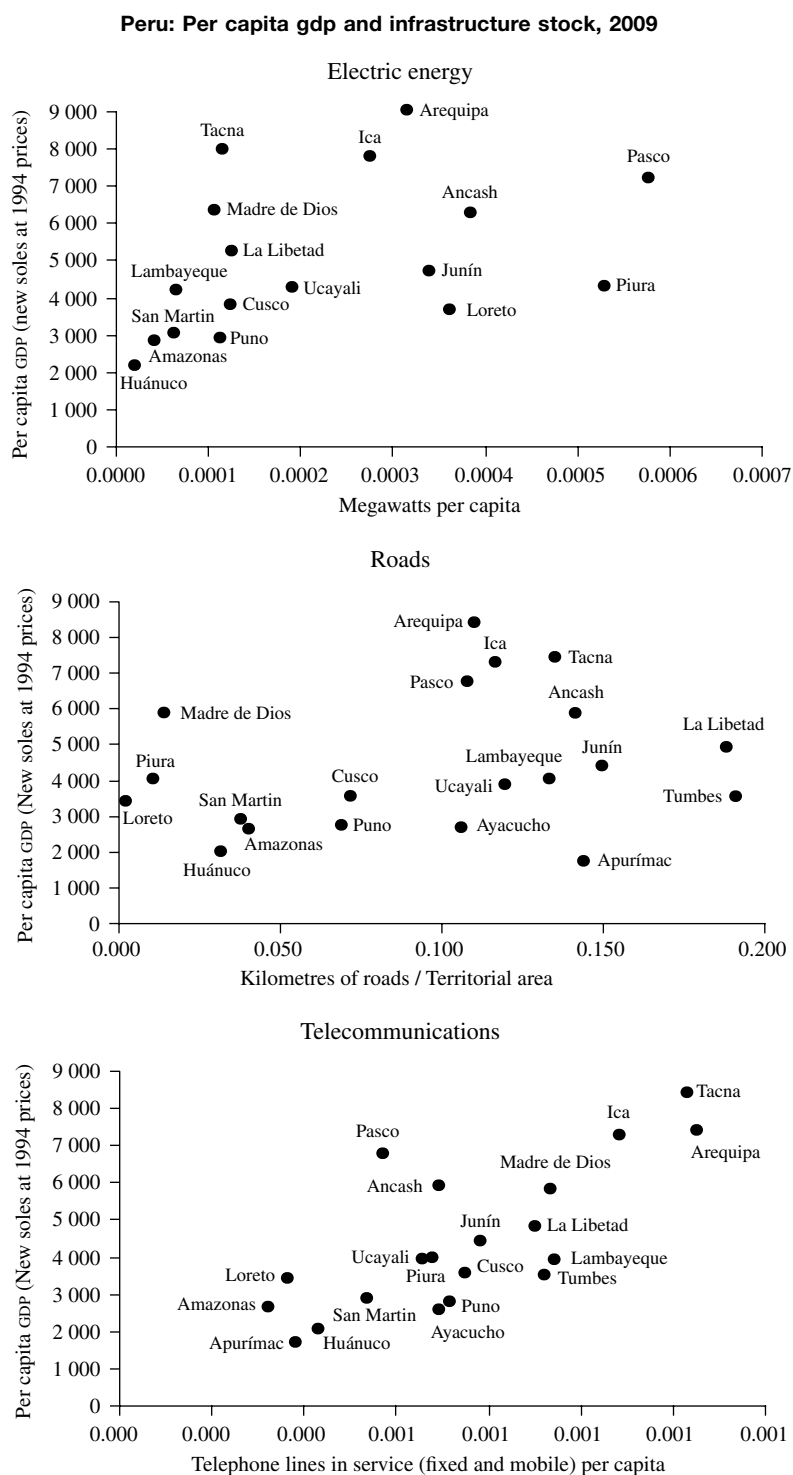
GDP: Gross domestic product.

large disparities in access to the different types of infrastructure, which constitutes one of the main obstacles to economic growth in the more remote localities of the country (see figure 2).

There is a positive correlation between the different types of infrastructure and per capita output

in the various regions of Peru, particularly in the case of telecommunications and electric energy infrastructures. It is therefore worth analysing this relation using econometric techniques to find which type of infrastructure has the greatest effect on regional production and economic growth.

FIGURE 2



Source: prepared by the authors on the basis of data from the National Institute of Statistics and Information (INEI), the Supervisory Agency for Private Investment in Telecommunications (OSIPTEL), the Ministry of Energy and Mines (MINEM) and the Ministry of Transport and Communications (MTC).  
Lima is excluded to avoid distorting the existing relation.

GDP: Gross domestic product.

# IV

## Analysis of results

The estimated models have simultaneously considered indicators for the energy, transport and telecommunications sectors, as was also done by Canning (1999; Calderón and Servén (2004b); and Vásquez and Bendezú (2008). Nonetheless, this article has not controlled for the stage of the business cycle in which the regional economy is located, unlike the first study mentioned which uses controls to correct for that effect, and the second study, which uses a five-year moving average. The model was tested with the inclusion of the dummy time variables, but these proved not significant.

### 1. Models in levels

The first group of models uses per capita output as the dependent variable and is estimated in levels, which is consistent with neoclassical exogenous growth theory and evaluates the temporary effects of infrastructure on output. These models report the presence of a positive and significant effect for all infrastructures on per capita regional output. In addition, the relation prevails with all of the various estimators used, showing that the results are robust (there is no change in sign, and the magnitude of the coefficients are similar between specifications).

For these models, the educated EAP was not significant, but total EAP was significant, with the highest coefficient. This shows the importance of this input in regional production, compared with other productive factors (physical capital, human capital and infrastructures) (see table 2).

The per capita electricity stock has the greatest effect on regional per capita output. This result is logical because electricity is related directly to productive activity, whereas telecommunications are much more closely linked to worker productivity. Moreover, the telecommunications boom in Peru is a phenomenon of the last decade, so its repercussions would be diluted when the evaluation is performed over a longer horizon.

It is also important to note that both the electricity stock and telecommunications stock have a greater effect on regional output than non-infrastructure capital. This would suggest that the differentiated infrastructure stocks per capita in Peru's regions clearly explains the differences in regional per capita output. Thus, if the political authorities take steps to reduce the existing

infrastructure gaps between the regions, progress can be made in reducing productive disparities.

Although the coefficient on the road stock indicator is not comparable with the coefficients of the other forms of infrastructure, this infrastructure explains much of the differences in regional production. One of the main problems at the regional level is the lack of roads and highways to bring markets closer to these localities. It is therefore important to prioritize investment in this infrastructure.

Each type of infrastructure explains the per capita output of each region in a different way. This may be due to the differences in the quality of regional infrastructure, the human capital in each region (which is not controlled for in the model, because the EAP did not prove significant), and other socioeconomic or political differences that might impose obstacles on the correct performance of infrastructures in certain regions. These differences explain how some regions can display greater or less than average effects for the different infrastructures on their respective output.

### 2. Models in differences

The second group of models uses the difference of per capita output as the dependent variable, as a function of differences in the model's explanatory variables. One of the main advantages of this specification is that it eliminates the unit roots encountered in the series. Against this, one of the main disadvantages is the loss of fit of the models through time (within-group  $R^2$ ), although there is a moderate fit between regions (between-groups  $R^2$ ) considering that it is a panel data model estimated in differences.

This result is consistent with the findings of Mankiw, Romer and Weil (1992), who argue that the empirical evidence supports neoclassical exogenous growth models. This explains the good fit of the models expressed in levels, compared to those expressed in differences. The loss of fit can be explained by the lack of regional controls (the dummy variables for each region proved insignificant) and to the elimination of the model's unobservable heterogeneity (by expressing the model in differences, making it time-invariant). When the model is estimated in differences, the latter is directly linked to regional

TABLE 2

## Model in logarithms of per capita gdp

Variable	Pooled data (OLS estimator)	Pooled data (IV - GMM estimator)	Static panel (GLS estimator)	Variable	Pooled data (OLS estimator)	Pooled data (IV - GMM estimator)	Static panel (GLS estimator)
Constant	10.9779*** (0.1243)	10.8915*** (0.1470)	10.9084*** (0.3199)	<b>Telecommunications</b> (continued)			
Log [Regional capital]	0.0607*** (0.0123)	0.0591*** (0.0117)	0.0543 (0.0379)	Log [telecom indicator] *Madre_de_Dios	-0.0900*** (0.0110)	-0.0956*** (0.0119)	-0.0744*** (0.0230)
Log [EAP]	1.3737*** (0.1281)	1.2960*** (0.1464)	1.4260*** (0.3023)	Log [Telecom indicator] *Pasco	-0.1397*** (0.0078)	-0.1405*** (0.0076)	-0.1358*** (0.0115)
<b>Electricity</b>				Log [Telecom indicator] *Piura	0.0590*** (0.0143)	0.0591*** (0.0141)	0.0589*** (0.0144)
Log [Electricity indicator]	0.1268*** (0.0091)	0.1265*** (0.0089)	0.1139*** (0.0206)	Log [Telecom indicator] *Puno	0.0470*** (0.0080)	0.0460*** (0.0077)	0.0569*** (0.0129)
Log [Electricity indicator] *Amazonas			0.0705*** (0.0202)	Log [Telecom indicator] *San_Martin	-0.0646*** (0.0174)	-0.0655*** (0.0168)	-0.0581*** (0.0123)
Log [Electricity indicator] *Apurimac	0.0101*** (0.0038)	0.0112*** (0.0038)	0.0132*** (0.0051)	Log [Telecom indicator] *Tacna	-0.2243*** (0.0106)	-0.1801*** (0.0209)	-0.2245*** (0.0219)
Log [Electricity indicator] *Cajamarca	0.0478*** (0.0136)	0.0475*** (0.0131)	0.0541*** (0.0112)	<b>Transport</b>			
Log [Electricity indicator] *Cusco	0.0223*** (0.0030)	0.0220*** (0.0030)	0.0242*** (0.0029)	Log [Transport indicator]	0.0395*** (0.0055)	0.0385*** (0.0054)	0.0331** (0.0156)
Log [Electricity indicator] *Huánuco	0.0163*** (0.0036)	0.0171*** (0.0034)	0.0201*** (0.0068)	Log [Transport indicator] *Amazonas			-0.2428*** (0.063)
Log [Electricity indicator] *Ica	-0.1226*** (0.0452)	-0.1160*** (0.0442)	-0.1184*** (0.0398)	Log [Transport indicator] *Cajamarca	-0.4364*** (0.1493)	-0.4309*** (0.1444)	-0.4908*** (0.1423)
Log [Electricity indicator] *Moquegua	-0.0935*** (0.0068)	-0.0964*** (0.0069)	-0.0972*** (0.0152)	Log [Transport indicator] *Ica	0.6401** (0.2959)	0.5926** (0.2895)	0.6207*** (0.2616)
Log [Electricity indicator] *San_Martin	0.0389*** (0.0067)	0.0381*** (0.0065)	0.0421*** (0.0078)	Log [Transport indicator] *Lima	-1.3135*** (0.1973)	-1.3913*** (0.2112)	-1.3060*** (0.2890)
<b>Telecommunications</b>				Log [Transport indicator] *Piura	-0.3007*** (0.0613)	-0.3002*** (0.0603)	-0.2927*** (0.0212)
Log [Telecom indicator]	0.0757*** (0.0077)	0.0786*** (0.0078)	0.0680*** (0.0178)	Log [Transport indicator] *Tacna		-0.0838*** (0.0344)	
Log [Telecom indicator] *Arequipa	-0.0951*** (0.0107)	-0.0986*** (0.0112)	-0.0938*** (0.0142)	Number of observations	480	480	480
Log [Telecom indicator] *Huánuco	-0.0332*** (0.0100)	-0.0345*** (0.0097)	-0.0326*** (0.0108)	R <sup>2</sup>	0.9411	0.9414	
Log [Telecom indicator] *Loreto	-0.0954*** (0.0104)	-0.0934*** (0.0103)	-0.0827*** (0.0259)	Within-group R <sup>2</sup>			0.6133
				Between-groups R <sup>2</sup>			0.9922
				Average R <sup>2</sup>			0.9431

Source: prepared by the authors on the basis of data from the National Institute of Statistics and Information (INEI), the Supervisory Agency for Private Investment in Telecommunications (OSIPTEL), the Ministry of Energy and Mines (MINEM) and the Ministry of Transport and Communications (MTC); and information from Vásquez and Bendezú, *Ensayos sobre el rol de la infraestructura vial en el crecimiento económico del Perú*, Lima, Economic and Social Research Consortium (CIES)/Central Reserve Bank of Peru (BCRP), 2008.

GDP: Gross domestic product. EAP: economically active population. Log: logarithm. OLS: Ordinary least squares.

GLS: generalized least squares.

Instrumental variables estimator (IV) through the generalized method of moments (GMM).

Standard errors in parentheses (robust).

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01



productivity according to the model's specification, which would capture the main differences in regional economic growth. This would also indicate that infrastructure, human capital and non-infrastructure physical capital partly fail to explain differences in long-term regional growth.

This evidence also suggests that other factors are more important in explaining the differences. One of these could be the almost non-existent decentralization of production. In addition, the presence of hydrocarbon, mining, or agro-export projects in some regions will also

explain the differences. Productive activities related to these sectors have been promoted during the last few years owing to the high international prices of certain agro-export, hydrocarbon and mineral products. All of this suggest that infrastructure would not have a long-term effect on economic activity or on long-term economic growth (see table 3).

As in the case of models expressed in levels, models in differences report the presence of a positive and significant effect of all infrastructures on regional

TABLE 3

**Model in differences of per capita gdp growth**

Variable	Pooled data (IV-GMM estimator)	Static panel (GLS estimator )	Static panel (within-group estimator)	Dynamic panel (GMM estimator)	Dynamic panel (system GMM estimator)
Constant	-0.0288*** (0.0074)	-0.0272*** (0.0062)	-0.0613*** (0.0107)	-0.0155 (0.0382)	-0.0831** (0.0406)
$\Delta$ Log [Per capita GDP (t-1)]				-0.1299*** (0.0287)	-0.1805*** (0.0574)
$\Delta$ Log [EAP with human capital]	0.4666** (0.2193)	0.4097*** (0.1542)	1.5109*** (0.3781)	0.3319 (1.2691)	2.2662* (1.3284)
$\Delta$ Log [regional capital]	0.1050*** (0.0324)	0.1067*** (0.0421)	0.1173** (0.0444)	0.0955* (0.0510)	0.1278** (0.0560)
$\Delta$ Log [electricity indicator]	0.0911*** (0.0247)	0.0919*** (0.0322)	0.0997*** (0.0341)	0.0889*** (0.0274)	0.1129*** (0.0286)
$\Delta$ Log [telecom indicator]	0.1209*** (0.0220)	0.1224*** (0.0244)	0.1204*** (0.0278)	0.0831*** (0.0307)	0.1141*** (0.0354)
$\Delta$ Log [transport indicator]	0.0463* (0.0275)	0.0464*** (0.0288)	0.0574*** (0.0303)	0.0921*** (0.0168)	0.0871*** (0.0176)
Number of observations	717	717	717	693	695
R <sup>2</sup>	0.0748	–	–	–	–
Within-group R <sup>2</sup>	–	0.0787	0.0862	–	–
Between-groups R <sup>2</sup>	–	0.1190	0.1085	–	–
Average R <sup>2</sup>	–	0.0749	0.0609	–	–
Sargan statistic	–	–	–	1.00	1.00
Arellano-Bond (first-order autocorrelation test)	–	–	–	0.0006	0.0009
Arellano-Bond (second-order autocorrelation test)	–	–	–	0.4604	0.7371

Source: Prepared by the authors on the basis of data from the National Institute of Statistics and Information (INEI), the Supervisory Agency for Private Investment in Telecommunications (OSIPEL), the Ministry of Energy and Mines (MINEM) and the Ministry of Transport and Communications (MTC); and information from Vásquez and Bendezú, *Ensayos sobre el rol de la infraestructura vial en el crecimiento económico del Perú*, Lima, Economic and Social Research Consortium (CIES)/Central Reserve Bank of Peru (BCRP), 2008.

Standard errors in parentheses (robust).

p<0.10; \*\* p<0.05; \*\*\* p<0.01.

GLS: generalized least squares.

Instrumental variables estimator (IV) through the generalized method of moments (GMM).

growth. Moreover, this relation prevails in all of the various estimators used, showing that the results are robust.

These models also find that lagged per capita output growth has a significant effect on contemporary growth, but with a negative sign. This reflects the fact that several regions do not have sustained growth, which suggests the need to develop regional infrastructure more to eliminate the obstacles to sustained growth. In particular, steps must be taken to avoid regional economic growth depending on isolated projects, which are governed by the volatility of prices on international markets.

In these models, the educated EAP was significant, showing that human capital is important for long-term regional economic growth. Nonetheless, as the average education level of the population in the regions is lower, this factor is not yet as important as might be expected.

## V

### Conclusions and recommendations

This study shows that public-service infrastructures are important in explaining disparities in regional per capita output in Peru, which is consistent not only with theory, but also with most of the studies undertaken in numerous countries.

The evidence supports the presence of significant differences in the repercussions of the different infrastructures — mainly electricity and telecommunications — on the per capita output of each region, which can be explained by differences in the quality of regional infrastructure. Accordingly, the political authorities need to focus on increasing the quantity and improving the quality of infrastructures and maintaining them adequately.

Nonetheless, the evidence is not conclusive regarding the incidence of infrastructure on long-term regional economic growth. Other factors would be more important in explaining the differences: human capital, technological progress, productive decentralization, among others. Accordingly, for infrastructure to have long-term repercussions on regional growth, complementary policies are needed to reduce regional gaps.

The main policy implication to arise from the analysis is the need to persevere in developing public-service infrastructure. The authorities should speed up pending concession processes and allow private initiatives

In these models, the relative importance of infrastructures is reversed, and it is now telecommunications that explains most of the effects on economic growth. This reflects the fact that telecommunications are more closely linked to worker productivity (human capital), which is a determinant of long-term regional growth; the development of electricity projects would be much more closely related to short-term variations in regional output. In any event, the electricity and telecommunications variables both have repercussions on regional growth that are similar to those of non-infrastructure capital.

Lastly, the roads indicator explains much of the differences in regional growth; and the development of this infrastructure is more important in reducing disparities in long-term growth between regions than in explaining the temporary gaps in regional output.

that require some degree of co-financing — obviously provided the project displays economic and social benefits in excess of its costs. Similarly, the different levels of government should assign greater budgetary funding to implement or finance this type of project than previously has been approved by the National Public Investment System.

A region can enjoy faster growth and a higher per capita output level if it invests resources in a timely and efficient manner to improve its road, telecommunications and electricity infrastructures. It is therefore unjustifiable that Peru has a group of regional and municipal governments with very low levels of budgetary execution, mainly in infrastructure, and that many of them are precisely in the country's most depressed zones.

Nonetheless, the numerical results need to be used with caution owing to problems of information quality at the regional level. For that reason, greater efforts should be made to review the information that is currently available, and to produce and process the information that has been identified as necessary to obtain more reliable results. This poses an additional challenge for the authorities, or more specifically for the institutions that produce and manage the statistics, although, as potential users of the information, the universities and research centres should also commit their support.

*(Original: Spanish)*

## APPENDIX

## Statistics of the variables used

Variable	Variability	Mean	Standard deviation	Minimum	Maximum	Number of observations
Per capita GDP <sup>a</sup>	Average	3 907.8	2 455.9	1 216.2	16 133.3	928
	Between groups		2 229.4	1 638.0	10 447.8	
	Within groups		1 108.8	-4 639.0	9 593.3	
EAP per capita	Average	0 312.0	0 043.5	0 230.7	0 478.3	903
	Between groups		0 034.6	0 255.8	0 407.2	
	Within groups		0 027.1	0 221.4	0 443.7	
EAP with secondary or higher education per capita <sup>a</sup>	Average	0 154.6	0 075.6	0 028.3	0 398.3	890
	Between groups		0 059.4	0 073.7	0 295.9	
	Within groups		0 048.3	0 057.3	0 354.1	
Regional non-infrastructure capital per capita	Average	0 000.3	0 000.6	0 000.1	0 002.9	812
	Between groups		0 000.6	0 000.0	0 002.3	
	Within groups		0 000.1	-0 000.9	0 001.0	
Electricity per capita <sup>b</sup>	Average	0 090.2	0 199.1	0 000.2	1 393.2	823
	Between groups		0 054.1	0 013.5	0 237.4	
	Within groups		0 191.8	-0 103.3	1 246.0	
Telecommunications per capita <sup>c</sup>	Average	0 002.4	0 007.9	0 000.0	0 119.8	888
	Between groups		0 004.6	0 000.1	0 023.1	
	Within groups		0 006.5	-0 018.7	0 099.1	
Transport <sup>d</sup>	Average	0 432.9	0 558.6	0 000.7	3 977.8	742
	Between groups		0 525.9	0 001.3	2 640.3	
	Within groups		0 215.3	-1 007.9	1 770.4	

Source: prepared by the authors on the basis of data from the National Institute of Statistics and Information (INEI), the Supervisory Agency for Private Investment in Telecommunications (OSIPTEL), the Ministry of Energy and Mines (MINEM) and the Ministry of Transport and Communications (MTC); and information from Vásquez and Bendejú, *Ensayos sobre el rol de la infraestructura vial en el crecimiento económico del Perú*, Lima, Economic and Social Research Consortium (CIES)/Central Reserve Bank of Peru (BCRP), 2008.

<sup>a</sup> Soles at 1994 prices.

<sup>b</sup> Megawatts.

<sup>c</sup> Fixed and mobile lines.

<sup>d</sup> Quality indicator between the stock of road networks.

GDP: Gross domestic product. EAP: economically active population.

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# Financial market reaction to central bank monetary policy communications under an inflation-targeting regime: the case of Brazil

*Gabriel Caldas M.*

## ABSTRACT

Central bank communications are important for guiding expectations. For emerging countries, however, research on this issue is scarce. Because Brazil represents an important emerging country under inflation targeting, this paper studies the influence of monetary policy and central bank communications on the term structure of interest rates in Brazil. The study uses ordinary least squares (ols), generalized method of moments (gmm) and vector autoregression (var) to examine the direction taken by interest rates when affected by central bank communications and monetary policy. The study finds evidence that because economic agents analyse the minutes of the Monetary Policy Committee meetings, monetary policy and central bank communications significantly influence the process of expectations formation for interest rates with different maturities in Brazil.

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## KEYWORDS

Central bank, communications, capital markets, monetary policy, interest rates, inflation, Brazil

## JEL CLASSIFICATION

E43, E44, E52, E58

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# I

## Introduction

Keeping inflation low and stable requires credible, committed and transparent policies that guide expectations. According to Blinder and others (2008), as it became increasingly clear that managing expectations is a useful part of monetary policy, communications policy rose in stature from a nuisance to a key instrument in the central banker's toolkit. The analysis of central bank communication is particularly important in emerging economies with an inflation-targeting regime, because the uncertainties about inflation control in such countries (Mishkin and Savastano, 2001) make it more difficult to guide expectations.

According to Blinder and others (2008, p. 940), “communication can be an important and powerful part of the central bank's toolkit since it has the ability to move financial markets”. However, empirical evidence is still necessary. As Blinder and others (2008, p. 941) stressed, “The limited number of studies that try to assess the directional intent of the central bank's messages generally find that markets move in the ‘right’ direction – that is, what used to be called ‘announcement effects’ help the central bank rather than hinder it. But there has been relatively little such research to date.... We need more evidence in order to be convinced on this point, plus further analysis of how, if at all, creating this type of directional news raises welfare”.

The literature for developed countries is wide and growing.<sup>1</sup> Research on emerging countries is scarce, however. This study analyses monetary policy and central bank communication in Brazil. Because Brazil

represents an important emerging country under inflation targeting, and given the increasing relevance of central bank communication, the paper studies the minutes of the Monetary Policy Committee (COPOM) meetings to assess the influence of monetary policy and central bank communications on the short end of the term structure of interest rates.

The study contributes to the literature in the following ways. First, unlike all previous studies on central bank communication, this paper complements the ordinary least squares (OLS) analysis by using generalized method of moments (GMM) and vector autoregression (VAR) to examine the direction taken by interest rates when affected by central bank communications and monetary policy. (To my knowledge, no study uses the VAR methodology to analyse dynamically whether central bank communication influences the direction of interest rates.) Second, the study provides an analysis for the term structure of an important emerging country under inflation targeting, based on the ideas presented in Fuhrer and Moore (1995a and 1995b), Fuhrer (1996) and Walsh (2010). The type of analysis presented in this paper has never been done by any other study on central bank communication.

The paper is organized as follows. Section II presents a brief overview of the literature. Section III uses the minutes of the COPOM meetings to examine the impact of monetary policy and central bank communications on the short end of the term structure of interest rates in Brazil and discusses the empirical results. The last section presents the conclusions.

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<sup>1</sup> For example, Kohn and Sack (2004); Connolly and Kohler (2004); Musard-Gies (2006); Andersson, Dillén and Sellin (2006); Rosa and Verga (2007); Reeves and Sawicki (2007); Ehrmann and Fratzscher (2007a and 2009); Hayo and Neuenkirch (2010); Brand, Buncic and

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Turunen (2010); Hayo, Kutan and Neuenkirch (2010); Rinaldo and Rossi (2010); Sturm and de Hann (2011); Rosa (2011); Berger, de Haan and Sturm (2011).

## II

### Central bank communications and monetary policy: literature review

Inflation targeting was widely adopted in the early 1990s, which heightened awareness of the importance of transparency for the process of expectations formation (Geraats, 2002; de Mendonça and Simão-Filho, 2007). In a forward-looking environment, monetary policy largely becomes an art of managing the expectations of private agents (Woodford, 2003). Consequently, studies about central bank communication have gained importance in the literature on this regime.

The degree of transparency and the regularity of the communication process depend on the level of discretion in the monetary regime adopted. Thus, the complexity of communication is associated with the type of monetary regime adopted. Regimes with less discretion are related to a more simple communication, whereas more flexible arrangements that allow greater discretion, such as inflation targeting, involve more complex communication (Blinder and others, 2008).

Inflation-targeting central banks generally announce four aspects of monetary policy: its objectives and strategies, the reasons behind political decisions, the outlook on the state of the economy and future monetary policy decisions. Since the objectives and strategies of central banks tend to be stable and thus vary less over time than the other three aspects, communications on this aspect are less frequent.

The literature includes two main approaches to analysing the influence of communications on the economy, which are complementary. One explores the impact of central bank communications on financial markets (for example, Kohn and Sack, 2004; Reeves and Sawicki, 2007; Ehrmann and Fratzscher, 2007a and 2009), while the other looks at the influence of different communication strategies among central banks on the economic performance (for example, Fujiwara, 2005; Rozkrut and others, 2007). Since central bank communications influence expectations for the future short-term interest rate, they also affect the long-term rates and, therefore, financial market prices. These prices can, in turn, affect some macroeconomic variables, such as inflation and output. However, while communications and monetary policy instantly affect the financial market, the economy as a whole is affected gradually and by several other factors.

There are basically three approaches to measuring central bank communication. The first seeks to classify all central bank communications according to their content or signals (possible intentions), using a numerical scale to encode these ratings (Jansen and De Haan, 2005; Ehrmann and Fratzscher, 2007b; Rosa and Verga, 2007; Musard-Gies, 2006). Some studies use the codes to indicate direction (Jansen and De Haan, 2005; Ehrmann and Fratzscher, 2007b). The second approach examines all forms of media communication by the Monetary Policy Committee or its members that is relevant for monetary policy (Jansen and De Haan, 2005; Ehrmann and Fratzscher, 2007b). In this case, the task is to extract information from statements, speeches, minutes and reports using a set of search words. When the objective is to assess the trend of monetary policy, the search includes the name of the committee member and the key words interest rate, monetary policy and inflation. When the objective is to assess the future economic environment, the key words are economy and economic outlook. Finally, the third approach takes advantage of some institutional features of the process of announcing monetary policy decisions to measure the impact of communications. An example of this approach is Brand, Buncic and Turunen (2010), who separate the reactions of the financial market into two effects: the monetary policy effect and the communication effect of the European Central Bank.

Different approaches have been developed in the literature to measure the effects of central bank communications (see Blinder and others, 2008, for more details). Starting with Kohn and Sack (2004), some studies have examined the effects of central bank communication events on the volatility of financial variables (Blinder and others, 2008, present several of these studies). The focus on volatility makes it unnecessary to assign a direction to each statement. In other studies, communications are quantified in order to assess both the direction (for example, Ehrmann and Fratzscher, 2007b) and magnitude (for example, Berger and others, 2011) of the effects on asset prices and thus to determine the extent to which a given communication has its intended effects.

In recent years, the general move in central banks to enhance their transparency, accountability and



communication has motivated a number of studies on the influence of central bank communication on financial markets.<sup>2</sup> This literature is mostly directed to developed countries, however. For Brazil, Costa Filho and Rocha (2009) discuss the role of communication in the conduct of monetary policy by the Central Bank of Brazil. They build a glossary that translates the qualitative information contained in the COPOM minutes into an ordered scale

index, similar to the one built by Rosa and Verga (2007). They find evidence of consistent behaviour by the COPOM, in the sense that its words are followed by actions in the same direction. Moreover, based on estimates of Taylor rules, they also find evidence that the index helps to understand interest setting. In a later work, (Costa Filho and Rocha, 2010) these authors explore whether better communication from the Central Bank of Brazil makes monetary policy more predictable. They find that interest rates increase on release days, indicating that central bank communication has a conservative bias, while interest rate volatility decreases. They also find evidence that the market's reaction is independent of the content released, although signals of interest rate reduction imply a decrease in volatility.

<sup>2</sup> For example, Kohn and Sack (2004); Connolly and Kohler (2004); Musard-Gies (2006); Andersson, Dillén and Sellin (2006); Rosa and Verga (2007); Reeves and Sawicki (2007); Ehrmann and Fratzscher (2007a and 2009); Brand, Buncic and Turunen (2010); Berger, de Haan and Sturm (2011).

### III

## Communications from the Central Bank of Brazil

Brazil adopted an inflation-targeting regime in 1999. Since then, the conduct of monetary policy by the Central Bank of Brazil has become more transparent and accountable, and communications more frequent and open, as policymakers realized the importance that expectations play in the economy. This change is consistent with the trend of the world's major central banks, especially those with inflation targeting.

In this paper, I use the information provided through the minutes of COPOM meetings to analyse the Brazilian case. The regular COPOM meetings are spread over two days, with the first session on Tuesdays and the second session on Wednesdays. On the first day of the meeting, the department heads present an overview of the economic environment. On the second day, the deputy-governors of monetary policy and economic policy present the alternatives for the short-term interest rate and their policy recommendations. Other members of the Board make their own comments and proposals, and then the members vote on a final proposal, with the goal of reaching a consensus decision. The final decision –the Special System of Clearance and Custody (SELIC) rate target and the bias, if any– is then announced.

Eight days after each meeting, the Committee releases the meeting minutes on the central bank's website. The minutes provide a summary of the COPOM discussions. The document describes the state of the economy, what

factors were relevant to the decision taken at the meeting and the outlook for future meetings.

Based on all the available information, the agents seek to estimate the state of the economy in the long term and the future behaviour of the policymaker in terms of monetary policy. In this sense, monetary policy and the committee's communications through the minutes will be effective if they can guide agents' expectations.

#### 1. Estimation

This section estimates the effects of central bank communications on the short end of the term structure of interest rates in Brazil. Central bank communications are quantified through dummy variables, and the interest rate spread is the difference between an interest rate with a specific maturity up to one year (measured by a swap rate) and the basic interest rate (measured by the SELIC rate).<sup>3</sup>

<sup>3</sup> The choice of swap rates as measures of interest rates with different maturities follows the literature on the term structure of interest rates in the Brazilian economy. For example, Lima and Issler (2003), Tabak and Tabata (2004) and Montes and Bastos (2011) use the same swap rates as proxies for long-term interest rates and for the interest rate spread. For more details, see Lima and Issler (2003), Tabak and Tabata (2004) and Montes and Bastos (2011).

For this purpose, the following data were used in the analysis: 360-day swap reference rate, based on the pre-set interbank (DI) rate on the Brazilian Mercantile and Futures Exchange (BM&F), per cent per year;<sup>4</sup> 180-day swap reference rate, based on the pre-set DI rate on the BM&F, per cent per year;<sup>5</sup> 120-day swap reference rate, based on the pre-set DI rate on the BM&F, per cent per year;<sup>6</sup> and the annualized SELIC interest rate, accumulated in the month.<sup>7</sup>

The period of analysis runs from June 2003 to April 2011, comprising the 85<sup>th</sup> meeting until the 158<sup>th</sup> meeting of the COPOM (74 observations). I chose to start with the 85<sup>th</sup> meeting because until this meeting, there was no clear rule on the disclosure of the minutes of previous meetings. The minutes have only been regularly released since the 85<sup>th</sup> meeting.

The dummy variables are built based on a prepared glossary (see table A.1 in the appendix), which is intended to codify the words and expressions contained in the minutes of the COPOM. The glossary was inspired by the work of Rosa and Verga (2007). When there is an indication in the minutes that the COPOM aims to reduce the SELIC rate at its next meeting, the dummy variable *dummy\_red* assumes a value of one (and zero otherwise). When there is an indication that the COPOM will not change the SELIC rate at its next meeting, the dummy variable *dummy\_neutra* assumes a value of one (and zero otherwise). When there is an indication that the COPOM aims to increase the SELIC rate at its next meeting, the dummy variable *dummy\_aum* takes a value of one (and zero otherwise).

To analyse the impact of these communications on the short end of the interest-rate term structure in Brazil, three equations were estimated based on the following basic equation:<sup>8</sup>

$$Spread_{kt} = \beta_{1k}dummy\_aum_t + \beta_{2k}dummy\_neutra_t + \beta_{3k}dummy\_red_t + \zeta_{kt}, \quad (1)$$

where  $Spread_{kt}$  is the difference between the swap rate with maturity  $k$  ( $k = 120, 180, 360$ ) and the basic interest rate (SELIC) prevailing at date  $t$ , and  $\zeta_{kt}$  represents the error terms (white noise). The series of *Swap\_360*, *Swap\_180* and *Swap\_120* were based on information from the day after the release of the COPOM minutes on the website

of the Central Bank of Brazil. The expected results are  $\beta_{1k} > 0$ ,  $\beta_{2k} = 0$  (that is, no significance) and  $\beta_{3k} < 0$ .

The COPOM communications will be effective if interest-rate expectations behave according to the monetary authority's signal, as identified in the minutes. The idea is to check whether monetary policy and communications serve as guides for interest-rate expectations and, as a consequence, affect the short end of the interest-rate term structure in Brazil in the desired direction. The analysis was performed through OLS and VAR using the EViews 7 software.

Table 1 reveals that the estimated coefficients for two of the dummy variables (*dummy\_aum* and *dummy\_red*) are significant for all maturities and present the expected signs. The estimated coefficients for the neutral dummy variable (*dummy\_neutra*) are not statistically significant, which means that when COPOM indicates that it will not change the SELIC rate, spreads do not change.

The evidence presented so far has shown that when the central bank indicates that it will tighten monetary policy, the spreads react by increasing, and when the central bank signals loosening, the spreads decrease. A relevant issue that arises concerns the influence of monetary policy and central bank communications on short-term rates, dynamically. Vector autoregressions (VAR) often employ impulse response functions because they support the evaluation of the impact of shocks (or innovations) on key variables over time (Sims, 1980). As pointed out by Lutkenpohl (1991), the conventional method applies an orthogonality assumption, so the result may depend on the ordering of the variables in the VAR. Koop, Pesaran and Potter (1996) and Pesaran and Shin (1998) develop the idea of the generalized impulse response function as a way of eliminating the problem of the ordering of variables in the VAR. The main argument is that the generalized impulse responses are invariant to any reordering of the variables in the VAR (see, for example, Ewing, 2003).

The analysis uses the SELIC rate, *Swap\_360*, *Swap\_180*, *Swap\_120*, *dummy\_red* and *dummy\_aum*. Because the different series for *Swap\_360*, *Swap\_180* and *Swap\_120* present structural breaks in the averages (as figures A.1, A.2 and A.3 in the appendix show), the VAR includes a dummy variable (named *dummy\_break*) as an exogenous variable, where *dummy\_break* takes a value of one from meeting 85 until meeting 123, and zero otherwise.

To check if the series are stationary, that is, if the series do not have a unit root, both Kwiatkowski-Phillips-Schmidt-Shin (KPSS) and Phillips-Perron (PP) tests were applied (see tables A.2 and A.3 in the appendix). The Akaike information criterion (AIC), the Schwarz

<sup>4</sup> Code 7806 (website of the Central Bank of Brazil).

<sup>5</sup> Code 7805 (website of the Central Bank of Brazil).

<sup>6</sup> Code 7804 (website of the Central Bank of Brazil).

<sup>7</sup> Code 4189 (website of the Central Bank of Brazil).

<sup>8</sup> The equations were estimated without the intercept to avoid perfect multi-collinearity.

TABLE 1

## Effect of dummy variables on Spreads

Explanatory variables	Dependent variables		
	Spread <sub>120</sub>	Spread <sub>180</sub>	Spread <sub>360</sub>
<i>dummy_aum</i>	0.45*** (0.00)	0.65*** (0.00)	0.91*** (0.00)
<i>dummy_neutra</i>	-0.013 (0.89)	0.008 (0.94)	0.35 (0.10)
<i>dummy_red</i>	-0.75*** (0.00)	-0.95*** (0.00)	-1.14*** (0.00)
<i>Summary statistics</i>			
$R^2$	0.54	0.55	0.45
Adjusted $R^2$	0.52	0.53	0.43
Standard error	0.48	0.62	1.01
No. observations	74	74	74

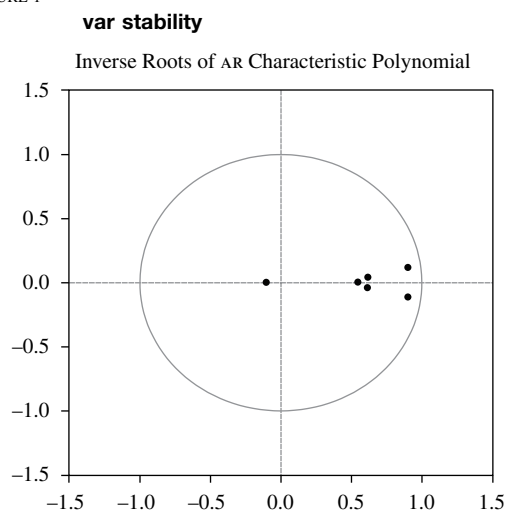
Source: author's estimates.

Notes: The equations are estimated using OLS; *p* values are in parentheses.

\*\*\* Statistically significant at the 1% level.

information criterion (SIC) and the Hannan-Quinn information criterion (HQ) were used to select the VAR order. The results indicate that the VAR order is one (see table A.4 in the appendix). Figure 1 shows the stability of the estimated VAR.

FIGURE 1



Source: author's elaboration.

Figure 2 presents the results of the generalized impulse response functions for a time horizon of 18 months. The evidence indicates that when the COPOM

minutes signal an increase in the SELIC interest rate for the next meeting, interest rates react by first increasing and then converging to equilibrium. When the COPOM signals a reduction in the SELIC interest rate for the next meeting, interest rates react by decreasing and then converging to equilibrium. These findings are statistically significant. Regarding the influence of monetary policy shocks on the short end of the interest-rate term structure, the results suggest that positive shocks on the SELIC interest rate cause an increase in interest rates. Again, these results are statistically significant.

The evidence obtained so far suggests that monetary policy and COPOM communications play an important role in the process of expectations formation about the behaviour of interest rates in Brazil. Because long-term interest rates also reflect macroeconomic aspects, I next examined the influence of monetary policy and COPOM communications on the short end of the interest-rate term structure, as well as the influence of inflation expectations and output deviations from its trend. To do so, I added the following series: output deviations (the difference between GDP<sup>9</sup> and trend GDP)<sup>10</sup> and inflation expectations (market expectations for inflation over the next 12 months, as measured by the Extended National Consumer Price Index (IPCA)).<sup>11</sup>

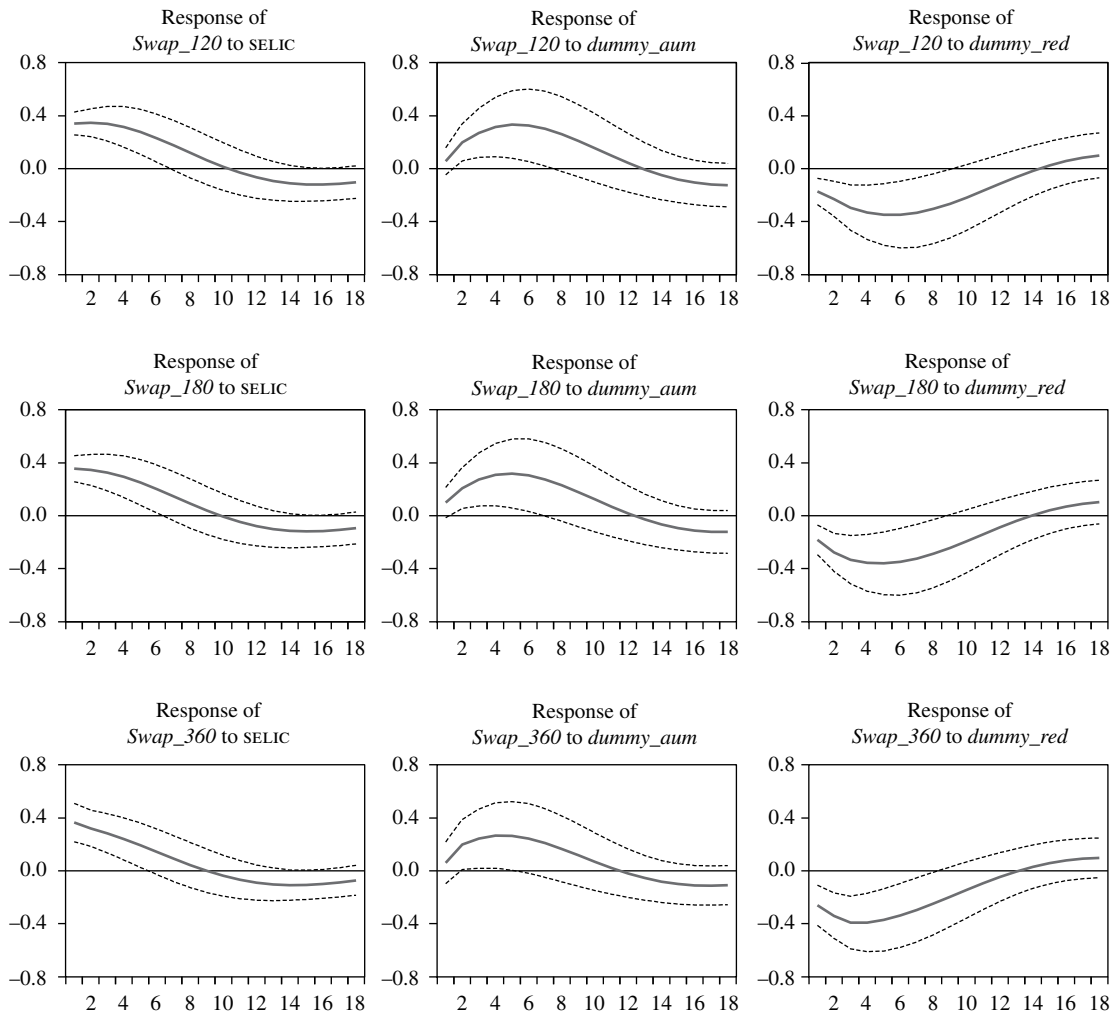
<sup>9</sup> Code 4191 (website of the Central Bank of Brazil).

<sup>10</sup> Obtained through the Hodrick-Prescott filter.

<sup>11</sup> Obtained from the Central Bank of Brazil website.

FIGURE 2

**Impulse responses to a one-standard-deviation shock**  
(±2 standard errors)



Source: author's elaboration.

I then estimated the following equation, based on Fuhrer and Moore (1995a and 1995b), Fuhrer (1996) and Walsh (2010), to analyse the influence of monetary policy, central bank communications, output deviations and inflation expectations on short-term rates:

$$S_{kt} = \alpha_k \pi_{t-1}^e + \delta_k (y_{t-1} - y_{t-1}^*) + \gamma_k (r_{t-1}) + communication\_dummies_t + \varepsilon_{kt} \quad (2)$$

where  $S$  is the swap rate with maturity  $k$  ( $k = 120, 180, 360$ ),  $\pi^e$  represents inflation expectations (twelve months ahead),  $(y - y^*)$  represents output deviations

from trend (which is a measure of the economic cycle),  $r$  is basic interest rate (SELIC) and  $\varepsilon$  is the error term. The macroeconomic variables were used with a lag, because this is the set of information available to economic agents when they form their expectations for interest rates. The expected signs for the coefficients of the macroeconomic variables are  $\alpha > 0$ ;  $\delta > 0$  and  $\gamma > 0$ . The *communication\_dummies* are the same dummy variables used before (*dummy\_aum*, *dummy\_red* and *dummy\_neutra*). The period of the study runs from June 2003 to April 2011, comprising the 85<sup>th</sup> through the 158<sup>th</sup> meeting of the COPOM.

The empirical analysis was conducted using ordinary least squares (OLS)<sup>12</sup> and generalized method of moments (GMM). One reason for using GMM is that while OLS estimates have problems of serial autocorrelation, heteroskedasticity or non-linearity, which is typical in macroeconomic time series, GMM provides consistent estimators for the regression (Hansen, 1982).

According to Wooldridge (2001, p. 95), “to obtain a more efficient estimator than two-stage least squares (or ordinary least squares), one must have overriding restrictions.” I used a standard J-test to test this property for the validity of the overidentifying restrictions (Hansen, 1982). Cragg (1983) argues that using overidentification analysis in the selection of instrumental variables improves the efficiency of the estimators. The chosen instruments need to be dated to the period  $t - 1$  or earlier to help predict the contemporaneous variables, which are unavailable at time  $t$ . This procedure for choosing instrumental variables follows Johnston (1984).<sup>13</sup>

A first condition to be analysed before applying the estimations is to check whether the series are stationary. Based on the tests, while the series of inflation expectations is I(1), all other series are I(0) (see tables A.2 and A.3 in the appendix).

## 2. Results

Tables 2, 3 and 4 present the results. The estimates show that for all specifications, the constant is positive and statistically significant, except for equation ( $S_{120a}$ ) which is not statistically significant. Regarding the *dummy\_break*, all estimated coefficients are positive and statistically significant, except those estimated in equations ( $S_{120e}$ ) by OLS and ( $S_{120d}$ ) by GMM which are not statistically significant.

With regard to inflation expectations, the results show that all the estimated coefficients in table 2 are positive, although those present in equations ( $S_{120c}$ ), ( $S_{120d}$ ) and ( $S_{120f}$ ) by OLS and ( $S_{120c}$ ) and ( $S_{120f}$ ) by GMM are not statistically significant. In table 3, the OLS estimates indicate a positive relationship between

inflation expectations and *Swap\_180*, although it is not statistically significant in equation ( $S_{180d}$ ). With GMM, the estimated coefficients in equations ( $S_{180a}$ ), ( $S_{180b}$ ), ( $S_{120d}$ ), ( $S_{120e}$ ) and ( $S_{120f}$ ) are all positive and statistically significant. The results for *Swap\_360* show positive, statistically significant coefficients in all specifications of both methods (see table 4). The economic explanation for the positive relation between inflation expectations and short-term rates is that the expectation of higher inflation leads to expectations that the central bank will tighten monetary policy by raising short-term interest rates in the future to slow economic growth and dampen inflationary pressures. Moreover, inflation expectations have the strongest impact on the longer-term interest rates of the short end of the term structure. This is basically due to the fact that inflation expectations are market expectations for the next 12 months.

The estimates presented in tables 2, 3 and 4 also show the positive influence of output deviations on short-term rates. All specifications in table 2 are statistically significant, whereas in tables 3 and 4, specifications ( $S_{180a}$ ), ( $S_{360a}$ ) and ( $S_{360c}$ ) by both OLS and by GMM are not statistically significant. The positive relation between output deviations (a measure of the business cycle) and short-term rates is explained as follows: when the economy warms up, inflationary pressures rise, leading economic agents to expect higher interest rates in the future.

Monetary policy has a direct relationship with the short end of the term structure, that is, when the SELIC rate increases, swap rates also rise. Based on the values of the estimated coefficients, this impact is smaller on longer-term interest rates. In this sense, the monetary policy of the Central Bank of Brazil, through the SELIC rate, exerts significant influence on the short end of the term structure.

The central bank’s communications also have a positive impact on short rates. The dummy variable for an upward signal, *dummy\_aum*, has a positive, statistically significant effect on the short end of the term structure. In other words, when the COPOM minutes reveal information that indicates a possible increase in the SELIC interest rate at the next meeting, short-term rates, as measured by swap rates, increase. A comparison of the *Swap\_120* and *Swap\_360* variables suggests that communications indicating tighter monetary policies in the future have a stronger effect on the 360-day swap rate than on the 120-day swap rate.

For a downward signal, the results for *dummy\_red* reveal a negative, statistically significant impact on the short end of the term structure. When the Brazilian

<sup>12</sup> The reported t-statistics in the ols estimates are based on the estimator of Newey and West (1987), which is consistent in the presence of both heteroskedasticity and autocorrelation of unknown form.

<sup>13</sup> The GMM estimations apply the following instrumental variables:  
 – For *Swap\_120*: constant,  $S_t^{120}(-1 \text{ to } -3)$ ,  $d_{\pi^e}(-2 \text{ to } -7)$ ,  $(y - y^*)(-2 \text{ to } -4)$  and  $r(-2 \text{ to } -8)$   
 – For *Swap\_180*: constant,  $S_t^{180}(-1 \text{ to } -3)$ ,  $d_{\pi^e}(-2 \text{ to } -7)$ ,  $(y - y^*)(-2 \text{ to } -4)$  and  $r(-2 \text{ to } -8)$   
 – For *Swap\_360*: constant,  $S_t^{360}(-1 \text{ to } -3)$ ,  $d_{\pi^e}(-2 \text{ to } -7)$ ,  $(y - y^*)(-2 \text{ to } -4)$  and  $r(-2 \text{ to } -8)$

TABLE 2

ols and gmm estimates: Swap\_120

Explanatory variable	ols estimates					GMM estimates						
	( $S_{120a}$ )	( $S_{120b}$ )	( $S_{120c}$ )	( $S_{120d}$ )	( $S_{120e}$ )	( $S_{120f}$ )	( $S_{120a}$ )	( $S_{120b}$ )	( $S_{120c}$ )	( $S_{120d}$ )	( $S_{120e}$ )	( $S_{120f}$ )
Constant	1.28 (0.83) [1.54]	3.29** (1.38) [2.38]	2.39** (1.14) [2.10]	2.43** (1.07) [2.26]	3.15** (1.52) [2.07]	2.13** (1.02) [2.07]	1.18*** (0.30) [3.82]	5.65*** (1.34) [4.20]	1.88* (0.99) [1.88]	2.19*** (0.71) [2.99]	5.54*** (1.44) [3.83]	1.67*** (0.57) [2.92]
$d_{-}(\pi_{t-1})$	1.50** (0.63) [2.36]	0.98* (0.55) [1.78]	0.67 (0.40) [1.40]	0.34 (0.38) [0.89]	0.95* (0.52) [1.80]	0.33 (0.31) [1.04]	4.55*** (0.45) [9.99]	1.78*** (0.47) [3.77]	1.25*** (0.34) [3.64]	0.06 (0.46) [0.14]	1.53*** (0.48) [3.17]	0.16 (0.34) [0.46]
$(y_{t-1} - y^*_{t-1})$	0.00001* (0.000005)	0.000016** (0.000006)	0.00001** (0.0000051)	0.000011** (0.0000054)	0.000016** (0.0000068)	0.000009** (0.0000044)	0.000012*** (0.000003)	0.000021*** (0.0000056)	0.000011*** (0.0000034)	0.000013*** (0.0000042)	0.000023*** (0.0000058)	0.000012*** (0.0000029)
$(r_{t-1})$	0.89*** (0.06) [14.18]	0.70*** (0.12) [5.71]	0.74*** (0.10) [7.38]	0.82*** (0.09) [8.61]	0.70*** (0.12) [5.51]	0.81*** (0.09) [8.74]	0.89*** (0.02) [37.07]	0.47*** (0.12) [3.64]	0.86*** (0.09) [9.19]	0.77*** (0.06) [12.52]	0.47*** (0.13) [3.52]	0.84*** (0.05) [15.66]
$dummy\_break$		1.52* (0.83) [1.82]	1.32** (0.65) [2.07]	0.99* (0.57) [1.74]	1.49 (0.86) [1.73]	1.01* (0.54) [0.79***]		3.14*** (0.80) [3.92]	0.71 (0.60) [1.18]	1.47*** (0.46) [3.20]	3.01*** (0.90) [3.34]	1.03*** (0.36) [2.84]
$dummy\_aum$			1.35*** (0.22) [5.94]			0.79*** (0.16) [4.82]			1.47*** (0.18) [7.95]			0.96*** (0.22) [4.36]
$dummy\_red$				-1.52*** (0.22) [6.91]		-1.12*** (0.18) [6.06]			-1.15*** (0.17) [6.76]		0.23 (0.27) [0.86]	-0.63*** (0.17) [3.69]
$dummy\_neutra$					0.15 (0.30) [0.48]							
<i>Summary statistics</i>												
R <sup>2</sup>	0.92	0.93	0.96	0.96	0.93	0.97	0.87	0.89	0.96	0.96	0.89	0.98
Adjusted R <sup>2</sup>	0.91	0.92	0.95	0.96	0.92	0.97	0.86	0.88	0.96	0.96	0.88	0.97
F statistic	257.31	219.64	307.87	378.31	174.07	406.21						
Probability (F statistic)	0.00	0.00	0.00	0.00	0.00	0.00						
Ramsey (U); p value	0.07	0.86	0.50	0.00	0.85	0.00						
Normality (Jarque-Bera test)	0.10	1.21	0.11	3.92	1.30	7.40						
Normality (Probability)	0.94	0.54	0.94	0.14	0.52	0.02						
Probability (J-statistic)							11.40	8.20	7.15	9.26	7.40	5.70
Rank							20	20	20	20	20	20
Chow breakpoint test:												
Observation												
F statistic												
Probability (F statistic)												

Source: author's estimates.

\* Statistically significant at the 10% level; \*\* statistically significant at the 5% level; \*\*\* statistically significant at the 1% level.

COPOM: Monetary Policy Committee of Brazil.

OLS: ordinary least squares.

GMM: generalized method of moments.

ols and gmm estimates: Swap\_180

Explanatory variable	ols estimates					GMM estimates						
	(S <sub>180a</sub> )	(S <sub>180b</sub> )	(S <sub>180c</sub> )	(S <sub>180d</sub> )	(S <sub>180e</sub> )	(S <sub>180f</sub> )	(S <sub>180a</sub> )	(S <sub>180b</sub> )	(S <sub>180c</sub> )	(S <sub>180d</sub> )	(S <sub>180e</sub> )	(S <sub>180f</sub> )
Constant	1.63* (0.89)	4.16*** (1.42)	3.12*** (1.12)	3.19*** (0.99)	4.05** (1.58)	2.83*** (0.93)	0.75** (0.40)	6.46*** (1.27)	3.29*** (0.81)	4.48*** (0.94)	6.49*** (1.33)	2.11*** (0.67)
$d_{(\pi^e_{t-1})}$	1.83 (1.83)	1.92*** (2.92)	0.91* (2.78)	3.22 (3.22)	1.24** (2.55)	3.02 (3.02)	1.84 (1.84)	5.06 (5.06)	4.02 (4.02)	4.73 (4.73)	4.87 (4.87)	3.14 (3.14)
$(y_{t-1} - y_{t-1}^*)$	0.70 (0.70)	0.60 (0.60)	0.51 (0.51)	0.41 (0.41)	0.58 (0.58)	0.31 (0.31)	0.49 (0.49)	0.51 (0.51)	0.06 (0.06)	0.34 (0.34)	0.53 (0.53)	0.23 (0.23)
$(y_{t-1} - y_{t-1}^*)$	0.00001 (0.0000065)	0.000019*** (0.0000074)	0.000011** (0.0000053)	0.00012** (0.0000056)	0.00019*** (0.0000074)	0.00001** (0.0000041)	0.0000048 (0.0000003)	0.000025*** (0.0000051)	0.000015*** (0.0000037)	0.000021*** (0.0000042)	0.000026*** (0.0000057)	0.0000056* (0.0000028)
$(r_{t-1})$	0.87*** (0.06)	0.63*** (0.12)	0.67*** (0.09)	0.76*** (0.09)	0.63*** (0.13)	0.75*** (0.08)	0.91*** (0.03)	0.41 (0.12)	0.66*** (0.07)	0.63*** (0.09)	0.40*** (0.12)	0.78*** (0.06)
<i>dummy_break</i>	13.01 (13.01)	1.92** (5.03)	1.68** (6.91)	1.32** (8.63)	1.89* (4.78)	1.34** (8.94)	30.95 (30.95)	4.38*** (3.38)	1.94*** (9.37)	7.01 (7.01)	4.46*** (3.22)	1.61*** (13.01)
<i>dummy_dum</i>		0.93 (2.06)	0.68 (2.44)	0.57 (2.32)	0.95 (1.98)	0.53 (2.50)		0.83 (5.27)	0.59 (3.25)	0.61 (3.91)	0.87 (5.09)	0.40 (3.97)
<i>dummy_red</i>			1.57*** (0.24)		1.98 (0.18)	0.96*** (0.18)			1.71*** (0.24)		1.26*** (0.18)	1.26*** (0.18)
<i>dummy_neutra</i>				-1.71*** (0.24)	0.12 (0.35)	-1.22*** (0.21)				-1.48*** (0.26)		-1.04*** (0.17)
<i>Summary statistics</i>												
R <sup>2</sup>	0.89	0.91	0.95	0.96	0.91	0.97	0.83	0.85	0.95	0.95	0.85	0.97
Adjusted R <sup>2</sup>	0.89	0.90	0.95	0.96	0.90	0.97	0.82	0.84	0.94	0.95	0.83	0.96
F statistic	193.38	172.94	269.64	320.84	136.70	378.69						
Probability (F statistic)	0.00	0.00	0.00	0.00	0.00	0.00						
Ramsey (1); p value	0.12	0.66	0.92	0.08	0.65	0.01						
Normality (Jarque-Bera test)	0.67	1.21	0.03	2.92	1.27	1.39						
Normality (Probability)	0.71	0.54	0.98	0.23	0.53	0.49						
Probability (J-statistic)							11.74	8.47	6.69	9.40	8.26	8.32
Rank							0.76	0.90	0.94	0.80	0.87	0.82
Chow breakpoint test							20	20	20	20	20	20
Observation		39 (Copom meeting no. 123)										
F statistic	5.54											
Probability (F statistic)	0.00											

Source: author's estimates.  
 \* Statistically significant at the 10% level; \*\* statistically significant at the 5% level; \*\*\* statistically significant at the 1% level.  
 COPOM: Monetary Policy Committee of Brazil.  
 OLS: ordinary least squares  
 GMM: generalized method of moments.

TABLE 4

ols and gmm estimates: Swap\_360

Explanatory variable	OLS estimates					GMM estimates				
	( $S_{360d}$ )	( $S_{360b}$ )	( $S_{360c}$ )	( $S_{360d}$ )	( $S_{360e}$ )	( $S_{360d}$ )	( $S_{360c}$ )	( $S_{360d}$ )	( $S_{360e}$ )	( $S_{360f}$ )
Constant	2.93*** (0.92)	6.01*** (1.39)	4.93*** (1.12)	4.90*** (0.81)	5.73*** (1.54)	1.18*** (0.43)	5.63*** (0.98)	6.71*** (1.10)	9.44*** (0.90)	4.54*** (0.84)
$d_L(\pi^e_{t-1})$	3.17 (0.84)	4.33 (0.66)	4.39 (0.63)	6.04 (0.42)	3.72 (0.63)	2.75 (0.53)	5.76 (0.48)	6.08 (0.43)	10.48 (0.55)	5.37 (0.34)
$(y_{t-1} - y^*_{t-1})$	2.91 (0.0000091)	2.51 (0.000019***)	2.05 (0.000012)	2.02 (0.000012*)	2.55 (0.000019**)	11.85 (0.0000094)	5.87 (0.000045)	2.60 (0.00013***)	6.33 (0.00023***)	6.13 (0.000071*)
$(r_{t-1})$	1.16 (0.06)	2.19 (0.12)	1.62 (0.09)	1.92 (0.07)	2.21 (0.12)	0.22 (0.03)	1.19 (0.08)	2.68 (0.10)	4.78 (0.09)	1.74 (0.07)
$dummy\_break$	11.95 (0.0000079)	4.07 (1.03)	5.77 (0.80)	8.79 (0.56)	4.02 (1.03)	29.04 (0.54)	5.39 (0.59)	4.51 (0.64)	1.80 (0.54)	8.22 (0.49)
$dummy\_aum$		2.25 (0.27)	2.59 (0.27)	2.95 (0.28)	2.20 (0.28)	3.09 (0.28)	5.09 (0.28)	5.56 (0.28)	10.14 (0.28)	4.89 (0.35)
$dummy\_red$				-1.95*** (0.27)				-2.07*** (0.31)		-1.36*** (0.30)
$dummy\_neutra$				-7.09 (0.72)	0.31 (0.42)			-6.52 (0.72)	-0.04 (0.35)	-4.45 (0.35)
Summary statistics										
$R^2$	0.84	0.87	0.92	0.94	0.86	0.76	0.88	0.91	0.76	0.94
Adjusted $R^2$	0.83	0.86	0.91	0.93	0.86	0.75	0.88	0.91	0.74	0.93
$F$ statistic	117.62	109.30	149.50	211.06	87.55	216.37				
Probability ( $F$ statistic)	0.00	0.00	0.00	0.00	0.00	0.00				
Ramsey ( $U$ ), $p$ value	0.26	0.29	0.98	0.17	0.22	0.02				
Normality (Jarque-Bera test)	2.08	0.89	13.48	1.44	1.31	2.30				
Normality (probability)	0.35	0.63	0.00	0.48	0.51	0.31				
$J$ -statistic										
Probability ( $J$ -statistic)										
Instrument rank										
Chow breakpoint test		39 (Copom meeting no. 123)								
Observation		5.78								
$F$ statistic										
Probability ( $F$ statistic)										

Source: author's estimates.

\* Statistically significant at the 10% level; \*\* statistically significant at the 5% level; \*\*\* statistically significant at the 1% level.

COPOM: Monetary Policy Committee of Brazil.

OLS: ordinary least squares.

GMM: generalized method of moments.



Monetary Policy Committee indicates a possible decrease in the SELIC rate at the next meeting, interest rates, as measured by swap rates, decrease. Once again, the results suggest that communications have a stronger effect on the 360-day rate than on the 120-day rate.

## IV Conclusions

Communication gives the Central Bank of Brazil a means of explaining its intentions, decisions and rationale. Because the central bank's inflation-targeting framework allows discretion, communication becomes an important tool for local policymakers to explain their decisions and help economic agents understand how the Central Bank of Brazil views the state of the economy and the economic outlook. Economic agents are then better able to formulate their expectations, which has a direct effect on financial market variables.

To contribute to the literature on the effect of central bank communications and monetary policy on financial markets, this study has analysed the influence of these factors on the term structure of interest rates in Brazil. The study shows that monetary policy actions and communications by the Brazilian monetary authority have a significant impact on the process of expectations formation for interest rates with different maturities in Brazil. Not only do financial markets respond to the publication of the COPOM minutes, but they move in the desired direction. In this sense, the minutes of COPOM meetings serve as an important tool for guiding expectations for interest rates, since economic agents use the minutes of COPOM meetings to estimate the future state of the economy, which reduces uncertainty about future monetary policy actions.

The results highlight the beneficial effects of communication in providing information to the general public and to the markets in particular, thus serving as an important instrument of the central bank. According to the evidence found in this work, the relevance of communication by the monetary authority lies in its ability to affect expectations for future interest rates, which in turn inform several key decisions of economic agents. This is because monetary policy decisions affect

None of the coefficients estimated for *dummy\_neutra* are statistically significant. This means that when COPOM signals that the SELIC interest rate will not be changed at the next meeting, interest rates, as measured by swap rates, do not change as a result.

short-term interest rates, while the relevant variables for monetary policy are influenced by long-term interest rates. Since these interest rates are determined by expectations about the future course of the short-term interest rates, the importance of central bank communication lies in its ability to affect market expectations.

Central bank communication is not the only variable determining the process of expectations formation in financial markets. Other variables also play a role. Therefore, in addition to exploring the impact of monetary policy and communications on interest-rate expectations, the study also analysed the effects of macroeconomic variables, such as output fluctuations and inflation expectations. Future research could expand the model to consider the conduct of other economic policies, such as fiscal policy by incorporating variables such as the debt-to-GDP ratio, the debt profile and fiscal credibility.

The financial market reaction to monetary policy and central bank communications is undoubtedly a topic of great interest to market participants and central banks. Investors are interested in anticipating the central bank's decisions because such decisions may affect the value of their portfolios, while the central bank seeks to estimate the likely effect of monetary policy on asset prices and on the economy as a whole. Future research could productively incorporate not only the topics suggested by Blinder and others (2008), but also the influence of central bank communications on monetary-policy transmission mechanisms through the following channels: (1) financial asset prices and, hence, investment and consumption decisions through the wealth effect; (2) credit, through banks' postures and credit decisions; and (3) expectations for macroeconomic variables, such as inflation expectations, exchange-rate expectations and output growth expectations.

*(Original: English)*

APPENDIX

Supplementary tables and figures

TABLE A.1

**Glossary of key words and expressions from minutes of copom meetings**

Dummy variable	Key words
<i>dummy_aum</i>	<ul style="list-style-type: none"> <li>– The Central Bank will not allow supply shocks to lead to an increase in the inflation rate.</li> <li>– Maintenance of the interest rate represents a non-negligible risk for meeting the target (projected inflation above target).</li> <li>– Risks to achieving the goal.</li> <li>– Potential inflationary impacts of supply shocks yet to materialize.</li> <li>– Monetary policy should remain vigilant in order to avoid the propagation of shocks and exchange rate depreciation.</li> <li>– Monetary policy firmly committed to meeting the inflation targets.</li> <li>– Inflation remains high / monetary policy should be firm.</li> <li>– The monetary authority will be ready to adopt an active posture if projected inflation diverges from the target.</li> <li>– Inflation trend incompatible with the target.</li> <li>– COPOM will need to be less tolerant if shocks threaten to raise inflation above the target.</li> </ul>
<i>dummy_neutra</i>	<ul style="list-style-type: none"> <li>– Analysis of supply and demand indicates the absence of imbalances that could translate into inflationary pressures over the relevant horizon for the inflation-targeting regime.</li> <li>– General context is favourable for (suitable for / compatible with) price stability; economic environment consistent with the inflation target, but risk factors need to be monitored (the question remains about the rate of decline in inflation).</li> <li>– Economic activity rising, but incompatible with economic stability.</li> <li>– Inflation behaviour stable in line with the expectations of COPOM.</li> <li>– Monetary policy is appropriate, but should be administered with caution (risks remain).</li> <li>– Prospects for lowering inflation towards the target, but there is a risk that inflation could remain high (inflation path consistent with the target).</li> <li>– Rising inflation calls for caution in monetary policy.</li> <li>– Concrete probability that current inflation could deviate from the target requires additional caution in monetary policy.</li> </ul>
<i>dummy_red</i>	<ul style="list-style-type: none"> <li>– COPOM decided to continue the process of monetary easing.</li> <li>– Expected inflation below target/expectations consistent with the inflation risks/targets are less significant.</li> <li>– Consolidation of favourable perspectives for inflation in the medium term / COPOM considers that there is still room for further cuts in the selic rate in the future.</li> <li>– Benign scenario for the evolution of inflation (with reduction of uncertainties / favourable external scenario).</li> <li>– Economic activity consistent with supply conditions, with low probability of inflation pressures.</li> </ul>

Source: author's elaboration.

COPOM: Monetary Policy Committee of Brazil.

SELIC: Special System of Clearance and Custody.

TABLE A.2

**Kwiatkowski-Phillips-Schmidt-Shin (KPSS) stationarity test**

Series	Bandwidth	Test	1% critical values	5% critical values	10% critical values
<i>Swap_120</i>	6	0.08 <sup>b</sup>	0.21	0.14	0.11
<i>Swap_180</i>	6	0.08 <sup>b</sup>	0.21	0.14	0.11
<i>Swap_360</i>	6	0.08 <sup>b</sup>	0.21	0.14	0.11
<i>Spread<sub>120</sub></i>	6	0.07 <sup>b</sup>	0.21	0.14	0.11
<i>Spread<sub>180</sub></i>	6	0.07 <sup>b</sup>	0.21	0.14	0.11
<i>Spread<sub>360</sub></i>	6	0.07 <sup>b</sup>	0.21	0.14	0.11
Inflation expectation	6	0.22 <sup>b</sup>	0.21	0.14	0.11
<i>d</i> (inflation expectation)	2	0.04 <sup>b</sup>	0.21	0.14	0.11
Output gap	5	0.03 <sup>a</sup>	0.73	0.46	0.34
SELIC rate	6	0.06 <sup>b</sup>	0.21	0.14	0.11

Source: author's estimates.

Notes: Andrews automatic bandwidth selection, using Bartlett kernel. Schwarz information criteria (SIC).

SELIC: Special System of Clearance and Custody.

<sup>a</sup> denotes constant.

<sup>b</sup> denotes constant and trend.

TABLE A.3

**Phillips-Perron (pp) unit root test**

Series	Bandwidth	Test	1% critical values	5% critical values	10% critical values
<i>Swap</i> <sub>120</sub>	6.51	-1.738 <sup>c</sup>	-2.597	-1.945	-1.613
<i>Swap</i> <sub>180</sub>	5.99	-1.654 <sup>c</sup>	-2.597	-1.945	-1.613
<i>Swap</i> <sub>360</sub>	2.51	-1.614 <sup>c</sup>	-2.597	-1.945	-1.613
<i>Spread</i> <sub>120</sub>	1.70	-3.647 <sup>c</sup>	-2.597	-1.945	-1.613
<i>Spread</i> <sub>180</sub>	1.37	-3.525 <sup>c</sup>	-2.597	-1.945	-1.613
<i>Spread</i> <sub>360</sub>	0.08	-3.416 <sup>c</sup>	-2.597	-1.945	-1.613
Inflation expectation	3.06	-2.378 <sup>a</sup>	-3.522	-2.901	-2.588
<i>d</i> (inflation expectation)	0.72	-7.150 <sup>c</sup>	-2.597	-1.945	-1.613
Output gap	3.69	-3.304 <sup>c</sup>	-2.597	-1.945	-1.613
SELIC rate	14.5	-2.849 <sup>a</sup>	-3.522	-2.901	-2.588

Source: author's estimates.

Notes: Andrews automatic bandwidth selection, using Bartlett kernel. Schwarz information criteria (SIC).

SELIC: Special System of Clearance and Custody.

<sup>a</sup> denotes constant.

<sup>b</sup> denotes constant and trend.

<sup>c</sup> denotes none.

TABLE A.4

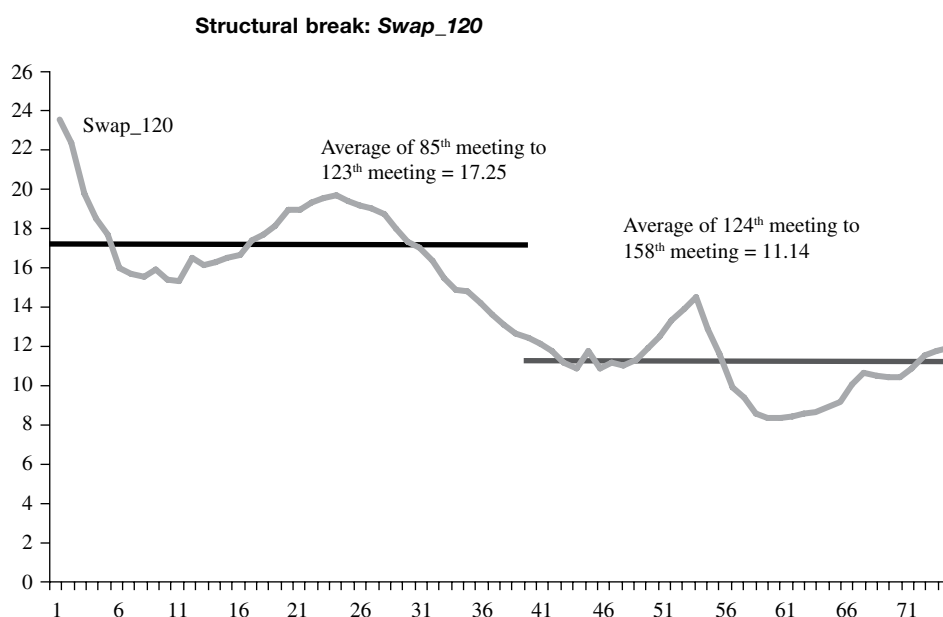
**aic, sc and hq criteria for var lag order**

VAR lag order	With constant			Without constant		
	AIC	SIC	HQ	AIC	SIC	HQ
0	7.74	7.94	7.82			
1	-0.13	1.23*	0.40*	-0.03*	1.13*	0.42*
2	0.14	2.68	1.15	0.25	2.60	1.18
3	0.29	4.01	1.77	0.49	4.01	1.88
4	0.53	5.42	2.47	0.82	5.52	2.68
5	0.27	6.34	2.67	0.57	6.44	2.89
6	-0.24	7.00	2.62	0.01	7.06	2.81

Source: author's estimates.

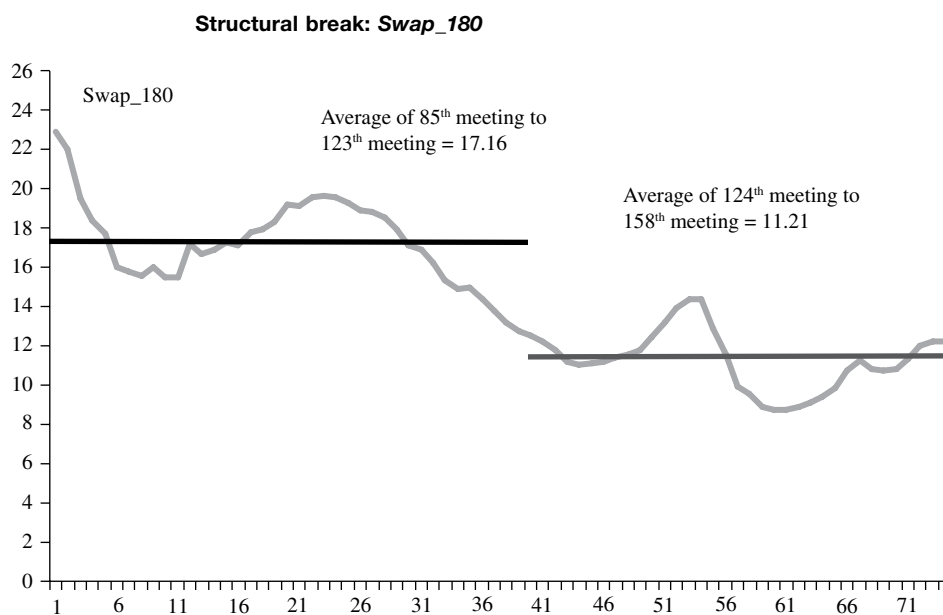
Notes: Akaike information criterion (AIC); Schwarz information criterion (SIC); Hannan-Quinn (HQ) information criterion. An asterisk indicates the lag order selected by respective criterion.

FIGURE A.1



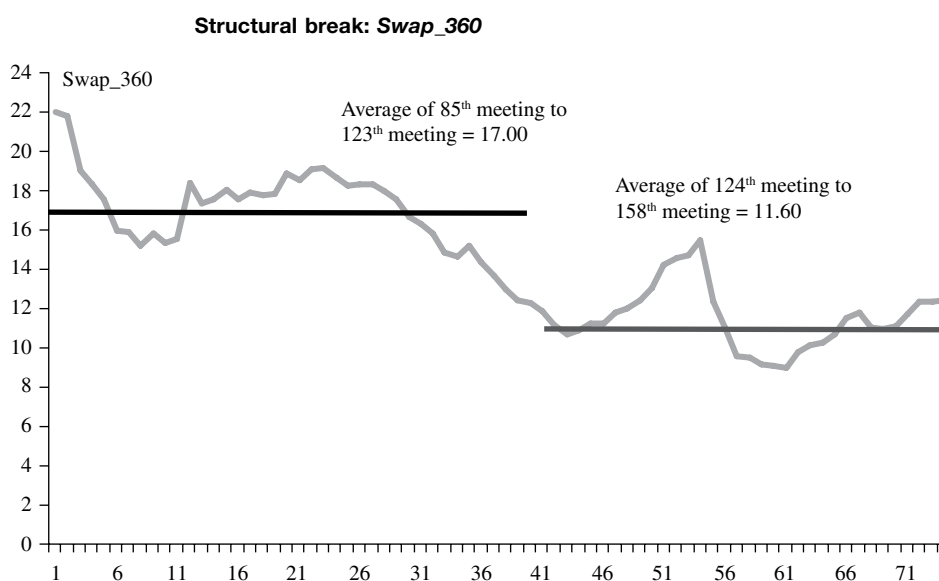
Source: author's elaboration.

FIGURE A.2



Source: author's elaboration.

FIGURE A.3



Source: author's elaboration.

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# Mexico: what is the impact of monetary policy on unemployment rates?

*Alejandro Islas C. and Willy Walter Cortez*

**ABSTRACT**

In this paper we analyse the effects of a monetary policy shock on Mexican unemployment rates. Unlike previous studies, this one re-estimates unemployment to produce alternative rates comparable to those of the Organization for Economic Cooperation and Development (oecd) member countries. We find that in response to tightening monetary policy, unemployment increases with a characteristic hump-shaped pattern also found in other studies. Our results are robust to different assumptions about the nature of Mexico's labour market.

**KEYWORDS**

Monetary policy, fiscal policy, labour market, unemployment, measurement, mathematical analysis, Mexico

**JEL CLASSIFICATION**

J60, E24

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# I

## Introduction

Since the late 1950s and early 1960s, inflation has become one of the major concerns in both industrialized and emerging economies. Friedman (1976) illustrated the negative impact of both high inflation and inflation volatility on economic performance. High inflation, for example, could reduce political cohesiveness since it overruns institutional arrangements and financial contracts based on a “normal” long-term price level. Higher price volatility, by increasing uncertainty, could lower economic efficiency and render market prices a less efficient system for coordinating economic activity. Because of all these negative effects on economic growth, central banks often consider inflation to be the greatest problem a country faces.

For Mexico, the empirical evidence concerning the negative impact of inflation on growth is somewhat mixed. For example, a recent study by Grier and Grier (2006) found that inflation uncertainty had had a negative and significant effect on Mexico’s output; moreover, higher average inflation rates had induced higher inflation uncertainty, further affecting growth. However, Risso and Sánchez (2009) argue that inflation has had a positive impact on growth as long as it has been below the threshold level of 9%. Inflation rates higher than this threshold have had a negative effect on growth.

By any reckoning, Mexico’s monetary policy over the past 25 years has been successful in achieving price stability: inflation declined from a monthly average rate of 4.3% during the 1980s to 0.4% during the early years of the twenty-first century. Mexico’s monetary authorities have used different monetary instruments to pursue price stability, ranging from exchange-rate controls to base money control to inflation targeting. To achieve its inflation targets, Banco de México<sup>1</sup> has maintained a policy of controlling the amount of money available to commercial banks via the balances they hold with it, resulting in changes to domestic interest rates. Higher interest rates, for example, have resulted in contractions of aggregate demand that have lowered domestic inflation. Furthermore, in an open economy with high capital mobility and flexible exchange rates, higher domestic interest rates further lower the inflation rate via appreciation of the domestic currency: an

appreciated domestic currency not only restrains exports, but also lowers the domestic prices of imported goods and increases the prices of exportable goods.

Empirical studies of the neutrality of monetary policy in Mexico present conflicting evidence. For example, Mendoza (2003) found that Mexico did not have a long-run volatility trade-off between output and inflation, so that monetary policy affected only prices in the long run. Galindo and Ros (2005), on the other hand, found that monetary policy had had some impact on the real sector.

Even though the negative impact of Mexico’s tight monetary policy on aggregate demand has been recognized,<sup>2</sup> a thorough discussion of how this policy has affected the labour market has yet to take place. This is a major shortcoming of the current research agenda in Mexico because it means that the cost of achieving price stability in terms of workers’ welfare is overlooked. Even if we recognize that price stability is a necessary condition for economic growth in the long run, we should not overlook the short- and medium-run costs for workers’ well-being.

We further explore the question of how responsive unemployment is to monetary policy in Mexico, a country that began its successful price stabilization programme during the second half of the 1980s. A related question is how permanent the impact of monetary policy on the unemployment rate is.

The model used to carry out the empirical analysis rests on the assumption that money is non-neutral; that is, we contend that changes in unemployment rates can be partly explained by monetary policy implemented to control inflation. Our central argument is that by affecting aggregate demand and thus output, monetary policy has some impact on unemployment rates. Our analysis involves the estimation of a structural vector autoregression model (SVAR). Variance decomposition shows which shocks have caused movements in the variables during the sample period, while the impulse response functions contain information about the magnitude and duration of the effect of a specific structural shock.

Another distinguishing feature of our analysis is that we consider both the official unemployment rate

<sup>1</sup> Banco de México is Mexico’s central bank.

<sup>2</sup> See, for instance, Díaz de Leon and Greenham (2000).

and an alternative one based on the definition used by the Current Population Survey (CPS) of the United States Bureau of Labor Statistics. We use the latter as a response to some criticisms made of the official unemployment rate.

Our results indicate that when the alternative unemployment rate is used, tightening monetary policy causes unemployment to increase with a characteristic hump-shaped pattern found in Alexius and Holmlund (2007) and Ravn and Simonelli (2008). The unemployment rate peaks after the second quarter at a level 0.26 points above its original level, and then slowly reverts back to that original level. Error variance decomposition results indicate that the monetary policy shock accounts for 3%

to 27% of the fluctuation in unemployment. When we use the official unemployment rate, however, monetary policy shocks do not have much impact.

The paper is organized as follows. Section II presents a brief discussion of the non-neutrality of money and describes how monetary policy can affect unemployment. Section III reviews the monetary policies followed by the Mexican authorities during the period of analysis, while section IV presents some key characteristics of the Mexican labour market and introduces an alternative indicator of unemployment rates. Section V discusses the methodology used to carry out the empirical analysis, section VI presents the main empirical results, and section VII concludes.

## II

### Is money neutral?

Discussions about money neutrality can be traced back to Cantillon's essay of 1775. His argument was that, under the gold standard, increases in the money supply would encourage higher spending, which in turn would stimulate production. This positive effect on production would be short-lived, however, for higher demand would also induce higher prices which, in turn, would have a negative impact on production. We find the same argument in Hume's (1985) paper on money. His views were restated by Newcomb (1885) and Fisher (1911) and became what is now known as the quantity theory of money.

The non-neutrality of money, on the other hand, is a key feature in Keynesian economics. Keynes's view about the impact of money on real variables is found in his *General Theory of Employment, Interest and Money*. Central to his argument is the role played by domestic interest rates in inducing changes to aggregate demand. In the Keynesian framework, the rate of interest is the reward for parting with liquidity. To the extent that the interest rate affects the marginal efficiency of capital, which in turn determines investment, changes in the quantity of money will affect output and employment. The overall impact on aggregate demand is further strengthened by the responsiveness of consumption to changes in investment. In Keynes's view, the interest rate depends partly on the state of liquidity preferences and partly on the quantity of money, so that changes in the quantity of money will induce changes in the

interest rate, *ceteris paribus*. Chick (1983), in turn, argues that interest rates will be affected by open market operations or by variations in banks' reserves or reserve requirements designed to affect liquidity or the supply of credit, or both.

Given the capacity of interest rates to affect output and thus unemployment, the monetary authority can use monetary policy to induce changes in the domestic interest rate in order to achieve certain specific goals. If, for instance, inflation is assumed to be caused by excess demand, then higher interest rates can be used to control inflation via the contraction of aggregate demand. Moreover, in an open economy with high capital mobility, higher interest rates will induce appreciation of the domestic currency, which will not only restrain price increases but also further reduce aggregate demand.

Taylor (1994), on the other hand, has suggested that the monetary authority's efforts to keep prices stable may also cause production to fluctuate more, while attempts to smooth the production cycle may induce higher price volatility. To reduce price volatility, monetary policy would have to be biased even more towards restraining aggregate demand.

In general, there is a consensus about the non-neutrality of money in the short run. Recently, however, there has been a growing debate about the long-run impact of monetary policy on the real sector. Blanchard (2003), for instance, contends that money is non-neutral and that monetary policy can have large and long-lasting

effects on real interest rates and, by implication, on unemployment. There are three possible channels of transmission for this. One could be the effect of the real interest rate on current unemployment. The longer a spell of unemployment is, the likelier the unemployed are to lose their skills. Therefore, sustained high unemployment will lead to an increase in the natural rate itself. A second possible channel is capital accumulation: the real interest rate affects the cost of capital, the cost of capital affects capital accumulation and capital accumulation affects the demand for labour and thus unemployment. Therefore, a sustained increase in real interest rates leads first to an increase in the actual unemployment rate and later, as capital accumulation decreases, to an increase in the natural rate. The third potential mechanism might be the effect of the real interest rate on a firm's mark-up. To the extent that this had a direct impact on employment, unemployment would be affected by monetary policy through this mechanism.<sup>3</sup>

The theory of long-run neutrality of money predicts that tight monetary policy will not affect the growth path; yet Schettkat and Sun (2008) illustrate that in Europe, for example, monetary policy has been asymmetrical because of central banks' fear of inflation. They present evidence that this asymmetry has lowered long-run trend growth

in some European economies.<sup>4</sup> This result is borne out by other studies that have also found evidence against long-run money neutrality.

To some extent, this asymmetry of monetary policy is an intrinsic feature of inflation targeting. Studies of the impact of asymmetric monetary policy on output in less developed economies are uncommon. One of the few that do exist is Galindo and Ros (2005). They argue that monetary policy in Mexico has been biased towards exchange-rate appreciation since inflation targeting began, i.e. the central bank has responded only when the exchange rate has been undervalued, not when the real exchange rate has been overvalued. Furthermore, the negative impact of real exchange-rate appreciation on output means that monetary policy (or inflation targeting) has restrained economic growth in Mexico.

A conclusion we can draw from this review is that there are strong theoretical arguments for expecting not only short-run non-neutrality but long-run non-neutrality as well. The question then becomes whether monetary policy has had a short- and long-term impact on Mexican unemployment. In the next section we briefly describe the monetary and fiscal policies implemented in Mexico during the period from 1987 to 2004.

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<sup>3</sup> There is a fourth potential mechanism which falls within the real business cycle approach: the labour supply depends on interest rates. This is an area that has not yet been investigated for less developed economies.

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<sup>4</sup> Schettkat and Sun (2008) give the following account. An external negative shock pushes the economy into a recession which is not fully counteracted by monetary policy. During the upswing, fearing inflation, the central bank does not fully accommodate the recovery. As a result, the economy will not swing back to its original growth path but will remain below it.

### III

## Monetary and fiscal policies in Mexico

Our analysis begins in 1987, in the midst of a period characterized by high macroeconomic instability. During that time, Mexico's monetary policy had the twin objective of promoting economic growth with price stability (Garriga, 2010). A distinguishing feature of this monetary policy was that it attempted to control inflation through exchange-rate stability. Messmacher and Werner (2002) argue that the Mexican authorities used multiple instruments to control inflation, with fiscal instruments being prominent alongside exchange controls. In addition, the government introduced a temporary wage freeze and price controls as part of an Economic Solidarity Pact.

The use of these instruments is explained by the assumption that inflation was mainly caused by fiscal deficits which pushed aggregate demand above aggregate supply. In this context, excess demand was seen not only as inducing higher domestic prices but also as leading to current account deficits. External deficits, in turn, would create pressure for devaluation of the exchange rate, which could further exacerbate inflation (Garriga, 2010).

As most of the price and wage controls were gradually lifted, the anti-inflation programme evolved into a more orthodox strategy in which fiscal adjustment and an exchange-rate anchor became the main policy elements. Between 1988 and 1994, the Mexican authorities made several modifications to the exchange-rate system, with the dual and fixed system being replaced by a pre-announced rate of devaluation (where the rate of devaluation was set below the rate of inflation). In November 1991, Mexico's central bank implemented a narrow exchange-rate band with a sliding ceiling (Messmacher and Werner, 2002). Between 1992 and October 1993, the nominal exchange rate was remarkably stable. In December 1993, Mexico's Congress granted the central bank operational autonomy and established that its only objective was to preserve the stability of the purchasing power of money. This replaced the twin objectives it had had until then.

Throughout most of this period, Mexico's managed exchange-rate regime was supported by prudent fiscal policy. Indeed, the country moved from a fiscal deficit of 12.5% of gross domestic product (GDP) in 1988 to a fiscal surplus in 1992 (Garriga, 2010). After 18 months, this combination of policies yielded the expected results: inflation fell drastically to less than 20% annually. From then on, though, the pace of disinflation became sluggish.

Sánchez (2005) maintains that between 1988 and 1994, the amount of credit going to the private sector grew significantly, at annual rates of about 30%. The absence of an adequate supervisory and regulatory framework, compounded by poor accounting standards and insufficient recognition of past loans falling due, among other things, meant that this lending explosion negatively affected the profitability of the banking system. Combined with a lack of consistency between monetary and exchange-rate policies, the problems of the banking system precipitated a very serious crisis at the end of 1994.

In December 1994, faced with a serious balance-of-payments and financial crisis, the central bank was no longer able to defend the predetermined United States dollar-peso parity and so allowed the peso to float. The peso immediately depreciated and domestic prices increased steadily, rising at a monthly rate of 3.6% throughout 1995. The interbank interest rate increased from 17% in the third week of August 1994 to 110% in the third week of March 1995, which induced a severe slump in the real economy. Output and employment suffered considerably: output fell by 6.2%, while open unemployment was up to 7.6% by mid-1995. Sánchez (2005) states that the recession and unemployment caused by the financial crisis were the worst since the Great Depression.

The new strategy achieved price stability indirectly, since it sought to modify agents' expectations as well as interest rates and the exchange rate. Because these elements affect aggregate demand, the central bank was able to determine the future behaviour of inflation (Díaz de León and Greenham, 2000). To induce changes in domestic interest rates, the central bank decreed changes in the cumulative monthly balance held with it by commercial banks (the *corto*).<sup>5</sup> In the monetary authorities' view, inflation was a problem caused by excess demand.<sup>6</sup> Therefore, unexpected increases in

<sup>5</sup> On 21 January 2008 the central bank adopted the overnight interbank rate as its operating target, replacing the measure used hitherto, which was the balance in commercial banks' current accounts held with the central bank.

<sup>6</sup> Garriga (2010) goes further and argues that the new monetary authorities did not believe in the existence of a trade-off between unemployment and inflation.

actual inflation or inflation expectations were dealt with by reducing the *corto*, thereby inducing commercial banks to bid up interest rates.

The evolution of monetary policy since the adoption of the floating exchange-rate regime has included the following main elements. First, adoption of quantitative objectives based on aggregates such as the monetary base, predominant during 1995-1997. Second, in early 1998 the central bank announced a change in its strategy: it began targeting inflation. In particular, the 1999 monetary programme set an annual inflation goal of no more than 13% for the National Consumer Price Index and proposed, as a commitment for the next five years, a gradual convergence with the inflation rate of the country's main trading partners. In 2001, the goal of monetary policy was to stabilize the National Consumer Price Index at 3%. However, in mid-2002 the central bank announced that this commitment would have a margin of tolerance of  $\pm 1$  percentage point.

Castellanos (2000) also shows that changes in the *corto* have had a strong impact on the entire interest rate structure and argues that the impact is strongest for short-term interest rates. The magnitude of this effect has

changed over time, and since June 1998 it has been more unstable. In point of fact, Gaytán and González (2006) found that there had been a change in the transmission mechanisms of monetary policy as a result of inflation targeting. They argued that exchange-rate fluctuations were having a smaller effect on price formation, the formation of inflation expectations and nominal interest rates, while changes in nominal interest rates had been more effective in influencing the real exchange rate and inflation.

To summarize, in this section we have described the monetary policy used by Mexico's central bank to control inflation. The instruments used have varied over time. During the early years, exchange-rate and price controls were used intensively. Then a fixed exchange rate was replaced by a floating rate to give the central bank the freedom to control monetary aggregates and interest rates, or both. During this second stage, interest rates were the predominant instrument used to control inflation. To the extent that both interest rates and exchange rates affect output and thus employment, we contend that monetary policy has the potential to have a significant impact on unemployment.

## IV

### The Mexican labour market

The purpose of this section is twofold. First, we describe key characteristics of Mexico's labour market with a view to providing a better understanding of employment dynamics and the way unemployment might respond to policy shocks. Second, in the light of some criticisms made of the official unemployment rate, we estimate an alternative unemployment rate and use it to assess the impact of monetary policy.

#### 1. The nature of the Mexican labour market

There are two contrasting views of the nature of the Mexican labour market. On the one hand, there is the idea that it is heavily regulated by laws that impede job creation (Heckman and Pagés, 2001; Gill and others, 2001). In this view, output growth does not translate into employment growth but rather into real wage changes. It is argued that job security provisions (which include severance payments) increase dismissal costs for firms. These costs discourage firms from dismissing workers

whenever there is a negative shock and reduce job creation in upturns. Heckman and Pagés (2001) found that Mexico exhibited one of the highest indices of job security in Latin America, which implies that it has one of the most regulated markets in the region.

Employment rigidity can also be increased by the existence of labour unions. Maloney (2009), for example, argues that Mexican unions value employment over wages, so that output fluctuations affect wage rates more than employment. This can be explained by several factors. First, Mexico has no unemployment insurance; hence, workers value employment stability more than wages. Second, since the early twentieth century the major unions have had a close and long-standing relationship with the government and have cooperated in implementing policies to reduce inflationary pressures. In particular, since the late 1980s unions have settled, on average, for nominal wage growth below inflation. Third, job growth was slow relative to population growth during the late 1980s and early 1990s. These elements explain

why output fluctuations are correlated more with real wage fluctuations than with employment changes. They might also explain Alcaraz's conclusion that real wages do not depend on unemployment in the formal sector (Alcaraz, 2009).

On the other side of the debate, there is the argument that even though Mexico's labour market is heavily regulated by employment laws, in practice compliance with such laws is very limited. Moreover, a number of schemes introduced since the late 1980s have increased employment flexibility (Marshall, 2004). Among these schemes we find the increased use of short-term contracts to avoid the inflexibility of permanent employment. This is particularly true of the maquila and service sectors, the fastest-growing sectors in the Mexican economy since the late 1980s.

Furthermore, Alcaraz and others (2008) contend that the employment share of the service sector has increased at the expense of Mexico's manufacturing employment since 2000. According to these authors, this recomposition of employment has entailed not only an increase in the service sector's employment share but an expansion of the informal sector as well. The upward trend of employment in the informal sector has occurred despite the wage differential between formal and informal employment. They also find evidence that the rate of transition between formal and informal employment is higher than that between manufacturing and service sectors. They point out that higher mobility between the formal and informal sectors (and vice versa) would indicate the existence of institutional labour market rigidities in Mexico's formal sector.

The existence of a large informal sector<sup>7</sup> somewhat offsets the employment rigidities caused by labour regulations in the formal sector. The question is whether or not this offsetting force is strong enough for us to be able to characterize the Mexican labour market as being fairly flexible.

In short, two types of factors coexist within Mexico's labour market. On the one hand, there are some labour market institutions that increase employment rigidity while also increasing real wage flexibility; namely, labour regulation and unions. On the other hand, we find elements that offset the negative effect of these on employment flexibility, including weak enforcement of labour regulations and the existence of the informal sector. A priori, we do not know which of these two types of factors has a stronger effect on employment flexibility.

<sup>7</sup> Alcaraz (2009) argues that the informal sector may represent as much 40% of the Mexican labour force.

## 2. How accurate are Mexico's unemployment figures?

To an outsider, Mexico's low official unemployment rates represent a puzzle. How could a country with such low rates of unemployment grow so little? At about 3.5%, Mexico's unemployment rate over the last 20 years or so has been on average one of the lowest among the members of the Organisation for Economic Cooperation and Development (OECD), with only Luxembourg and the Republic of Korea presenting lower rates.<sup>8</sup> Yet its average annual rate of per capita GDP growth has been 1.2%, far lower than the 5.8% reported by the Republic of Korea, which has similar unemployment rates.<sup>9</sup>

Several authors have argued that Mexico's low official unemployment rates can be explained by a combination of several elements, namely: (i) the lack of unemployment benefits, (ii) the existence of a large, fairly well-remunerated informal sector, (iii) high rates of labour migration to the United States, and (iv) the exclusion of rural areas when unemployment rates are estimated, as unemployment is higher there than in urban areas.

Our contention, however, is that although some of these factors might partially account for the low rates of unemployment in Mexico, a more significant explanation can be sought in some methodological issues relating to the estimation of unemployment rates. Fleck and Sorentino (1994) and Martin (2000), for example, argue that if the concepts and methodology used by the United States Bureau of Labor Statistics are followed, Mexican unemployment rates increase by between 40% and 70%. Revenga and Riboud (1993) reach the same conclusion, although for a different reason: the official statistics do not take into account the temporarily unemployed, or those who are unemployed but not included in the surveys.<sup>10</sup>

To tackle one of the main criticisms of the official statistics, we re-estimated Mexico's unemployment rate using the quarterly National Survey of Urban Employment (ENEU) and following the CPS criteria. First, we considered

<sup>8</sup> OECD members averaged a rate of 5.93% between 1987 and 2004 (<http://stats.oecd.org>).

<sup>9</sup> Between 1987 and 2004, Mexico's total real GDP grew at an annual average rate of 3.01%, while its population grew by an average of 1.8% a year. The Republic of Korea, on the other hand, grew at an annual rate of 6.2%, while its population growth was 0.33% during the same period (output data are from the OECD website <http://stats.oecd.org>, while data on population growth come from *World Population Prospects: The 2006 revision*, United Nations, 2007, table A.8).

<sup>10</sup> This is particularly relevant when a person is unemployed and not seeking work at the time of one survey but then finds a job before the next survey is carried out and thus features as employed.

only workers between the ages of 16 and 75.<sup>11</sup> Second, to obtain the overall unemployment rate, we used only the original 16 cities included in the ENEU. Third, we did not treat as employed those who were on strike or laid off because of shortages of working capital or raw materials or a lack of repairs. We also excluded people working without pay for up to 15 hours a week. That is, they were not categorized as part of the economically active population (EAP) or as employed. The resulting series allows Mexico's unemployment rates to be compared directly to those of the OECD countries.

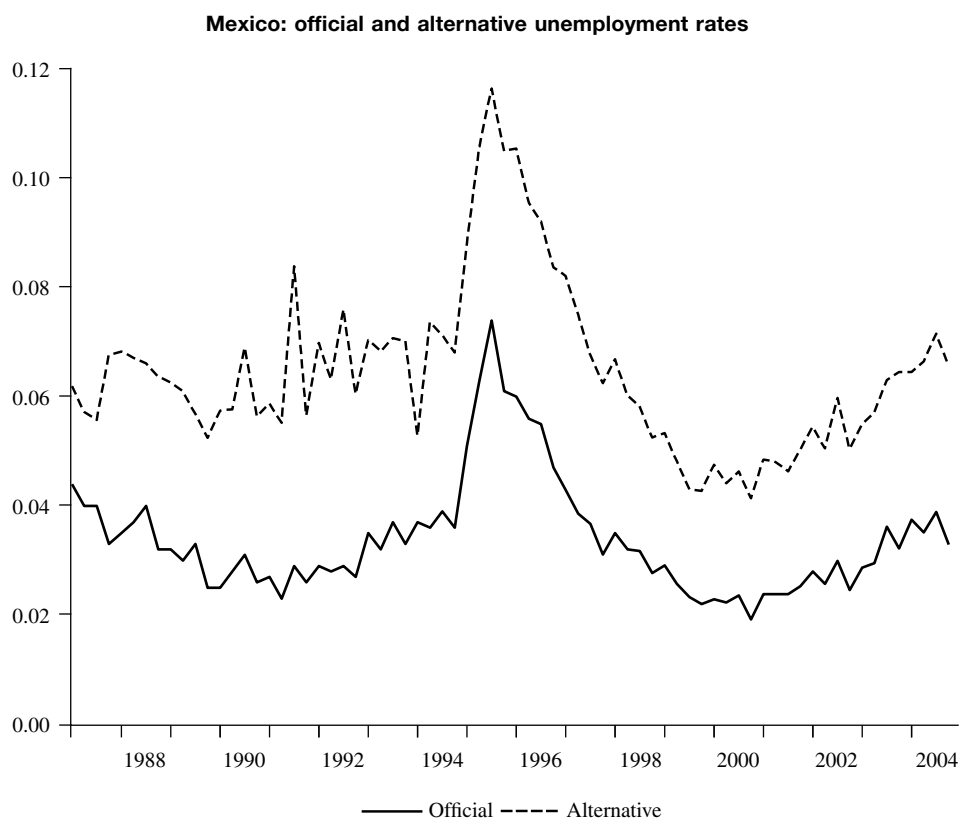
The evolution of official and alternative unemployment rates is displayed in figure 1. Compared to the official rates, the alternative measure is about 100% higher, i.e. the average rate of unemployment for the 1987-

2004 period goes up from 3.4% to 6.4%. The overall behaviour of the two series, however, is fairly similar. The main difference is seen during the period prior to the 1995 crisis. In the early 1990s, both series show a slight upward trend which peaks by the end of 1995. The unemployment rate begins to decline rapidly in 1996, bottoming out by the end of 2000 in both series. This improvement is short-lived, however, for in the next year unemployment begins to trend upward again. Both unemployment series exhibit large cyclical fluctuations as well as short-run variations.

In the previous section we described the main monetary and fiscal policies followed in 1987-2003. We argued that the main objective of both sets of policies was to control inflation. To do this, however, the central bank needed to restrain aggregate demand, which in turn resulted in a contraction of output and thus in an expansion of unemployment. The econometric technique used in this analysis is presented below.

<sup>11</sup> Prior to 2005, Mexican statistics covered people working from the age of 12. In response to criticisms, the lower age limit was raised to 14 in 2005.

FIGURE 1



Source: National Institute of Statistics and Geography (INEGI), National Survey of Urban Employment (ENEU), various years.

# V

## Methodology

We use a structural vector autoregression model (SVAR) to analyse the dynamic impact of monetary policy on unemployment. It should be noted that another way to perform the analysis is through the use of a Markov-switching vector autoregression model. Given the small sample size of our data set, however, the degrees of freedom would have been quickly eroded, which is why we did not carry out an analysis of that type. Our analysis is complemented by estimation of the impulse response function and variance decomposition.

Thus,

$$AX_t = B(L)X_{t-1} + \varepsilon_t \quad (1)$$

where  $X_t$  is an  $(nx1)$  vector of endogenous variables;  $A$  is an  $(n \times n)$  matrix of coefficients describing the contemporaneous correlation among the variables;  $B(L)$  is an  $(n \times n)$  matrix of polynomials in the lag operator,  $L$ ; and  $\varepsilon_t$  is an  $(nx1)$  vector of structural shocks. Thus, each of the system's variables can be influenced by its own idiosyncratic shocks and by shocks from the other variables. The matrices  $A$  and  $B(L)$  determine how shocks to each variable are transmitted through the system, both contemporaneously and in subsequent periods. The reduced form of the SVAR can be expressed by:

$$X_t = A^{-1} B(L)X_{t-1} + A^{-1} \varepsilon_t = C(L)X_{t-1} + e_t \quad (2)$$

where  $e_t = A^{-1} \varepsilon_t$  describes the relationship between the model's reduced and structural shocks. In fact, the model's reduced shocks are linear combinations of the pure structural shocks.

A necessary condition for establishing the relationships between the reduced and structural shocks is that the system be identified. As is well known, to identify the structural model from an estimated VAR, it is necessary to impose  $(n^2 - n)/2$  restrictions on the structural model.

Several different methods of identification are available in the literature on SVARS. Blanchard and Diamond (1989) use a priori assumptions about the signs of structural parameters to identify the range of values of matrix  $A$  that are consistent with the data. Shapiro and Watson (1988) and Blanchard and Quah (1989) use assumptions about long-run multipliers to

achieve identification. Blanchard and Quah (1989) start with orthogonal shocks. In a two-variable model, one is assumed to represent a supply shock and the other a demand shock. For example, productivity shocks are separated from demand shocks by assuming that demand shocks do not affect real output in the long run while productivity shocks do. On the other hand, Sims (1980) argues that identification is achieved using short-run restrictions on the timing of the effects of shocks only, i.e. monetary policy shocks are frequently identified by assuming that changes in the interest rate do not affect inflation in the same period because prices are sticky and respond with a delay. In our analysis, we follow Sims' (1980) approach to identify our model.

### 1. Definition of variables and data

Our SVAR includes the following variables: unemployment rates, the output gap (since demand for labour is a derived demand that depends on the fluctuations of output), and an indicator of monetary policy. We also include three variables that are thought to affect Mexican unemployment: United States output, an indicator of fiscal policy, and labour productivity. The inclusion of these variables in our analysis is justified below.

Our sample period covers both fixed and floating exchange-rate regimes. Under a fixed exchange-rate system, central banks lose the freedom to determine their monetary policy, while with floating exchange rates they gain control over monetary policy and can use it to attain their specific goals. With a floating exchange rate, moreover, interest rates and the exchange rate become interdependent on each other. The effects they have on output and thus unemployment operate through different mechanisms. Instead of using exchange rates and interest rates independently as instruments for measuring monetary policy, we use a composite index of monetary policy. Specifically, we use the Monetary Conditions Index (MCI), which captures the total effect (direct and indirect) of the exchange rate and the interest rate on domestic output.

The MCI is typically measured as the weighted sum of changes in the short-term interest rate and exchange rate relative to a base period, with the weights being generally derived from empirical econometric models reflecting the estimated impact of these variables on



output or inflation.<sup>12</sup> Thus, the MCI determines the extent of tightening or loosening of monetary conditions in an economy by capturing deviations in these two variables from the base period. Accordingly, lower interest rates drive looser or more expansionary monetary conditions and higher rates denote tighter conditions, which may also be achieved through domestic currency appreciation or a combination of both measures.

In our work, we use the MCI as an indicator of policy stance. For instance, the MCI calculated relative to a base period indicates whether policy has become tighter or looser relative to that base period. In this construct, the absolute value of the MCI does not provide the basis for any meaningful interpretation; rather it is the direction of movement which reveals the change in policy stance. Using the estimated coefficients of the interest-rate and exchange-rate variables in the cointegration vector of the aggregated output system, the ratio or weight of the MCI index turns out to be 1:4.2, which indicates that the exchange rate has a larger impact on aggregate output than interest rate effects.<sup>13</sup>

We define the output gap as the difference between observed output and potential output, and we assume that potential output is best characterized as being driven by a stochastic process and can be obtained using the Hodrick-Prescott filter.<sup>14</sup> Thus, the domestic output gap is  $\tilde{y} = (y - y^*)$ , where  $y^*$  is the permanent component of output,  $y$  being observed real GDP.

Insofar as Mexico's stabilization programme included the reduction of fiscal deficits, we need to control

for the impact of fiscal policy on unemployment. We therefore introduced the structural primary surplus into our model. The structural primary surplus is calculated as the difference between the observed deficit and the cyclical deficit. The structural deficit, in other words, is the government deficit adjusted for business cycles measured as the ratio of potential output to actual output. Following Pastor and Villagómez (2007), we adjust the government deficit for business cycle fluctuations.<sup>15</sup> This adjustment is made by multiplying tax revenues by the ratio of potential GDP to actual GDP, raised to the power of the elasticity of tax revenues to actual GDP. To construct the structural primary surplus, budgetary data obtained from the Ministry of Finance and Public Credit were used.

Several studies have shown the high degree to which Mexican business cycles are co-dependent upon those of the United States. This finding is self-evident, given that more than 90% of exports go to the United States economy. To control for the impact of this on unemployment in Mexico, we include the United States output gap,  $\tilde{q}$ , as the indicator of foreign demand in our model. Thus,  $\tilde{q} = (q - q^*)$ , where  $q^*$  is potential United States output, estimated using the Hodrick-Prescott filter, and  $q$  is observed United States output.

Finally, we also include a proxy for technical change. It has been argued that labour-saving technical change can affect unemployment rates, and to control for such changes in technical efficiency we introduce labour productivity into our model as an exogenous variable. Labour productivity is measured as output per employed worker.

We use available quarterly data from the first quarter of 1987 to the fourth quarter of 2004, giving a total of 74 observations. The Mexican output gap is estimated from real GDP, obtained from the National Institute of Statistics and Geography (INEGI), while the United States output gap is calculated from United States real GDP as obtained from the main OECD economic indicators. The indicator of Mexico's fiscal policy is the fiscal surplus, while the indicator of labour productivity is output per worker.

We use both the official and the alternative unemployment series, both of them seasonally adjusted using TRAMO-SEATS. By the same token, the Mexican and

<sup>12</sup> We derived the relative weights of the interest rate and exchange rate for the MCI from an aggregate demand equation. The literature has suggested three approaches to estimating relative weights: (i) the single equation approach, involving estimation of either an output or a price equation; (ii) the trade share approach, involving estimation of an equation for the ratio of long-run exports to GDP; (iii) the multiple equation approach, involving estimation of the system of equations through cointegration. We used vector autoregressive (VAR) and Johansen cointegration models to avoid omitted variable bias, dynamic exogeneity and feedback problems. The cointegration approach takes care of these problems.

<sup>13</sup> Recent empirical studies have shown that there has been a change in the transmission mechanism of monetary policy since 2001 as a consequence of the new anti-inflation strategy based on inflation targeting. Gaytán and González (2006) argue that output and inflation have become more sensitive to interest rates, whereas the real exchange rate has become less important. Our results differ somewhat because our period of analysis goes back to 1987, when the exchange rate was the nominal anchor. In fact, the nominal exchange rate was the predominant instrument until 1994.

<sup>14</sup> Choosing a large  $\lambda$  in the Hodrick-Prescott filter implies the view that supply shocks are deterministic and that variations in output come almost entirely from demand shocks. Choosing a very small  $\lambda$  implies the view that most variations in output are also variations in potential or trend output and hence are driven by supply shocks.

<sup>15</sup> According to Hayford (2005) the logic behind structural measures is that "One problem in identifying the effect of fiscal policy [...] is that government revenues and transfer payments respond to fluctuations in economic activity as well as potentially cause fluctuation in economic activity. One way to deal with this problem is to control for the effect of cyclical fluctuations by using cyclically adjusted or structural measures of fiscal policy."

foreign output gaps were obtained using the Hodrick-Prescott filter with  $\lambda = 1600$ , following seasonal adjustment using TRAMO-SEATS.

## 2. Identification

The SVAR model includes three endogenous variables: monetary policy ( $mci$ ), the domestic output gap ( $\tilde{y}$ ) and unemployment ( $u$ ), and three exogenous variables: the United States output gap ( $\tilde{q}$ ), productivity ( $p$ ) and fiscal policy ( $g$ ). These last three variables were tested for exogeneity following Hyeon-Seung (2005). We found that  $\chi^2(48) = 37.007[0.87]$ .<sup>16</sup>

The order of matrix  $A$  is as follows. Monetary policy is shown first, followed by excess domestic demand and then the unemployment rate. Monetary policy is identified by assuming that changes in the interest rate do not affect excess demand in the same period because prices are sticky and respond with a delay. This implies that  $\alpha_{21} = 0$ . Given the existence of a large informal sector and the high degree of transition between formal and informal employment (see section IV, subsection 1), unemployment rates will not necessarily change as output changes. Output fluctuations will induce flows between the formal and informal sectors, so the unemployment rate will remain fairly rigid. This translates into

<sup>16</sup> Values in parentheses refer to the degree of freedom and those in square brackets are the marginal significance levels of the test.

$\alpha_{32} = 0$ . It is important to note that labour market rigidity is not posited on strict labour legislation preventing output fluctuations from affecting unemployment. Instead, rigidity is posited on the existence of a large informal sector and high labour mobility between the formal and informal sectors so that unemployment is not affected contemporaneously by output fluctuations. It is paradoxical that, in Mexico, labour rigidity results from the existence of a labour market that is very flexible indeed.<sup>17</sup>

The third restriction is derived from the fact that monetary policy does not depend on unemployment, i.e.  $\alpha_{13} = 0$ .

<sup>17</sup> Calderon-Madrid (2000), Alcaraz and others (2008) and Alcaraz (2009) present some evidence for the high degree of labour mobility between the formal and informal labour markets. The existence of a large informal labour market that is closely intertwined with the formal one means that output fluctuations do not necessarily translate into fluctuations in unemployment, or vice versa. In other words, the existence of a large informal labour market indicates that the relationship between the cyclical components of output and unemployment is not necessarily linear or contemporaneous. Instead, we might observe that a given change in output will induce higher labour mobility between the formal and informal sectors so that the unemployment rate remains constant. Consider, for example, that if employment is decomposed into its formal ( $e_f$ ) and informal ( $e_i$ ) components, then the following should be true:  $u = 1 - e_f - e_i$ . That is, variations in unemployment will ensue only if formal and informal employment move in the same direction, which in reality does not occur. Thus, the impact of output variations on unemployment will be fairly low unless the informal sector lacks the requisite flexibility. This holds true even in the face of the institutional rigidities mentioned by Heckman and Pagés (2001).

# VI

## Empirical analysis

In this section, we present the estimates of the parameters and carry out some complementary analyses such as impulse response analysis and analysis of variance. We also conduct tests to verify the robustness of our results.

### 1. svar estimation

Since the primary interest in the SVAR analysis is to determine the relationship between the variables and not the parameter estimates in themselves, we follow the recommendation of Sims (1980) and Sims, Stock and Watson (1990) against differencing even if the variables contain a unit root. Sims, Stock and Watson (1990) argue that transforming the model into a stationary form is in

many cases unnecessary, for the real issue is whether the estimated coefficient or test statistics of interest have a distribution that is non-standard when in fact the regressors are integrated. However, we have added some deterministic components in a way that yields a stationary VAR.

Thus, given that both unemployment series (the official one and the alternative one) are non-stationary over the sample period,<sup>18</sup> and since we want to determine the

<sup>18</sup> See table A.2, which includes the unit root tests. We use the Lee and Strazicich (2003) minimum Lagrange multiplier unit root test with two structural breaks.

persistence of monetary policy shocks rather than assume that the effects are permanent, we added a deterministic time trend to the model to yield a stationary SVAR and also a stationary unemployment rate. To the extent that monetary policy might be affected by expected inflation, we added this to the SVAR. We used lagged inflation as a proxy for expected inflation. While lagged inflation was statistically significant only in the MCI equation, including this variable did not have any qualitative effect on the rest of the results. The econometric results are shown in the appendix (see table A.1). Our analysis is therefore based on a parsimonious model without expected inflation.

Before estimating our SVAR model, we tested the identification restrictions ( $\alpha_{21} = \alpha_{32} = \alpha_{13} = 0$ ). The likelihood ratio test was 0.003 and was not significant when contrasted with critical values of the chi-square distribution with three degree of freedom; accordingly, the joint hypothesis could not be rejected. The optimal lag length was derived using the Akaike information criterion (AIC) and the Bayesian information criterion

(BIC), leading to a choice of two lags. When the official unemployment rate was used, the estimated SVAR coefficients were either statistically insignificant or had the wrong signs. In fact, the initial impact of a monetary shock was a reduction of the unemployment rate, a result that is clearly contrary to economic theory.<sup>19</sup>

Table 1 reports the SVAR coefficients estimated using the alternative unemployment series. As we can see, there are no signs of misspecification in any of the equations. Table 1 contains the sum of coefficients on the two lags of each variable and the Wald test for their joint significance; p-values are in parentheses. The results are as expected; a tight monetary policy increases unemployment and decreases domestic demand. Higher domestic demand decreases unemployment. A fiscal surplus decreases domestic demand, while the impact on

<sup>19</sup> In figure 3 we compare the results of the impulse response functions for the two unemployment rates (model 1 and model 5).

TABLE 1

**svar estimates**  
(p-values in parentheses)

	Unemployment <i>Ln(u)</i>	Domestic demand ( <i>y-y*</i> )	Monetary policy ( <i>mci</i> )
<i>Ln(u)</i>	0.759 (0.000)	-0.351 (0.081)	0.516 (0.398)
( <i>y-y*</i> )	-0.061 (0.090)	0.568 (0.000)	0.351 (0.263)
<i>L(MCI)</i>	0.024 (0.064)	-0.067 (0.007)	0.582 (0.000)
United States output ( <i>q-q*</i> )	-0.183 (0.014)	0.293 (0.036)	0.315 (0.457)
Productivity ( <i>t</i> )	-0.017 (0.943)	1.809 (0.000)	5.175 (0.000)
Fiscal surplus ( <i>g</i> )	0.153 (0.758)	-2.711 (0.005)	-7.690 (0.009)
Time trend	0.0008 (0.884)	-0.038 (0.001)	-0.011 (0.744)
Dummy95	1.766 (0.012)	-3.138 (0.018)	35.167 (0.000)
Adjusted ( <i>R</i> <sup>2</sup> )	0.834	0.811	0.837
Log likelihood -339.93			
Portmanteau (12) 105.1633 (0.1311)			

Source: authors' estimates.

Note: The table contains the sum of the coefficients on the two lags of each variable. Wald test for joint significance of both lags of each variable. The portmanteau joint test for white noise residuals is shown.

*mci*: Monetary Conditions Index.

unemployment has the right sign but is not significant. United States output shocks decrease unemployment and increase domestic demand, while productivity shocks increase domestic demand.

## 2. Impulse response functions

Since we are particularly interested in the effects of monetary policy shocks on the unemployment rate, figure 2.A shows the dynamic response of unemployment to an exogenous tightening of monetary policy, along with its percentile bands. The results show that unemployment responds positively to positive monetary policy shocks, indicating that an exogenous monetary policy tightening of 1% induces an increase of 0.26 percentage points in unemployment after two quarters. After five years, unemployment is still 0.06 percentage points higher than it would have been without the shock. As this is a stationary VAR, all shocks are temporary but monetary policy itself is persistent, so the shock dies away only gradually. In response to the tight monetary policy, unemployment increases with a characteristic hump-shaped pattern like the one found by other studies.<sup>20</sup> It peaks after three quarters before slowly reverting back to its original level.

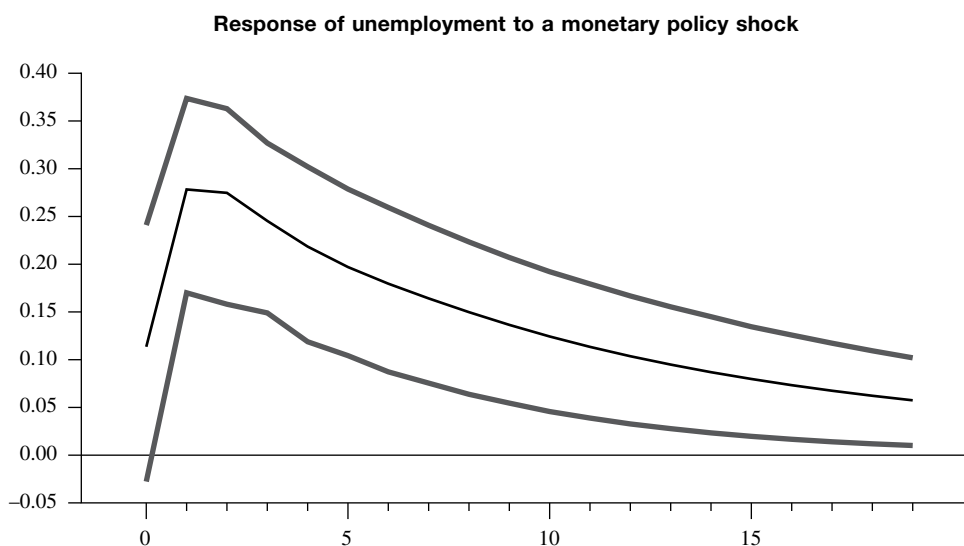
<sup>20</sup> See, for example, Alexius and Holmlund (2008) and Ravn and Simonelli (2008).

Our results indicate that unemployment in the labour market adjusts more quickly in Mexico than in Sweden, where Alexius and Holmlund (2008) estimated that a monetary policy shock had its maximum effect on unemployment after nine quarters. In a study evaluating the impact of a monetary policy shock on unemployment in the United States economy, Ravn and Simonelli (2008) found that half the peak effect of such a shock on unemployment had disappeared after 10 quarters and none remained after 10 years.

Hence, the effect of an exogenous tightening of monetary policy on unemployment is less persistent in Mexico than in Sweden and somewhat similar to the effect in the United States economy. The speed of the adjustment can be put down to the existence of a large informal sector and of a number of schemes that have added some employment flexibility despite heavy regulation in the Mexican formal labour market. Labour regulation and labour unions, on the other hand, might explain the low elasticity of employment in the presence of policy shocks. Our results are consistent with previous findings in Latin America.<sup>21</sup> Unlike those studies, however, this one contends that the existence of a large informal sector and a growing service sector could explain the speed of adjustment found.

<sup>21</sup> See, for example, Loboguerrero and Panizza (2007) and González-Anaya (2002).

FIGURE 2.A



Source: authors' estimates.

Note: Response to a temporary one standard deviation shock in monetary policy. Confidence bands computed by Monte Carlo integration. Following Sims and Zha (1999), we compute percentile bands.

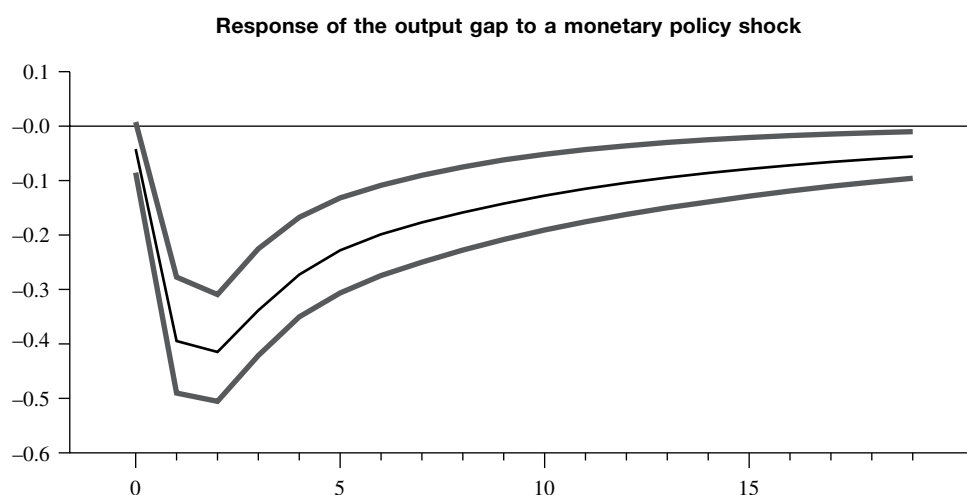
Figure 2.B shows that a contractionary monetary shock has a negative effect on excess domestic demand. The effect peaks after the first quarter, as compared to the second quarter in the case of unemployment. Half of the peak effect has disappeared by the end of the seventh quarter. These results are statistically significant and different from zero. Much as in the case of unemployment, the estimated impulse response of excess domestic demand reverts back to zero after six years. This result indicates that output falls when monetary policy is restrictive, which is logical since real interest rates affect the cost of capital and thus consumption and investment.

In short, the results indicate that an exogenous tightening of monetary policy will increase unemployment while driving output below its potential level.

### 3. Variance decomposition

Next, we examine the forecast error variance. The forecast error variance decomposition tells us the proportion of the movement in a sequence that is due to its own shocks as opposed to shocks to the other variables. Table 2 reports the forecast error variance decomposition at the 1, 10, 20 and 30 quarter horizons. We are interested in ascertaining what share of unemployment fluctuations is due to monetary policy shocks and to domestic demand shocks (first row). The results indicate that monetary policy shocks account for 1% to 26% of fluctuations in unemployment, depending on the time horizon. Excess domestic demand shocks account for about 5% in the short run, while the share falls to 4% over a

FIGURE 2.B



Source: authors' estimates.

Note: Response to a temporary one standard deviation shock in monetary policy. Confidence bands computed by Monte Carlo integration. Following Sims and Zha (1999), we compute percentile bands.

TABLE 2

#### Variance decomposition

	$\ln(u)$				$\tilde{y}$				$mci$			
	1	10	20	30	1	10	20	30	1	10	20	30
$\ln(u)$	93.35	71.71	69.71	69.50	5.47	4.28	4.40	4.42	1.17	23.99	25.80	26.07
$\tilde{y}$	0.00	9.07	11.17	11.40	100	59.34	56.08	55.73	0.00	31.57	32.71	32.85
$mci$	0.00	5.02	6.92	6.88	0.72	4.94	5.04	5.04	99.27	90.02	88.26	88.06

Source: authors' estimates.

Note: The figures in the second row are horizons (i.e. quarters); all other figures are estimates rounded to two decimal places, so rounding errors may sometimes prevent perfect percentage decomposition.

$mci$ : Monetary Conditions Index.

$\ln$ : natural logarithm.

$\tilde{y}$ : output gap.

longer horizon. We can observe that, in the short run, unemployment is explained by its own innovation to the extent of about 93%, a share that falls to 69% over a longer horizon.

#### 4. Robustness

Given that the SVAR is estimated on a number of specific assumptions, we investigated the robustness of our results to different sets of assumptions. We estimated four additional models in addition to our baseline model. Model 2, for example, includes as a measure of monetary policy an MCI with derivations of relative weights for interest rates and exchange rates using a trade share approach by estimating an equation for the ratio of long-run exports to GDP. Model 3 is a SVAR model with three lags. This is because, according to the AIC and BIC criteria, there are arguments in favour of two or three lags. In our baseline model we settled for the more parsimonious model specification, i.e. two lags.

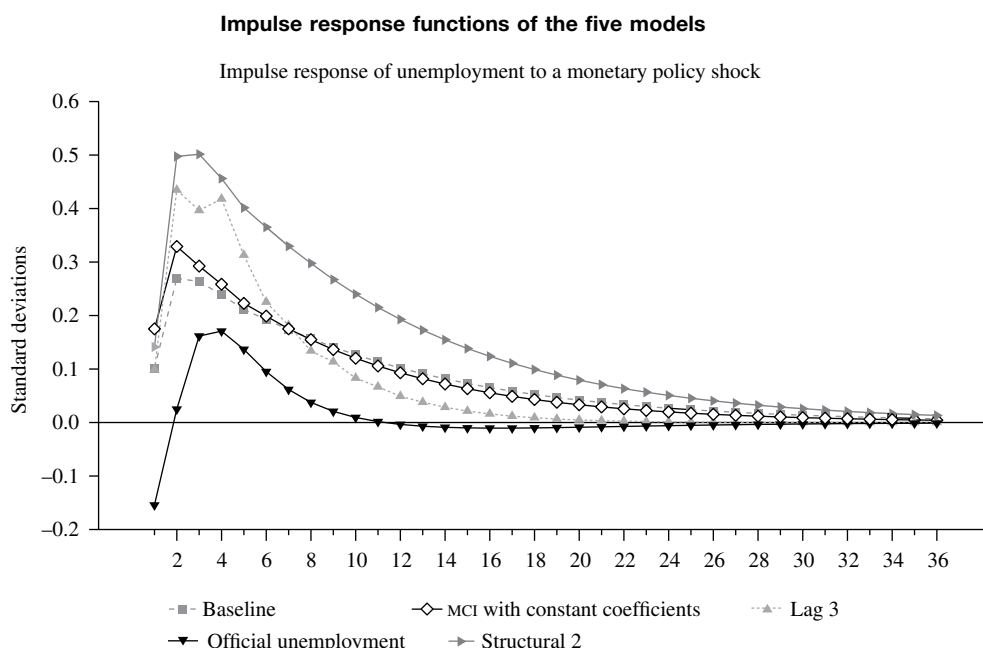
In model 4 we drop the assumption that unemployment is not affected by output and let the coefficient be determined by the model, assuming instead that monetary policy does not respond contemporaneously to excess demand ( $\alpha_{12} = 0$ ). We maintain the assumption that monetary shocks do not affect excess demand contemporaneously ( $\alpha_{21} = 0$ ) and that unemployment

does not affect monetary policy contemporaneously ( $\alpha_{13} = 0$ ). Models 1 to 4 are estimated using the alternative unemployment rate. Model 5, on the other hand, is the baseline model using the official rate of open unemployment.

Figure 3 shows the impulse response function of unemployment to monetary policy shocks for all five models. Except for model 5, the results are quite robust, with the effects peaking after two quarters. The magnitude of the maximum effect varies between 0.26 and 0.50 percentage points when the response is calculated for a monetary policy shock of one standard deviation. As already noted, coefficients estimated using the official unemployment rate are not consistent with economic theory.

Another interesting feature of this comparative analysis is that, five years after the initial shock, unemployment is between 0.004 and 0.12 percentage point higher than it would have been without the shock. Figure 3 also indicates that when we drop the assumption that Mexico's labour market is rigid, the effect of monetary policy on unemployment is even higher (model 4). The higher estimated persistence can also be attributed to the restriction we imposed of monetary policy not responding contemporaneously to the economy. The model with the lowest estimated persistence is the one we assume to have three lags (model 3).

FIGURE 3



Source: authors' estimates.

Notes: Model 1 = baseline; model 2 = MCI with constant coefficients; model 3 = lag 3; model 4 = structural 2; model 5 = official unemployment.

Table 3 reports the forecast error variance decomposition of all five different models at a 1, 10, 20 and 30 quarter horizon. As we may observe, the share of monetary policy shocks in the variance decomposition of unemployment is quite robust at the 10, 20 and 30 quarter horizon for models 1 to 4. The results indicate that monetary policy shocks account for 21% at the longer horizon in a model with three lags, as compared to 26% in our baseline model.

Model 5, the one based on the official rate of unemployment, deserves special attention. Our results

suggest that an exogenous tightening of monetary policy (shock) of one percentage point would induce a 0.15 percentage point drop in unemployment contemporaneously, and that the effect would then peak after four quarters. The estimated impulse response returns to zero after two and a half years. The variance decomposition analysis indicates that official unemployment rates are exogenous with respect to monetary policy shocks. At this point we do not have a clear explanation for this result, and can only suggest further exploration.

TABLE 3

Variance decomposition for the different models

	$Ln(u)$				$\tilde{y}$				$mci$			
	1	10	20	30	1	10	20	30	1	10	20	30
Model 1	93.35	71.71	69.71	69.50	5.47	4.28	4.40	4.42	1.17	23.99	25.80	26.07
Model 2	90.45	67.35	65.63	65.05	5.88	6.10	6.92	6.95	3.65	26.03	27.43	27.54
Model 3	97.87	74.45	74.55	74.55	1.21	3.61	3.99	3.99	0.95	21.93	21.45	21.44
Model 4	38.88	28.82	27.58	27.45	60.33	48.60	48.08	48.03	0.77	22.57	24.32	24.50
Model 5	88.61	92.14	92.51	92.51	9.28	5.54	5.31	5.30	2.10	2.29	2.17	2.17

Source: authors' estimates.

Note: The figures in the second row are horizons (i.e. quarters); all other figures are estimates rounded to two decimal places, so rounding errors may sometimes prevent perfect percentage decomposition.

*mci*: Monetary Conditions Index.

*Ln*: natural logarithm.

$\tilde{y}$ : output gap.

## VII

### Conclusions

We have estimated the impact of macroeconomic stabilization policies on Mexican unemployment rates. The analysis has been carried out for two series of unemployment rates (the official rate and an alternative rate estimated following the methodology used by the cps of the United States Bureau of Labor Statistics) and for different model specifications.

When official unemployment rates are used, the impulse response function indicates that monetary policy shocks induce an initial drop of about 0.15 percentage points in unemployment. This quickly increases to 0.18 percentage points by the fourth quarter. However, unemployment then returns to its initial level by the tenth

quarter; that is, official unemployment rates suggest that the Mexican labour market is very fluid.

When the alternative unemployment rate is used, our results indicate that monetary policy is non-neutral in the short and medium terms. We tested the robustness of our findings under different sets of assumptions. We conclude that our results do not depend on a particular assumption. For example, we find the same qualitative result when we assume a rigid labour market as when we assume a flexible one. The impulse response functions suggest that the impact of a monetary policy shock on unemployment falls by between 0.26 and 0.50 percentage points under different sets of assumptions. Another important result is

that five years on from the initial shock, unemployment is between 0.004 and 0.12 percentage points higher than it would have been without the shock. We did not find evidence for a long-term impact of monetary policy on unemployment in any case.

Variance decomposition analysis complements the impulse response function findings. While the models based on our alternative measure of unemployment suggest that monetary policy can explain up to 27% of overall variance, the model based on the official unemployment rate indicates that monetary policy can only explain up to 2.2% of total variations in unemployment. Obviously, these results represent a puzzle that needs further investigation.

Our estimates of the elasticity of unemployment to monetary shocks suggest that their effect is rather small. However, adjustment to such shocks is faster than in European countries, for example. The low impact of monetary policy can be explained by the existence of some institutional rigidity; namely, intrusive labour regulation and labour unions. These rigidities impede a fuller adjustment to policy shocks. However, there are other elements within the labour market that allow a relatively quick adjustment to such shocks to take place. Among these elements, we consider the existence of a large informal sector and a growing service sector where much labour legislation goes unenforced.

*(Original: English)*

## APPENDIX

TABLE A.1

**svar estimates**  
(Model with lagged inflation, *p*-values in parentheses)

	Unemployment <i>Ln(u)</i>	Domestic demand ( <i>y-y*</i> )	Monetary policy ( <i>mci</i> )
<i>Ln(u)</i>	0.761 (0.000)	-0.369 (0.072)	0.837 (0.133)
( <i>y-y*</i> )	-0.005 (0.919)	0.562 (0.000)	0.246 (0.382)
<i>L(MCI)</i>	0.025 (0.081)	-0.073 (0.007)	0.689 (0.000)
United States output ( <i>q-q*</i> )	-0.184 (0.015)	0.300 (0.036)	0.188 (0.621)
Productivity ( <i>t</i> )	-0.026 (0.918)	1.894 (0.000)	3.645 (0.008)
Fiscal surplus ( <i>g</i> )	0.105 (0.869)	-3.149 (0.011)	-15.615 (0.000)
Lag_inf ( $\pi_{t-1}$ )	-0.0005 (0.905)	0.004 (0.563)	-0.084 (0.000)
Time trend	0.0009 (0.878)	-0.037 (0.002)	-0.021 (0.498)
Dummy95	1.763 (0.013)	-3.107 (0.020)	34.596 (0.000)
Adjusted ( $R^2$ )	0.831	0.809	0.869
Log likelihood -331.18			
Portmanteau (12) 107.1656 (0.1411)			

Source: authors' estimates.

Note: The table contains the sum of the coefficients on the two lags of each variable. Wald test for joint significance of both lags of each variable. The portmanteau joint test for white noise residuals is shown.

*mci*: Monetary Conditions Index.



TABLE A.2

## The endogenous two-break Lagrange multiplier unit root test

Official unemployment. Model C:  $K=1$ ,  $T_{B_1} = 1995:1$ ,  $T_{B_2} = 1999:3$ ,  $N = 72$ ,  $\lambda_1 \cong 0.4$ ,  $\lambda_2 \cong 0.7$   
Critical values 5% (-5.67)  $t_0 = 2.769$

Parameter	$\mu$	$d_1$	$d_{t_1}$	$d_2$	$d_{t_2}$	$\phi$
Estimator	-0.294	1.515	0.058	0.364	0.233	-0.217
T-statistics	-2.349*	5.030*	0.392	1.206	2.272*	-2.769

Alternative unemployment. Model C:  $K=1$ ,  $T_{B_1} = 1995:1$ ,  $T_{B_2} = 1999:3$ ,  $N = 72$ ,  $\lambda_1 \cong 0.4$ ,  $t_0 = -5.452$   
Critical values 5% (-5.67)  $t_0 = -5.452$

Parameter	$\mu$	$d_1$	$d_{t_1}$	$d_2$	$d_{t_2}$	$\phi$
Estimator	-0.574	1.874	0.383	0.487	0.808	-0.6412
T-statistics	-3.583*	3.062*	1.622**	0.797	3.761*	-5.452

Source: authors' estimates.

Note: \* and \*\* denote significance at 5% and 10%, respectively.

Null:  $y_t = \mu_0 + d_1 B_{1t} + d_{t_1} D_{1t} + d_2 B_{2t} + d_{t_2} D_{2t} + y_{t-1} + v_{1t}$

Alternative:  $y_t = \mu_1 + \gamma t + d_1 D_{1t} + d_{t_1} DT_{1t} + d_2 D_{2t} + d_{t_2} DT_{2t} + v_{2t}$

where  $D_{jt} = 1$  for  $t \geq T_{Bj} + 1$ ,  $j = 1, 2$  and 0 otherwise;  $DT_{jt} = t - T_{Bj}$  for  $t \geq T_{Bj} + 1$ ,  $j = 1, 2$  and 0 otherwise and  $T_{Bj}$  denotes time period when a break occurs.

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