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A R T I C L E S

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.

Aspects of recent developments in the Latin American and Caribbean labour markets

Jürgen Weller

ABSTRACT

This article presents three stylized facts that characterized the evolution of labour markets in Latin America and the Caribbean in the period 2003-2012 and represented breaks from previous trends. It is argued that these changes have to do with the economic and production context and the political and institutional framework. We show how the magnitude and patterns of economic growth impact on the nature of job creation, especially on shifts within and between economic sectors and the various segments of different productivity levels. We emphasize how changes in labour institutions have contributed to the evolution of labour indicators and, lastly, look at recent advances and persistent weaknesses in labour performance, as well as a number of risks to the continuity of recent favourable labour trends.

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I

Introduction

In the first decade of the 2000s, labour performance diverged markedly from the previous two decades in Latin America and the Caribbean. Especially from 2003 onwards, there was a break from several previous trends: the unemployment rate came down, many employment quality indicators improved amid increasing job formalization, and wage gaps between skilled and unskilled workers narrowed. These factors helped to reduce poverty rates and inequality between households in this period.

This favourable picture may be attributed in part to a number of factors that weighed in to one extent or another in the countries of the region, especially economic and production factors and political-institutional developments.

The analysis in this article centres on the 10-year period beginning in 2003, looking at how a more benign economic and production setting affected the labour markets. By contrast with the two preceding decades, in this period the region's economy enjoyed relatively sustained, high growth rates, interrupted only by the economic and financial crisis of 2008-2009.[1] At the same time, many countries moved away from the growth and development paradigm that prevailed in the region in the 1980s and 1990s (reliance on the superior efficacy and efficiency of the functioning of markets), which implied, in many cases, adopting new labour policies. As this article will discuss, both factors had major consequences for labour market performance in this period.

The sections following this introduction review recent changes in the region's labour markets and interpret them against the backdrop of the changes in the economic-industrial and political-institutional setting. Section II sets forth some stylized facts with regard to labour in the recent period, and contrasts them with previous performance. Section III presents a scheme developed to analyse the factors determining these changes, justifying the emphasis on the economic-industrial and political-institutional context. Section IV examines the characteristics of these factors in the decade 2003-2012, furthering understanding of recent developments in the labour market. Here, we show that the relatively high economic growth in recent times was the main factor driving job creation and bringing down the regional unemployment rate. A modest rise in labour productivity, thanks to several processes, facilitated gains in employment quality, as did strong labour demand, which led to many of the new jobs being created in medium- and high-productivity segments and shifted the structure of employment favourably. Patterns of labour demand also helped to reduce income gaps between people at different levels of employment. Lastly, a shift in labour institutionality in many countries also helped to close gaps and drove gains in employment quality. Section V concludes by discussing recent progress and persistent weaknesses in labour performance, and draws attention to a number of factors that pose risks to the continuity of recent benign labour trends.[2]

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[1] See ECLAC (several years) and, specifically for the subperiod 2003-2008, Kacef and López-Monti (2010).

[2] This article does not attempt to analyse all aspects of the recent labour market. The review of stylized facts concentrates instead on aspects that show a break in trend from previous performance, and skips over indicators that remained the same. This refers, for example, to the characteristics of labour supply, in which demographic trends held steady, labour participation continued to rise gradually and level of formal education continued to increase. Obviously, these stylized facts are not applicable to all the countries of the region, since they each have specific patterns regarding the determinants of labour performance.

II

Three stylized facts

The first stylized fact regarding the development of labour markets over the recent period is the reduction in the open unemployment rate in urban areas. Between 2002 and 2012 this rate came down from 11.2% to 6.4% at the regional level, to reach a 20-year low (ECLAC/ILO, 2013).[3] This was a break from the general upward trend in unemployment in the 1990s, when the rate fell slightly in times of high economic growth and rose significantly in times of zero or slack growth, producing an upward-sloping jagged pattern in the regional unemployment rate.[4]

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[3] The rate thus returned to the levels of the 1970s and 1980s. However, a precise comparison is not possible because of methodological changes made in many countries in the intervening period.

[4] In a study on 19 Latin American countries for the period 1990-2007 —although with differences depending on data availability— Ball, De Roux and Hofstetter (2011) found evidence of a hysteresis effect that transformed short-term rises in unemployment (caused by contractions in aggregate demand) into long-term impacts.

The fall in unemployment starting in 2003 resulted from a rapidly rising employment rate, as shown in figure 1.

While the participation rate reflected the long-term gradual increase in women's participation in the labour market, the employment rate rose sharply as of 2003, interrupted only in 2009 by the global economic and financial crisis.

Starting in 2003, the faster rise in employment, together with higher wages for those in work, pushed up labour income, which was the main driver of poverty reduction in the region in this period (ECLAC, 2012, p. 50; Azevedo and others, 2013).

The second stylized fact is the improvement in employment quality. As noted in Weller and Roethlisberger (2011), over the recent period almost all quality indicators show improvements, except for a rise in temporary contracts, which was attributable to more

FIGURE 1

Latin America and the Caribbean: urban participation, employment and unemployment, 1990-2012
(Percentages)
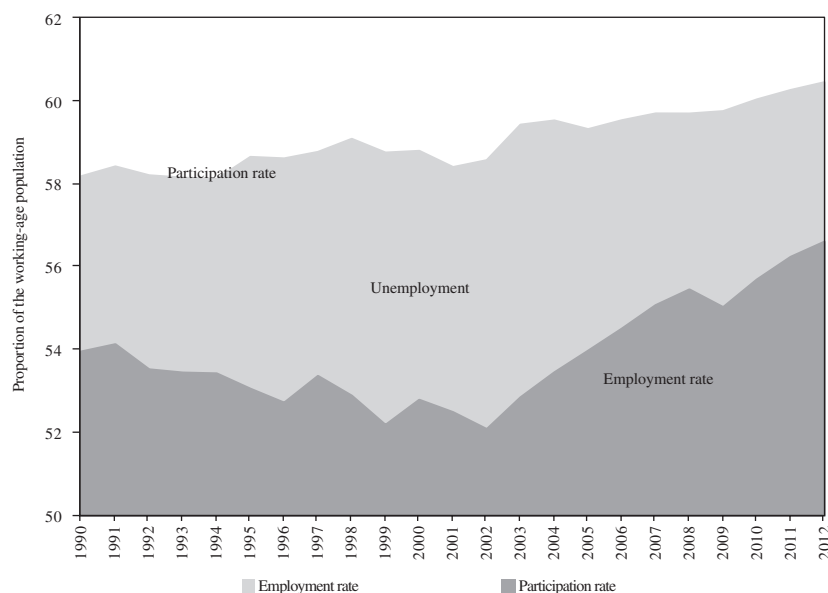
Source: prepared by the author, on the basis of official data from the countries.

Note: in the figure unemployment is shown as the gap between the participation and employment rates, so the values do not correspond to the unemployment rate, which is calculated as a proportion of the workforce.

unstable labour markets. Quality indicators tend to be better for wage earners than for non-wage earners, but in the recent period employment quality has in general improved for both categories.[5]

As noted in the work cited above, these improvements are closely linked to processes of labour formalization which have made great strides in some countries. As shown in figure 2, in the decade 2003-2012 formal employment expanded more than in the preceding period, and notably more than employment overall, in many of the region's countries.

The third stylized fact is the reduction in wage gaps, in a break from the previous trends of wage structure polarization.[6] In most of the countries, the reduction in

the wage gap was the main driver of reduction in income inequality at the household level in the past decade. For an average of 15 countries, around two thirds of the reduction came from smaller differences in income per employed person (ECLAC, 2012, p. 56).[7] The second important factor was non-labour income, with the introduction and expansion of programmes targeting the poorest households. By contrast, demographic changes in the great majority of the countries (a smaller gap between the dependency rates of the first and fifth quintiles) contributed very little to the lessening of inequality. On average, the contribution of higher employment rates —which had a positive impact on poverty reduction— had even a slightly negative effect on equality because the proportion of employed adults rose at least as much or more in the higher income quintiles as in the lowest.

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[5] See information on coverage differentiated by type of social protection system and changes in this regard in ILO (several years).

[6] On wage gap narrowing, see, for example, Gasparini and others (2011); López-Calva and Lustig (2010); and Keifman and Maurizio (2012).

[7] In this connection, see also Azevedo, Inchauste and Sanfelice (2013).

FIGURE 2

Latin America (selected countries): annual growth in (registered) formal employment and total employment, 1990-2002 and 2003-2012
(Percentages)

■ Formal employment 1990-2002   ■ Formal employment 2002-2012   Total employment 2002-2012
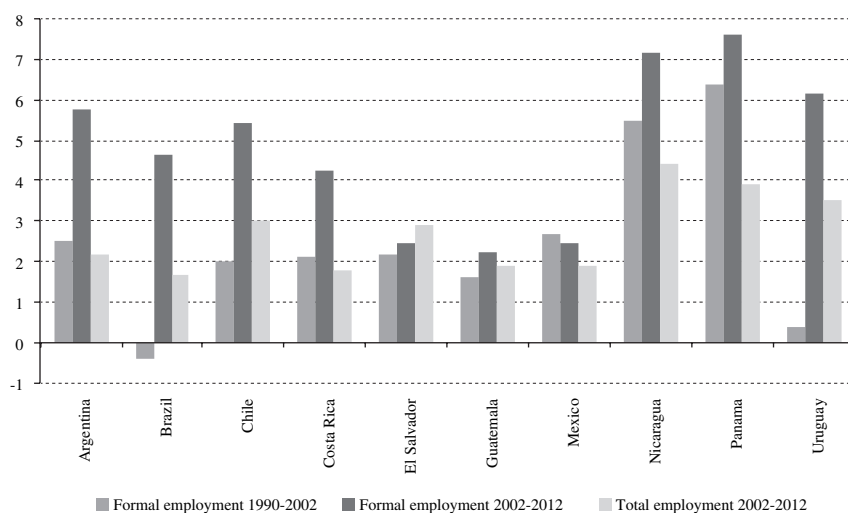
Source: prepared by the author, on the basis of official data from the countries.

Note: the data on formal employment refer to those paying into or affiliated to a system of contributory social protection, except in Brazil (register of formal employment). The data on total employment for Argentina and Uruguay refer to urban employment. The data on total employment for Guatemala and Nicaragua refer to 2002-2011 and 2003-2010, respectively. In the first period, the data on formal employment refer to 1991-2002 for Panama; 1994-2002 for Chile, Mexico and Nicaragua; 1995-2002 for Argentina, and 1998-2002 for El Salvador.

III

Conceptual aspects

The main determinants of employment generation and job characteristics are the economic and production context and labour institutions.[8] Figure 3 summarizes the main links in this regard.

The production context is expressed, first, in economic growth based largely on greater use of production factors, including labour. Growth impacts not only the magnitude of employment generation, but also —through its characteristics (sectoral composition, technical intensity, and so forth)— labour demand, differentiated by skills, knowledge, etc., and therefore influences the relative labour conditions of different groups of workers.

Second, and obviously related to the first aspect, the economic and production context is also expressed in an economy's average labour productivity. This affects the capacity to improve job quality, because it is a determinant of the profit margin allocated to workers. In this respect, the main link is between labour productivity and wage level. The comparison between countries shows that this link tends to be a close one, although labour productivity gains do not translate automatically into wage gains, as demonstrated by the recent worsening of functional income distribution.[9] But non-wage aspects of employment quality tend to benefit from increased productivity too, inasmuch as the various aspects of quality tend to generate costs, and the capacity of economies to cover those costs depends on the resources available. Accordingly, high productivity tends to feed directly into good quality employment, while low productivity usually

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[8] Here, we are leaving aside the close long-term correlation between employment level and demographic evolution (magnitude and growth of the working-age population), modified by the upward trend in labour participation caused by the increasing incorporation of women into the labour market. In this connection, see Weller and Kaldewei (2013, pp. 31 and 32).

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[9] ECLAC/ILO (2012) shows both the high correlation between labour productivity and average wages, and the recent fall in wages as a proportion of GDP.

FIGURE 3

Determinants of employment generation and quality
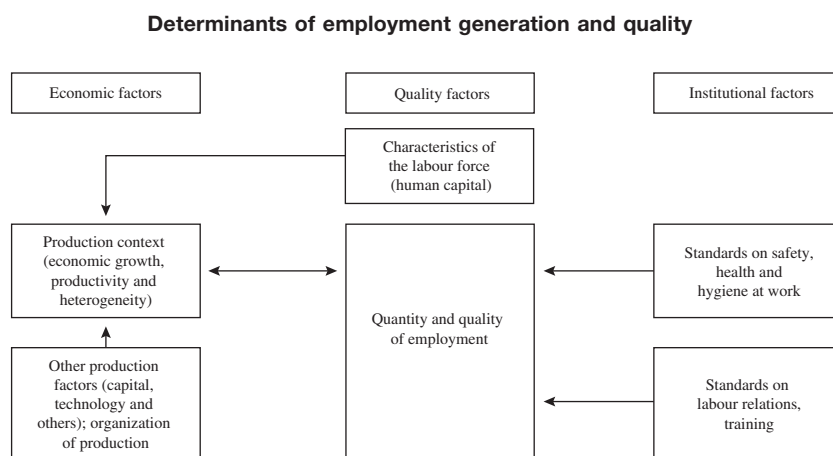
Source: prepared by the author, on the basis of Jürgen Weller and Claudia Roethlisberger, "La calidad del empleo en América Latina", *Macroeconomía del Desarrollo series*, No. 110 (LC/L.3320-P), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), 2011. United Nations publication, Sales No. S.11.II.G.39.

goes hand in hand with processes of exclusion from productive employment.[10]

Rising labour productivity at the aggregate level reflects two different, but related, dynamics. On the one hand, economic development is closely related to structural change processes that involve reassigning resources from low-productivity sectors —which typically create low quality jobs— to intermediate- and high-productivity sectors (productivity gain through intersectoral changes). On the other hand, productivity with an activity can be boosted by more intensive use of physical or human capital or both, by technological changes, by more efficient use of resources, or by the closure of unproductive firms and the formation of new firms that are more productive (productivity gain through intrasectoral changes). The relative weight of the two processes typically varies with the march of economic development, with the contribution of structural change gradually diminishing (Rodrik, 2013).

However, and in third place, in highly heterogeneous production structures, the importance of the production context in generating and informal employment cannot be captured by the rate of economic growth and the evolution of average productivity alone.

The segmentation hypothesis is often refuted by the argument that a significant proportion of employment informal is voluntary and arises from cost-benefit calculations on the part of firms and workers. Specifically, it is possible to tap into the social benefits that are also increasingly accessible for informal employees, without having to assume formalization-related costs. Studies on flows of workers within this market also indicate a degree of mobility between the different segments, which appears to contradict the theory of segmented markets (Perry and others, 2007; Bosch, Cobacho and Pagés, 2012). Without denying the role of cost-benefit rationale

of both formality and informality, it must be emphasized that there are theoretical and empirical reasons to treat markets as segmented (Fields, 2004; Ocampo, Rada and Taylor, 2009; Infante, 2011):

— The region's production structure is highly heterogeneous, with large productivity gaps between and within sectors.

— Because of weak labour demand in medium- and high-productivity segments and the jobs that are created mainly in response to this demand, other jobs are created mainly in response to the pressure of labour supply, reflecting the need for income in the respective households.[11]

In any case, the different approaches in the literature on labour market segmentation have made progress in recognizing the heterogeneous nature of the informal sector itself.[12] While certain approaches differentiate between "excluded" and "voluntary" informal workers, from the standpoint of production, a subsegment with a certain capacity of accumulation is distinguished from one whose income is basically stuck at subsistence level. Accordingly, there would appear to be a countercyclical subsegment —which grows in phases of the economic cycle in which the labour demand from the medium- and high-productivity segments is low— and another that behaves procyclically, expanding in response to income opportunities in growing economies.

In addition, the simultaneous existence of different labour market segments —whose behaviour is determined chiefly by labour supply and demand, respectively— is evident in the way labour adjusts to the economic cycle. Specifically, the fact that a large segment of the labour market obeys labour supply dynamics contributes much to the highly procyclical behaviour of labour productivity (ECLAC/ILO, 2012).

In sum, the level and composition of informality depend on two main factors: the production structure —represented by per capita GDP and the productivity gaps between the different segments— and the legal and

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[10] Weller and Roethlisberger (2011, pp. 54-58) show some correlations between per capita GDP (as an indirect variable for labour productivity) and several indicators of employment quality. The most obvious positive links occurred between payment into social security systems (pensions and health), contracts and, to a lesser extent, bonuses and vacation. Other indicators (trade union membership, overtime pay, training) showed high dispersion, which points to the importance of other factors beyond per capita GDP and, related to that, average productivity, specifically the importance of labour institutions, which will be examined later. Notably, the link between labour productivity and employment quality is two-directional, as has been observed historically, for example with the shortening of the working day. Efficiency wage theory examines the impact of better wages on higher productivity. In this regard, see Akerlof and Yellen (1986).

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[11] In this article "segment" means the set of those parts of different branches of activity or sectors that share similar productivity levels, drawing a simplified distinction between low-productivity segments and medium- and high-productivity segments. The shift in the relative importance of the two segments over the business cycle is recognized by Perry and others (2007).

[12] See, for example, Tokman (1987); Fields (2004) and Perry and others (2007).

institutional factors that determine the costs and benefits of both formality and informality.[13]

The existence of segmented markets with large productivity gaps means that changes in the composition of occupational structure —especially in the relative weight of the lower- or higher-productivity segments— influences its overall averages as well as labour income. Labour market segmentation has distributive implications as well. Although the theories disagree as to whether low-productivity segments should be modelled with marginal output close to zero or positive, declining output (Fields, 2004), an increase in the number of individuals employed in these segments will tend to lower average income and widen the income gap with respect to the higher-productivity segments. By contrast, a reduction in the number of individuals in these poor performing segments will increase average income and narrow the gap with respect to the average or higher-productivity segments. One implication of this is that the income gap between different productivity levels will be wider in countries with a larger set of low-productivity segments than in countries with a smaller set of such segments: in the first group of countries, low-productivity segments tend to show smaller average income, owing to the larger proportion of jobs generated by supply pressure, thereby increasing the gap between this income level and the income of medium- and high-productivity segments.[14]

Lastly, labour institutions —based on labour legislation or on collective bargaining— shape the characteristics of employment, particularly matters of quality and the gaps between different groups of workers in this regard (for example, through formalization or minimum wage policies). Labour institutions have a dual function (ECLAC, 2010, p. 173): (i) contribute to the efficient functioning of the labour market (by bringing the workforce increasingly into productive jobs), boost productivity (including the effective distribution of the fruits thereof) and design mechanisms to adjust to the fluctuations of the economic cycle; and (ii) promote the protection of workers as the structurally weakest stakeholders, especially vulnerable groups with specific problems in participating in productive labour.

To this end, labour legislation and collective bargaining affect the process of establishing wages and other benefits, contracts, social protection, and training, among other aspects. In turn, standards on hygiene and safety at work and on the organization of work (pace, breaks and so on) affect labour conditions.

On the other hand, the capacity of firms to comply, the coverage and efficiency of labour surveillance and labour justice, and the control and pressure that workers can exert determine the degree to which the quality aspects covered in the legislation or negotiations come to fruition (Bensusán, 2008).

Institutions can only meet their objectives in a sustainable manner if they are positioned on two fronts (Berg and Kucera, 2008, p. 27): first, they reflect the social norms created historically in a specific country, so they vary from one country to another. It is thus no surprise that the theoretical literature is increasingly considering the possibility of moving from models that assume a single optimum configuration of regulations, to others that allow for the existence of two or more institutional configurations capable of generating similar outcomes (Eichhorst, Feil and Braun, 2008). Second, they respond to the production context, so that in any given country they can vary over time in response to social and political changes.

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[13] There are also secondary aspects, such as the lack of information on these costs and benefits for informal firms and workers.

[14] Weller (2012, p. 35) demonstrates this for Latin America.

IV

Changes in the determining factors and in their links with the stylized facts

This section explores how changes in the economic and production context and in labour institutions may have impacted the stylized facts described in section II during the period beginning in 2003.

1. The economic and production structure

(a) *Economic growth and overall employment*

The growth and characteristics of employment were the main factor explaining the rise in employment levels, and thus the declining unemployment rate. In the period beginning in 2003, the Latin American and Caribbean economies evolved very differently from the preceding decades. New global growth patterns and buoyancy pushed up prices for the region's main export commodities, which improved terms of trade to the benefit of countries exporting oil, gas, minerals and agricultural products.[15] This was a key factor in boosting the region's economic growth above the performance of previous decades. Economic authorities used the opportunity offered by this context to reduce vulnerabilities, lower public debt (especially external debt), and build up international reserves. The combination of brighter growth prospects and reduced vulnerabilities helped to improve external borrowing conditions, especially amid highly liquid global markets (ECLAC, several years).

The region's economic growth rose from 2.7% per year between 1990 and 2002 to 3.8% per year from 2003 to 2012, despite the harsh impact of the global economic and financial crisis in 2008-2009.[16] Growth patterns have varied throughout the past decade, since in 2003-2008 exports increased rapidly (from 16.9% of GDP on average in 1990-2002 to 22.7% on average in 2003-2008, at constant prices). By contrast, in 2009-2012 household consumption and gross fixed capital formation were the main drivers of aggregate demand (with average rises from 63.0% in 2003-2008 to 65.0% in 2009-2012 for household consumption and from 19.1% to 21.2% for

gross fixed capital formation).[17] By sector, growth was concentrated in the various branches of the tertiary sector, and this pattern deepened between 2009 and 2012.[18]

As shown in figure 4, the rise in the employment rate noted earlier (see figure 1) is attributable in large measure to these higher rates of economic growth.

With the exception of 2009, in all the years between 2003 and 2012 the urban employment rate rose by 0.4 percentage points or more.

The correlation between economic growth and employment rate variation indicates, as well, an increase in the labour intensity of growth. The data in figure 4 show that in the 1990s, economic growth of 3% at the regional level was accompanied by a drop in the regional urban employment rate of 0.1 percentage point, while in the period beginning in 2003 this same output growth rate was accompanied by a rise of over 0.3 point in the employment rate (ECLAC, 2014b). The low labour intensity of growth in the 1990s has been associated, among other causes, with the structural reforms of the time (Weller, 2000; IDB, 2003). This effect could have eased later, and in the following period there were few large-scale liberalizing reforms (ECLAC, 2014b). Be this as it may, the low labour intensity of growth at the regional level in the 1990s chiefly reflected the performance of a few countries (Argentina and Brazil), and in most of the countries of the region "jobless growth" was not the rule; most of them were rather characterized at this time by "employment without growth" (Pagés, Pierre and Scarpetta, 2009), reflecting the supply side pressure of labour in the context of low and volatile economic growth.

In sum, by comparison with the previous period, in the decade 2003-2012 the employment rate was significantly boosted by higher economic growth and stronger intensity of the labour factor in the process. Since the increase in the participation rate did not diverge from its long-term trend, the more robust job

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[15] Differences in the composition of the export and import baskets were obviously reflected in very varied terms of trade evolutions in the different countries of the region.

[16] The region grew by 4.5% per year between 2003 and 2008, 4.4% per year between 2010 and 2012, and contracted by 1.6% in 2009.

[17] Author's calculation on the basis of data from the Economic Commission for Latin America and the Caribbean (ECLAC).

[18] Together, these branches of activity increased their share in GDP from 54.5% on average for 1990-2002 to 55.3% for 2003-2008, and 56.8% for 2009-2012.

FIGURE 4
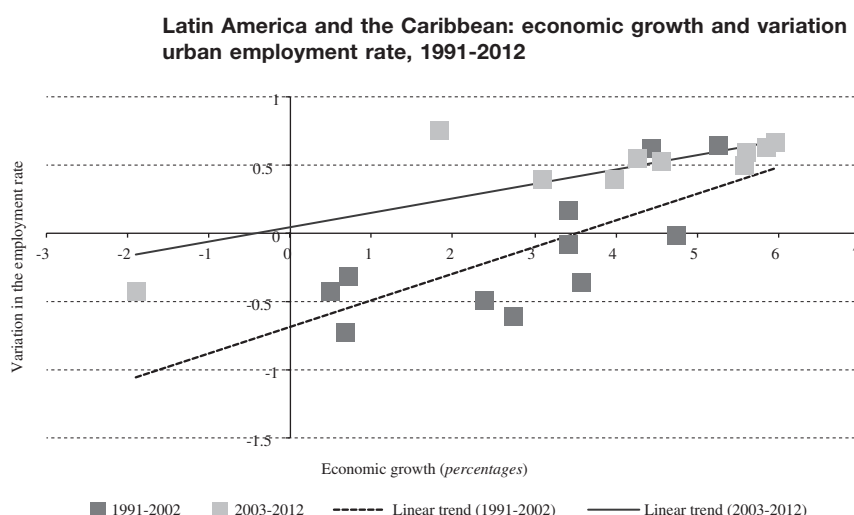
Latin America and the Caribbean: economic growth and variation in the urban employment rate, 1991-2012

Source: prepared by the author, on the basis of data from the Economic Commission for Latin America and the Caribbean (ECLAC).

creation translated directly into a notable fall in the unemployment rate.

(b) *Changes in labour productivity*

Labour productivity evolution is a key determinant of improvement in both wage and non-wage aspects of employment quality. In 2003-2012, the more benign economic environment led to a rise in average labour productivity, which had fallen in the 1980s and stood still in the 1990s (Weller and Kaldewei, 2013).[19]

As noted earlier, this increase could have come from changes within economic sectors, or from the reallocation of resources —specifically the workforce— between sectors (structural change). For the 1980s, ECLAC (2007) found a sharp fall in average labour productivity, caused by intrasectoral effects with slightly positive intersectoral effects, while for 1991-2003 it found —in the simple average for nine countries— a slight rise in average labour productivity, with small positive contributions from both components. By contrast, McMillan and Rodrik (2011) found a strong positive contribution from intrasectoral changes, partially offset by negative intersectoral change, for the period 1990-2005, also in the average for nine countries.[20]

Table 1 shows the results of an exercise for the periods 1990-2002 and 2003-2011/2012, for which the methodology used by McMillan and Rodrik (2011) was applied to 23 countries of Latin America and the Caribbean, as follows:

$$\Delta Y_t = \sum_{i=1}^{n} \Theta_{i,t-k} \Delta y_{i,t} + \sum_{i=1}^{n} y_{i,t} \Delta \Theta_{i,t}$$

where Y_t and $y_{i,t}$ represent the level of productivity for the economy overall and for sector i, respectively, while $\Theta_{i,t}$ is the share of sector i in employment. Δ represents the change in productivity or in the proportion of employment, as the case may be. The first term on the right is the sum of the variations in productivity of the different sectors, weighted by their share in employment at the start of the period under analysis. This term thus represents changes in productivity within sectors. The second term represents the contribution of structural change to total productivity variation, calculated as the sum of sectoral changes in share of total employment, weighted by the corresponding productivities.[21]

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[19] However, the 1.6% rise in average labour productivity between 2002 and 2012 was modest by comparison with some other world regions. Owing chiefly to the rapid increase in productivity in East Asia, by 2012 the gap that the region had gained with respect to the world average, which expanded by 2.2% in this period, was almost closed (author's calculation on the basis of data from Key Indicators of the Labour Market (KILM), eighth edition (ILO, 2013)).

[20] For other recent studies that break down the evolution of labour productivity for different periods, see Ocampo, Rada and Taylor (2009) and Ros (2011).

[21] Thus, if a sector loses share in the structure of employment to another sector with higher average productivity, aggregate productivity increases, and vice versa.

TABLE 1

**Latin America and the Caribbean: variation in average labour productivity and
contributions of intra- and intersectoral changes, 1990-2002 and 2003-2011/2012**

Period		1990-2002			2002-2011/2012		
		Yearly productivity variation	Intersectorial contribution	Intrasectorial contribution	Yearly productivity variation	Intersectorial contribution	Intrasectorial contribution
Argentina urban areas[a]	1990-2002 and 2002-2012	1.0	0.8	0.2	3.9	0.2	3.7
Bahamas	1989-2003 and 2003-2011	0.0	0.4	-0.4	0.2	0.3	-0.1
Barbados	1990-2002 and 2002-2012	-1.1	-0.7	-0.4	1.8	0.3	1.5
Bolivia (Plurinational State of)	1996-2002 and 2002-2009	1.5	0.1	1.4	0.2	1.4	-1.2
Brazil	1990-2002 and 2002-2011	-0.4	0.0	-0.4	1.9	0.7	1.2
Chile	1990-2002 and 2002-2012	3.4	-0.2	3.6	1.4	0.5	0.9
Colombia	1991-2000 and 2002-2012	1.0	-0.3	1.3	1.7	0.8	0.9
Costa Rica	1990-2002 and 2002-2012	0.7	0.3	0.4	2.3	0.1	2.2
Dominican Republic	1991-2002 and 2002-2012	2.9	0.1	2.8	1.8	-0.1	1.9
Ecuador	1990-2001 and 2002-2012	-0.7	-0.1	-0.6	3.5	0.8	2.6
El Salvador	1992-2002 and 2002-2012	1.4	1.3	0.1	0.3	0.1	0.3
Guatemala	1989-2002 and 2002-2011	-0.3	-0.7	0.5	1.8	2.0	-0.2
Honduras	1990-2002 and 2002-2012	-0.4	0.5	-0.9	1.7	0.2	1.6
Jamaica	1992-2002 and 2002-2012	0.0	0.2	-0.2	-0.2	0.3	-0.5
Mexico	1991-2002 and2002-2012	0.3	0.9	-0.5	0.8	1.1	-0.3
Nicaragua	1990-2003 and 2003-2010	-1.0	0.5	-1.5	-0.7	-0.1	-0.6
Panama	1991-2002 and 2002-2012	0.2	0.9	-0.8	4.8	0.3	4.5
Paraguay	1997-2002 and 2002-2011	-2.6	-0.6	-2.0	0.5	0.2	0.3
Peru	1994-2002 and 2002-2011	-1.7	-0.4	-1.2	4.0	1.7	2.3
Saint Lucia	1994-2002 and 2002-2007	-0.6	-0.3	-0.3	-0.2	1.1	-1.2
Trinidad and Tobago	1990-2002 and 2002-2012	1.0	0.4	0.6	3.2	0.4	2.8
Uruguay urban areas[a]	1990-2002 and 2006-2011	1.8	0.9	0.9	4.2	0.7	3.4
Venezuela (Bolivarian Republic of)	1990-2002 and 2002-2012	-2.9	-1.6	-1.3	1.5	1.7	-0.2
Latin America and the Caribbean[b]		0.2	0.1	0.1	1.8	0.6	1.1
Northern subregion of Latin America[b]		0.5	0.5	0.0	1.6	0.4	1.2
Southern subregion of Latin America[b]		0.1	-0.1	0.2	2.3	0.9	1.4
The Caribbean[b]		-0.1	0.0	-0.1	1.0	0.5	0.5

Source: prepared by the author, on the basis of Jürgen Weller and Cornelia Kaldewei, "Empleo, crecimiento sostenible e igualdad", *serie Macroeconomía del Desarrollo*, No. 145 (LC/L.3743), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), 2013; and official data from the countries and the Economic Commission for Latin America and the Caribbean (ECLAC).

[a] The data for Argentina (31 urban agglomerations) and Uruguay (for 1990-2002) (urban total) are indicative only, because information on non-agricultural output growth was combined with urban employment data, in the absence of nationwide employment figures.

[b] Simple average.

Note: rates of intra- and intersectoral contributions do not necessarily add up to the variation in productivity, because of rounding. The total refers to the sum of value added of the different branches of activity. The calculation was performed in dollars at constant 1995 prices for 1990-2002 and at constant 2005 prices for 2002-2011/2012.

The northern subregion corresponds to the countries from Mexico to Panama, plus the Dominican Republic; the southern subregion corresponds to the Latin American countries to the south of Panama.

The result of this calculation shows the contribution of intrasectoral processes and structural change to variation in aggregate labour productivity, in constant dollar at 1995 prices for the first subperiod and at 2005 prices for the second. In order to compatibilize the results of the countries individually, and in view of the fact that the periods under analysis are of different length, annual growth rates of labour productivity were calculated for all countries and the contributions of intra- and intersectoral changes were translated into contributions to those growth rates.

Again, average labour productivity growth was faster in the second period, as compared with small rises in the first. In the regional average, between 1990 and 2002 neither intrasectoral changes nor structural change contributed to average labour productivity growth, whereas both made a positive contribution in the second period, with structural change representing about a third of aggregate labour productivity growth, and intrasectoral changes the other two thirds. There were large differences between countries and subregions in both periods, however. In the first period, intersectoral changes made a stronger contribution in the northern subregion, possibly because of the expansion of the maquila industry and mass emigration, especially to the United States. In the second period, the southern subregion showed better results in both components of productivity growth. In both periods, the Caribbean showed weaker results.

Slightly rising labour productivity helped bring about increases in real wages. According to household survey data, on average in the Latin American countries, average urban wages rose from 4.1 to 4.7 poverty lines per capita between 2002 and 2012, having risen from 3.8 to just 4.2 poverty lines per capita between 1990 and 2002 (ECLAC, 2013). However, real wages generally rose at lower rates than labour productivity, which points to the importance of the work of labour institutions, as well (ECLAC/ILO, 2012).

The evolution of labour productivity differentiated by branch of activity, resulting from intra- and intersectoral changes, also affected productivity gaps between these branches. As may be observed in table 2, in 1990-2002 productivity gaps broadened between branches of activity in the region (both in the weighted average of productivities, and in the simple average of productivities at the level of each economic activity), thereby deepening the region's hallmark structural heterogeneity. By contrast, in the following period the gaps narrowed by about the same amount as they had widened in the previous period, reflecting changes in

the patterns of employment generation in segments with different productivity levels, as will be discussed in the following section.

TABLE 2

Latin America and the Caribbean (23 countries): coefficient of variation of labour productivity in the different branches of activity
(Averages)

	Weighted average	Simple average
1990	0.78	0.96
2002	1.05	1.04
2002	1.63	1.15
2010-2011	1.36	1.08

Source: Jürgen Weller and Cornelia Kaldewei, "Empleo, crecimiento sostenible e igualdad", *Macroeconomía del Desarrollo series*, No. 145 (LC/L.3743), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), 2013.

Note: the first two lines (1990 and 2002) are based on productivity calculations in dollars at constant 1995 prices; the following two (2002 and 2010-2011) are based on productivity calculations in dollars at constant 2005 prices. The column "Weighted average" refers to the coefficient of variation of productivity of the various branches in the weighted average for the countries.

In sum, in 2003-2012, process of intra- and intersectorial change generated modest rises (with significant differences between countries) in labour productivity. This supported gains in real wages and improvements in non-wage indicators of employment.

(c) *Economic growth and employment generation in the segments of production*

As proposed in section III, in heterogeneous labour markets it is not enough to review the impact of changes in aggregate indicators between and within branches of activity; it is also essential to look at changes occurring between and within segments of varying productivity levels. This section illustrates the importance of this second aspect.[22]

As shown in figure 5, in the 1990s urban employment generation was concentrated mainly in low-productivity segments, which —in the simple average for the countries with information available— increased their share of

[22] Since the information available is not sufficient to measure the size of these segments regularly, labour indicators are used as a proxy. For some time now, ECLAC has been measuring the size of low-productivity segments in urban areas by the proportion of employed who are own-account workers (excluding professionals and technical workers), wage earners and employers in microenterprises, domestic service workers, or unpaid family workers.

urban employment from 45.7% to 50.1%. Starting around 2002, the proportion of employment in medium- and high- productivity segments rose in almost all the countries in the region, and fell in the low-productivity segments to around 44.1% on average.

Owing to data availability limitations, the analysis of the relationship between economic growth and the characteristics of employment generation looks at two categories of employment as proxies for labour

segments driven by supply and demand, respectively: wage employment and own-account work.[23]

Figure 6 shows, for the region overall, a high positive correlation (0.86) between economic growth and wage

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[23] Although not all wage employment corresponds to the demand-driven segment, and not all own-account work to the supply-driven segment, as will be seen, the great majority of the first category shows demand-driven patterns, and most of the second, supply-driven patterns.

FIGURE 5

Latin America: proportion of the urban employed working in low-productivity segments, 1990-2002 and 2002-2012

(Percentages)
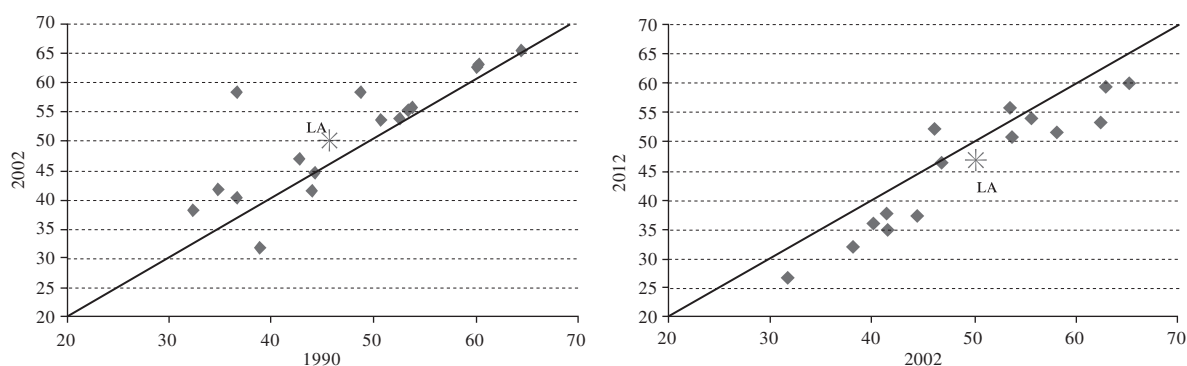
Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Social Panorama of Latin America, 2013* (LC/G.2580), Santiago, Chile, 2013. United Nations publication, Sales No. E.14.II.G.6.

LA: Latin America.

FIGURE 6

Latin America and the Caribbean: economic growth and changes in employment generation, 1995-2012

(Percentages)
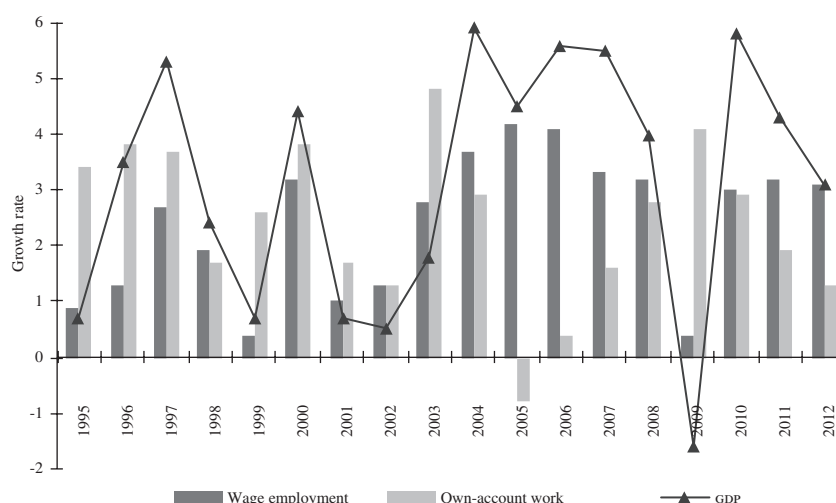
Source: prepared by the author, on the basis of official information from the countries and the Economic Commission for Latin America and the Caribbean (ECLAC).

GDP: gross domestic product.

employment in 1995-2012, since wage employment rose notably in years of high economic growth and very little in slow-growth or crisis years.

There is, conversely, a much less clear-cut relationship between economic growth and own-account work. In several years, own-account work behaved countercyclically, reflecting supply-side dynamics (for example in 1995, 1996, 1999 and 2009 in the context of weak wage employment generation, and between 2005 and 2007, in a relatively lengthy period of buoyant wage job creation). This behaviour reflects the nature of low-productivity segments, driven from the supply side by household need.

However, own-account work also behaves procyclically in some years, both amid relatively strong economic growth (1997, 2000, 2004, 2008 and 2010) —when not only was labour demand high, but individuals needing income found favourable opportunities for independent work— and amid low growth (2001 and 2002).

These varied dynamics underscore the internal heterogeneity of low-productivity segments, as mentioned in section III. Not only those excluded from wage employment enter own-account work; there is also a dynamic subsegment of opportunity-seekers. The overall result of the different rationales was that in 1995-2012 the correlation between GDP growth and the generation of own-account work at the regional

level was -0.23 (in other words, the countercyclical factor prevailed).

These same results are found at the country level. As shown in table 3, in the median for 14 countries wage employment has a correlation coefficient of 0.58 with economic growth, whereas the coefficient for own-account work is -0.27. Albeit with large differences between countries, wage employment behaves clearly procyclically. By contrast, the presence of both procyclical and countercyclical dynamics in own-account work leads to quite low correlation coefficients; the negative sign in almost all the countries appears to indicate that the countercyclical pattern prevails, however.

Higher economic growth thus especially favoured wage employment generation, which contributed to labour formalization. Since the pattern of wage employment is closely correlated with economic growth, in the aggregate growth is a stronger determinant of total employment generation in countries with higher relative rates of wage employment[24] (Weller, 2012).

The output elasticity of wage employment was approximately 0.5 in the median for the group of countries in the period 1995-2012. Although with much variation between countries, the predominant pattern points to consistent efforts to increase productivity, which (in the

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[24] Proportion of wage employment in total employment.

TABLE 3

Latin America (selected countries): employment-economic growth correlation coefficients and GDP elasticity of wage employment, 1995-2012

	Employment-economic growth correlation coefficient			GDP elasticity of wage employment
	Total employment	Wage employment	Own-account work	
Argentina (17)	0.71	0.77	-0.07	0.56
Brazil (18)	0.63	0.62	0.21	0.75
Chile (17)	0.54	0.65	-0.27	0.38
Colombia (18)	0.15	0.53	-0.34	0.26
Costa Rica (18)	0.37	0.45	-0.27	0.59
Dominican Republic (18)	0.61	0.20	0.50	0.54
Ecuador (17)	-0.19	-0.13	-0.01	1.32
El Salvador (16)	0.04	0.44	-0.30	0.45
Honduras (14)	-0.31	0.20	-0.03	0.91
Mexico (17)	0.79	0.87	-0.58	0.50
Panama (18)	0.34	0.70	-0.42	0.37
Peru (13)	0.08	0.33	-0.08	0.26
Uruguay (11)	0.67	0.77	-0.30	0.06
Venezuela (Bolivarian Republic of) (18)	0.47	0.78	-0.35	1.05
Latin America (median)	0.42	0.58	-0.27	0.52

Source: prepared by the author, on the basis of official information from the countries and the Economic Commission for Latin America and the Caribbean (ECLAC).

Note: the figure in brackets is the number of years with information available in each country.
GDP: gross domestic product.

aggregate) is partially offset by the expansion —albeit slowly more recently— in low-productivity jobs, reflecting persistent structural heterogeneity.

These changes in employment generation patterns helped to increase average labour income. Specifically, the concentration of new job creation in medium- or high-productivity segments led to a rise in average labour income, as shown in figure 7.

While in the 1990s the expansion of employment mainly in low-productivity segments had a slightly negative impact on average labour income, in the following period part of the rise in labour income was attributable to the reallocation of a portion of the workforce from low-productivity segments to medium- or high-productivity segments.

Since labour arrangements are much more formalized in the employment categories that make up the medium- and high-productivity segments, the shift in composition reflects improvements in formality levels and, thus, in employment quality.[25]

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[25] See Weller and Roethlisberger (2011) and ILO (several years). In addition, formalization policies targeting both sectors may have an impact (in this respect, see section IV.2.b).

The concentration of a large share of new jobs in the medium- and high-productivity segments, reflecting strong labour demand, was related to the expansion of formal employment in the tertiary sector, which in less favourable circumstances typically provides an informal and low-productivity refuge amid labour supply pressure (ECLAC, 2014b).

As figure 8 shows, in many countries commerce and services, and also construction, showed rates of formal employment growth well in excess of the rate in manufacturing and agriculture. This sectoral breakdown of formal employment reflects above all the pattern of economic growth increasingly focused on domestic-demand-related activities (those producing mainly non-tradable goods and services), which concentrated labour demand in those activities, thus facilitating the expansion of formal employment there.

The largest gaps between the expansion of total employment and formal employment occurred in the agricultural sector, mining, commerce, and community, social and personal services. This appears to be due to three factors: first, some of these sectors have low entry barriers, so that in low growth periods supply-driven employment creation is concentrated there, and this pattern

FIGURE 7

Latin America (median of 16 countries): breakdown of increases in labour income, by intra- and intersectoral contributions of segments of varying productivity levels, 1990-2002 and 2002-2011

(Per capita poverty line equivalents)

■ Latin America   ■ Southern subregion   ■ Northern subregion
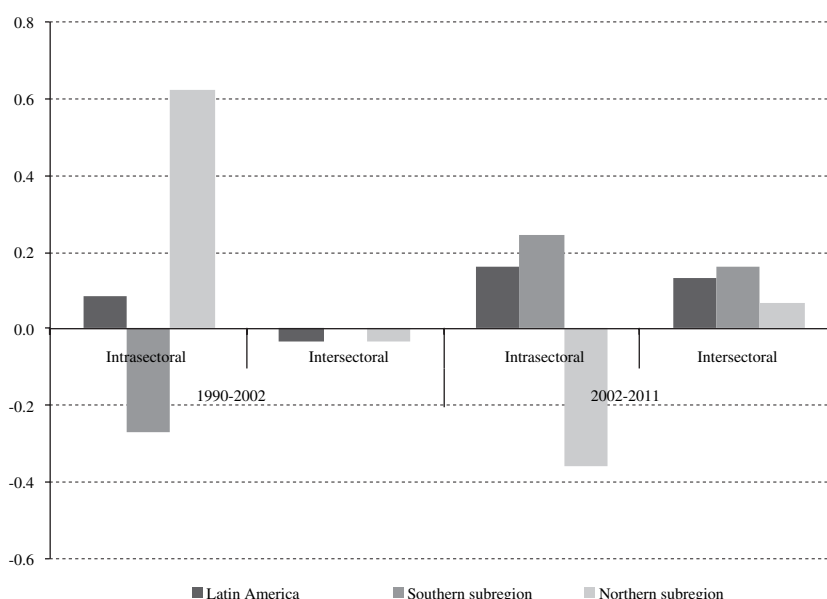
Source: prepared by the author, on the basis of Economic Commission for Latin America and the Caribbean (ECLAC), *Social Panorama of Latin America, 2012* (LC/G.2557-P), Santiago, Chile, 2013. United Nations publication, Sales No. E.13.II.G.6.

FIGURE 8

Latin America (median of 11 countries): formal and total employment and value added by branch of activity, annual growth rates, 2002-2012
(Percentages)

■ Formal employment   ■ Total employment   ▪ Value added
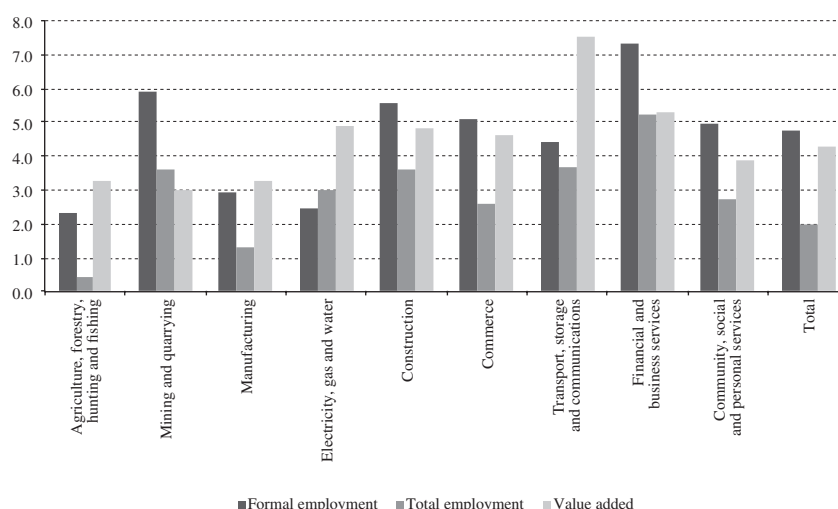
Source: prepared by the author, on the basis of official data from the countries.

Note: the information covers the following countries: Argentina, Brazil, Chile, Costa Rica, Ecuador, El Salvador, Guatemala, Mexico, Nicaragua, Panama and Peru. The data on formal employment refer to those paying into or affiliated to a contributory social protection system, except in Brazil (register of formal employment), Ecuador and Peru (surveys of firms with 10 or more workers in selected branches of activity). The data of annual growth in total employment and value added refer to the period 2002-2012, except in the cases of Brazil, Guatemala and Peru (2002-2011), Ecuador (2003-2012) and Nicaragua (2003-2010).

eases when economic growth is higher. Second, formal activities expanded strongly in some sectors, especially commerce, partly to the detriment of informal segments. And, third, efforts to formalize labour markets may have had a differentiated effect by sector, with greater progress in the abovementioned sectors.

In sum, the characteristics of labour demand have impacted the recomposition of employment, allowing advances in wage and non-wage aspects of work and improvements within branches of activity.

(d) *Growth, characteristics of labour demand and reduction of wage inequality*

Did economic growth and its characteristics play a role in the third of the stylized facts, the narrowing of the wage gap? As noted in section IV, the rise in the quantity of employment did not contribute directly to reducing inequality at the household level, but employment traits may have narrowed the gap in labour income, the most important mechanism in this regard. One key finding was that the rise in educational level appears to have helped to improve distribution by reducing gaps between household quintiles with different levels of per capita income (Cruces, García Domenech and Gasparini, 2012).

The labour policies applied during this period were another important factor (see section IV.2).

There are also signs that the skills bias in labour demand may have reversed during the first decade of the 2000s.

Among the causes of narrower income gaps, López-Calva and Lustig (2010) identify, for the four case studies they present on Argentina, Brazil, Mexico and Peru, decreasing demand bias for skilled workers, as the impact of intensive technological change on qualifications (triggered by the economic reforms of the 1980s and 1990s) runs its course.

Gasparini and others (2011) argue that demand for less skilled labour may have increased in the context of commodity expansion and intrasectoral processes, such as technology spread and the mismatch between the skills of workers with higher levels of formal education and the jobs available. The World Bank (2012) suggests that the concentration of growth in non-tradable sectors may have reduced the demand for higher-skilled workers, which is lower in these sectors than in manufacturing.

Table 4 shows the composition of additional employment for 15 countries, by level of education and differentiating wage employment (reflecting

demand for labour on the part of firms) from non-wage employment (representing different dynamics, mainly supply-side pressure).[26] As found for the 1990s (Weller, 2000), here, the majority of the new jobs are created are wage employment for workers with medium and high levels of education. As well, in keeping with progress in education systems, only a very small percentage of new employment (around 5% in the median for 15 countries) corresponds to individuals with 9 or fewer years of schooling.

Comparison of these results with those of the seven countries for which this same calculation was performed for a period in the 1990s (Weller, 2000, p. 157), shows slightly higher labour demand for less educated workers, whose numbers fall in unwaged employment in the median for these seven countries, but rise in the wage worker category. This appears to point to a labour demand that is more balanced by level of education, with less bias towards the most skilled. However, in the median of 15 countries, both wage and unwaged employment expand for individuals with a low level of schooling, albeit slightly more for unwaged. In any case, compared with the results for the 1990s, when the ratio of job creation for the least skilled in wage employment with respect to unwaged employment was around 0.5 (for seven countries) in the 2000s labour demand for this group was slightly stronger (with a ratio of wage to unwaged employment of 0.8), as it was as well for the larger group of countries.

In sum, labour demand continued to favour workers with an intermediate or high level of education, although there were also new opportunities for those with little formal education.

To analyse the sectoral characteristics of labour demand, a breakdown was performed using the methodology of Berman, Bound and Griliches (1994) to estimate the contributions of intra- and intersectoral changes both to higher demand for individuals with intermediate and high levels of formal education, and to lower demand for individuals with less formal education.[27]

As is evident in table 5, as in the 1990s, the expansion of wage employment for highly skilled workers was centred in the tertiary sector. Services —the sum of community, social and personal services and financial, real estate and business services— accounted for over half of these new jobs. By contrast with the 1990s, changes in commerce (for example, the large-scale expansion of retail commerce: supermarkets and hypermarkets,

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[26] The results are also presented for a group of seven countries for which this same information is available for the 1990s (Weller, 2000). Notably, those data cover a period prior to the "lost half-decade" that began in the late 1990s.

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[27] The breakdown is as follows:

$$\Delta S = \sum_{i=1}^{n} \Delta A_i S_i + \sum_{i=1}^{n} \Delta S_i A_i$$

for $i = 1, …, n$ branches of activity, where:
S = proportion of workers with a specific level of education in total wage employment.
S_i = proportion of workers with a specific level of education in the branch of activity i.
A_i = wage employment in branch i as a proportion of total wage employment.
The bars show the averages corresponding to the start and end years. The first term on the right of the function thus captures the contributions of changes between branches of activity (i.e. different with respect to the rise in wage employment), while the second term captures the contribution of changes within the branch of activity (i.e. variations in the share of personnel with a specific level of education in wage employment in that branch of activity).

TABLE 4

Latin America (median for 7 and 15 countries): composition of net additional employment, by level of education, for wage and non-wage workers, around 2002-2012

Group of countries	Employment category	Level of schooling			
		Up to 9 years	10-12 years	13 years or more	Total
7 countries	Employed	3.4	46.7	44.2	100.0
	Waged	3.3	24.7	32.6	82.4
	Non waged	-5.6	13.8	7.4	17.6
15 countries	Employed	4.7	46.3	44.2	100.0
	Waged	3.3	26.4	32.6	77.9
	Non waged	4.1	13.8	8.6	22.1

Source: prepared by the author, on the basis of data from household surveys conducted in the respective countries.

Note: the seven countries presented separately are Argentina, Brazil, Chile, Colombia, Costa Rica, Peru and the Plurinational State of Bolivia. The group of 15 countries also includes Bolivarian Republic of Venezuela, Dominican Republic, Ecuador, El Salvador, Honduras, Mexico, Panama and Paraguay.

malls and so on) pushed up demand for highly skilled personnel, and not only because of the expansion of this area of activity (the effect of intersectoral changes), but also because of intrasectoral changes. Conversely, manufacturing made only a weak contribution to demand for highly skilled workers, mainly because of the reduction in the sector's share in total employment. Intrasectoral changes did help to increase demand for skilled workers in manufacturing, although —as shown in the last column of table 5 (a)— the share of highly skilled personnel rose less than in other sectors. In relative terms, what stands out is the upgrading of skills demanded in construction, mining and, again, commerce.

Overall, the rise in the proportion of highly skilled workers within wage earners was due almost entirely to changes within branches of activity.[28] In several branches, especially in the tertiary sector but also in construction, new jobs were generated on the basis of intersectoral changes, but those additional jobs were largely offset by losses in other branches of activity.

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[28] This does not necessarily mean production shifts; change within a branch of activity often consists of the substitution of older workers who are retiring with younger workers who have a higher level of formal education.

TABLE 5

Latin America (median of 15 countries): contribution of intra- and intersectoral changes to variation in the share of education groups in wage employment, around 2002-2012
(Percentages)

(a) Wage-earners with a high level of education (13 years or more)

	Intrasectoral changes	Intersectoral changes	Total	Relative increase[a]
Total	4.09	0.20	4.29	1.00
Agriculture	0.14	-0.48	-0.34	1.01
Mining	0.07	0.11	0.18	1.19
Manufacturing	0.42	-0.29	0.13	0.72
Construction	0.08	0.22	0.31	1.42
Commerce	0.75	0.27	1.02	1.18
Transport and communications	0.26	0.16	0.42	1.14
Services	2.37	0.22	2.59	0.94

(b) Wage-earners with an intermediate level of education (10-12 years)

	Intrasectoral changes	Intersectoral changes	Total
Total	3.56	0.84	4.38
Agriculture	0.41	-0.03	0.37
Mining	-0.02	0.09	0.07
Manufacturing	1.18	-0.69	0.49
Construction	0.54	0.33	0.88
Commerce	0.80	0.89	1.69
Transport and communications	0.43	0.19	0.62
Services	0.20	0.06	0.25

(c) Wage-earners with a low level of education (up to 9 years)

	Intrasectoral changes	Intersectoral changes	Total
Total	-7.56	-1.01	-8.58
Agriculture	-0.61	-1.74	-2.34
Mining	-0.06	0.08	0.02
Manufacturing	-1.57	-1.24	-2.81
Construction	-0.66	0.77	0.11
Commerce	-1.50	0.84	-0.66
Transport and communications	-0.67	0.24	-0.43
Services	-2.49	0.03	-2.46

Source: prepared by the author, on the basis of data from household surveys conducted in the respective countries.

[a] Ratio between percentage growth of the education group in the particular branch of activity, and the percentage growth of the education group across all wage-earners.

Note: The countries covered are: Argentina, Bolivarian Republic of Venezuela, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Honduras, Mexico, Panama, Paraguay, Peru and the Plurinational State of Bolivia.

The rise in the proportion of workers with an intermediate level of formal education was also due mainly to intrasectoral changes (and, thus, part of the generalized rise in education level). However, intersectoral changes had a much stronger impact for this group than for more highly educated wage earners. In this respect, labour demand was notably strong from commerce and, to a much lesser degree, construction, transport and communications. Commerce also stands out for a large rise in workers with intermediate levels of education driven by intrasectoral changes, which underscores the impact of upgrading as noted earlier in relation to more skilled workers. Manufacturing also shows clear signs of upgrading of personnel structure, with sharp increases in workers with intermediate and (as already seen) high levels of education.

The contraction of employment of workers with low levels of formal education was also concentrated in changes within branches of activity, pushed along in part by upgrading of the educational structure in services, manufacturing and commerce. However, intersectoral shifts also played a role in this process, especially a reduction in employment in agriculture and manufacturing. The expansion of commerce and, in particular, construction, also produced jobs for workers with a low level of formal education.

The concentration of economic growth in the tertiary sector in 2003-2012 did not, then, reduce demand for highly qualified workers. As in the 1990s, such demand was in fact concentrated in the tertiary sector (Weller, 2000). In commerce, specifically, there are signs of upgrading driving demand for skilled workers.[29] As well, and unlike in previous years, in some cases shifts within —and sometimes between— sectors increased demand for workers with intermediate education and, to a lesser extent, with little formal education. Again, these processes occurred especially in the tertiary sector, although internal shifts also favoured expansion of employment for the group with intermediate education in manufacturing and agriculture.[30] This partial change in labour demand patterns appears to have benefited relatively less skilled workers (at least in terms of income) and helped to close wage gaps.

The shift in employment towards medium- and high-productivity segments also benefited average income in the low-productivity segments. As noted earlier, employment in these segments is heterogeneous. In countries with lower per capita GDP and thus a smaller proportion of wage-earners among the employed, a large share of own-account employment reflects supply pressure (Weller and Kaldewei, 2013, pp. 35-39). In these countries, per the theoretical arguments outlined in section IV, average labour income from own-account work is lower than in countries with a smaller proportion of own-account workers (where many of them choose to work independently in search of advantages) (Weller, 2012, p. 35).

Accordingly, a relative reduction in employment in low-productivity segments should also help to drive intrasectoral changes by lessening supply pressure and, specifically, should increase average income in these segments. Between 1990 and 2000-2002, the average income of wage workers (excluding professional and technical workers) in firms with five or more employees remained constant in poverty line terms, while the income of own-account workers (again excluding professional and technical workers) dropped by 0.6 of a poverty line. By contrast, between 2000-2002 and 2009-2010 the income of both groups rose (on average) by 0.4 and 0.6 of a poverty line, respectively.[31]

In sum, better economic conditions favoured the income of those employed at the base of the labour income scale, mainly because of two related mechanisms: stronger labour demand (especially in tertiary sector activities) for workers with low and intermediate levels of education, and declining supply pressure on low-productivity segments.

2. Labour institutions and employment characteristics

Apart from economic and production context, labour institutions have the greatest impact on the evolution and characteristics of employment. Recent changes in labour institutions have helped bring about improvements, especially in terms employment quality wage gaps.

In the first decade of this century the prevailing views on labour institutions shifted in many countries. The reforms of the 1990s emphasized expanding the

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[29] This result contradicts the finding of the World Bank (2012) that the strengthening of non-tradable sectors led to a fall in demand for skilled labour.

[30] Klasen, Otter and Villalobos Barría (2012) found that the natural resources boom in the mid-2000s had a beneficial distributive effect in rural areas in Honduras, by improving the income of agricultural workers. There is also anecdotal evidence from several countries to the effect that reduced labour supply has led to income gains in the agricultural sector.

[31] Author's calculations on the basis of ECLAC (2012).

range of hiring modalities, especially by using fixed-term contracts instead of the traditional indefinite contract, extending the use of trial periods and facilitating outsourcing mechanisms. Reforms also reduced the cost of dismissal, mainly by broadening the definition of fair dismissal and introducing unemployment insurance systems based on individual accounts (Vega Ruiz, 2005).

Generally speaking, and often as part of macroeconomic stabilization packages, real minimum wages fell sharply in the 1980s, then stagnated in the 1990s. In many cases labour inspection practices also weakened, amid broader strategies to reduce the role and size of the State. As a result, in many cases the gap between legal provisions and the reality at work tended to widen (Bensusán, 2006).

At the same time, the proportion of employment in medium- and high-productivity segments fell (owing to low rates of economic growth, a sharp fall in the proportion of public-sector employment and, at least temporarily, a drop in wage employment-GDP elasticity), which led to "de facto flexibilization". It also sapped the power of the trade unions.

The poor results of the reforms of the 1980s and 1990s and the various crises that broke out in Latin America and the Caribbean after the mid-1990s undermined the credibility of deregulation-based labour policy as a tool for job creation. Against this backdrop, in the 2000s new political proposals emerged in the region under the premise that the response to globalization should not be a one-fits-all approach to production restructuring and economic and labour policy (Fraile, 2009; Weller, 2009; Lee and McCann, 2011). At the same time, radical deregulation began to be treated with increasing caution in the international debate (IDB, 2003; Freeman, 2005). In Latin America, scepticism regarding deregulation is also driven by the fact that large-scale liberalizing reforms were considered to have had little impact on economic growth (IDB, 1997), and that the expectations of formal jobs creation attached to the reforms were not fulfilled.

In the 2000s, trade union organization improved in some countries and the decline in organized labour eased or reversed.[32] In this scenario, collective bargaining began to cover a slightly wider range of issues and new groups of workers, such as seasonal and domestic workers. In some cases, outsourcing was regulated after evidence that this tool tended to be abused, and employment conditions for domestic workers were brought into line with those for the general workforce.

Several countries addressed the gap between legislation in place and actual compliance by boosting resources for labour inspection. Many also developed schemes to encourage business and labour formalization, specifically in microenterprises and SMEs (ILO, 2014). Since informality is determined both by aspects of the production structure and by institutional factors, formalization policies also help to reduce labour market segmentation. In particular, formalization of contractual relations is crucial for employment quality, because the evidence shows that a formal contract of employment is often the key that unlocks other benefits that come with good-quality jobs (Weller and Roethlisberger, 2011; ECLAC/ILO/FAO, 2012).

A number of countries adopted reforms with a protective slant regarding individual labour relations, for example by reducing weekly working hours, increasing compensation for unfair dismissal, restricting the use of overtime or increasing overtime pay, and extending prenatal and postnatal leave.

At the same some, some countries strengthened unemployment insurance schemes or created new models (and a number of countries are in the process of doing so) to broaden systems to protect workers in the context of more volatile markets. Many countries have taken a more active stance on minimum wage policy, as well.[33] As in the 1990s, in Mexico the drop in the minimum wage was identified as having contributed significantly to broadening income gaps (Cortez, 2001; Bosch and Manacorda, 2010). Concerning the recent period, Cornia (2014), Keifman and Maurizio (2012), and ECLAC (2014c) all found that minimum wage gains and increased formality —or the combination of both—have been important factors in narrowing in gaps in several countries.

In short, unlike during preceding decades, in the recent period stronger measures were taken to strengthen workers' individual and collective rights in respect of the twofold purpose of labour institutions mentioned earlier, supported by measures such as business and labour formalization policies, albeit generally without leaving aside the aim of labour market efficiency.

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[32] See ILO (2009) for an illustration of the decline in labour organization between 1989 and 2005.

[33] In the median for 20 countries, the real minimum wage shows no change in 1990-2003, but increased by 2.0% in 2003-2012. If the changes are weighted by the working-age population, the annual increase for the recent period was 4.4% (author's calculation on the basis of official data from the countries).

V

Conclusions

In the period 2003-2012, the performance of the labour markets of Latin America and the Caribbean represented a departure from previous patterns in several aspects. In particular, the open unemployment rate fell noticeably thanks to a rise in employment levels, employment quality indicators improved in a context of labour formalization, and income gaps between more and less skilled workers narrowed.

To understand the factors influencing this performance, this article proposed analysing the behaviour of the economic and production context (economic growth, labour productivity trends and changes in structural heterogeneity) and of labour institutions. Review of these factors for the decade considered shows that the combination of the two factors shaped the three stylized facts characterizing recent labour performance. Relatively high economic growth stimulated labour demand, which boosted employment generation, especially in medium- and high-productivity segments, facilitating increased formality and higher labour income. The characteristics of labour demand, centred on non-tradable sectors (the tertiary sector and construction), set the patterns for employment generation. Intra- and intersectoral shifts led to rises in productivity, related —in several branches of activity, such as commerce and transport, storage and communications— to upgrading of the occupational structure, which helped to improve employment quality. Labour demand characteristics improved opportunities for workers with low and intermediate levels of education, as well, which helped to narrow income gaps. Institutional changes also contributed to narrowing these gaps, to employment formalization and to improvements in employment quality indicators. Strong employment generation was a key factor in bringing down poverty rates, as was the reduction in income gaps for lessening inequality at the household level.

Despite the progress noted, which reversed previous trends, labour markets in the region continued to show severe weaknesses, such as high levels of informality, large productivity gaps, a high percentage of poor and unprotected workers, low levels of labour market participation by women, sharp labour inequalities between men and women both within and outside labour markets, discrimination against various groups of workers, poor employment quality indicators, and low rates of continuous training, trade union membership and collective bargaining. Obviously, recent advances notwithstanding, the challenges remain considerable.

A number of factors threaten to at least slow the pace of labour improvements in the near future. First, amid slower global economic growth than in the recent past, the outlook for regional growth is less promising amid slacker external demand (ECLAC, 2014b). At the same time, in many countries domestic demand growth (driven chiefly by household consumption) is slowing owing to factors such as the end of the terms-of-trade gain (which slows the increase in disposable national income), the end of a period of exchange-rate appreciation and high levels of household indebtedness. At the regional level, employment generation was already weak by 2013, both in absolute terms and in relation to that year's economic growth (ECLAC, 2014a).

From the policy standpoint, the tendency in many countries to focus formalization efforts on incentives and more stringent oversight could start to yield diminishing returns. This is because many firms and workers with the production potential to assume the necessary costs have already done so, while other firms and workers still operating in informal conditions are labour-supply driven and their productivity is too low to support full formalization. It may, then, be time to rethink instruments for promoting development, especially of microenterprises and SMEs. It is also important to strengthen the virtuous cycle between labour productivity gains and employment quality. Key steps to this end are improving education, professional training and capacity-building, and strengthening the voice of workers by expanding organized labour and collective bargaining.

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The earnings share of total income in Latin America, 1990-2010

Martín Abeles, Verónica Amarante and Daniel Vega

ABSTRACT

This article analyses the share of total income represented by employment earnings in the countries of Latin America over the last two decades. It first considers the wage share of gross domestic product (GDP) and then adds in the earnings of self-employed workers. The findings indicate that both total wages and total earnings declined as a share of GDP in most of the region's countries over the period, although there were some exceptions. The reduction in earnings inequality seen over the past decade was not usually accompanied by an increase in the GDP share of earnings. This means that the improvement in personal income distribution was not matched by an improvement in functional distribution.

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I

Introduction

In recent decades, the great majority of studies on inequality have concentrated on analysing income distribution among individuals and households. Although functional income distribution has received greater attention in advanced countries over recent years, largely because of the decline in the wage share of income in those countries during the past three decades, the subject does not seem to have attracted the same interest in the countries of the Latin America region. This article argues that functional income distribution needs to be studied systematically and discusses some of the information constraints that usually hinder efforts to do so, particularly in the countries of Latin America.

The recent trend of earnings as a share of total GDP in the region's economies is analysed. The empirical evidence presented is structured around two main categories of earnings. First, information on the total wage share in the region's countries during the period from 1990 to 2011 is considered. Second, the wage share of GDP is corrected by adding self-employment earnings. Two methods are used to make this adjustment. The first is to assume, as is very commonly done in the literature, that all self-employed workers earn the average wage in the economy. The second is more rigorous and uses household survey data. The first step in this second adjustment is to use information from continuous household surveys to estimate what portion of the mixed

income of self-employed workers (both own-account workers and employers) comes from earnings. Once the self-employment earnings total has been identified, the proportion it bears to the wage total is calculated, once again from household survey information. On the basis of this ratio, the wage total identified by systems of national accounts is adjusted to obtain an estimate of total earnings as a share of GDP. On the basis of these two methodological approaches, the article presents new estimates for the volume of earnings in Latin America, while also illustrating their evolution and reflecting on the problems and constraints involved in studying functional income distribution in the region.

The article is organized as follows. First, the functional and personal approaches to studying income distribution are discussed (section II). Some issues involved in measuring the earnings share of total income are then described (section III), after which recent studies on functional income distribution are summarized (section IV). The following section discusses methodological aspects, presenting the information sources available for studies of this type in Latin America and describing the methodological options adopted in this paper (section V). Thereafter, the evolution of total wages as a share of total income in Latin America is analysed (section VI). Having highlighted the importance of self-employment work in Latin America (section VII), the article presents the results arrived at when this wage total is corrected to incorporate the earnings of self-employed workers (section VIII). Lastly, section IX contains some concluding remarks.

II

Functional and personal income distribution

The classical economists were concerned to analyse the relationship between functional income distribution and the production and capital formation process. In the now famous commentary at the start of his *On the Principles of Political Economy and Taxation*, David Ricardo argued that determining the laws that governed the division of output between workers, capitalists and

landowners was the chief problem of political economy (Ricardo, 1973). As Serrano and Medeiros (2001) argue, the idea of an economic surplus as conceived in the classical approach permeated to varying degrees into a number of the seminal works on economic development, as in the case of the well-known dual economy model propounded by Arthur Lewis (1954). Analysis of the

relationship between economic development and falling employment in traditional or subsistence activities, typically in rural areas (see Bhaduri, 1983), and indeed of the relationship between the creation of the surplus and capital accumulation from a sectoral and structural perspective (Rodríguez, 2006), entails some kind of analysis of the distribution of the surplus between the different social classes or sectors.

The classical emphasis on functional income distribution survived the marginal revolution of the late nineteenth century, albeit within a different conceptual and methodological framework whereby each factor of production (the social classes of the classical authors) appropriated a portion of output on the basis of its marginal contribution to the production process. A fundamental indicator in this school of thought is the wage share of total output in the economy. The consolidation of neoclassical economics around the mid-1950s, with its stress on analysis based on the study of economic agents' individual behaviour, led to the emphasis among mainstream economists shifting from functional income distribution to personal income distribution (Goldfarb and Leonard, 2005). At the outset, this interest in studying personal income distribution as opposed to functional distribution was resisted by post-Keynesian and neo-Ricardian economists, who argued for the primacy of the functional distribution debate not only on analytical grounds[1] but with the explicit objective of stressing the centrality of the social conflict between capitalists and workers in the development of capitalist economies.[2] They thus sought to highlight the idea that individual choices were heavily influenced by each person's position in the social stratification. The shift in emphasis towards personal distribution became patent in the 1960s and analysis of functional income distribution was relegated to the background (Atkinson, 2009).

Different historical or institutional factors drove the growing interest in personal income distribution. The complexity of modern production processes and the internal heterogeneity of the groups associated with the different factors of production help to explain why analyses of inequality have tended to centre on personal distribution. Not only can individuals and households derive income from different factors of production, but inequality can be very high within a given group (wage earners, for example). From an institutional perspective,

the consolidation of welfare States has given rise to a need for more accurate identification of the most vulnerable social groups, the main beneficiaries of public assistance, and for a more rigorous examination of income distribution within the working class. The personal approach has made it possible to analyse the impact of redistributive State action more thoroughly by using statistical information from household surveys to consider the effects of taxes and transfers on income. Thus, the growing popularity of the personal approach was also connected with the increasing use of specific surveys to collect household-level information and with methodological and technological advances in applied research.

It might also be said that analysis of the evolution of functional income distribution tended to fall out of favour because the data on the wage share of income were so stable in the period after the Second World War, and this empirical observation came to be identified as a stylized fact of capitalist economies (Kaldor, 1961). This empirical regularity would be reinforced in turn by the consolidation of neoclassical growth theory and the idea that the production potential of an economy could be captured by a Cobb-Douglas production function,[3] which implies an elasticity of substitution of 1 between labour and capital, and constant factor shares.

The subject has come back to prominence in recent years, however. In academia, a number of authors working in the post-Keynesian or structuralist tradition, or both, have systematically studied the impact of changes in functional income distribution on aggregate demand and economic growth.[4] Empirically, the assumed stability of functional income distribution was called into question by the downward trend observed in the wage share of income in virtually all industrialized countries from the early 1980s (see section III below). This new development even aroused the attention of academia, as a number of recent studies show.[5] Greater

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[1] Among other things, they pointed out the need for macroeconomic analysis to differentiate the various social classes' propensity to save.

[2] Authors such as Joan Robinson, Nicholas Kaldor and Luigi Pasinetti developed arguments along these lines.

[3] According to Paul Douglas, the division of national income between capital and labour was roughly constant for a long period. The most recent United States data are also consistent with a Cobb-Douglas production function. Despite the various changes in the economy over the past four decades, the division of income is easily explained by a Cobb-Douglas production function (Mankiw, 2007, pp. 55-58, cited in Atkinson, 2009).

[4] See, for example, Bhaduri and Marglin (1990) and Taylor (1991) on the subject of seminal contributions. For a summary of this literature, see Abeles and Toledo (2011).

[5] See, for example, Bentolila and Saint-Paul (2003); Gollin (2002); Serres, Scarpetta and Maisonneuve (2001); Feldstein (2008); IMF (2007), European Commission (2007); ILO (2008) and Ellis and Smith (2010).

interest was also shown in the subject in developing countries. In Latin America and the Caribbean, for example, the export commodity price boom gave a renewed centrality to the implications of the scale and sectoral origin of the economic surplus for the development process (ECLAC, 2012a), especially in the South American countries, and estimates of the rents associated with natural resource extraction have become an important policymaking input (Campodónico, 2008; ECLAC, 2013).

III

Measuring the earnings share of total income

The nature of the process whereby income is generated from economic activity is reflected in the income generation account of the System of National Accounts (SNA). This account shows how gross value added is distributed between workers, the owners of capital (including land and other natural resources whose rents can be appropriated by private individuals) and the government. In the 1993 revision, value added is treated as a resource in the income generation process, while remuneration for wage employees and taxes on products and production less subsidies are treated as use. The accounting balance is the operating surplus or mixed income, depending on the nature of the account. Mixed income reflects the surplus yielded by the production activities of unincorporated businesses, i.e., households.[6] It thus implicitly contains an element of remuneration for both the labour and the capital involved in the production activity being analysed. At best, the national accounts provide aggregate information on these two components of mixed income, and cannot separately identify the yield of labour and capital.[7] This is one of the main constraints on efforts to measure the wage share of income, most particularly in developing countries, where self-employment prevails. The total income of self-employed workers is usually included in this mixed income, with no distinction made between the remuneration of labour and capital.

All that is usually considered when the earnings share of total income is analysed is the ratio of wages to total gross domestic product (GDP).[8] This ratio may be expressed at market prices or at factor cost, depending on whether taxes on products and production less subsidies are included in the GDP measurement. Taken alone, this ratio shows that the wage share varies enormously between countries, ranging from 14% in Nigeria to 59% in Switzerland, and the region's countries tends to present low values for this indicator (see figure 1).

One regularity that emerges when the wage share of GDP around the world is analysed is the positive association with a country's level of wealth. Wages represent a larger share of GDP in richer countries (see figure 2). This relationship may be deceptive, however, since the fact that the share rises with per capita GDP may be due to the greater size of the informal economy in less developed countries. Thus, there may be large biases in comparisons between different countries and time periods. Comparisons across time will be affected if, as the evidence suggests, wage incomes and self-employment incomes react differently to the economic cycle. Comparisons between countries, meanwhile, can be expected to be heavily skewed by non-inclusion of self-employment income, as this will result in underestimation of the total income share going to labour: the greater the proportion of self-employment and thence the overall earnings of these excluded workers, the greater the underestimation will be.

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[6] These are essentially self-employed or own-account workers (street vendors, for example).

[7] In some of the region's countries, such as Peru between 1950 and 1965, self-employed workers' income used to be published as part of the national accounts statistics, but the information was discontinued as national practices were adapted to United Nations proposals for standardizing systems of national accounts. See [online] http://institutodelperu.org.pe/descargas/Publicaciones/De%20otras%20entidades/DOC/1966_webb_cuentas_nacionales_del_peru.pdf.

[8] Labour force participation studies based on data from surveys of businesses or industrial censuses have a similar limitation, as they measure the activity of firms above a certain size threshold (whether of output or number of employees), so that small or family businesses are excluded (see Rodríguez and Ortega, 2006, for a detailed description of the databases in which this type of information is compiled).

FIGURE 1

Wages as a share of GDP at market prices, around 2010
(Percentages)
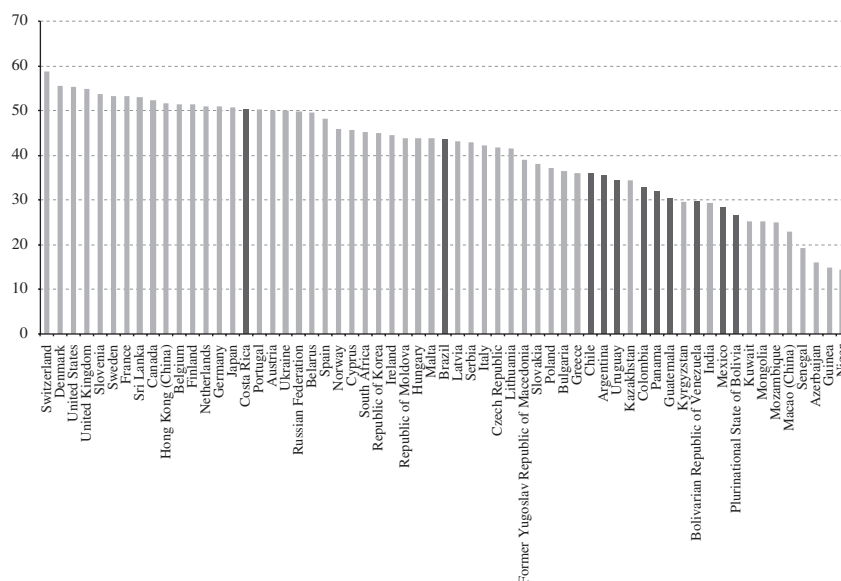
Source: prepared by the authors, on the basis of data from the United Nations Statistics Division (UNSD).

GDP: gross domestic product.

FIGURE 2

Wages as a share of GDP and per capita GDP at market prices, 2010
(Percentages)
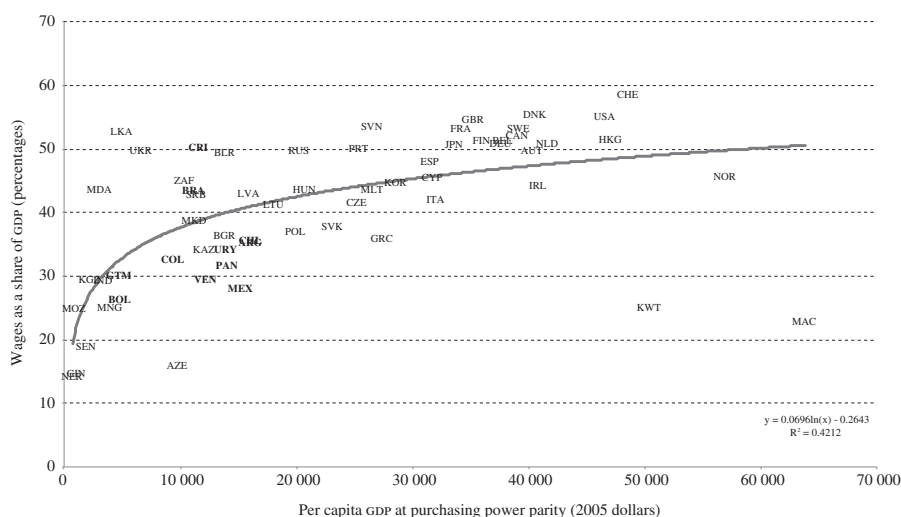
$$y = 0.0696\ln(x) - 0.2643$$
$$R^2 = 0.4212$$

Per capita GDP at purchasing power parity (2005 dollars)

Source: prepared by the authors, on the basis of data from the United Nations Statistics Division (UNSD) and International Monetary Fund (IMF), World Economic Outlook Database.

GDP: gross domestic product.

CHE: Switzerland, DNK: Denmark, USA: United States, GBR: United Kingdom, SVN: Slovenia, FRA: France, SWE: Sweden, CAN: Canada, FIN: Finland, BEL: Belgium, LKA: Sri Lanka, JPN: Japan, DEU: Germany, HKG: Hong Kong (China), NLD: Netherlands, UKR: Ukraine, CRI: Costa Rica, BLR: Belarus, RUS: Russian Federation, PRT: Portugal, ESP: Spain, AUT: Austria, MDA: Republic of Moldova, ZAF: South Africa, BRA: Brazil, SRB: Serbia and Montenegro, LVA: Latvia, HUN: Hungary, KOR: Republic of Korea, CYP: Cyprus, IRL: Ireland, CZE: Czech Republic, ITA: Italy, LTU: Lithuania, NOR: Norway, MLT: Malta, MKD: Former Yugoslav Republic of Macedonia, SVK: Slovakia, POL: Poland, BGR: Bulgaria, GRC: Greece, CHL: Chile, ARG: Argentina, URY: Uruguay, PAN: Panama, COL: Colombia, VEN: Bolivarian Republic of Venezuela, MEX: Mexico, GTM: Guatemala, BOL: Plurinational State of Bolivia, KWT: Kuwait, MOZ: Mozambique, MAC: Macao (China), MNG: Mongolia, SEN: Senegal, AZE: Azerbaijan, GIN: Guinea, NER: Nigeria.

IV

Recent studies on the earnings share of total income and its determinants

Recent studies of functional income distribution have all identified a significant change in the last three decades. By contrast with the so-called *trente glorieuses*, the three decades of strong growth that followed the Second World War, the earnings share of total income has been falling in the countries of the Organisation for Economic Co-operation and Development. The trend is less homogeneous in developing countries and emerging economies, although the earnings share has also been dropping in most of them. Recent studies providing evidence of this are Stockhammer (2013) and ILO (2011 and 2013). These studies look at the evolution of the adjusted wage total, calculated by multiplying the average compensation of wage earners by the number of workers in the economy. Self-employed workers are thus incorporated on the assumption that they earn roughly the same as wage workers.

The drop in the earnings share of total income has not generally been due to structural changes in economic activity involving a shift from sectors with a large wage share to others with a smaller share (displacement effects). Rather, it has been due to a decline in the wage share within certain sectors (ILO, 2011). In particular, the ratio has declined considerably in financial intermediation and high- and medium-technology manufacturing, with a less pronounced drop in services, construction and low-technology manufacturing. It has also been found that the downward trend in the adjusted earnings share in developed countries has been mainly due to the declining share of low- and medium-skilled workers' earnings, while the earnings share of highly skilled workers has tended to rise (ILO, 2013).

In recent years, a quite substantial literature has attempted to relate the recent evolution of the earnings share with the structural reforms implemented in the past few decades, analysing possible links with various developments such as global offshoring of production

processes, labour market deregulation, the deregulation and increasing predominance of financial markets, and changes in institutions and the degree of unionization, among other things (Bentolila and Saint-Paul, 2003; Bernanke and Gürkaynak, 2002; Fichtenbaum, 2009; Gollin, 2002; Harrison, 2002; Hogrefe and Kappler, 2012; IMF, 2007; Jayadev, 2007; Rodríguez and Ortega, 2006). However, there has been little in the way of systematic approaches to the link between the evolution of functional and personal income distribution. While studies of functional distribution take a macroeconomic approach, those centring on personal distribution treat it as a microeconomic phenomenon, accounted for basically by the distribution of individuals' personal characteristics. One attempt to relate the two approaches can be found in a study by Daudey and García-Peñalosa (2007) providing econometric evidence that a low wage share of output has a negative and significant effect on personal income inequality.

For a better understanding of the determinants of income inequality and the connection between personal and functional inequality, it is first necessary to have an accurate diagnosis of functional income distribution and its evolution. There are analyses from a factorial perspective for some countries in the region, including Lindenboim (2008), Lindenboim, Kennedy and Graña (2010) and Graña (2007) for Argentina; Hernández Laos (1998) for Mexico; UNDP (2010) and Amarante and Vigorito (2011) for Uruguay; and Ministry of Planning and Cooperation (2000) for Chile. However, there is no analysis combining a comparative perspective in the region with systematic, comparable inclusion of self-employment income. The present article seeks to advance in this area, and while the matter may seem straightforward, a number of information availability problems have to be dealt with, as detailed below.

V

Methodology

1. The information available in Latin America

National accounts statistics in the region are prepared by central banks or national institutes of statistics.[9] Not all countries make disaggregated information on mixed income publicly available. In the region, this information is available for Argentina, the Bolivarian Republic of Venezuela, Brazil, Chile, Colombia, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru and Uruguay, although in most cases only for the most recent period (usually since the last base change), while in some cases it is not disaggregated by branch of activity.[10] This information is assembled by the databases of the Economic Commission for Latin America and the Caribbean (ECLAC) and the United Nations Statistics Division (UNSD).[11]

The ECLAC data are available in CEPALSTAT, a database that includes information for recent years on 14 of the region's 18 countries (not counting Cuba or Haiti), without distinguishing mixed income, which is consolidated with the operating surplus (even in cases where the information available from the countries is disaggregated). The detail of the information available in this database is presented in table A.1 of the annex. One advantage of the database is that it holds long-term information, although in practice there are large hiatuses in the time series because of base changes or other alterations in methodology.

UNSD holds information on a great many countries, including 16 in the region, distinguishing mixed income from the operating surplus and including a breakdown

of the different series by business sector.[12] However, the data cover a more limited time period, with information going back to the 1970s for just 7 of the 16 countries. The detail of the information on Latin America held by UNSD is presented in table A.2 of the annex.

This paper uses information from the CEPALSTAT database, supplemented by information from the relevant official bodies for countries not included in CEPALSTAT (Argentina, Costa Rica and Guatemala). In the case of Uruguay, where SNA information only runs up to 2005, the wage ratio was updated in line with the average nominal wage index, the employment rate and GDP at factor cost.

2. Methodologies for estimating total earnings

To avoid the biases in the measurement of the earnings share that arise when the analysis does not cover the totality of earnings but only wage income, as discussed in section III, the earnings of self-employed workers need to be estimated.

A first problem to be addressed, then, is how to separate out from the mixed income total the share deriving from the remuneration of labour and the share deriving from returns to capital. The first component should be added to wage employees' remuneration to obtain the true labour share of income generated in the economy. Different methods have been suggested for making this correction. One possibility is to carry out estimates on the assumption that self-employed workers earn roughly the average wage. Gollin (2002) makes adjustments of this type for a large group of countries, and concludes that a substantial part of the differences in the earnings share of total income between rich and poor countries is due to methodological errors caused by the non-inclusion of self-employment incomes. Studies by Stockhammer (2013) and ILO (2011 and 2013) also rely on a correction of this type. The present paper carries out estimates using two methodologies, the first of which consists in assuming that self-employed workers earn roughly as much on average as wage employees.

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[9] Institutes of statistics are responsible for gathering this information in Argentina, Brazil, Colombia, Mexico, Panama, Peru and the Plurinational State of Bolivia, while central banks do so in the Bolivarian Republic of Venezuela, Chile, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Paraguay and Uruguay.

[10] Some countries have information on mixed income prior to 1990 in their systems of national accounts.

[11] There are other sources of information for analysing the wage share of GDP, based not on national accounts data, however, but on business surveys or censuses. The two main databases of this type are those of the United Nations Industrial Development Organization (UNIDO) and the Organisation for Economic Co-operation and Development (OECD). Details of these databases can be found in Rodríguez and Ortega (2006).

[12] This total does not include Ecuador, whose data only go up to 1991. In the breakdown by business sector, mixed income figures are not always available.

A more rigorous solution is to try to separate the employment remuneration share from capital returns in the mixed income total for countries that calculate it separately. For this, the earnings of self-employed workers can be simulated by considering their personal characteristics and the economic sector they work in (rather than using the average wage for all of them). A solution of this type is adopted by Young (1995) for the countries of Asia on the basis of census information, on the assumption that self-employed workers earn the same as wage workers who are similar in age, sex, education level and economic sector. Even when no official information is available on mixed income, the estimate of the earnings share can be corrected. To this end, the household survey is first used to calculate the ratio between the wage total and self-employment income, and then this coefficient is applied to the wage income recorded in the national accounts.

These estimates can now be made using information from household surveys. This is the second methodological option adopted in this article. The ratio between total wage income and total self-employment income is estimated on the basis of microdata from household surveys, and this ratio is used to correct the total share of wages in GDP.

As a first step, the employment income of self-employed workers is estimated in the light of their personal characteristics and economic sector, on the assumption that their earnings are similar to those of wage employees. The procedure is to start by estimating wage equations for private-sector wage earners, using as dependent variables sex, age and age squared, years of education and binary variables distinguishing by branch of activity. The coefficients obtained in these wage equations are applied to the characteristics of self-employed workers so that the earnings of each self-employed worker included in the survey can be predicted. When these predictions for the earnings of self-employed workers are lower than the income reported in household surveys, the difference is assumed to represent returns to capital. Accordingly, the figure yielded by the prediction is taken to be the amount earned by these self-employed workers. If the earnings predicted for self-employed workers are higher than the earnings declared in household surveys, the whole of the latter amount is taken. On the basis of this new vector of self-employed workers' earnings, it is possible to establish a relationship of proportionality between the total earnings of self-employed workers and the wage total (also reported in household surveys). This ratio is applied to the SNA wage data to reach a final estimate of total earnings, which is then compared to GDP.

VI

The wage share of total income in Latin America

Information from the countries' national accounts data can be used for an initial analysis of the evolution of the wage share of national income in the region's countries. As already discussed, this is a rough approximation, as it only includes the earnings of wage workers. Again, there are large jumps in the time series for the region at points where the base year for the national accounts changes, in view of which the decision was taken to consider the continuous time series available for the countries in the period between 1990 and the latest year available (which differs by country). The ratio between remuneration of labour and GDP at factor cost is considered.[13] CEPALSTAT information is supplemented

by data from the relevant official bodies in cases where countries are not incorporated into CEPALSTAT (Argentina, Costa Rica and Guatemala). The wage share in Uruguay, for which SNA information only goes up to 2005, was updated using the average nominal wage index, the employment rate and GDP at factor cost.

Taking the latest year with information available (around 2009), the total wage share ranges from 24% in Peru to 56.7% in Costa Rica (see table 1). Analysis of the evolution of this share reveals a decline in most of the countries (8 out of a total of 12), the exceptions being the Bolivarian Republic of Venezuela, Chile, Costa Rica and Paraguay. Of the countries where there was an improvement in the period considered, Costa Rica stands out as the only one to show a steady upward trend in wages as a share of GDP. In the Bolivarian Republic of Venezuela, Chile and Paraguay, the wage share of GDP

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[13] The measurements yield larger shares at factor cost than at market prices, since the market price GDP calculation includes product and production taxes minus subsidies.

shows a decline in the last decade after rising strongly between 1990 and 2000.[14] The countries where the wage share fell between 1990 and the late 2000s followed a more heterogeneous path. In Argentina and Brazil, a drop in the 1990s was followed by a partial recovery in the 2000s. In the Plurinational State of Bolivia, the wage share improved in the 1990s and fell in the 2000s. Colombia, Honduras, Panama and Peru registered declines throughout the period (with quite sharp drops over the 1990s in the first three cases). Mexico shows almost no change between the start and end of the period, as an increase in the 1990s was followed by an almost symmetrical decline in the 2000s. Developments in all years are shown for each country in figure A.1 of the annex.

If the countries are classified into three groups, distinguishing (i) those with a wage share of up to 35%, (ii) those with a share of between 35% and 45% and (iii) those with a share of over 45%, the country ranking proves fairly stable, since Mexico and Peru are in the first group, Argentina, Colombia and Paraguay in the second and Brazil, Costa Rica and Honduras in the third

in all three years. The other countries either do not have information for all three years or change their position in the ranking in one of them (see table A.4).

The evolution of the wage share of income depends on differences in real wage and labour productivity growth. Figure A.2 of the annex compares changes in real wages and labour productivity in the region's countries. In the 1990s, productivity grew by more than real wages in Argentina, the Bolivarian Republic of Venezuela, Chile, Guatemala, Panama, Peru, the Plurinational State of Bolivia and Uruguay, which explains why the wage share fell there in that period, and by less in Colombia, Costa Rica and Paraguay, which explains why the wage share rose there. In Brazil, Mexico and Nicaragua, they grew at a similar pace, and as a result there were no significant changes in functional income distribution in those countries over the period. In the 2000s, real wages grew faster than labour productivity in Argentina, the Bolivarian Republic of Venezuela, Brazil, Colombia and Costa Rica, which accounts for the rise in the wage share over the period. The opposite held true in Chile, Guatemala, Mexico, Panama, Paraguay, Peru, the Plurinational State of Bolivia and Uruguay.

A very important change in the region's social indicators has been a shift away from the worsening trend in personal income inequality that was seen to a

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[14] The specific years the table 1 data relate to for each country are presented in table A.3 of the annex. The differences are determined by data availability.

TABLE 1

Wages as a share of GDP at factor prices

	Wages as a share of GDP			Change in the wage share of GDP		
	Around 1990 (a)	Around 2000 (b)	Around 2009 (c)	1990-2000 (b)-(a)	2000-2009 (c)-(b)	1990-2009 (c)-(a)
Argentina	44.7	40.5	42.9	-4.2	2.4	-1.8
Bolivia (Plurinational State of)	38.2	41.9	34.5	3.8	-7.4	-3.6
Brazil	53.5	47.1	51.4	-6.3	4.3	-2.1
Chile	38.7	46.5	45.4	7.8	-1.1	6.7
Colombia	41.4	36.2	36.1	-5.3	-0.1	-5.3
Costa Rica	48.3	50.6	56.7	2.3	6.1	8.4
Guatemala		36.3	32.8		-3.5	
Honduras	54.8	47.5	47.4	-7.3	-0.1	-7.4
Mexico	32.3	34.5	32.2	2.2	-2.3	-0.1
Nicaragua	59.6	56.2		-3.4		
Panama	58.6	40.6	35.2	-18.0	-5.4	-23.4
Paraguay*	43.4	59.0	47.2	15.7	-11.9	3.8
Peru	28.7	27.0	24.0	-1.8	-3.0	-4.7
Uruguay		47.4	45.8		-1.6	
Venezuela (Bolivarian Republic of)	31.1	35.6	33.5	4.5	-2.1	2.4

Source: prepared by the authors, on the basis of information from CEPALSTAT, the National Institute of Statistics and Censuses (INDEC) of Argentina, the Central Bank of Costa Rica, the Bank of Guatemala and the Central Bank of Uruguay.

* In Paraguay, the 1990 figure is 50% below the average for the indicator in 1991-2009. Including it hugely distorts the evolution of the time series, so the decision was taken to start the analysis for that country in 1991.
GDP: gross domestic product.

greater or lesser degree in virtually all the Latin American countries during the 1990s. After rising for a decade in most of them at that time, inequality indicators began to decline in many cases in 2002 or 2003, depending on the country (see ECLAC, 2012a and 2012b). The various studies agree in identifying the role of the labour market in this overall decline in household income inequality, since income from the labour market has become less unequal, driving the decline in inequality.[15] However, as is revealed by the foregoing analysis and illustrated in figure 3, the greater homogeneity of earnings, which occurred in a context of rising incomes, has not been

matched by a greater share for wages in total GDP. Income inequality fell between 2002 and 2009 in all the Latin American countries except Costa Rica, but only in Argentina, Brazil, Costa Rica and Uruguay did the wage share of total GDP rise.[16] Distributive improvements at the household level have not usually been matched by a more egalitarian share-out in terms of appropriation by capital and labour. One theory is that this might be because the income figures on which personal distribution indicators such as the Gini coefficient are based do not fully incorporate property income in practice owing to issues of data capture. If this is so, it might be said that total wages have been distributed more equitably overall in the last decade, without significant changes (or indeed with greater concentration in asset-owning sectors) in the distribution of the economic surplus generated in the region.

[15] One of the main limitations of household surveys is that they struggle to capture incomes properly at the top of the distribution. One option that has gained ground in recent years is the incorporation of other sources of data into the analysis, especially income and wealth data from fiscal records (see Piketty, 2003; Atkinson and Piketty, 2007 and 2010). Studies of this type have been carried out for some countries in the region (see Alvaredo, 2010; Alvaredo and Londoño, 2013; Burdín, Vigorito and Esponda, 2014). Traditional inequality estimates from household survey data have also been corrected using national accounts data (see Yamada, Castro and Bacigalupo, 2012).

[16] Figure 3 does not include Guatemala, since the latest Gini index figure available for the country is from 2006.

FIGURE 3

The wage share of GDP and the Gini index, 2002-2009
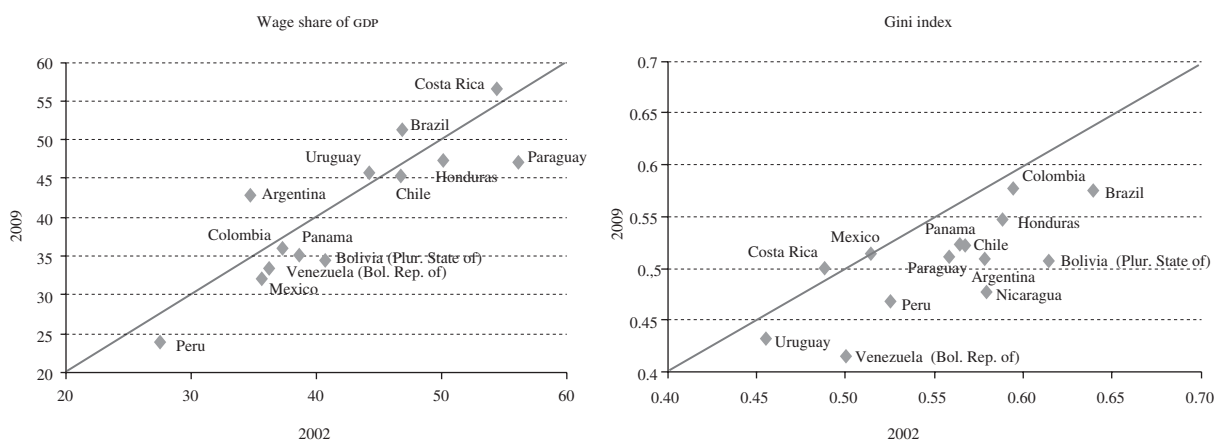
Source: prepared by the authors, on the basis of information from CEPALSTAT, the National Institute of Statistics and Censuses (INDEC) of Argentina, the Central Bank of Costa Rica and the Central Bank of Uruguay.

GDP: gross domestic product.

VII

The scale of self-employment in Latin America

One of the distinctive features of labour markets in Latin America is the scale of self-employment, which encompasses own-account workers and employers. Self-employment accounts for a very large proportion of total employment in the region: almost 32% on average in the countries considered, ranging from 22% in Argentina to over 49% in Colombia around 2011. The share of wage employment has increased in the last decade from 59.8% to 63.7% of total employment in the region, and there has also been a small increase in the wage share of per capita household income (see table 2).

The income reported by self-employed workers represents a very substantial proportion of total per capita household income (about 31% in the region). Theoretically, given the nature of the activities involved, some of this income is payment for labour and another part is returns to capital. As explained earlier, this income is not included in the wage share reported in the national accounts, and this is a major limitation, especially when it comes to comparing countries with different degrees of development. Two adjustments to traditional estimates of the earnings share designed to incorporate self-employed workers' incomes will now be presented.

TABLE 2

Wage and self-employment work and incomes

| | Around 2000 | | | | Around 2011 | | | |
| | Total employment share | | Household income share | | Total employment share | | Household income share | |
	Wage workers	Self-employed	Wage income	Self-employment income	Wage workers	Self-employed	Wage income	Self-employment income
Argentina	72.0	26.8	42.4	30.3	76.9	22.4	49.8	25.1
Bolivia (Plurinational State of)	32.1	47.5	41.5	27.7	41.3	40.8	46.8	37.3
Brazil	62.8	31.1	35.4	20.7	68.4	28.7	42.4	19.4
Chile	74.4	24.1	46.4	29.9	77.4	22.3	52.8	26.3
Colombia	49.4	45.6	45.2	27.8	46.0	49.5	44.0	29.7
Costa Rica	71.6	26.5	64.9	19.8	75.9	22.8	62.8	17.3
Guatemala	47.0	38.8	38.2	45.8	51.4	35.0	32.5	42.1
Honduras	49.6	41.2	45.5	29.0	43.7	45.7	47.4	28.5
Mexico	66.1	26.6	46.7	28.4	73.0	22.1	49.7	13.6
Nicaragua	52.3	35.1	50.7	40.8	48.9	39.3	50.4	38.2
Panama	62.7	32.3	60.3	24.5	67.5	28.7	54.5	28.9
Peru	40.5	44.0	39.4	29.8	44.9	42.9	42.5	31.1
Paraguay	44.8	45.2	42.9	37.8	52.9	39.5	47.0	41.7
Uruguay	72.7	25.7	42.1	16.1	71.9	26.8	46.5	16.3
Venezuela (Bolivarian Republic of)	56.4	41.9	45.5	39.1	57.2	41.9	52.3	27.9
Latin America	59.8	33.4	45.4	31.7	63.7	31.6	46.2	30.9

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of continuous household survey data.

VIII

Reestimation of the labour share including self-employment income

As detailed in subsection V.2, two adjustments were made to estimate the earnings share of GDP. The first is the more current in the literature (being similar, for example, to that used in ILO, 2013) and consists in imputing the average wage estimated from SNA data to all self-employed workers and adding this amount to SNA-reported wages and salaries.[17]

The second option, detailed in subsection V.2, is more rigorous and consists in using information from household surveys to estimate the ratio between total wages and total self-employment income, and then correcting the wage share of GDP on this basis.

Wage equations were estimated for the totality of wage employees in the economy, with sex, age and age squared, years of education and binary variables distinguishing branches of activity being taken as the dependent variables.[18] Setting out from the coefficients estimated in these equations, an earnings prediction was made for each of the self-employed workers (both own-account workers and employers) included in the household surveys. When the predicted earnings of self-employed workers proved lower than the income reported by them in household surveys, returns to capital were assumed to make up the difference. Accordingly, the figure yielded by the prediction is taken to be the amount earned by these self-employed workers. If the earnings predicted are greater than the earnings declared in household surveys, the whole of the latter amount is taken as the earnings of the self-employed workers. The result of following this criterion was that the predictions were used for only 41% of own-account workers (taking the average across the countries for the years considered), although for employers the predictions

were used 71% of the time. This outcome is reasonable, as it presumably reflects the greater importance of returns to capital among employers. A new earnings vector was thus estimated for each of the self-employed workers included in the household survey. The ratio between the wage total given by the survey and the earnings total estimated by this methodology was then calculated. This ratio was applied to the wage total reported in the SNA for each country and year, and total earnings were thus estimated (i.e., wage income plus self-employed workers' earnings) and measured against GDP. Table 3 compares the three results: the wage share of GDP according to the SNA, the correction arrived at by assuming that self-employed workers earn roughly the average wage, and the more detailed correction made using the methodology explained above.

In all cases, the adjustment made by imputing average wages leads to a large overestimation of total earnings in the region's countries. In the cases of Honduras (2010), Paraguay (2001) and the Plurinational State of Bolivia (2000), the result is that earnings amount to almost 100% of GDP measured at factor cost. When the estimates are carried out by the second method, the finding is that a substantial proportion of self-employed workers, and own-account workers in particular, declare lower earnings in surveys than would be expected from the predictions based on their personal characteristics and branch of activity.[19] This income gap relative to wage workers indicates that simply imputing average wages produces a substantial bias. On average, this second method of estimation increases the size of wage earnings by 25 points.

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[17] Specifically, what is added is the product of the average wage multiplied by the number of self-employed workers in the country. The estimates for the self-employed worker total come from continuous household surveys and CEPALSTAT.

[18] The results of these estimates are available from the authors on request.

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[19] A limitation of the adjustment methodology used in this study is its assumption that wage workers and self-employed workers pay similar amounts of social security contributions and taxes and that the proportions contributing are likewise similar (given that a ratio obtained from the net incomes reported in household surveys is applied for most of the countries) to a variable (the wage total) that includes contributions.

TABLE 3

Total wages and estimated total earnings as shares of GDP

		Wages/GDP	Earnings/GDP Estimate 1	Earnings/GDP Estimate 2
Argentina	2000	40.5	54.4	45.7
	2006	41.5	54.2	48.7
Bolivia (Plurinational State of)	2000	41.9	100.1	56.9
	2007	34.5	70.9	47.0
Brazil	2001	47.7	68.2	56.9
	2009	51.4	70.6	59.7
Chile	2000	46.5	61.3	54.9
	2009	44.5	58.1	52.8
Colombia	2000	36.2	68.3	41.2
	2009	44.5	58.1	52.8
Costa Rica	2000	50.6	69.8	55.8
	2010	56.9	73.8	65.0
Guatemala	2003	35.5	61.3	46.6
	2007	33.5	53.7	44.4
Honduras	2010	47.5	93.1	65.5
Mexico	2000	34.5	48.2	45.6
	2008	31.4	41.1	36.2
Panama	2000	40.6	54.4	47.8
	2009	35.2	49.2	40.6
Paraguay	2001	58.5	116.7	84.3
	2007	47.2	87.7	68.0
Peru	2000	27.0	55.1	35.9
	2009	23.3	46.0	31.3
Uruguay	2000	47.4	63.6	57.0
	2010	45.8	62.0	54.3
Venezuela (Bolivarian Republic of)	2000	35.6	56.4	46.5
	2010	38.4	58.2	44.5

Source: prepared by the authors, on the basis of information from CEPALSTAT, the National Institute of Statistics and Censuses (INDEC) of Argentina, the Central Bank of Costa Rica, the Central Bank of Uruguay and continuous household surveys.

GDP: gross domestic product.

Estimation by the second method yields a substantial increase in the earnings share over the SNA figures, which only include wages, but the results are lower than those produced by imputing the average wage. This new estimation, which is considered the best for the purposes of this paper, reflects the volume of earnings, which range from 31% of GDP in Peru to 65% in Costa Rica. Taking the average for all the countries considered, the earnings share increases by 10 percentage points over the figure for wages alone.

Changes in the earnings total are fairly similar across the board, although greater in countries where there is more self-employment, such as Colombia.

The household survey information can be used to analyse the distribution of the total earnings estimated by the second methodology in accordance with worker characteristics, taking the sum of wage incomes and the new own-account worker earnings vector from the household survey, by worker education level and sex. Where education levels are concerned, the distribution evinces great stability across countries, with over half of all earnings being generated by workers with complete or incomplete tertiary education (see figure 4). Women generate an average of 35% of all earnings in the region's economies, and their share has been rising in most of the countries analysed (see figure 5).

FIGURE 4

Shares of total earnings by education level, around 2000 and 2009[a]
(Percentages)
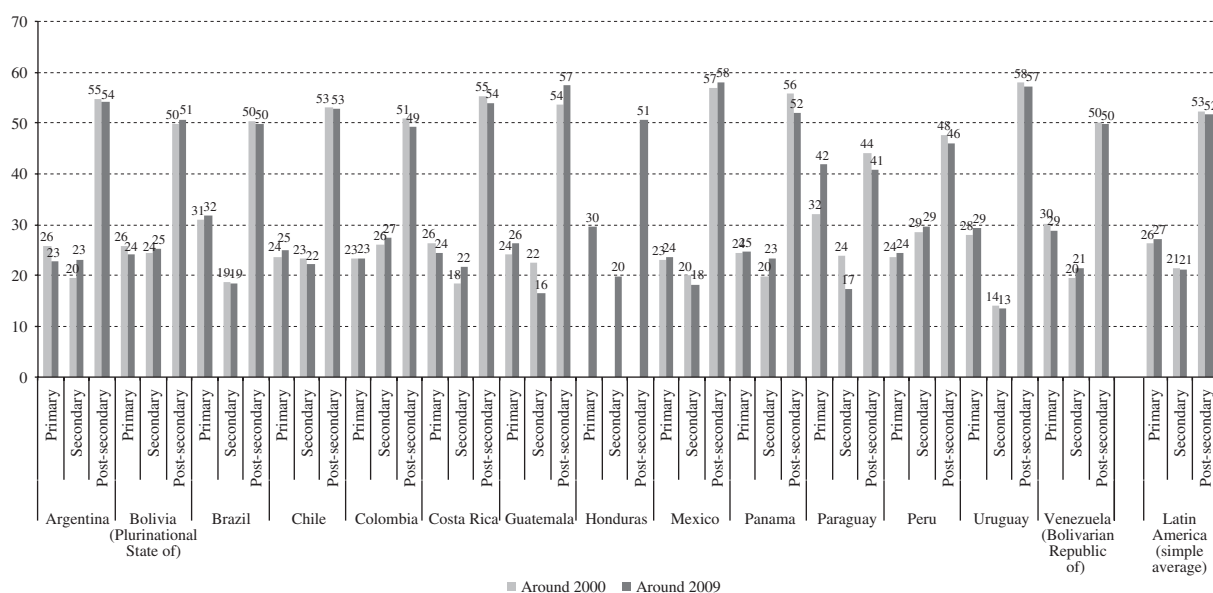
Source: prepared by the authors, on the basis of continuous household survey data.

[a] The bars show the percentages of total earnings accounted for by workers with complete primary, secondary and post-secondary education, respectively. For the first period, the years other than 2000 are 2001 for Brazil and 2003 for Guatemala. For the second period, the years other than 2009 are 2006 for Argentina, 2007 for the Plurinational State of Bolivia, 2008 for Mexico and 2010 for Costa Rica, Guatemala and Uruguay.

FIGURE 5

Shares of total earnings generated by women, around 2000 and 2009[a]
(Percentages)
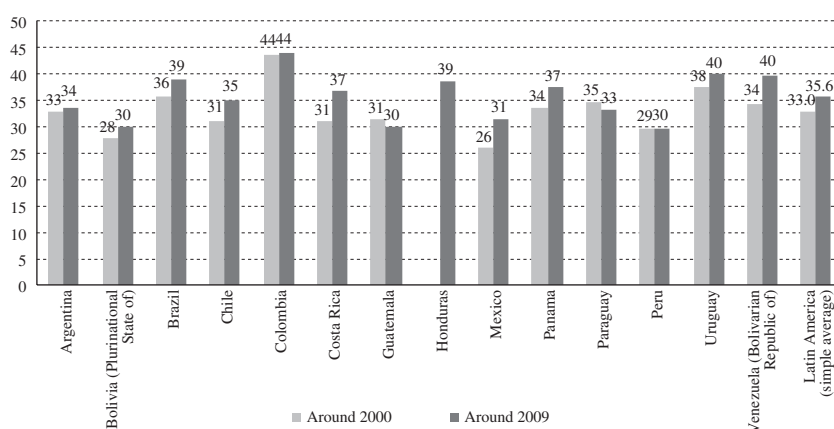
Source: prepared by the authors, on the basis of continuous household survey data.

[a] The bars show the percentages of total earnings accounted for by workers with complete primary, secondary and post-secondary education, respectively. For the first period, the years other than 2000 are 2001 for Brazil and 2003 for Guatemala. For the second period, the years other than 2009 are 2006 for Argentina, 2007 for the Plurinational State of Bolivia, 2008 for Mexico and 2010 for Costa Rica, Guatemala and Uruguay.

IX

Concluding remarks

Analysis of income distribution currently centres on inequality between households and individuals, with a particular focus on the microeconomic fundamentals of its evolution. This article has argued that it is important to retain the functional perspective and seek to comprehend the reality by considering and relating the two approaches. Integrating functional income distribution into research agendas is a challenge in the region, partly because of the limitations of the information available. Doing so, however, can reveal new facets of the distribution situation in the region. The decline in income inequality between households that the region has been experiencing for a decade has not been matched by improvements in the share of the proceeds of growth appropriated by workers.

ANNEX

TABLE A.1

Information available at ECLAC

Country	Period	RL	OS	CFK	GDPfc	(T-S)xm	GDPmp
Bolivia (Plurinational State of)	1988/2008						
Brazil	1970-1975-1980-1985[a] 1990/2009						
Chile	1960/1985 1985/1996 1996/2006 2003/2009 2008/2010						
Colombia	1970/1994 1994/2000 2000/2010						
Costa Rica	1970/1991						
Ecuador	1970/1989						
Honduras	1950/1995 1996/2000 2000/2011						
Mexico	1970/1980 1980/1988 1988/2003 2003/2011						
Nicaragua	1994/2011						
Panama	1960/1970 1970/1980 1980/1996 1996/2011						
Paraguay	1970/1991 1991/2007						
Peru	1991/2010						
Uruguay	1971/1983 1983/1988						
Venezuela (Bolivarian Republic of)	1970/1984 1984/1997 1997/2011[b]						

Source: prepared by the authors, on the basis of CEPALSTAT information.

[a] Hyphens do not denote a range of years but are only separators for the years for which information is available.

[b] There are no data for 2010.

Note: RL: remuneration of labour; OS: operating surplus; CFK: consumption of fixed capital; GDPfc: gross domestic product at factor cost; (T-S)xm: taxes on production and imports less subsidies; GDPmp: gross domestic product at market prices.

TABLE A.2

Information available at UNSD

Country	Period	RL	MI	OS	CFK	(T-s)xm	GVAbp
Argentina	1993/2007	░	░	░		░	░
Bolivia (Plurinational State of)	1970/2011	░		░		░	░
Brazil	1992/2003 1995/2009	░	░	░		░	░
Chile	1974/1985 1985/1998 1996/2009 2008/2010	░	░ (white in 1974/1985, 1985/1998)	░	░	░ (white in 1974/1985)	░
Colombia	1970/1995 1992/2005 2000/2010	░		░	░	░	░
Costa Rica	1970/1993 1991/2010	░		░	░	░	░
Ecuador	1970/1991	░		░		░	░
Guatemala	2001/2010	░		░		░	░
Honduras	1992/2006 2000/2010	░		░	░	░	░
Mexico	1988/2004 1993/2004 2003/2010	░		░	░	░	░
Nicaragua	1994/2007	░	░	░		░	░
Panama	1989/2000 1996/2010	░		░		░	░
Paraguay	1994/2010	░	░	░	░	░	░
Peru	1970/1998 1991/2010	░		░	░	░	░
Dominican Republic	1991/2005	░		░	░	░	░
Uruguay	1997/2005	░	░	░		░	░
Venezuela (Bolivarian Republic of)	1970/1984 1984/2002 1997/2010	░		░	░	░	░

Source: prepared by the authors, on the basis of data from the United Nations Statistics Division (UNSD).

Note: RL: remuneration of labour; MI: mixed income; OS: operating surplus; CFK: consumption of fixed capital: (T-s)xm: taxes on production and imports less subsidies; GVAbp: gross value added at basic prices.

TABLE A.3

Actual years for country data in table 1

	Around 1990	Around 2000	Around 2009
Argentina	1993	2000	2007
Bolivia (Plurinational State of)	1990	2000	2007
Brazil	1991	2000	2009
Chile	1990	2000	2009
Colombia	1990	2000	2009
Costa Rica	1991	2000	2009
Guatemala	…	2001	2009
Honduras	1990	2000	2009
Mexico	1990	2000	2009
Nicaragua	1994	2000	n/a
Panama	1990	2000	2009
Paraguay[a]	1991	2000	2009
Peru	1990	2000	2009
Uruguay[b]	n/a	2000	2009
Venezuela (Bolivarian Republic of)	1990	2000	2009

Source: prepared by the authors.

[a] In Paraguay, the 1990 figure is 50% below the average for the indicator in 1991-2009. Including it hugely distorts the evolution of the time series, so the decision was taken to start the analysis for that country in 1991.

[b] The information from the Central Bank of Uruguay runs up to 2005, so the ratio was updated using the evolution of the average nominal wage index, the employment rate and gross domestic product (GDP) at factor cost.

TABLE A.4

Country ranking by wage share of GDP

Wages/GDP	Around 1990	Around 2000	Around 2009
Up to 35%	Peru, Mexico, Bolivarian Republic of Venezuela	Mexico, Peru	Plurinational State of Bolivia, Guatemala, Mexico, Peru, Bolivarian Republic of Venezuela
35%-45%	Argentina, Plurinational State of Bolivia, Chile, Colombia, Paraguay	Guatemala, Argentina, Bolivia, Colombia, Panama, Bolivarian Republic of Venezuela	Argentina, Colombia, Panama
Over 45%	Brazil, Costa Rica, Honduras, Nicaragua, Panama	Brazil, Chile, Costa Rica, Honduras, Nicaragua, Paraguay, Uruguay	Brazil, Chile, Costa Rica, Honduras, Paraguay, Uruguay

Source: prepared by the authors.

GDP: gross domestic product.

FIGURE A.1

Latin America (15 countries): wages as a share of GDP
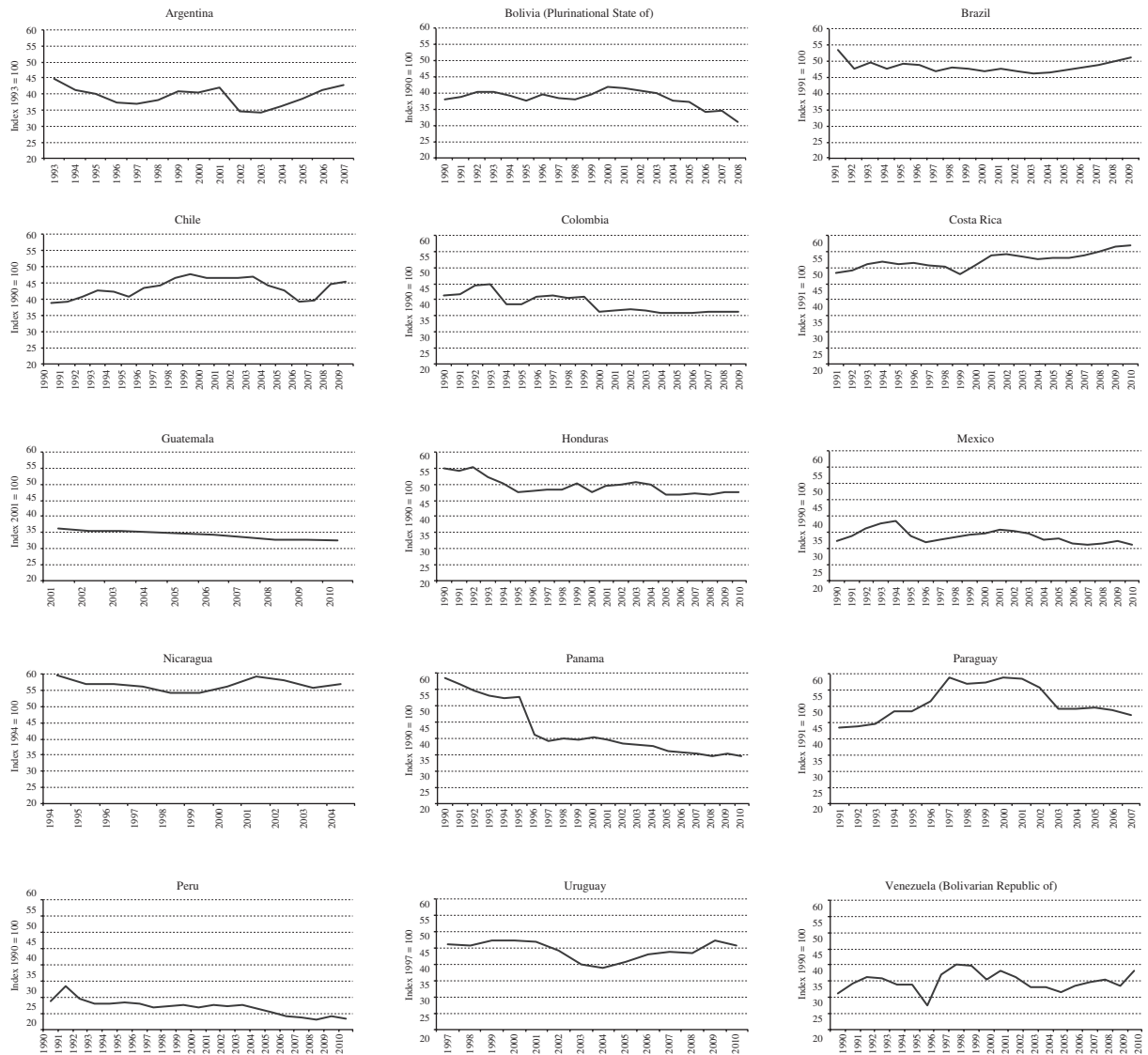
Source: prepared by the authors, on the basis of information from CEPALSTAT, the National Institute of Statistics and Censuses (INDEC) of Argentina, the Central Bank of Costa Rica, the Bank of Guatemala and the Central Bank of Uruguay.

GDP: gross domestic product.

FIGURE A.2

Latin America (14 countries): real wages and labour productivity, 1990-2010
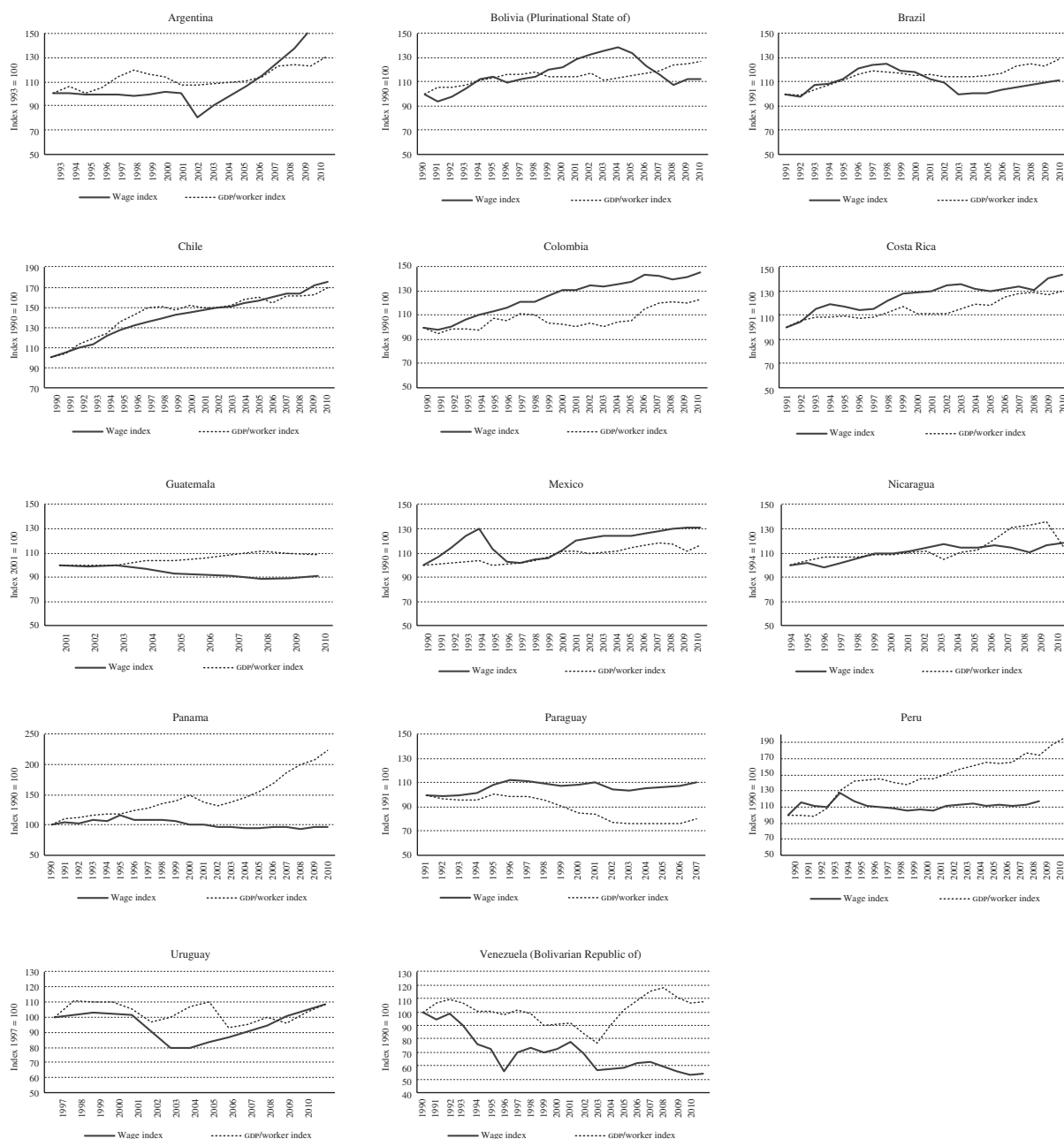
Source: prepared by the authors on the basis of information from CEPALSTAT, the National Institute of Statistics and Censuses (INDEC) of Argentina, the Central Bank of Costa Rica, the Bank of Guatemala and the Central Bank of Uruguay.

GDP: gross domestic product.

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Latin America: Total factor productivity and its components

Jair Andrade Araujo, Débora Gaspar Feitosa and Almir Bittencourt da Silva

ABSTRACT

This article applies the stochastic-frontier model to examine total factor productivity (TFP) and its components in Latin America between 1960 and 2010. The likelihood-ratio test shows that, for a selection of Latin American countries over the 50 years analysed, the macroeconomic variables of technical inefficiency included in the model generally have a significant effect; and they allow for a better understanding of technical inefficiency throughout the region. The key variables explaining technical inefficiency in the selected countries are public expenditure and the inflation rate; and there is also an inverse relation between technical inefficiency and the extent to which local prices diverge from purchasing power parity.

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I

Introduction

Using the concept of total factor productivity (TFP), quantified using the Cobb-Douglas production function, Solow (1957) introduced the measurement of the contribution made by technical progress to per capita output growth. This author estimated the production function of the United States economy from 1909 to 1949, and established the existence of a residual, measured as the difference between the growth rates of real output and the weighted growth rates of the individual factors of production, capital and labour. The importance of technical progress, which was discovered when attempting to break down the growth rate of real output using the growth rates of the factors of production, is known as the Solow residual.

The notion of technical progress then came to be used as an abbreviated expression for any shift of the production function. Nonetheless, based on empirical studies founded on growth accounting and inspired in the neoclassical model, some authors started to claim that several causes could be closely related to the measurement of the residual. Drawing on Solow's work, a number of empirical studies were performed —such as those of Griliches (1996), which uses various methodologies and samples— aimed at analysing the components of the aforementioned residual, with a view to quantifying as precisely as possible the real contribution that technical progress makes to output growth.

Orea (2002) studies panel data based on information from Spanish banks and proposes a parametric breakdown of the Malmquist index. The results show that TFP growth can be attributed mainly to technical progress. Färe, Grosskopf and Roos (1998) also study productivity and the Malmquist index. The empirical studies of Färe and others (1994); Johnson and Kuosmanen (2012); Lee and others (2013), and Wang and others (2014), among various authors, also show that it is possible to study the productivity of economic agents using non-parametric or semi-parametric methods. For example, data envelopment analysis (DEA) is a non-parametric methodology that can be used to evaluate the technical efficiency of productive units and estimate the Malmquist index.

The present article reports an application of the TFP decomposition procedure suggested by Bauer (1990) and Kumbhakar (2000) to a sample of Latin American countries for the period 1960-2010, based on the stochastic production-frontier model. The advantage of this approach is that allows TFP to be broken down into components that characterize the general production process. The procedure used makes it possible to identify the components of technical efficiency, which reflect the way an economy moves towards the production frontier, as distinct from the technical progress component, which represents a shifting of the frontier itself.

An advantage of the procedure used by Bauer (1990) and Kumbhakar (2000) is that by permitting a flexible specification of the production frontier, such as translog, TFP can be broken down into the components of technical efficiency, allocative efficiency, scale effect and technical progress. This procedure is superior to decomposition using the TFP Malmquist index (based on a production frontier that is restricted by the imposition of constant returns to scale), which is used in many other studies. In this case, according to Färe and others (1992), TFP is divided into just two elements: the variation in technical efficiency and technological change. This line of research also includes studies by Kumbhakar and Lovell (2003); Sauer, Frohberg and Hockmann (2006), and Henningsen and Henning (2009).

This article uses the stochastic-frontier model to analyse the contribution made by TFP to economic growth in a sample of Latin American countries; for which purpose it examines the components of technical efficiency, allocative efficiency, scale effect, and technical progress in the variation of TFP in those countries. It thus contributes to the empirical literature for a better understanding of the real factors that underlie the economic performance of the sample countries over a 50-year period. A further aim is to understand the influence of the vector of macroeconomic variables on the technical efficiency of the countries in the sample, through the technical inefficiency model, following Battese and Coelli (1995).

The article is divided into six sections including this introduction. Section II briefly explains the stochastic-frontier model and the TFP decomposition procedure; and section III presents the databases, sample of countries and the econometric model used. Section IV demonstrates the calculation of the TFP decomposition, using the Bauer (1990) and Kumbhakar (2000) procedure; and section V presents the results of the estimation and breakdown. The sixth and last section puts forward a number of final thoughts.

II

Stochastic frontier and TFP decomposition

This study uses stochastic production-frontier analysis, which is one of the methods adopted in the technical-inefficiency literature, to identify one of the components of TFP, namely technical efficiency.

The approach uses econometric (parametric) techniques, whose production-frontier models are used to study technical inefficiency, and it is recognized that output can be affected by random disturbances that are outside producer control. Unlike non-parametric approaches, which assume deterministic frontiers, stochastic-frontier analysis allows for deviations from the frontier, for which the error can be broken down into changes in technical efficiency and random disturbances.

In the deterministic-frontier models, deviations from the production frontier are attributed to the producer's technical inefficiency; but those models ignore the fact that production can be affected by random disturbances outside producer control, such as strikes or environmental conditions, among others.

Stochastic-frontier analysis originated in articles by Aigner, Lovell and Schmidt (1977) and Meeusen and Broeck (1977), which were followed by the work of Battese and Corra (1977). Those original studies present the structurally composed error term in the context of the production function. Since then, various authors have collaborated, including Battese and Coelli (1995), who modelled technical inefficiency as time-variant, formalizing the technical inefficiency of the stochastic production function for panel data. The present article adopts the model proposed by Battese and Coelli (1995) and Coelli, Rao and Battese (1998). Accordingly, the stochastic production-frontier model can be described through equation (1), where y_{it} is the vector of quantities produced by the various countries in period t; x_{it} is the vector of factors of production used in period t, and β is the vector of parameters defining the production technology.

$$y_{it} = f\left(t, x_{it}, \beta\right) \cdot exp\left(v_{it}\right) \cdot exp\left(-u_{it}\right), u \geq 0 \qquad (1)$$
$$i = 1, ..., N, t = 1, ..., T$$

The terms v_{it} and u_{it} are vectors that represent different error components. The first relates to the random part, with a truncated normal distribution, independent and identically distributed, with a constant variance of σ^2, ($v \sim$ iid N $(0, \sigma_v^2)$); whereas the second represents technical inefficiency, in other words the part that constitutes a retreat from the production frontier, which can be inferred from the negative sign and the constraint $u \geq 0$. These are non-negative random variables with a zero-truncated normal distribution, independently distributed (not identically) with mean μ_{it} and constant variance σ_u^2; in other words ($u \sim$ NT (μ, σ_u^2)). As the error components are mutually independent and x_{it} is assumed exogenous, the model can be estimated using the maximum-likelihood technique.

Unlike the model used by Pires and Garcia (2004), this one has the advantage of allowing inefficiencies and input elasticities to vary through time, which makes it easier to identify changes in the production structure.

The effects of technical inefficiency (e_{it}) are expressed with the following characteristics:

$$e_{it} = z_{it}\delta + w_{it}$$

where: z_{it} is a vector of explanatory variables of the technical inefficiency of the i-th productive unit (country) measured in time t; δ is a vector of parameters associated with the variables z_{it}; and w_{it} is a normally distributed random variable with zero mean and variance σ_w^2. It is assumed that e_{it} has a zero-truncated normal distribution, so its mean is $w_{it} = z_{it}\delta_t$.

Under this formulation, a functional form is defined, as presented below; and this is used to obtain TFP, which is then broken down into its components.

The decomposition of TFP through the well-known Malmquist index, which separates the total productivity index into technological variation and efficiency variation, has been widely used by a number of authors. For example, Laborda, Sotelsek and Guasch (2011) study productivity growth in 16 Latin American countries between 1996 and 2006, using a stochastic-frontier approach, and they perform a decomposition of the Malmquist index. Nonetheless, in a more wide ranging study, Bauer (1990) and Kumbhakar (2000) propose a type of decomposition which, in addition to the components listed above, captures production-scale effects and changes in the inefficiency of factor allocation. Section III contains a detailed analysis of how to incorporate these components into analyses of TFP variations.

III

Methodology

1. Description of the sample and the data used

The analysis considers the following 19 Latin American countries: Argentina, the Bolivarian Republic of Venezuela, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Paraguay, Peru, the Plurinational State of Bolivia, Trinidad and Tobago, and Uruguay. The data relate to the period 1960-2010, and were obtained from the following sources: Penn World Table 7.1 (PWT 7.1) and the World Development Indicators published by the World Bank. The availability of information from those databases was decisive in choosing 2010 as the upper bound of the sample.

The variables gross domestic product (*PIB*), labour (*L*), government consumption expenditure (*G*) and deviation of local prices from purchasing power parity (*DPPA*) were taken from Penn World Table 7.1. The series for physical capital (*K*) of the individual countries was constructed from estimates based on gross investment, using the perpetual-inventory technique.

The inflation rate data came from the World Development Indicators, although the difficulties in obtaining data for certain countries meant that other sources were also used. In the case of Brazil, the general price index-domestic supply (IGP-DI) published by the Getulio Vargas Foundation was used.

The sample consists of annual data on capital, labour, GDP, government expenditure, purchasing power parity and inflation from the 19 selected countries, totalling 950 observations forming a balanced panel.

2. Econometric model

Total factor productivity was calculated using the stochastic production-frontier model proposed by Aigner, Leobel and Schmidt (1977) and Meeusen and Broeck (1977), which was subsequently improved by Pitt and Lee (1981) and Schmidt and Sickles (1984). This makes it possible to model the panel data with the productive technical-inefficiency component, according to the foundations used by Battese and Coelli (1995), which suggest that technical inefficiency is modelled by a vector of variables.

This being the case, a functional form of the production frontier is modelled, in conjunction with a hypothesis about the distribution of technical inefficiency (Battese and Coelli (1995)).

Firstly, one model was tested using the Cobb-Douglas functional form and another using the translog form. The adequacy test identified the latter functional form as superior in terms of data consistency.

Accordingly, the translog production-frontier function for the 19 selected Latin American countries was specified as follows:

$$LnY_{it} = \alpha_i + \alpha_2 t + \alpha_3 \frac{1}{2}t^2 + \alpha_4 LnK_{it} + \alpha_5 tLnK_{it}$$
$$+ \alpha_6 LnL_{it} + \alpha_7 tLnL_{it} + \alpha_8 \frac{1}{2}\left(LnK_{it}\right)^2 + \alpha_9 \frac{1}{2}\left(LnL_{it}\right)^2 \quad (2)$$
$$+ \alpha_{10} LnK_{it} LnL_{it} + v_{it} - u_{it}$$

where:

Y_{it} = GDP of country i in period t.

K_{it} = physical capital stock of country i in period t.

L_{it} = labour in country i in period t.

α_i = fixed effects, with the aim of capturing unobserved heterogeneities in the sample of countries.

t = linear trend.

$\frac{1}{2}t^2$ = quadratic trend.

v_{it} = random disturbances of the production function, which are assumed to be normally distributed with zero mean and constant variance.

u_{it} = technical inefficiency of production, modelled as follows:

$$u_{it} = \delta z_{it} + \omega_{it} \quad (3)$$

where:

z_{it} = (z_{1t}, z_{2t}, z_{3t}, z_{4t}) represents a vector of variables that explain technical inefficiency, and δ is a parameter of associated with z_{it}.

ω_{it} = assumed normally distributed $N(0,\sigma_\omega^2)$.

Under the foregoing hypothesis, it is also assumed that u_{it} is independently distributed in a truncated normal distribution with mean $w_{it} = \delta z_{it}$, and constant variance of σ_ω^2.

The choice of the variables used to model the technical-inefficiency term is based on a number of empirical studies that use this procedure to estimate parametric frontiers involving aggregate data.

The inefficiency variables considered are as follows:

z_{1t} = trend effect.

z_{2t} = government consumption expenditure relative to the GDP of each country. Some empirical studies have been conducted to quantify the effect of current expenditure outgoings on inefficiency. For example, Bittencourt and Marinho (2007) analyse TFP in Latin American countries and discuss the effects of macroeconomic variables in explaining the technical inefficiency component through the stochastic frontier. They find that current government expenditure contributed to increasing technical inefficiency in the countries of the sample between 1961 and 1990. Thus, an increase in government expenditure would be expected to make production more technically inefficient.

z_{3t} = corresponds to the logarithm of 1 + the inflation rate, π, in other words ln $(1 + \pi)$. This expression is used because it captures the non-linear effects of inflation on technical inefficiency. According to De Gregorio (1992), some countries experienced periods of deflation and hyperinflation, but the influence of those extreme situations on the inefficiency term is attenuated by using the expression indicated above. Inflation is expected to increase the technical inefficiency of production.

z_{4t} = corresponds to the deviation of the local price level from purchasing power parity, using the United States as the benchmark country. This variable serves above all to control for the technical-inefficiency effects of trade policies that involve devaluation of the real exchange rate.

The parameters of equations (2) and (3) are estimated using the maximum-likelihood method, which makes it possible to calculate the magnitude of technical efficiencies for each country in the sample.

3. Tests conducted

(a) *Functional form*

Firstly the Cobb-Douglas and then the translog production functions were estimated, for the purpose of using the adequacy test to choose which functional form to use in the study. Although the Cobb-Douglas functional form is commonly used in frontier-estimation models, it is a simple model with few properties, including constant elasticity and returns to scale (Coelli, Rao and Battese, 1998).

Thus, in line with several studies, the functional form test is used to estimate both the Cobb-Douglas and the translog forms; and the null hypothesis that Cobb-Douglas is the appropriate form for presenting the data is tested, given the translog specifications. This can be tested using the likelihood-ratio test. The table published in Kodde and Palm (1986) is used to compare the critical values of the results, given the degrees of freedom. The test proceeds as follows:

After obtaining the two models and their respective maximum-likelihood ratios (LL), the generalized-likelihood statistic (LR) of the estimated production functions is considered. Then the hypothesis test is applied:

H_0: LL Cobb-Douglas.

H_1: LL translog.

and, consequently, the generalized-likelihood ratio,

LR = - 2 [ln LL H_0 – Ln LL H_1]

LR > T KP (Kodde and Palm, 1986 table) H_0 is rejected.

To find an ideal model to represent the data, further functional form tests were conducted in addition to that described above between Cobb-Douglas and translog. These tests only changed some of the inefficiency variables, but owing to a lack of convergence between certain models, it was impossible to make comparisons.

(b) *Absence of technical progress*

This test considers whether or not the coefficients of the time-related variables in the translog function are equal to zero. In other words, it tests the hypothesis that α_2, α_3, α_5, α_7 in equation (2) are equal to zero. Thus:

H_0: α_2, α_3, α_5, $\alpha_7 = 0$.

H_1: complete translog.

Using the generalized-likelihood ratio,

LR = - 2 [ln LL H_0 – Ln LL H_1]

LR > T KP (Kodde and Palm, 1986 table) H_0 is rejected.

(c) *Effect of technical inefficiency on the production function*

This case tests for the nonexistence of technical inefficiency; in other words, whether in fact the inefficiency variables depend on the model. For that purpose, the log-likelihood value (LL) is taken of the model estimated without these variables, and the generalized-likelihood test is performed again, comparing it with the critical value of Kodde and Palm (1986). The degrees of freedom correspond to the inefficiency variables.

Thus:

H_0: nonexistence of technical inefficiency.

H_1: alternative hypothesis: the technical inefficiency must be taken into account in the model.

(d) *Absence of fixed effects*

This test is used to evaluate the model without the presence of fixed effects captured by its dummy variables. The model is once again estimated without taking account of the presence of those dummy variables, and the generalized-likelihood test is applied,

with reference to the critical value of Kodde and Palm (1986).

In this particular study, the estimation without fixed effects did not converge after a large number of iterations, so the model could not be estimated and was rejected for comparison purposes.

IV

Decomposition of TFP

1. Composition of the data

In order to break the TPF down into its components, the country data were used to develop the initial econometric model, along with the data calculated from that model.

The 19 countries of the sample were maintained for the econometric model, and the period 1960-2010 was maintained for the analysis, with data on capital (K), labour (L) and GDP (Y) mainly being used. The factor shares S_K and S_L were obtained from calculations based on Penn World Table 7.1 data.

The elasticities ε_k and ε_L were calculated on the basis of the respective derivatives of the translog production function used in relation to the corresponding factors of production.

2. Decomposition procedure

Bauer (1990) and Kumbhakar (2000) proposed a productivity decomposition that goes beyond changes in productivity to capture the effects of technical innovation. This approach also takes account of production-scale effects. That decomposition is performed by firstly estimating the model of equations (2) and (3), after which it is possible to "compose" the rate of change of TPF based on the results.

According to that model, which was used by Pires and Garcia (2004), on the basis of the formulation proposed by Battese and Coelli (1993), it is possible to study the effects of each TPF component. The main advantage of this is that it admits the possibility of variable returns to scale.

In this way, the components of productivity can be identified after some algebraic manipulations on the expression that represents the deterministic part of the production frontier. Pires and Garcia (2004) present an index for the TPF growth rate expressed as:

$$g_{PTF} = \frac{\mathring{y}}{y} - s_K \frac{\mathring{K}}{K} - s_L \frac{\mathring{L}}{L} \qquad (4)$$

in the deterministic part, it can be seen that:

$$\frac{\mathring{y}}{y} = \frac{\partial \ln f(t, K, L, \beta)}{\partial t} + \varepsilon_K \frac{\mathring{K}}{K} + \varepsilon_L \frac{\mathring{L}}{L} - \frac{\partial u}{\partial t} \qquad (5)$$

where:

S_K = the capital share of income; S_L = the labour share of income; ε_K = the elasticity of capital; and ε_L = the elasticity of labour.

Returns to scale (RTS) are defined as the sum of elasticities, such that:

$$RTS = \varepsilon_K + \varepsilon_L$$

where,

g_K = growth rate of K
g_L = growth rate of L

Setting, $\lambda_K = \dfrac{\varepsilon_K}{RTS}$ and $\lambda_L = \dfrac{\varepsilon_L}{RTS}$, and substituting in the index, a number of algebraic operations are then performed:

$$g_{PTF} = PT - \mathring{u} + (RTS - 1) \cdot \left[\lambda_K \cdot g_K + \lambda_L \cdot g_L \right] \\ + \left[(\lambda_K - s_K) \cdot g_K + (\lambda_L - s_L) \cdot g_L \right] \qquad (6)$$

Equation (6) describes the rate of variation of TFP, g_{PTF}, which can be broken down into four elements: technical progress, variation of technical efficiency, variations in the scale of production, and variations in the efficiency of resource allocation.

Technical progress (PT) is represented by the derivative of the production function with respect to time:

$$PT = \frac{\partial \ln f(t, K, L, \beta)}{\partial t}$$

The change in technical efficiency is denoted by the technical inefficiency coefficient with a negative sign $-\mathring{u}$.

It should be noted that the change in production scale is given by the expression that contains the returns to scale and growth rates of capital and labour, in other words the third term of equation (6): $(RTS-1).[\lambda_K.g_k + \lambda_L.g_L]$.

Changes relating to allocative efficiency are represented by the last term in equation (6), which relates proportionate returns to scale, the shares of capital and labour, and the growth rates, and is thus measured by: $[(\lambda_K - s_k).g_K + (\lambda_L - s_L).g_L]$.

This methodology, with which productivity is broken down into the four components mentioned, makes it possible to evaluate the repercussion of each one separately. For example, if technology does not change (if $PT = 0$ in the item defined above), this will not contribute to productivity gains. Similarly, technical inefficiency, which changes through time, will have repercussions on the rate of variation; otherwise, if $-\mathring{u} = 0 = 0$, it will not affect that rate.

With constant returns to scale ($RTS = 1$), the third component of the formula for the variation in productivity is zero. Nonetheless, if $RTS \neq 1$ productivity can partially explain returns to production scale.

By setting $\lambda_K + \lambda_L = 1$, one can discern a symmetry in the distances of the shares of K and L with respect to λ, where the capital and labour shares are symmetric and, consequently, have opposite signs. According to a reallocation factor, this means that the intensity of one factor will reduce the intensity of the other; in other words, that capital intensity will reduce the amount of labour, and vice versa.

V

Estimation and results

1. Analysis of the estimation of the production frontier

Table 1 shows the model that corresponds to the estimation of the production frontier in the translog functional form, which was the model that best fit the data after the appropriate tests described above. All of the estimated parameters are statistically significant at the 5% level, except for the α_2 of variable t, which did not return a conclusive result.

Nonetheless, the parameters of the stochastic production frontier estimated in terms of the trend components, provide clear evidence that technical progress occurred at an increasing rate (shown by the positive sign of the t^2 variable, which is significant at 1%), which thus means an acceleration in the variation of technical progress.

The value of the technical inefficiency indicator, γ, is 0.51. This means that 51% of the total variance of the composed error of the estimation of the translog production function is explained by the variance in technical inefficiency. This makes it very important to incorporate technical inefficiency into the model.

Table 1 shows that all of the estimated parameters of the variables included to explain the technical inefficiency are statistically significant at the 1% level, and have the expected signs.

For example, the estimated coefficient of the trend variable (z_{1t}) in the technical inefficiency model has a positive sign and is statistically significant at 1%, which could indicate a tendency for inefficiency to increase in the period studied.

The government current expenditure variable (z_{2t}) is significant and has a positive sign, which suggests that the large share of current expenditure in the composition of aggregate spending in Latin American countries, on average, produces inefficiency in the economy. To some extent, these results agree with those obtained by Klein and Luu (2001), who concluded that countries with high levels of current expenditure tend to be less efficient, since a high level of public expenditure crowds out productive investments and thus generates distortions in resource allocation.

The coefficient of the inflation rate (z_{3t}) proved positive and significant, in keeping with the empirical literature that shows the harmful effects that higher rates of inflation have on resource allocation in the economy. Such rates end up inhibiting trade and discouraging capital formation. In this context, it is important to stress that several Latin American countries experienced lengthy

TABLE 1

Results of the model in the translog[a] functional form, 1961-2010

Variables	Estimations	Z-value
$d1$	0.395	8.8
$d2$	-0.683	-13.5
$d3$	1.490	9.9
$d4$	-0.226	-8.2
$d5$	0.416	10.3
$d6$	-0.592	-7.9
$d7$	-0.475	-10.5
$d8$	-0.770	-24.6
$d9$	-0.540	-9.3
$d10$	-0.400	-9.5
$d11$	-0.930	-14.6
$d12$	-0.931	-13.6
$d13$	1.150	14.4
$d14$	-1.020	-13.0
$d15$	-1.073	-18.2
$d16$	-0.155	-5.5
$d17$	-0.844	-7.5
$d18$	-0.934	-16.8
t	-0.014	-1.3
$\frac{1}{2}t^2$	0.001	11.8
LnL	0.973	4.4
LnK	-0.327	-2.2
$tLnL$	0.001	1.8
$tLnK$	-0.002	-3.2
$LnL \cdot LnK$	0.061	5.8
$\frac{1}{2}\left(LnL\right)^2$	-0.069	-4.4
$\frac{1}{2}\left(LnK\right)^2$	0.024	2.9
Constants	11.22	11.2
Z_1-trend effect	0.018	4.3
Z_2-government consumption expenditure	30.729	5.7
Z_3-inflation rate	0.098	2.9
Z_4-degree of openness	-0.806	-3.4
Constants	-0.696	-3.3
lnsigma2	-3.829	-17.7
Ilgtgama	0.042	0.93
sigma2	0.021	-
gamma	0.510	-
sigma_u2	0.011	-
sigma_v2	0.010	-

Source: prepared by the authors, on the basis of the research data.

[a] Number of observations: 950; log-likelihood probability: 729.28 and probability>chi-squared = 0.0000.

Note: the "d" variables represent the fixed effects of the countries. The other variables correspond to those indicated in equation (2). Gamma and sigma correspond to the results of the log-likelihood function expressed in terms of the parameterization specified by $\gamma = \dfrac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2}$.

inflationary periods, which had negative repercussions on the technical inefficiency and development of their economies.

In the case of the variable that captures the deviation of local prices from purchasing power parity (z_{4t}), the estimated coefficient is significant and has the expected negative sign. This indicates that countries which adopted

trade policies based on exchange-rate devaluation succeeded in reducing the level of inefficiency. This type of devaluation can boost exports and consequently support an increase in the installed capacity of the external sector, which leads in turn to an expansion of domestic demand. It is worth highlighting that this effect is greater, the larger is share of the external sector in the local economy.

2.   Analysis of the hypothesis tests

Once the models had been estimated, the respective tests were conducted for functional form, the absence of technical progress and technical inefficiency.

Table 2 sets out some of the results. Firstly, the Cobb-Douglas functional form was tested in comparison with the translog model, and then the likelihood-ratio was used to verify the best functional form. This means testing

the hypothesis that all of the second-order coefficients and the coefficients of the cross-products of the function defined in (2) are equal to zero. It should be noted that the value of the likelihood ratio was 9.77, which is above the 7.04 critical level of the value statistic of Kodde and Palm (1986) (critical value to the right of the χ^2 distribution at 5% with 3 degrees of freedom). It can therefore be assumed that the most appropriate model for the problem under study is the translog functional form.

TABLE 2

Likelihood-ratio test of the parameters of the stochastic production frontier

Test	Null hypothesis	Value of λ	Critical value	Decision (5% level)
Functional form	H_0: $\alpha_8 = \alpha_9 = \alpha_{10} = 0$	9.55	7.04	Reject H_0
Absence of TP	H_0: $\alpha_2 = \alpha_3 = \alpha_5 = \alpha_7 = 0$	161.23	8.76	Reject H_0
Nonexistence of technical inefficiency	H_0: $z_1 = z_2 = z_3 = z_4 = 0$	118.01	8.76	Reject H_0

Source: prepared by the authors.

λ: Statistical test of the likelihood ratio in which λ = -2 {log [likelihood (H_0)] – log [likelihood (H_1)]}. This test has a roughly chi-squared distribution with degrees of freedom equal to the number of independent constraints.
TP: technical progress.

Once the functional form had been chosen, the absence of technical progress was tested. In line with the test described above, the model was estimated in the translog functional form, and with the absence of technical progress. The respective values of the log-maximum-likelihood of each estimation were used to obtain LR = - 2 [648.67 – 729.28] = 161.22. The result of the test exceeds the critical value of 8.76 with 4 degrees of freedom and significant at 5% in the table of Kodde and Palm (1986). Consequently, H_0 is rejected, and hypothesis H_1 is accepted, which confirms the presence of technical progress.

Subsequently, the test for the absence of technical inefficiency was applied to the model, with the following results: LR = - 2 [670.28 – 729.28] = 118.01. Nonetheless, the critical value of the Kodde and Palm table is 8.76, with 4 degrees of freedom and a 5% significance interval. Consequently, the value of the maximum-likelihood ratio exceeds the critical value of the Kodde and Palm (1986) table, thus indicating the presence of technical inefficiency in the model.

3.   TFP and its components

Based on the results of the model estimation obtained above and the income distribution data (s_K and s_L), total factor productivity is broken down according to the model described in section IV. Table 3 shows the

country averages of the decomposition throughout the period analysed (1962-2010).[1] The results shown in tables 3, 4, 5, 6, 7 and 8 are the average values for each country over 10-year time intervals.

The average economic growth rate in Latin America in the 50 years of the study was 4.2%, whereas the rate of change of TFP for the sample as a whole was -0.3% in that period (see table 3). The following tables present those rates separately for each country.

In general, the results agree with those obtained in the studies by de Fajnzylber, Loayza and Calderón (2002) on the growth of the Latin American economies and other countries. Tables 6 and 7 show that the economic growth rates of some countries in the 1990s were less than those recorded in the previous decade. A case in point is Colombia, which grew by 4.67% between 1981 and 1990, and by 4.55% in the following decade. Cárdenas (2007), who obtains similar results, also shows that the long-term economic growth rate in Colombia has fallen since 1980 owing to increasing levels of violence fuelled by an expansion in drug trafficking activities. Among other countries, the Bolivarian Republic of Venezuela recorded growth of 3.7% between 1980 and 1990, but only 3.6% in the following decade.

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[1] The breakdown was performed as from 1962 owing to the availability of data on the variation of technical inefficiency based on the translog model estimated using 1961-2010 data.

TABLE 3

TFP results: averages 1962-2010

Country	Economic growth	Capital accumulation	Expansion of labour force	Change in TFP	Technical progress	Technical efficiency	Scale economies	Distributive gains	Random disturbances
Argentina	0.0360	0.0496	0.0161	0.0002	0.0021	-0.0013	0.0102	-0.0109	-0.0299
Bolivia (Plurinational State of)	0.0400	0.0600	0.0240	-0.0093	-0.0019	-0.0014	0.0087	-0.0147	-0.0347
Brazil	0.0550	0.0604	0.0301	0.0096	0.0044	-0.0004	0.0136	-0.0080	-0.0451
Chile	0.0427	0.0553	0.0230	-0.0011	0.0002	-0.0005	0.0116	-0.0124	-0.0346
Colombia	0.0503	0.0583	0.0309	0.0043	0.0027	-0.0014	0.0125	-0.0096	-0.0432
Costa Rica	0.0516	0.0648	0.0348	-0.0049	-0.0022	-0.0038	0.0151	-0.0140	-0.0431
Dominican Republic	0.0541	0.0838	0.0306	-0.0101	0.0010	-0.0010	0.0126	-0.0226	-0.0502
Ecuador	0.0392	0.0419	0.0288	0.0038	0.0044	-0.0028	0.0056	-0.0034	-0.0354
El Salvador	0.0355	0.0583	0.0233	-0.0101	0.0004	-0.0048	0.0095	-0.0152	-0.0360
Guatemala	0.0411	0.0579	0.0263	-0.0051	0.0007	-0.0041	0.0111	-0.0128	-0.0381
Honduras	0.0448	0.0644	0.0327	-0.0079	0.0006	-0.0062	0.0119	-0.0142	-0.0444
Jamaica	0.0229	0.0501	0.0131	-0.0177	-0.0035	-0.0062	0.0084	-0.0165	-0.0226
Mexico	0.0575	0.0607	0.0333	0.0081	0.0017	-0.0011	0.0160	-0.0085	-0.0446
Nicaragua	0.0409	0.0555	0.0344	-0.0077	-0.0005	-0.0098	0.0125	-0.0099	-0.0412
Paraguay	0.0459	0.0681	0.0291	-0.0071	0.0014	-0.0015	0.0103	-0.0174	-0.0442
Peru	0.0450	0.0416	0.0301	0.0086	0.0011	-0.0006	0.0121	-0.0040	-0.0352
Trinidad and Tobago	0.0327	0.0526	0.0162	-0.0137	-0.0066	-0.0005	0.0106	-0.0173	-0.0223
Uruguay	0.0231	0.0509	0.0078	-0.0145	-0.0018	-0.0005	0.0064	-0.0186	-0.0211
Venezuela (Bolivarian Republic of)	0.0522	0.0424	0.0352	0.0113	-0.0010	-0.0004	0.0155	-0.0028	-0.0367

Source: prepared by the authors.

TFP: total factor productivity.

TABLE 4

TFP decomposition: averages 1962-1970

Country	Economic growth	Capital accumulation	Expansion of labour force	Change in TFP	Technical progress	Technical efficiency	Scale economies	Distributive gains	Random disturbances
Argentina	0.0802	0.1549	0.0143	-0.0438	-0.0183	-0.0006	0.0205	-0.0454	-0.0452
Bolivia (Plurinational State of)	0.0681	0.1785	0.0182	-0.0717	-0.0174	-0.0012	0.0132	-0.0663	-0.0569
Brazil	0.1014	0.1568	0.0328	-0.0263	-0.0143	-0.0008	0.0215	-0.0328	-0.0619
Chile	0.0641	0.1421	0.0137	-0.0529	-0.0198	-0.0005	0.0161	-0.0487	-0.0388
Colombia	0.0771	0.1477	0.0242	-0.0438	-0.0165	-0.0005	0.0162	-0.0431	-0.0509
Costa Rica	0.0718	0.1599	0.0327	-0.0647	-0.0212	-0.0012	0.0172	-0.0596	-0.0560
Dominican Republic	0.0939	0.2030	0.0417	-0.0695	-0.0169	-0.0007	0.0168	-0.0688	-0.0813
Ecuador	0.0723	0.1450	0.0259	-0.0506	-0.0195	-0.0014	0.0177	-0.0474	-0.0481
El Salvador	0.0812	0.1701	0.0364	-0.0609	-0.0188	-0.0013	0.0174	-0.0581	-0.0644
Guatemala	0.0764	0.1709	0.0256	-0.0619	-0.0182	-0.0012	0.0165	-0.0590	-0.0582
Honduras	0.0759	0.1909	0.0310	-0.0775	-0.0185	-0.0029	0.0155	-0.0717	-0.0685
Jamaica	0.0579	0.1626	0.0114	-0.0745	-0.0227	-0.0008	0.0159	-0.0669	-0.0416
Mexico	0.1066	0.1802	0.0299	-0.0385	-0.0175	-0.0005	0.0263	-0.0468	-0.0650
Nicaragua	0.0826	0.2100	0.0321	-0.0854	-0.0203	-0.0005	0.0183	-0.0830	-0.0741
Paraguay	0.0608	0.1528	0.0260	-0.0640	-0.0163	-0.0007	0.0098	-0.0567	-0.0540
Peru	0.0781	0.1452	0.0235	-0.0440	-0.0195	-0.0005	0.0200	-0.0441	-0.0466
Trinidad and Tobago	0.0427	0.1243	0.0110	-0.0672	-0.0252	-0.0005	0.0125	-0.0540	-0.0254
Uruguay	0.0436	0.1174	0.0083	-0.0561	-0.0205	-0.0007	0.0108	-0.0458	-0.0260
Venezuela (Bolivarian Republic of)	0.0853	0.1485	0.0304	-0.0430	-0.0212	-0.0004	0.0236	-0.0451	-0.0505

Source: prepared by the authors.

TFP: total factor productivity.

TABLE 5

TFP decomposition: averages 1971-1980

Country	Economic growth	Capital accumulation	Expansion of labour force	Change in TFP	Technical progress	Technical efficiency	Scale economies	Distributive gains	Random disturbances
Argentina	0.0409	0.0608	0.0145	-0.0133	-0.0096	0.0001	0.0117	-0.0156	-0.0211
Bolivia (Plurinational State of)	0.0375	0.0495	0.0228	-0.0108	-0.0081	0.0001	0.0084	-0.0112	-0.0240
Brazil	0.0810	0.1003	0.0359	-0.0026	-0.0059	0.0000	0.0208	-0.0176	-0.0525
Chile	0.0334	0.0192	0.0260	0.0020	-0.0098	0.0002	0.0089	0.0026	-0.0139
Colombia	0.0521	0.0612	0.0302	-0.0056	-0.0074	0.0001	0.0127	-0.0110	-0.0336
Costa Rica	0.0667	0.0837	0.0410	-0.0144	-0.0124	-0.0007	0.0185	-0.0198	-0.0436
Dominican Republic	0.0681	0.1119	0.0345	-0.0255	-0.0088	-0.0001	0.0161	-0.0327	-0.0528
Ecuador	0.0211	0.0353	0.0273	-0.0111	0.0125	-0.0091	-0.0196	0.0051	-0.0304
El Salvador	0.0462	0.0699	0.0299	-0.0194	-0.0098	-0.0049	0.0126	-0.0174	-0.0341
Guatemala	0.0479	0.0762	0.0227	-0.0192	-0.0097	0.0003	0.0122	-0.0220	-0.0318
Honduras	0.0418	0.0678	0.0230	-0.0201	-0.0098	0.0000	0.0101	-0.0203	-0.0289
Jamaica	0.0367	0.0339	0.0299	-0.0096	-0.0138	-0.0074	0.0133	-0.0017	-0.0175
Mexico	0.0781	0.0671	0.0505	0.0084	-0.0084	0.0001	0.0219	-0.0052	-0.0479
Nicaragua	0.0455	0.0459	0.0368	-0.0086	-0.0114	-0.0066	0.0135	-0.0042	-0.0286
Paraguay	0.0619	0.1194	0.0301	-0.0343	-0.0081	0.0006	0.0131	-0.0399	-0.0533
Peru	0.0402	0.0248	0.0312	0.0036	-0.0096	-0.0002	0.0111	0.0023	-0.0194
Trinidad and Tobago	0.0636	0.1078	0.0299	-0.0334	-0.0165	-0.0001	0.0207	-0.0375	-0.0406
Uruguay	0.0256	0.0734	0.0035	-0.0347	-0.0114	0.0002	0.0070	-0.0305	-0.0165
Venezuela (Bolivarian Republic of)	0.0745	0.0644	0.0469	0.0040	-0.0121	0.0001	0.0228	-0.0067	-0.0409

Source: prepared by the authors.

TFP: total factor productivity.

TABLE 6

TFP decomposition: averages 1981-1990

Country	Economic growth	Capital accumulation	Expansion of labour force	Change in TFP	Technical progress	Technical efficiency	Scale economies	Distributive gains	Random disturbances
Argentina	0.0059	0.0046	0.0180	-0.0021	0.0013	-0.0139	0.0058	0.0047	-0.0147
Bolivia (Plurinational State of)	0.0220	-0.0005	0.0246	0.0168	0.0031	-0.0026	0.0056	0.0108	-0.0189
Brazil	0.0325	0.0222	0.0311	0.0117	0.0046	-0.0058	0.0105	0.0025	-0.0325
Chile	0.0333	0.0128	0.0290	0.0164	0.0017	-0.0007	0.0090	0.0064	-0.0251
Colombia	0.0467	0.0319	0.0369	0.0164	0.0033	-0.0010	0.0123	0.0018	-0.0384
Costa Rica	0.0363	0.0214	0.0369	0.0079	-0.0016	-0.0113	0.0136	0.0072	-0.0299
Dominican Republic	0.0401	0.0327	0.0317	0.0092	0.0015	-0.0028	0.0111	-0.0004	-0.0335
Ecuador	0.0355	0.0140	0.0312	0.0155	0.0000	-0.0024	0.0109	0.0070	-0.0252
El Salvador	0.0121	0.0046	0.0166	0.0045	0.0011	-0.0068	0.0048	0.0053	-0.0135
Guatemala	0.0280	0.0074	0.0298	0.0139	0.0011	-0.0055	0.0089	0.0094	-0.0231
Honduras	0.0395	0.0116	0.0386	0.0196	0.0011	-0.0048	0.0110	0.0122	-0.0303
Jamaica	0.0178	0.0152	0.0104	0.0019	-0.0024	0.0017	0.0048	-0.0023	-0.0097
Mexico	0.0217	0.0206	0.0136	0.0055	0.0019	-0.0009	0.0067	-0.0022	-0.0180
Nicaragua	0.0033	0.0204	0.0339	-0.0220	-0.0003	-0.0394	0.0113	0.0063	-0.0289
Paraguay	0.0501	0.0541	0.0348	0.0041	0.0013	-0.0014	0.0129	-0.0086	-0.0428
Peru	0.0239	0.0042	0.0318	0.0119	0.0019	-0.0094	0.0091	0.0103	-0.0241
Trinidad and Tobago	-0.0017	0.0196	0.0093	-0.0244	-0.0067	-0.0186	0.0058	-0.0049	-0.0062
Uruguay	0.0110	0.0121	0.0082	-0.0010	-0.0012	-0.0017	0.0037	-0.0017	-0.0083
Venezuela (Bolivarian Republic of)	0.0379	-0.0056	0.0401	0.0268	-0.0007	-0.0023	0.0124	0.0174	-0.0234

Source: prepared by the authors.

TFP: total factor productivity.

TABLE 7

TFP decomposition: averages 1991-2000

Country	Economic growth	Capital accumulation	Expansion of labour force	Change in TFP	Technical progress	Technical efficiency	Scale economies	Distributive gains	Random disturbances
Argentina	0.0327	0.0128	0.0144	0.0322	0.0129	0.0131	0.0057	0.0006	-0.0267
Bolivia (Plurinational State of)	0.0323	0.0124	0.0305	0.0285	0.0149	-0.0018	0.0075	0.0079	-0.0391
Brazil	0.0344	0.0124	0.0292	0.0322	0.0161	0.0028	0.0086	0.0047	-0.0395
Chile	0.0372	0.0532	0.0184	0.0087	0.0125	0.0001	0.0102	-0.0140	-0.0431
Colombia	0.0455	0.0263	0.0406	0.0287	0.0145	-0.0039	0.0130	0.0051	-0.0501
Costa Rica	0.0460	0.0235	0.0335	0.0287	0.0097	0.0015	0.0129	0.0046	-0.0397
Dominican Republic	0.0357	0.0407	0.0218	0.0140	0.0124	0.0004	0.0093	-0.0082	-0.0408
Ecuador	0.0327	-0.0001	0.0338	0.0328	0.0118	-0.0030	0.0100	0.0139	-0.0337
El Salvador	0.0316	0.0255	0.0188	0.0209	0.0125	0.0047	0.0068	-0.0031	-0.0336
Guatemala	0.0247	0.0166	0.0217	0.0190	0.0127	-0.0031	0.0073	0.0021	-0.0326
Honduras	0.0418	0.0336	0.0441	0.0170	0.0125	-0.0145	0.0142	0.0048	-0.0530
Jamaica	0.0065	0.0259	0.0069	-0.0043	0.0085	-0.0084	0.0045	-0.0089	-0.0220
Mexico	0.0562	0.0194	0.0503	0.0398	0.0138	-0.0003	0.0165	0.0098	-0.0533
Nicaragua	0.0515	-0.0018	0.0397	0.0507	0.0119	0.0084	0.0111	0.0194	-0.0371
Paraguay	0.0297	0.0181	0.0267	0.0210	0.0123	-0.0039	0.0086	0.0039	-0.0360
Peru	0.0480	0.0101	0.0376	0.0421	0.0138	0.0071	0.0109	0.0103	-0.0418
Trinidad and Tobago	0.0331	-0.0066	0.0188	0.0360	0.0052	0.0107	0.0075	0.0126	-0.0150
Uruguay	0.0205	0.0300	0.0104	0.0072	0.0099	0.0008	0.0057	-0.0091	-0.0271
Venezuela (Bolivarian Republic of)	0.0369	-0.0047	0.0361	0.0388	0.0116	0.0010	0.0107	0.0156	-0.0334

Source: prepared by the authors.

TFP: total factor productivity.

TABLE 8

TFP decomposition: averages 2001-2010

Country	Economic growth	Capital accumulation	Expansion of labour force	Change in TFP	Technical progress	Technical efficiency	Scale economies	Distributive gains	Random disturbances
Argentina	0.0201	0.0150	0.0192	0.0279	0.0243	-0.0050	0.0072	0.0014	-0.0420
Bolivia (Plurinational State of)	0.0254	0.0063	0.0281	0.0380	0.0265	-0.0047	0.0065	0.0096	-0.0471
Brazil	0.0257	0.0101	0.0217	0.0328	0.0213	0.0017	0.0065	0.0033	-0.0390
Chile	0.0455	0.0492	0.0279	0.0204	0.0166	-0.0015	0.0138	-0.0085	-0.0520
Colombia	0.0300	0.0246	0.0229	0.0257	0.0196	-0.0019	0.0085	-0.0006	-0.0431
Costa Rica	0.0370	0.0354	0.0300	0.0179	0.0145	-0.0073	0.0131	-0.0024	-0.0464
Dominican Republic	0.0326	0.0306	0.0233	0.0213	0.0168	-0.0019	0.0096	-0.0031	-0.0426
Ecuador	0.0342	0.0152	0.0261	0.0326	0.0174	0.0017	0.0091	0.0044	-0.0396
El Salvador	0.0062	0.0212	0.0150	0.0043	0.0171	-0.0157	0.0058	-0.0028	-0.0343
Guatemala	0.0282	0.0184	0.0317	0.0228	0.0177	-0.0108	0.0104	0.0055	-0.0448
Honduras	0.0250	0.0179	0.0268	0.0214	0.0175	-0.0087	0.0088	0.0039	-0.0412
Jamaica	-0.0045	0.0127	0.0070	-0.0019	0.0132	-0.0160	0.0036	-0.0027	-0.0222
Mexico	0.0248	0.0164	0.0220	0.0252	0.0187	-0.0038	0.0085	0.0017	-0.0387
Nicaragua	0.0216	0.0030	0.0293	0.0268	0.0174	-0.0110	0.0082	0.0121	-0.0375
Paraguay	0.0268	-0.0041	0.0281	0.0375	0.0179	-0.0020	0.0073	0.0144	-0.0347
Peru	0.0347	0.0235	0.0262	0.0293	0.0191	-0.0002	0.0094	0.0011	-0.0443
Trinidad and Tobago	0.0258	0.0178	0.0122	0.0202	0.0103	0.0061	0.0066	-0.0028	-0.0244
Uruguay	0.0147	0.0218	0.0085	0.0120	0.0145	-0.0010	0.0046	-0.0061	-0.0277
Venezuela (Bolivarian Republic of)	0.0266	0.0094	0.0226	0.0298	0.0172	-0.0004	0.0079	0.0050	-0.0352

Source: prepared by the authors.

TFP: total factor productivity.

Table 3 also shows that the countries that recorded a larger contribution of technical progress to productivity growth in the 50-year period analysed were Argentina, Brazil, Colombia and Ecuador, with indices of around 0.3%. Brazil displayed an average index of 0.4%, as well as the highest indices in the last three decades (see tables 6, 7 and 8). These results coincide with those reported by Pires and Garcia (2004), which also identified low rates of technical progress in Brazil between 1970 and 2000, because the authors take account of the fact that this country was not a member of the Organisation for Economic Co-operation and Development (OECD), and that the markets of the Bolivarian Republic of Venezuela, Mexico and Peru underwent a process of import substitution related to episodes of economic liberalization, during which the industrialization process slowed down.

As shown in table 3, the 19 countries analysed in this study recorded decreasing technical efficiency, which assumes that the contribution of that efficiency to TFP was negative in all countries. Nonetheless, there was some technical progress in most cases, and output increased in all of them. It is well known that technical efficiency is determined by the distance from the technological frontier and effective use of technologies, so these results suggest that the expansion of the frontier was more intense and faster than the dissemination of new technologies. In other words, some of the countries analysed did not fully keep pace with the technological developments that occurred in the period analysed, possibly owing to problems in the process of diffusion and adoption of more modern technologies.

In a general analysis of the decomposition of TFP, table 8 shows that most of the countries display positive allocative gains, including Brazil. Those results reflect improvements in resource allocation among the factors of production used in those countries.

These results agree with those reported by Pires and Garcia (2004), whose estimations show that Costa Rica and Trinidad and Tobago displayed the largest distributive gains, represented by indices of 4.2% and 13.5%, respectively. Those two countries were also the leaders in the sample in terms of technical progress during the period studied.

Tables 4 and 5 show that Brazil suffered allocative efficiency losses in the first two decades analysed, which are the clear result of a growth strategy that did not take account of the adjustment. It can also be seen that both output and physical capital grew more strongly in the 1970s than in other decades. Those findings agree with those obtained by Pires and Garcia (2004), who argue that in the 1970s there was an intensive process of resource allocation in the economy, which led to a considerable investment in infrastructure in Brazil.

The analysis of the data presented in tables 4 and 5 shows that the indices of economic growth in Brazil were higher in the first two decades before dropping to around 3% between 1980 and 2000. This is explained by a slackening of growth in the country owing to the exhaustion of the industrialization-via-import-substitution model.

In the five decades examined separately, only Trinidad and Tobago posted negative growth in the decade 1981-1990. In general, the pattern of economic growth in the countries is similar, and, as shown in table 6, the average does not exceed 6% in the period studied. The cases of Brazil, Colombia and Paraguay stand out as those with the highest indices of economic growth, averaging 4.3%. The countries with the lowest average growth indices were Argentina and Uruguay, with just 0.59% and 1.10%, respectively.

As can be seen in table 4, all of the Latin American countries analysed displayed negative indices of TFP variation in the first period studied (1962-1970). This situation changed in the subsequent decades, when some countries displayed positive indices. Table 7 and 8 show that all countries except the Jamaica achieved positive indices of TFP growth in the decades of 1990 and 2000. The average growth rate of Brazilian productivity throughout the period analysed were 0.9% per year (see table 3).

Table 8 shows that in the analysis of the decade of 2000, there was positive economic growth (averaging 2.5%) in all countries except Jamaica, where output declined by about 0.04%, with Chile growing by an average of 4.5%. Technical progress and economies of scale were positive in all countries; but, while some recorded positive indices with respect to distributive gains, such as Brazil, the equivalent indices were negative in others, such as Uruguay.

VI

Final thoughts

The analysis of TFP and its components in Latin America in the period 1960-2010, using a stochastic-frontier model which includes macroeconomic variables of technical inefficiency, shows that those variables generally have a significant effect that enables better understanding of technical inefficiency throughout the region.

The significance of the effects is found both through likelihood tests and through the parameter γ, of value 0.51, in the model estimation.

The most important variables for explaining the technical inefficiency of the sample countries, in other words those that display a positive relation to inefficiency, are public expenditure and the inflation rate: the higher these rates are, the more they are associated with technical inefficiency.

In contrast, the variable corresponding to the deviation of local prices from purchasing power parity (used as a proxy variable for the exchange rate) displays an inverse relation with respect to technical inefficiency: the larger deviation of this relative price, the less is technical inefficiency.

Although relatively low throughout the period studied, the average rate of economic growth of the countries studied was positive. Brazil is one of the leading countries in this respect, with a growth rate of 5.5%. The analysis of the 1960s and 1970s shows that the average Brazilian growth rates were around 7%, which possibly coincides with the adoption of the import substitution industrialization model in the countries of the region.

Costa Rica, the Dominican Republic, Ecuador, Guatemala, Mexico and Paraguay recorded similar average GDP growth rates of 5.1%; 4.0%; 4.1%; 5.7%; 4.5%, and 5.4%, respectively. The worst performer in the period was Uruguay, where the average growth rate was just 2.3%.

The results of the decomposition of the change in TFP into technical progress, technical efficiency, economies of scale and distributive gains vary between the countries analysed. Although there is unanimity with respect to technical progress (the average was positive in most of the countries throughout the period analysed), the results in terms of the other components are different.

Lastly, it is worth stressing that the great advantage of this TFP decomposition model compared to that known as the Malmquist index is the possibility of incorporating scale and allocative effects in the analysis of the results.

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Financial constraints on economic development: Theory and policy for developing countries

Jennifer Hermann

ABSTRACT

This article contains a theoretical and policy analysis of the financial constraints on economic development in developing countries. Following a Keynesian interpretation, it concludes that financial policies are needed to relieve these constraints, given the natural tendency of financial systems to operate in ways that are dysfunctional to economic development. It then proposes three lines of policy that take account of the special characteristics of developing countries: resource allocation policies targeted at segments of strategic importance for economic and financial development; policies to control financial and external fragility; and compensatory policies of a more interventionist cast, in particular directed credit programmes for both public- and private-sector lending to complement resource allocation policies, and countercyclical regulatory barriers so that fragility can be better controlled.

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I

Introduction

The importance of financial dynamism to economic development is generally acknowledged and has been empirically confirmed in innumerable studies on the subject. History shows, however, that there is no one ideal model for a financial system capable of supporting economic development and that very few countries have managed to combine financial and economic development. The only instances that can be cited are Germany, the United Kingdom and the United States, the latter two with a financial system based on capital markets, the former with one based on private credit (Zysman, 1983). Other countries whose industrialization accelerated in the post-war period, including the developing countries studied in this article, backed the process with some combination of public and external credit, and the varying degrees of success they achieved revealed the mismatch between the dynamics of their financial systems and the financing needs of economic development.

Although generalizing is difficult, it is possible to identify features common to countries at similar levels of development. In industrialized countries, it is innovation that is hardest to finance, both in the research and development (R&D) phase and in the new process implementation phase (Hall, 2002; Matouk, 2010), given the particular riskiness of these investments. In developing countries, the challenges raised by underdevelopment itself and by competition from more advanced economies create further difficulties. A number of sectors have a particularly acute need for resources, but underdevelopment is also a feature of financial systems, which are usually limited and undiversified (Gerschenkron, 1962; Furtado, 1967). In these cases, economic performance may be directly constrained by the shortcomings of a country's financial system.

The present article is a contribution to this debate and contains a theoretical and policy analysis intended to assist in the task of understanding and identifying financial constraints on economic development in developing countries. At the theoretical level, it offers a Keynesian interpretation drawing on the work of two offshoots of this tradition, the new-Keynesian school, represented here by the contributions of J. Stiglitz (Stiglitz and Weiss, 1981; Stiglitz, 1994), and post-Keynesian thinking as derived from the writings of J.M. Keynes (1943, 1937a and 1937b) and H. Minsky (1982 and 1986). Setting out from this interpretation, the article proposes a basic list of financial policies designed to make the financial system more functional to economic development, bearing in mind the special characteristics of the countries aspiring to this.

Section II starts the discussion with a summary of the theoretical debate on the role of the financial system in economic development. The sections that follow apply the Keynesian approach to the analysis of developing countries, concentrating on three aspects: their specific economic development financing needs (section III), the conditions under which the financial system can contribute to this process (section IV) and the profile of the financial policy required to expand it (section V). Section VI offers conclusions.

II

The financial system and
economic development

J. Schumpeter (1934) and J.M. Keynes (1943, 1937a and 1937b) laid the foundations for the theoretical debate about the macroeconomic role of the financial system. Schumpeter highlighted the importance of credit to economic development and Keynes argued that the money market was the main driver of economic dynamics in both the short and the long run.

The debate was stoked in the 1950s and afterwards by the publication of a well-known article by Gurley and Shaw (1955), followed by other important contributions that include Gurley and Shaw (1960), Shaw (1973), McKinnon (1973), Stiglitz (1994) and Minsky (1982 and 1986), among others. The first of the articles cited gave rise to the Gurley-Shaw model and the next two

to the Shaw-McKinnon model, both of which derive from the neoclassical theoretical tradition and are briefly summarized in the following subsection. The last two, which are described in more detail further on (since they provide the basis for the policies proposed in this paper), provided the main theoretical underpinnings for the Keynesian approach in its new-Keynesian and post-Keynesian variants, respectively.

1. A brief summary of the neoclassical view

The Gurley-Shaw model postulates that a diversified financial system providing a variety of ways to allocate savings is favourable to economic growth. A kind of Say's Law is proposed for the financial market: a supply of profitable assets, with varied characteristics, tends to attract a portion of aggregate saving, thus creating its own demand. Thus, the demand for money and equilibrium interest rates are lowered and the supply of funds to finance investments is increased. This approach, however, says nothing about what conditions and policies favour financial development, an issue that is not dealt with until the Shaw-McKinnon model.

The Shaw-McKinnon model relies on three core hypotheses (Fry, 1995; Hermann, 2003): (i) saving is required to finance economic growth; (ii) aggregate saving is a positive function of the real interest rate, and (iii) freely operating financial markets ensure that the real interest rate, aggregate saving and, by extension, economic growth settle at their "optimum" levels.

The first two hypotheses are simply applications of well-known neoclassical monetary theory. The third synthesizes the efficient market hypothesis (Malkiel, 1994), according to which, in the absence of exogenous barriers to agents' free choices, interest rates correctly reflect the microeconomic and macroeconomic fundamentals of the assets concerned.

According to this approach, any market segment becomes viable if it is free to price assets in accordance with their fundamentals. A situation where financing for economic development is constrained is interpreted as a symptom of malfunctioning not in the financial system, but in the wider economy of which it is part.

What is recommended for the creation of a "complete" financial market, then, are: (i) liberalization policies so that regulatory obstacles do not prevent prices from adjusting to asset risks and returns; (ii) supervision of the sector (to safeguard individual investors), and (iii) macroeconomic policies focused on monetary stability to keep risk levels low. According to this approach, such policies stimulate asset demand (by reducing risk) and supply (by reducing costs) and foster market diversification (by doing away with regulatory barriers), thus promoting financial development.

2. The Keynesian approach

The Keynesian approach to the financial system is based on a position that is critical of the efficient market hypothesis. In new-Keynesian theory, this hypothesis is replaced by that of market failures, structural conditions that, even in free markets, prevent prices from adjusting to economic fundamentals. In the financial market, the main failure identified is information asymmetry between potential borrowers and lenders.[1] Because of this asymmetry, banks cannot properly distinguish the differing risk levels of potential borrowers and thus set efficient interest rates for each project. Given this limitation, they set homogeneous rates for projects that differ in riskiness. This results in a first source of inefficiency: equilibrium interest rates in the market for assets do not properly reflect their microeconomic fundamentals, because the lender does not perfectly know them. Since it is not possible to identify each risk, banks follow two conventional evaluation criteria: (i) the greater the rate of return, the higher the risk (Tobin, 1958), and (ii) the interest rate accepted by borrowers is indicative of the returns they expect and their appetite for risk. Accordingly, even if lenders anticipated high levels of risk, incorporating them fully into interest rates would not be a solution, owing to the adverse selection effect (attracting borrowers with a greater risk appetite and putting off more conservative ones). Thus, potential lenders tend to protect themselves by rationing credit and causing the market to become incomplete in segments where it is particularly hard to evaluate or compensate for risk.[2] Rationing and incompleteness arise most frequently:

(i)   In the capital market, as it is highly risky for non-professional investors.
(ii) In long-term financing and the financing of innovations generally, as risks are hard to predict.
(iii) In lending to small and medium-sized enterprises (SMEs).

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[1] Other market failures may be noted, such as transaction costs, information costs, positive and negative externalities, incomplete markets and imperfect competition (Stiglitz, 1994; IDB, 2005, chap. 11). All except the last are intrinsic to financial markets.

[2] A market is deemed incomplete when one or more segments that are theoretically possible do not exist in practice because of a lack of interest on the demand or supply side.

(iv) In lending to people on low incomes, who are considered risky because of their lower levels of income and collateral, so that in many countries they are affected by financial exclusion.

The indisputable importance of these segments for economic development highlights another inefficiency in the financial system: its tendency to operate in a way that is not functional to this process.

The post-Keynesian approach is even more radical in its criticism of the efficient market hypothesis, its argument being that the main obstacle to market efficiency is the uncertainty surrounding all economic decision-making, and particularly financial operations (Carvalho, 2010; Hermann, 2011a). As Kregel (1980) observed, the problem is not confined to information costs and access, but includes the very existence, at the critical juncture, of the forward-looking indicators needed to estimate asset risks and returns. Uncertainty, unlike risk, cannot be priced, i.e. cannot be factored into market interest rates. This makes it reasonable that there should normally be some preference for liquidity, as a way of protecting against unforeseeable risks.

In Keynes's view, the preference for liquidity is the main source of macroeconomic inefficiency in resource allocation, both in asset markets, where it creates a short-termist tendency that makes it harder (and more expensive) to finance investment, and in the market for goods, where it is the main cause of recessions. This exacerbates the difficulties involved in financing economic development, as already discussed. The post-Keynesian view is that these difficulties reflect, on a larger scale, the difficulties of financing aggregate investment. According to Keynes, such financing is carried out in two stages. The first, which he called the finance stage, consists in demand for credit from firms to initiate new investments, and can be met with short-term loans. For investments to be completed, however, firms must be able to issue longer-dated securities (including shares) whose maturities are compatible with that of the asset to be financed. Keynes called this the funding stage.

As Kregel (1986) observed, the finance stage is not obligatory, since investment can be financed directly by issuing shares or long-term debt. This situation is less likely than the one depicted by Keynes, however. In both stages, what makes the investment viable is a context of low (or falling) preference for liquidity (which reduces equilibrium interest rates in the asset market), but willingness to forego liquidity obviously needs to be greater in the funding phase. This has implications for financing costs: the interest rates demanded for long-term securities by the savers and financial institutions that might acquire them are generally higher than those for short-term securities. In other words, the yield curve (the interest-rate term structure) is typically rising (Cargill, 1983; Hermann, 2011b). This situation makes the second phase more fraught than the finance phase, implying that activities requiring long-term funding will be penalized more heavily.

In the finance phase, the crucial actors are commercial banks; as they take in sight deposits (very short-term liabilities), they also concentrate their assets in short-term operations. Once this demand has been met, investment generates new income and thence more saving. Long-term funding is not guaranteed even if savings are identical in value to new investments (Keynes, 1937a), since where there is a strong preference for liquidity, savings will be allocated predominantly to short-term assets (including cash). In this phase, non-bank financial institutions need to be willing and able to attract new savings for medium- and long-term assets.

With the Keynesian approach, in summary, the vital actors in the investment financing process are not savers (firms and families keeping resources in the financial system) but financial institutions: commercial banks in the finance phase and other financial institutions (including universal banks) in the funding phase (Carvalho, 1997). This interpretation justifies the central role attributed in the post-Keynesian approach to the financial system as a key factor in economic development.

Besides the preference for liquidity, uncertainty justifies what Keynes (1943, chap. 12) called conventional behaviour: going along with the majority at times when risks are hardest to evaluate. Because of this, the market tends to amplify asset appreciation or depreciation trends, creating speculative bubbles in the first case and asset deflation crises in the second. Minsky (1982 and 1986) adds to this analysis the financial fragility hypothesis, pointing out that: (i) phases of economic growth are always accompanied by higher debt; (ii) the level of debt tends to rise with the degree of development of the financial system; (iii) the expectations driving this borrowing are surrounded by uncertainty; (iv) the ability to make repayments may be jeopardized when these expectations are not met, creating the risk of liquidity crises in the financial system, and (v) fulfilment of these expectations does not in itself guarantee safety for the market either, as it tends to prolong phases of bullishness, sometimes unduly, thus creating speculative bubbles that likewise trigger financial crises when they burst (Kregel, 1997).

Financial fragility in market economies thus has structural causes: the uncertainty inherent in financial relationships and the development of the financial system itself. The degree of fragility in the economy in each period will depend on the conditions of the lending contracts signed. On this subject, Minsky offers a taxonomy of borrowers, classifying them as: (i) hedgers, whose expected incomes exceed their debt repayments; (ii) speculative borrowers, whose expected income (in the early phase of the contract) only covers interest costs, making it necessary to refinance the principal, and (iii) Ponzi schemes, used by speculative borrowers who are even greater risk-takers and expect to refinance the principal and the interest in that initial phase. Speculative borrowers (including those engaged in Ponzi schemes) operate with a greater degree of fragility since, besides the risk of their earnings expectations not being met, they depend on new loans to cover the maturity mismatch between their assets (longer) and their liabilities (shorter).

Thus, financial fragility in the economy is increased by two factors: the size of agents' debts and the proportion of speculative borrowers. The former reflects the rate of economic growth and the degree of financial development in the country, with progress in this tending to expand agents' access to external financing sources. As for the latter, a large proportion of speculative borrowing is not an anomaly but a common feature reflecting the chronic difficulty of securing long-term financing in market economies, which induces firms to borrow short in order to finance assets with long maturities. Financial system fragility is thus intrinsic to financial development.

In short, from a post-Keynesian perspective, the financial system tends to operate in a way that is doubly dysfunctional to economic development: market incompleteness in the segments with the greatest uncertainty compounds the tendency towards financial fragility.

Keynesian-inspired approaches argue for a number of forms of State action in the financial system. Besides the supervision of the sector suggested in the neoclassical approach, recommended policies include prudential regulation (restrictions on the free allocation of resources) ranging from incentives to specific allocations to priority sectors and, given the difficulties of development financing, more interventionist types of action as well, involving public-sector and directed private-sector lending policies, with the former perhaps extending to the creation of public-sector development banks.

III

The financing of economic development

1. Characteristics of the development process

Economic development is a complex phenomenon requiring prolonged gross domestic product (GDP) growth in conjunction with structural transformations in the economy. This process is brought about by a series of investments in new production capacity, in two ways: the capital stock is expanded and new types of physical and human capital are brought into use. Thus, development always involves some degree of innovation, which comes about through the introduction of new products, sectors of activity, production processes and consumption patterns (Schumpeter, 1934).

A general movement towards increased investment of the kind that characterizes each phase of economic development needs something to supplement self-financing. From this basic condition arises the importance of financial development for economic development, as the various schools of theory dealing with the issue recognize. The complexity of the development process, however, has major implications when it comes to understanding and determining financing needs (Studart, 2005; Carvalho, 2010; Hermann, 2011a). The greatest difficulties include:

(i) The large volume of capital required: this restricts many firms' access to what prove to be scarce or costly outside resources.

(ii) Innovations: new sectors, products and production processes do not have a track record of profitability, and this exposes innovative firms to credit rationing, as well as limiting their ability to self-finance.

(iii) Externalities: some of the investments needed to advance the development process are used to expand productive and urban infrastructure, often with the characteristics of a public good (with a social return greater than the expected microeconomic return), which limits private-sector interest.

(iv) Consumption: for investment and innovation to expand sustainably, domestic consumption needs to grow too. As with investment, this increased consumption can hardly be financed from personal resources alone, even if these tend to grow because of increased employment and, possibly, some improvement in the income distribution profile. Thus, favourable borrowing conditions for families are an important complement to the financing structure of economic development.

(v) Possible effects on the trade balance: some of the forward and backward linkage effects created by the new investment can result in certain sectors quickly coming up against the limit of their capacity, creating bottlenecks on the supply side, while other effects may stimulate demand in sectors that have the capacity to expand supply but are not very competitive externally. In both cases, imports (of capital, intermediate or consumption goods) will be strongly stimulated, resulting in balance-of-payments disequilibria and possibly inflation (Tavares, 1979; Furtado, 1967). In this case, the development process will only be sustainable under favourable external financing conditions.

(vi) Financial market incompleteness: when the financing of a particular firm is considered, it is implicitly or explicitly assumed that there is a diversified financial infrastructure enabling the firm to assess market opportunities and opt for the combination of its own and outside capital that best suits it. In other words, markets are assumed to be complete. According to the theoretical approach adopted in this study, as has been shown, this condition is not guaranteed even for individual firms, let alone the whole economy.

Given these conditions, it is clear that, by contrast with what conventional approaches recommend, the financing of economic development requires far more than free markets and business expertise if "optimum" capital structures are to be created. In the absence of a diversified financial system geared in some degree towards dealing with the specific needs of this process, even the most promising projects can be rendered unviable by financing difficulties.

2. Special features of developing countries

The effort to understand the heterogeneity of economic development in different countries gave rise to a taxonomy ranking them into three major categories in the international economy:

(i) developed countries (also known as industrialized countries because the industrial sector dominated this process until the late twentieth century), which head the ranking;

(ii) underdeveloped countries, a term that gradually fell into disuse so that in the 1980s they became known instead as developing or less developed countries, with a subdivision by income levels (medium and low);

(iii) emerging economies, a term used for developing countries that implemented trade and financial liberalization policies in the 1980s or 1990s, so that international connections became substantially more important in their development profile.

The first indicator normally offered as a marker for developing countries is their level of GDP and per capita income, which have historically been lower than in industrialized countries with similar populations and land areas. Strictly speaking, what distinguishes developing countries is that they have remained in this position for decades or even centuries. Despite this, developing countries are not exactly characterized by difficulty in achieving economic growth, even if this is a recurrent problem in many of them. The greater difficulty is to generate development, i.e. to associate growth with structural shifts that enhance economic and social indicators and the country's position in the international market:

> "Underdeveloped economies can experience prolonged phases of growth in their overall and per capita output without any diminution of the external dependency and structural heterogeneity that are their essential characteristics" (Furtado, 1967).

What distinguishes developing countries more than their relatively low incomes is the difficulty they have in implementing and, most particularly, generating innovations in an international market already dominated by technologically more advanced countries. Thus, many authors consider technological underdevelopment the main distinguishing feature of developing countries. Although hard to measure, this can be clearly perceived in some of its effects: (i) the low productivity of capital and labour by developed-country standards; (ii) chronic difficulty in competing in domestic and external markets even under favourable exchange-rate conditions; (iii) import and export patterns concentrated, respectively, in industrial and primary goods; (iv) frequent trade deficits, and (v) high external indebtedness, among other things.

Other features of developing countries are a high degree of financial system incompleteness and external constraints, although these conditions are also present

to some degree in industrialized countries.[3] The special characteristics of developing countries in these respects are the greater intensity with which problems manifest themselves and the extent of the constraints they place on development.

On the Keynesian view, as has been shown, the financial system tends to operate in a way that is largely dysfunctional to economic development in any country. It is widely recognized, for example, that capital markets are difficult to develop anywhere because of the greater risks and costs they involve relative to the banking sector (Herring and Chatusripitak, 2000). Financing difficulties and even financial exclusion in higher-risk segments are also found in industrialized countries (Dymski, 2005 and 2006). In developing countries, however, lower incomes and economic growth difficulties constrain the expansion of the financial system in lower-risk segments too, so that even short-term credit is scarce and dear. Besides, higher-risk groups are a larger share of the population in less-developed countries, which aggravates the resource scarcity affecting them.

Under these conditions, yield curves in developing countries acquire a profile that is quite unfavourable to

potential borrowers (Hermann, 2011b): starting from a high base that reflects the high cost of short-term credit, they are short (because the market is incomplete in long-term segments) and steep (because of the chronic reluctance of the financial system to engage in longer-term lending, which is also manifested in the high cost of the loans that are made despite this rationing) (see figure 1).

FIGURE 1

Developed and developing countries: financing conditions
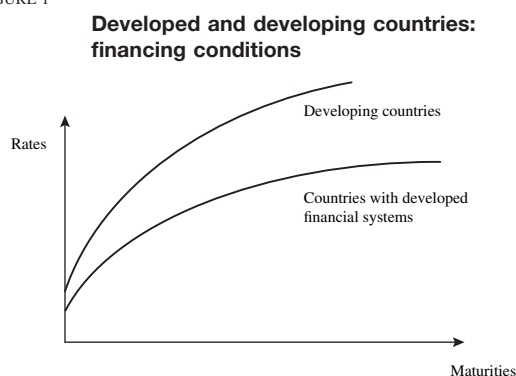
Source: prepared by the author.

As for the external constraint, given the growing importance of international trade and financial relationships, any country's development process is shaped (and ultimately constrained) by the performance of its balance of payments. In developing countries, though, this constraint tends to take the form of a chronic problem because it derives from a structural situation, namely greater dependence on external financing, either to make up for the incompleteness of the financial system or to cover balance-of-payments deficits associated with technological underdevelopment.

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[3] Other conditions not directly related to development financing are often identified as causes or manifestations of the relative backwardness of developing countries. These conditions include: (i) the large share of GDP represented by goods with low value added, reflecting lesser access to more elaborate technologies; (ii) poor production and urban infrastructure and inadequate education and health services, which feed back into technological underdevelopment; (iii) low wages, reflecting a poorly trained workforce and a low investment rate; (iv) a greater tendency to inflation in both growth and recession stages, driven by a number of factors that include the high propensity to consume typical of low-income economies; (v) low productivity; (vi) distributional conflicts, and (vii) frequent currency devaluations to cope with the external constraints.

IV

The functionality of the financial system to economic development

A basic condition for a financial system to operate in a manner functional to economic development in any country is the availability of a diversified set of financial institutions and instruments capable of meeting both the varied demands associated with this process and the profit objectives of the financial institutions themselves (Carvalho, 2010). This condition, however, cannot be

equated with the concepts of efficiency and financial development as these terms are usually employed. The former, which is common to neoclassical approaches, emphasizes the microeconomic functions of the financial system, the aim of which is to meet the profit objectives of financial institutions and enhance their clients' wealth. The efficient market hypothesis maintains that

performing these functions efficiently is a necessary and sufficient condition for the financial system to also perform its macroeconomic function of providing finance for production activity.

The Keynesian approach does not deny the importance of these microeconomic functions, but it rejects the efficient market hypothesis and, with it, the equivalence between microeconomic and macroeconomic efficiency in the financial system. Besides the natural tendency of financial systems towards incompleteness when it comes to meeting economic development needs, there is the fact that the conditions determining the efficiency of the financial system are not all necessarily met at the same time. A financial system can perform the financing function with a structure that is both undiversified (with a heavy concentration of commercial banks, for example) and inefficient at assessing risk. This was the contradiction identified in developing countries by the theorists of financial liberalization (Shaw, 1973; McKinnon, 1973), who attributed the problem to the policy of financial repression, i.e. to strong State action through regulation and public credit programmes.

It is also possible for a financial system to meet the objective of increasing wealth without properly performing the financing function. This has been the case in many developing countries since the liberalization policies of the 1990s, which sought to expand and diversify financial systems but left many existing financing difficulties in place, including financial exclusion and external dependency (Hermann, 2004).

The functionality of the financial system cannot be equated with the idea of financial development either, when the term is understood, as it usually is, in a purely quantitative sense. On this definition, development is measured by aggregated indicators such as the number and types of financial institutions, the value added of their assets, the size of the sector and the scale of lending as a share of GDP, etc.[4] Although important, these indicators are not enough to capture the broader concept of macroeconomic functionality. According to Keynes's and Minsky's approaches, a financial system functional to economic development needs to be able to fulfil two essential conditions in addition to the physical existence of a diversified financial structure: (i) the ability to meet the demand for financial resources in its various forms, encompassing both finance and funding needs, and (ii) the ability to control the level of financial fragility, given that some fragility is inevitable:

"Functionality is defined as follows: a financial system is functional to the process of economic development when it expands the use of existing resources in the process of economic development with the minimum possible increase in financial fragility and other imbalances, that may halt the process of growth for purely financial reasons" (Studart, 1995, p. 64).

The special conditions of developing countries suggest two extensions of Studart's concept. First, the expansion of existing resources needs to meet certain allocation criteria to reduce credit rationing and the financial exclusion affecting sectors essential to development. A financial system that is functional to economic development in developing countries needs to have a variety of financing mechanisms to support: (i) investment in innovations in all their phases; (ii) expansion and modernization of productive and urban infrastructure; (iii) small and medium-sized enterprises (SMEs); (iv) sectors with the characteristics of a public good; (v) home ownership, and (vi) durable goods consumption. The low-income population should be included in the last two cases.

Where the financing of innovations is concerned, given the high degree of uncertainty and credit rationing involved, the experience of more developed countries points to the capital market as the best channel, operating essentially through venture capital funds. Thus, meeting the requirement of functionality involves a more specific requirement for the structure of the financial system: capital market development.

The second needful extension of Studart's concept concerns financial fragility: to be functional to development in developing countries, a financial system needs to have mechanisms to monitor external financial fragility in the area of what the author calls "other imbalances". By analogy with Minsky's original concept, this fragility is determined by currency mismatches, which can result from the build-up of foreign currency borrowings by agents whose income is in local currency (i.e. everyone except exporters) or from maturity mismatches in exporters' external debts.

From the Keynesian theoretical perspective, therefore, the concept of functionality needs to encompass four aspects: (i) the volume of resources; (ii) allocation to sectors that are strategically important to development; (iii) domestic financial fragility, and (iv) external financial fragility. Although these dimensions may be dealt with separately for analytical purposes and usually require different instruments for good results, they are not independent of one another, as the absence

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[4] An example of this type of approach can be found in IDB (2005, chap. 1).

of one may compromise the rest. For example, excessive credit expansion and misallocation of resources (with maturities shorter than the ideal or very high costs) increase financial fragility in the economy. Fragility can spread to the external sector if these financial system failings are compensated for by high external borrowing. Lastly, a high degree of financial fragility or external fragility in the economy tends to restrict the supply of funds, making it hard for the resource volume condition to be met.

The issues of allocation and external fragility are especially important in developing countries. Given the chronic difficulty of raising funds in the domestic market, external fragility becomes an almost inevitable tendency in phases of abundant international liquidity.

Except where there are barriers (economic or otherwise) to foreign capital, these phases result in a large expansion of external borrowing in developing countries. Thus, some of the financial fragility of these countries is manifested as external fragility.

This interpretation is not meant to suggest that the volume of resources is irrelevant but only to emphasize that, taken alone, it says little about the functionality of financial systems in developing countries. Resource volume growth is supposed to be an indicator of improving financing conditions in any country, but this hypothesis is only borne out if the expansion is properly directed, reducing the degree of credit rationing and financial exclusion without unduly increasing financial and external fragility.

V

Policies to enhance the functionality of financial systems in developing countries

A major practical implication of Keynesian financial theory is that, given the natural tendency of the financial system towards incompleteness and financial fragility, it is unlikely to qualify as functional to economic development in the absence of State action to achieve this (Carvalho, 2010; Hermann, 2011a) in the form of: (i) policies to encourage the development of the financial system with a view to making it less incomplete; (ii) policies to control domestic and external financial fragility, always recognizing that these tendencies cannot be wholly eliminated from the financial system, and (iii) compensatory policies to supplement the other two kinds. This section discusses possible lines of action in each of these areas, taking the four dimensions of financial functionality for developing countries referred to above.

1. Policies on the amount and allocation of resources

The policies needed to induce the financial system to expand its operations in segments essential to economic development have to be guided by the extent and characteristics of financial system incompleteness in each developing country. Despite these countries' specific characteristics, their financing difficulties have features in common: the scarcity and costliness of both

short- and long-term private financing sources, summed up in high, short and steep yield curves.

The incentive policies needed to improve the situation would have to include measures to stimulate demand for financial assets, particularly long-term ones, including variable-income securities (shares), in the capital market. As regards compensatory policies, what are recommended are directed private-sector lending programmes and, most particularly, public credit policies targeted on sectors essential to development in each period, with pricing and maturities that are less onerous than the terms available in the market (in segments where this option exists).

As will now be argued, such policies, taken together, have the effect of lowering, extending and flattening yield curves in the different segments of the financial system. In addition, they indirectly serve to reduce the financial fragility involved in economic development, as better maturity and cost conditions reduce credit risk.

Demand for a given asset is shaped by estimates of its likely risks and returns relative to alternative assets; by the macroeconomic environment, there being an increased preference for liquidity in situations of great uncertainty and for longer-dated securities at times of greater optimism; and by the incentive structure that financial policy creates (Carvalho, 2010). Besides a macroeconomic environment of low uncertainty, what

is needed to stimulate demand for long-term assets is an incentive structure that produces some comparative advantage for these assets over lower-risk ones. This structure can be created in two ways, which are not mutually exclusive: increased risk-adjusted rates of return for long-dated securities, and lower rates for short-dated securities. The profile of the yield curve in developing countries points to the latter as the most advisable course.

Reducing short-term interest rates favours longer-dated operations (including the capital market) in two ways: (i) it will lower the yield curve, thus reducing the costs of all financial operations, including long-term ones, by also causing the curve to lengthen, and (ii) it will flatten the yield curve, reinforcing the previous effect, since lower returns on short-dated securities will tend to increase investors' preference for longer-dated assets, which will provide the only route to increased profitability for their portfolios in the new environment of low interest rates (figure 2).

FIGURE 2

Developing countries: the effects of lower short-term interest rates on the yield curve
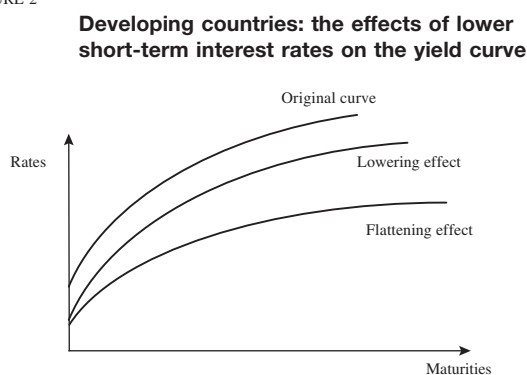
Source: prepared by the author.

A systematic policy of encouraging low short-term interest rates also contributes to a macroeconomic environment that is more favourable to financial development. High interest rates tend to have a perverse effect on the demand for assets in general because of adverse selection, which increases credit risk for lenders (Stiglitz and Weiss, 1981) and potentially compromises returns. Uncertainty and the preference for liquidity increase in this context, penalizing longer-dated assets in particular.

Short-term rates that are appropriately low (i.e. that do not create the macroeconomic imbalances mentioned below) tend to reduce borrowing risks and, by stimulating economic growth, improve expectations of returns on

assets, including longer-dated ones. The constraints on this policy are, naturally, the risks of inflation, overborrowing (and thence financial crises) and balance-of-payments disequilibria. Nonetheless, the perverse effects of a high interest-rate policy are such that, even given these risks, it should be used with diffidence and on a temporary basis and be supplemented by other instruments that act more directly on these macroeconomic disequilibria (discussion of which is beyond the scope of this article).

In summary, this paper rejects the idea, upheld by the Shaw-McKinnon model and widely propounded in this debate, that high interest rates might contribute to economic development, whether in developing or developed countries, by expanding the supply of loanable funds. According to the Keynesian approach, higher interest rates can, at least in theory, increase the profits of financial institutions, thereby stimulating lending. This possibility, however, is subject to two types of risk: a rapid rise in defaults by borrowers and the consequent risk of a financial crisis. In both cases, the profitability of financial institutions will be negatively affected and credit growth will be cut short. Thus, it is considered that a policy of low short-term interest rates would do more good than harm to the economic development process: in conjunction with the risk spreads of each form of financial operation (reduced, ideally, by macroeconomic policy), such interest rates would result in final rates that were reasonable for borrowers and compatible with the levels of returns that financial institutions consider reasonable and satisfactory.

Lastly, what a directed credit policy requires first and foremost is the creation of secure long-term funding sources to ensure that the private- or public-sector banks discharging this function do not end up creating the very financial fragility (and fiscal fragility too in the case of public-sector banks) that they ought to be mitigating. Given the environment of constrained demand for long-term assets in which these policies have to be implemented, the best source of long-term funding to underpin them are non-market resources, i.e. funds that are fiscal or parafiscal (compulsory saving) in origin.

Second, in practice these policies can only succeed in compensating for the lack of lending to sectors deemed strategically important to development if credit is actually provided when required. In this respect, public-sector credit tends to be more effective than directed credit. The latter, although it may help to make the market less incomplete, suffers from a limitation common to more indirect forms of State action in the financial system (supervision, regulation and incentives), in that it is a non-coercive policy which only acts through incentives.

Directed credit programmes create rules for allocation from particular private-sector funding sources, or make public fiscal or parafiscal funds available at below-market costs so that these institutions can provide the loans in question. These measures are meant to induce private-sector institutions to provide credit, but do not force them to, so their effectiveness may be limited by the same lack of interest that caused the market to be incomplete in the first place. Thus, the only sure way to improve the situation is for the government to directly take on the risks the private sector rejects. This requires the creation of development banks, i.e. public-sector banks with specific functions in the economic development process.

2. Policies on financial fragility

(a) *Domestic financial fragility*

Financial fragility can be partially controlled by market hedging mechanisms such as highly liquid assets, organized secondary markets, market makers, futures markets and derivatives. For these operations to take place, however, it is necessary for the financial system to have a reasonably well-developed capital market, which is rarely the case in developing countries. This limitation reinforces the need referred to earlier for these countries to coordinate allocation policies with those designed to control financial fragility.

Even in countries that meet this condition to some degree, however, the fact that hedge operations, like the ones covered by them, are based on expectations means that these market instruments may prove inadequate or even counterproductive as a financial system defence measure. This is so, for example, in situations of particular asset price volatility, which encourage speculative operations aimed rather at profit than at protection, and those where herd behaviour takes over, since volatility makes it hard to arrive at reliable estimates (Kregel, 1997).

Under such conditions, what is required if these instruments are to be negotiated with reasonable security is not just physical infrastructure in the form of financial institutions and markets but also an institutional (regulatory) infrastructure operating on two fronts: (i) preventive control of risk-taking in the financial system, and (ii) compensation of the macroeconomic effects when preventive measures prove inadequate or ineffective.

Preventive regulation needs to focus on protection for the end saver and control of financial fragility. What is basically required for the former is a regulatory apparatus that establishes the responsibility of financial institutions for providing information on the risks of operations they undertake using resources raised from

savers and, at least in part, for any resultant losses. Besides protecting savers, which is necessary in itself, such regulation contributes indirectly to the development of the country's financial system by making the market more attractive to savers in general.

As for financial fragility, although prudential regulation can only deal with specific operations, its final objective from the point of view of the functionality of the financial system must be to control systemic risk, i.e. the degree to which the economy is exposed to risk in the financial system. As well as the risks taken or caused by specific agents, the possible channels of contagion between them are also important. Controlling systemic risk requires restrictions on the build-up of speculative debts (including Ponzi schemes), as a way of managing risk-taking, and on the leverage of financial institutions, to limit contagion between them.

Agents' borrowing profiles and the channels of contagion in the financial system are not clearly perceptible in the economy, however, which means that despite the macroeconomic cost involved in restricting the potential growth of the whole market, action to forestall systemic risk needs to rely essentially on control of the overall risk exposure of the financial system. Historically, such control has involved subjecting financial institutions to regulatory barriers and costs associated with the expansion of their lending operations (Carvalho, 2005).

Regulatory barriers usually take the form of market segmentation preventing commercial banks from operating in the capital market, along the lines of the Glass-Steagall Act of 1935 in the United States. The main objective of such a ban is to prevent contagion between the two segments of the financial system. Although successful in the United States and several other countries up until the 1980s, this model fell into disuse from the 1990s with the spread of liberalization policies (likewise initiated in the United States), which promoted the gradual removal of regulatory barriers to the free choice of portfolios by financial institutions.

In this new financial system model, the only option left is to impose costs on the choices with the greatest potential to generate systemic risk, essentially those involving the greatest liquidity risk (Carvalho, 2009). These costs have taken a variety of forms (Carvalho, 2005): the requirement for minimum levels of liquidity and capital on the balance sheets of financial institutions (compulsory levies on deposits, loan provisions, Basel rule, etc.), similar regulation of the derivatives market (off-balance sheet operations) using liquidity and capital buffers, and tax measures, among others.

In developing countries classified as emerging markets, where capital markets are reasonably well developed, prudential regulation needs to be extended to both the corporate debt and the share segments of these markets. Corporate debt is similar to bank credit, except for the greater liquidity of corporate securities, even though this is typically not very high either (Herring and Chatusripitak, 2000). Shares do not increase the level of debt in the economy, and indeed are an alternative to debt, but nor are they free from systemic risk. This essentially derives from: (i) the market risk typical of shares; (ii) this segment's greater exposure to herd behaviour, facilitated by the liquidity of shares relative to other types of assets, and (iii) the fact that many investors, and especially larger ones, are leveraged, i.e. work with borrowed resources, creating the risk of banking-sector contagion in the event that the share market performs poorly.

Controlling the systemic risk associated with the capital market thus requires instruments similar to those applied to banks: requiring intermediaries to disclose information accurately and making them liable for any losses that result from failures in this regard; requiring liquidity and capital buffers; and limiting financial institutions' leverage and holdings of securities on their balance sheets.

The effectiveness of the cost-based risk control model is limited, however, by factors that are largely beyond the control of the regulatory authorities, such as the phase of the business cycle and ongoing financial innovation. Where the business cycle is concerned, prudential regulation can be expected to be least effective in expansion phases when markets are most bullish, which is just when financial expansion most needs controlling. The financial system tends to play down the burden of regulatory costs in this situation, expecting them to be more easily offset by the greater earnings forecast. This limitation can be eased, although not wholly overcome, by a countercyclical structure for regulatory costs based, for example, on a sliding scale of costs that rises with the volume of resources or with the rate of expansion of each type of operation to be controlled.

Financial innovations place a twofold limitation on the effectiveness of controls designed to prevent financial fragility by imposing costs. First, they gradually make the current cost structure obsolete, as certain types of operation become less of a feature of the market. Second, they make it hard to recalibrate control instruments, since the new types of operation are still relatively unknown:

"Innovation (both financial and organizational) […] is in itself a source of institutional unsuitability. […] [U]nder the effect of the development of financial systems, formal institutions […] become ineffective and no longer sufficiently counter the endogenous dynamic of risk taking" (Sinapi, 2011, p. 18).

These limitations suggest the advisability of applying compensatory policies of more direct intervention in the financial system to supplement prudential regulation, such as: (i) regulatory barriers to risk-taking by financial institutions; (ii) emergency hedging instruments for times of particular uncertainty (emergency open market operations using public securities and currency, for example); (iii) lending of last resort by the central bank to financial institutions with temporary liquidity problems; (iv) programmes to restructure the banking sector when there are prolonged difficulties indicative of solvency problems, and (v) circuit breaker mechanisms in the capital market implemented by official regulators or by private-sector self-regulation bodies.

(b)   *External financial fragility*

As has been pointed out, the external financial fragility of developing countries is structurally determined by the profile of their production structure and the particularly fragile position they thus occupy in the international financial market. These conditions are beyond the scope of financial policy action, which does however play an important role in controlling the systemic risk associated with possible contagion in the domestic financial system when a country's external fragility results in liquidity difficulties for financial institutions. This contagion can take place via three channels: the external liabilities of financial institutions themselves, those of the non-financial sector (including balance sheet and off-balance sheet operations in both cases), and the currency market.

The first of these produces contagion, in particular, from the financial system to the balance of payments, since in this case the liabilities of the financial system are one of the causes of the country's external fragility. Contagion through the second channel arises as a counterpart of the external fragility of the non-financial sector, whose demand for currency can unleash a large-scale movement to redeem domestic financial investments, increasing banks' very short-term liabilities (in reserves). Systemic crises arising through these two channels can be avoided if the flow of external liabilities is compatible with the volume of currency available in the country. Thus, the systemic risk associated with these channels can be contained by a strategy similar to the one identified earlier

for controlling domestic financial fragility: regulatory limits on the accumulation of external liabilities by the financial system and the non-financial sector, conjoined with differentiated control measures that should focus on short-term transactions, as these keep demand for currency systematically high.

Contagion through the currency market takes place when adverse exchange-rate movements are able to inflict major losses on the financial system. Given that developing countries are more likely to suffer from external fragility, exchange-rate depreciation is particularly risky because it raises the cost of a country's external liabilities (including the financial system's) and aggravates the effects from the other two channels. Currency appreciation, however, is not necessarily beneficial for a developing country's financial system, as it will tend to worsen its international trade position, thereby exacerbating external fragility. Moreover, in developing countries with reasonably developed futures markets, a category that includes most emerging markets, both currency depreciation and appreciation can inflict large losses on the financial system in the event that it is heavily committed to currency derivatives, since it is enough for the direction or strength of the exchange-rate movement to take a large part of the market by surprise.

In this context, there needs to be a permanent policy of controlling exchange-rate volatility in addition to the limits on external liabilities already referred to. The latter reduce the exposure of the financial system to exchange-rate risk, while controls on volatility, by making the exchange rate more predictable, tend to reduce the currency risk entailed in any kind of operation that creates external liabilities.

In the managed exchange-rate regimes that prevailed in developing countries until the late 1990s, currency volatility was avoided by the constant action of central banks committed to keeping the exchange rate at the level set. As second-generation models indicate (Obstfeld, 1994), the sustainability of these regimes depends on the confidence of the market, and financial institutions in particular, in the ability of the central bank to meet the exchange-rate target announced. If this condition is not met, the country becomes vulnerable to speculative attacks (such as a sudden increase in the preference for foreign currency over local-currency investments) strong enough to force the central bank to alter the exchange-rate target or, in extreme cases, to abandon the managed exchange-rate regime altogether. As is well known, the severe shock to the credibility of these regimes from the trade and financial liberalization policies implemented

in developing countries in the 1990s triggered a series of currency crises there and led to the old model being replaced with floating currency regimes.

Exchange-rate volatility is a fact of life in floating currency regimes since, by definition, the central bank does not adopt any formal commitment on the exchange rate. On the other hand, an unquestionable commitment by any government to macroeconomic stability, which implies some degree of monetary and financial-system stability, requires central banks operating hybrid regimes with flexible exchange rates to engage in the task of containing currency volatility. This gave rise to the dirty float regimes that became predominant in the late 1990s.

In this model, exchange-rate volatility can be controlled by central bank interventions in spot and futures markets involving the trading of currencies and currency derivatives. In spot operations, the bank acts directly on the current exchange rate, while in the futures market it influences exchange-rate expectations. In neither case, however, is the central bank wholly immune to difficulties deriving from the great mobility of capital, which limit its ability to control the exchange rate in managed currency regimes. Specifically, in situations of great uncertainty, herd behaviour in the financial system limits the central bank's ability to act in the face of strong pressure for currency appreciation or depreciation. Given that ultimately these situations cannot be avoided, it is advisable for central banks not only to act on the price of the currency, but also to introduce mechanisms to control the capital flows influencing this.

Selective countercyclical control of capital inflows is particularly important in developing countries, given their greater propensity to borrow abroad at times when foreign investors are particularly bullish. Regulatory or tax barriers to capital inflows at these times, with greater restrictions on short-term operations, help to forestall excessive expansion of external borrowing. In very bearish phases, likewise, selective controls can be applied to discipline the movement of capital outflows from the country. In both cases, the country's external fragility and the volatility of the currency market are mitigated.

Note should be taken, finally, of the risk that policies to control financial fragility may conflict with development financing needs, as they tend to restrict the total volume of operations in the financial system. This dilemma shows the extreme importance of coordinating such control with the allocation policies mentioned earlier in order to shape a financial system that is more functional to development.

VI

Conclusions

To be functional to economic development, a financial system must be capable of meeting its financing needs at acceptable cost and with appropriate maturities. The absence of these conditions does not necessarily prevent the process from moving forward, but it does give it a "stop and go" character, as the financing structure will suffer from a high degree of financial fragility due to the preponderance of high-cost short-term debt, and perhaps external fragility too, in cases where the shortcomings of the domestic financial system are compensated for by external borrowing. Thus, a functional financial system is not just a desirable condition that facilitates economic development but a necessary one if this process is not to turn into a source of systemic risk and, in all probability, of banking and currency crises that impose major sacrifices on the economy.

From a Keynesian perspective, as has been shown, the normal operating conditions of the financial system tend to make it generally incomplete and dysfunctional, even in countries at an advanced stage of economic and financial development. Thus, it is unlikely that these conditions will be achieved without State policies designed for the purpose. In developing countries, the difficulties are compounded by the very conditions that mark them out as less developed, in particular a lack of structural diversification in the financial system and intermittent dependence on external financing. These conditions make developing countries more subject to periods of growth without development (Furtado, 1967) and to financial fragility, especially in its external dimension, creating a vicious circle that perpetuates their unfavourable position on the international stage.

Improving the situation requires a coordinated set of financial policies, resting on two pillars: (i) allocation policies, focusing on segments of strategic importance to economic and financial development, and (ii) policies to control financial fragility, both domestic and external. Considering, however, that even large and diversified financial systems still show signs of behaviour that is dysfunctional to economic development (such as a lack of interest in projects with the character of public goods, financial exclusion, etc.), incentive- and cost-based conventional policies aimed at deregulated markets will not be enough to induce an adequate degree of functionality in developing-country financial systems.

Accordingly, there is also a need for compensatory policies of more direct intervention wherever stimulation or restraint is called for. This group includes, in particular: (i) programmes of directed public- or private-sector credit in the field of allocation policies (with beneficial indirect effects for the control of financial fragility as well); (ii) non-market regulatory barriers in the field of financial fragility control policies, and (iii) countercyclical measures to restrict the free flow of capital in order to control external fragility.

Interventionist policies are not risk-free either. The difficulties encountered by agents generally in predicting the behaviour of relevant indicators also affect the government bodies responsible for implementing these policies. Even so, the financial history of the twentieth century and the early decades of this one suggests that the macroeconomic damage deriving from this forecasting risk could be less than that deriving from market risk.[5]

During the five decades the interventionist model lasted (from the mid-1930s to the 1980s), no systemic crisis struck the world economy, despite the indisputable progress of economic and financial development. In that period, the world experienced two mortgage crises (during the 1970s and 1980s) originating in rich countries with great influence on the international market, the United States and Japan, plus the Latin American external debt crisis of the 1980s. Although these were very painful for the countries affected, the regulatory barriers of the time meant that none turned into an international systemic crisis.

The events of recent years, however, have not been a good advertisement for the incentive-based conventional financial policy model that has predominated in the era of liberalization. In a little over 20 years of existence, this model has not been able to prevent two systemic crises of international reach, coming against a background of lower economic growth than in the earlier period: the crisis in developing Asia, which began in 1997 and spread to Latin America between 1999 and 2003, and

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[5] The exception is the political risk (of corruption, for example) associated with any kind of government action. This is not a specific problem of financial policy, however, or even of economic policy in general, but is of a political and legal nature and ought to be dealt with in that context.

the crisis that began in 2008 (symptomatically enough in the "cradle of liberalization", the United States) and is still ongoing as of 2013. The latter crisis reinforces the hypothesis that the current model is ineffective, as it has been severest in rich countries with developed financial systems.

Without ignoring the differences in macroeconomic context that make linear comparison between the periods and countries concerned impossible, it is difficult not to associate these crises with the shift in the model for controlling systemic risk that resulted from financial liberalization. Recent events make it advisable, at the very least, for the subject of interventionist policies (which need not necessarily be in the same mould as the old ones) to be put back on the agenda of the continuing debate about possible ways of making the financial system more functional to economic development, not just in developing countries, but in industrialized ones too.

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The impact of China's incursion into the North American Free Trade Agreement (NAFTA) on intra-industry trade

Jorge Alberto López A., Óscar Rodil M. and Saúl Valdez G.

ABSTRACT

China has become a major player in world trade. Although it has not signed any trade agreements with the countries of the North American Free Trade Agreement (NAFTA), China has been gaining ground as a supplier of goods, making vigorous inroads into this area. One of the dominant trends in economic integration has been the development of intra-industry trade, which has flourished in the NAFTA signatory countries. This paper focuses on the analysis of intra-industry trade in the context of this free trade area, where the production structure of the countries involved has changed significantly since trade liberalization, revealing the internationalization of production chains. Lastly, changes in the trade structure induced by the growing presence of China in the NAFTA region are captured. Trade within this area works like a radiated wheel, with the United States acting as the axis, while China, Canada and Mexico operate as the spokes.

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I

Introduction

This paper seeks to analyse the pattern of intra-industry trade (exchange of varieties of the same good) in the context of the emergence of China in the area of the North American Free Trade Agreement (NAFTA). This country has become a prominent player in world trade, in particular in North America. Although this Asian giant has not signed any trade agreements with the NAFTA countries, it has entered into this area, gaining ground as a goods supplier. Our aim is to determine the significance of these trends and their implications, with special attention to the intra-industry integration model.

In addition to analysing intra-industry trade flows over the period 1993-2011, this study ties in with the theoretical debate relating to the establishment of economic areas. These integration processes have sparked off heated theoretical controversy over the trade effects they have generated. For a long time, pioneering authors such as Viner (1950) and Dornbusch (1992) have maintained that the member countries of the economic areas have achieved welfare gains at the expense of the rest of the world. In a case such as NAFTA, reducing domestic barriers could boost competitiveness among member countries by increasing the relative efficiency of the NAFTA economic area and intra-NAFTA imports and exports. Hence, assuming the existence of economies of scale, externalities and dynamic comparative advantages, intra-NAFTA imports would replace those from the rest of the world. However, empirical evidence suggests that the United States has lost market share in Mexico (Dussel and Gallagher, 2013), although this is due mainly

to parts and components originating in China (Gazol, 2007), which has gained market share in Mexico in recent years.[1]

As for the debate about the effects arising from the integration process, different economic theories abound and no definitive answer has been provided about the regional impact of the integration processes, since the effects vary depending on the theoretical approach adopted (Rodríguez-Pose and Petrakos, 2004). Therefore, empirical analysis is needed to establish the main economic changes linked to the NAFTA process, and in particular to demonstrate how China has integrated into the NAFTA zone as a goods supplier.

The paper is structured as follows. Section II addresses the conceptualization and methodological aspects of intra-industry trade. Section III examines China's incursion into NAFTA and its repercussions for complementarity and competition. Globalization, restructuring and models for the integration of two emerging economies, in this case Mexico and China, are covered in section IV. Meanwhile, section V examines China's incursion into the North American market and the ensuing changes to the NAFTA intra-industry trade model. Lastly, the main conclusions of the study are presented in section VI.

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[1] Hence the successive revisions to Annex 401 of NAFTA in order to relax rules of origin; the geographical location of providers has been changed but they remain the same providers (Gazol, 2007).

II

Intra-industry trade: conceptualization and methodological aspects

Theoretically, the problem of intra-industry trade was first discussed in the 1960s with the studies by Verdoorn (1960), Balassa (1963) and Grubel (1967). These authors found that a growing share of trade took place within the same industries and sectors. This novel form of

international trade led to the economic concept now known as intra-industry trade.

Authors such as Krugman (1995) or Grossman and Helpman (1990) focused on intra-industry trade and discovered notable developments on the basis of

new theories of international trade. Modern trade theory provides a set of explanatory elements grounded in imperfect competition, economies of scale and different varieties of goods. Intra-industry trade emerges as a result of increasing returns, product differentiation and consumers with diverse preferences. First, economies of scale promote production concentration, meeting large demands from a small number of production centres. Second, each company can differentiate its products from those of rival companies in order to segment demand and maintain a degree of monopoly over its own variety. Third, one prerequisite for intra-industry trade is the existence of a consumer mass with different preferences for the multiple product varieties offered. These three conditions tend to become more visible in the case of developed economies, which explains why some integration areas, such as the European Union, have excelled in such exchanges.

Several processes have developed in parallel with the rise of intra-industry trade and, in a sense, have been driven by it. Progress in trade liberalization, particularly of industrial products, has occurred both globally under the General Agreement on Tariffs and Trade (GATT) and the World Trade Organization (WTO) and regionally through the European Union, NAFTA, the Association of Southeast Asian Nations (ASEAN), the Southern Common Market (MERCOSUR) and the Central American Common Market (CACM). These processes have been guided primarily by the expansion of intra-firm trade in pursuit of the free movement of intermediate and final goods to the benefit of multinational corporations. Some authors (Navaretti, Haaland and Venables, 2002; OECD, 2002; Helpman, 2006) introduced this last aspect in the analysis of intra-industry trade, focusing on the role of multinationals. Indeed, according to these authors, multinationals are the real protagonists of the current globalization process.

To summarize, we can identify three models of intra-industry trade: first, the model based on product differentiation and economies of scale (the most common); second, the model of functionally homogeneous goods (closely linked to border and periodic or seasonal trade); and lastly, the model based on the technology gap, the product life cycle and the internationalization of the production process (intra-firm).

Another perspective is the differentiation between vertical and horizontal intra-industry trade. Horizontal intra-industry trade occurs when two separate production chains of the same industry and a similar level of development exchange goods internationally. Vertical intra-industry trade occurs when the same production line is located in different countries, leading to the re-export of goods (Dussel and León González, 2001).

From a methodological viewpoint, several indicators are designed to measure the degree of intra-industry trade in different economies, the most common being the Grubel-Lloyd (GL) index.[2] This index is built on the basis of bilateral trade flows between countries. These flows can be divided into two groups: inter-industry trade (different goods) and intra-industry trade (similar goods). The GL index ranges from 0 to 1, depending on the absence (GL = 0) or total occurrence (GL = 1) of intra-industry trade.[3] Frequently, an alternative adjusted expression of the GL index is used at the aggregate level to avoid the destabilizing effect of the trade balance.[4] In addition, other authors (Cárdenas and Dussel, 2011) use an index proposed by Hamilton and Kniest (1991) which measures marginal intra-industry trade with respect to total aggregate trade.

An important point to note is that the degree of data disaggregation influences the measurement of intra-industry trade. It is best to use the largest possible sectoral disaggregation in order to accurately identify intra-industry trade flows. The statistics used in this study provide a complete sectoral breakdown for the two-digit level (tariff chapters) of the Harmonized Commodity Description and Coding System, with information from the United Nations Commodity Trade Statistics Database (COMTRADE). Information at the four-digit (heading) level is used only for the chapters where a higher intensity of intra-industry trade is observed.

It should be noted that this paper analyses trade between countries with very different levels of development, for example, between the United States or Canada, on the one hand, and China or Mexico, on the other. These combinations allow us to consider various patterns of trade, including North-North, North-South and South-South.

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[2] The formula of the aggregate index of Grubel and Lloyd is: $GL = 1-[\sum|x_i-m_i|/\sum(x_i+m_i)]$, where x_i and m_i are the value of exports and imports of sector i respectively. The adjusted version of the aggregate index of Grubel and Lloyd is expressed: $GL_{adjusted} = [\sum(x_i+m_i)-\sum|x_i-m_i|]/[\sum(x_i+m_i)-|\sum x_i-\sum m_i|]$, where x_i and m_i are the value of exports and imports of sector i, respectively.

[3] The aggregate version of the GL index is: $GL = 1-[\sum|x_i-m_i|/\sum(x_i+m_i)]$, where x_i and m_i are the value of exports and imports of sector i, respectively.

[4] The adjusted version of the aggregate version of the GL index is expressed as $GL_{adjusted} = [\sum(x_i+m_i)-\sum|x_i-m_i|]/[\sum(x_i+m_i)-|\sum x_i-\sum m_i|]$, where x_i and m_i are the value of exports and imports of sector i, respectively.

III

China's incursion into NAFTA: between complementarity and competition

Prior to the 1990s, China had shown little interest in signing formal agreements and pursuing regional trade; this was partly because it was not yet ready to deal with the rapid liberalization of trade and investment. With the advent of the twenty-first century, however, China's attitude to regional cooperation changed dramatically (Wang, 2004, cited by Yu, Xue and Hong, 2006). Joining WTO forced China to take on several commitments in terms of market liberalization, and integrated the country into the world economy (Yu, Xue and Hong, 2006). China is now a signatory to 10 free trade agreements with 24 countries, including 3 from Latin America (Chile, Costa Rica and Peru). Another three free trade agreements are under negotiation with Australia, Norway and Switzerland (WTO, 2013).

From a theoretical point of view, one of the main arguments in favour of free trade agreements is that they seek to improve the economic dynamics of the signatory countries. However, trade between the NAFTA countries

and China has been growing rapidly, especially between the United States and China, even though none of them has signed a free trade agreement with China. In fact, China has emerged as the leading supplier in the United States market, replacing Mexico in 2003 and Canada in 2009 (see figure 1), and as the second supplier in the Mexican market since 2002, ousting Canada (see figure 2).

The coverage ratio (defined as the percentage of trade conducted under agreements in relation to total trade) stands at 11.2% for China, 34.4% for the United States, 68.4% for Canada and 81.5% for Mexico (Rosales and Kuwayama, 2012) (see table 1). As these data show, China has had no need of free trade agreements to become a world trade power.

Analysts hold opposing views as to whether the role of China and Mexico in the United States market is competitive or complementary. Some authors, such as Feenstra and Looi Kee (2009), estimate that there is increasing competition between these two countries for

FIGURE 1

United States: imports from China and its NAFTA partners as a share of total imports, 1993-2011
(Percentages)
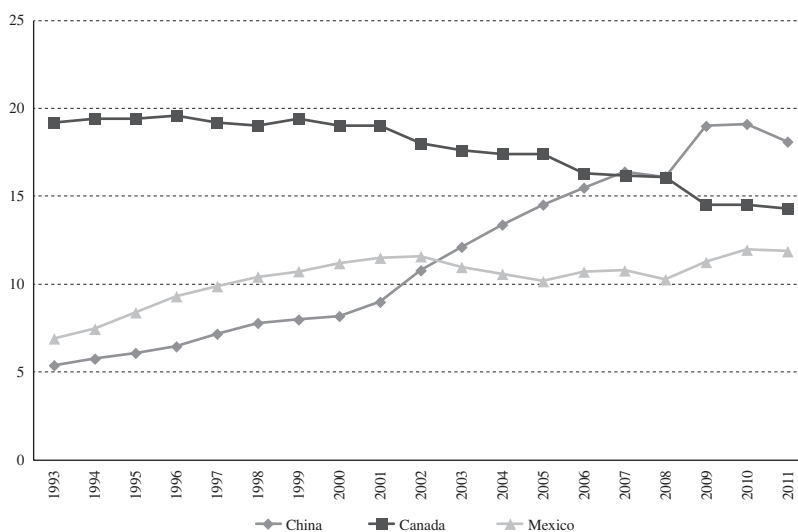
Source: United States Census Bureau, [online] http://www.census.gov/foreign-trade/statistics/country/, 2013.

**Mexico: imports from China and its NAFTA partners
as a share of total imports, 1993-2011**
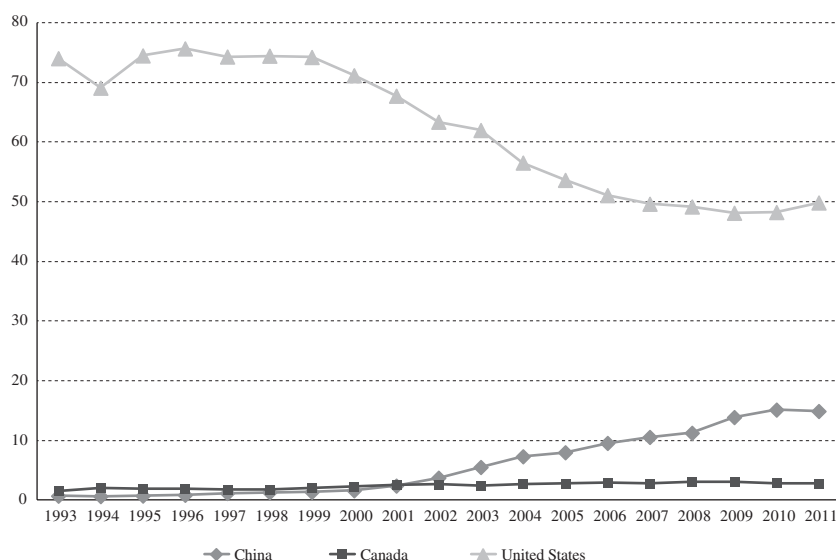*(Percentages)*

Source: prepared by the authors, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

TABLE 1

NAFTA[a] countries and China: coverage ratio of trade agreements, 2009
(Percentages)

Country	Free trade agreement coverage		
	Exports and imports	Exports	Imports
United States	34.4	40.1	30.5
Canada	68.4	77.7	59.2
Mexico	81.5	93.0	70.2
China	11.2	10.1	12.6

Source: Japan External Trade Organization (JETRO), 2010 JETRO Global Trade and Investment Report. A Global Strategy for Japanese Companies to Open New Frontiers in Overseas Markets, Tokyo, 2010; and O. Rosales and M. Kuwayama, China and Latin America and the Caribbean: Building a Strategic Economic and Trade Relationship, Libros de la CEPAL, No. 114 (LC/G.2519-P), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), March 2012. United Nations publication, Sales No. E.12.II.G.2.

[a] North American Free Trade Agreement.

the United States market and that foreign direct investment (FDI) has been shifting towards China at the expense of Mexico (De la Cruz, Núñez and Ruiz-Porras, 2008, cited by De la Cruz and Marín, 2011). Feenstra and Looi Kee (2009) further argue that the difference between Mexico and China is that the former slashed its tariffs to an excessive degree while China did so unilaterally, protecting some branches such as agriculture. Neme (2006), however, argues that Mexican manufacturers do not compete with China in the United States market, but that each country has its own niche, according to the specialization patterns that emerged in the 1990s.

Of particular interest in this paper is the analysis of intra-industry trade, which should clarify to what extent these economies are complementary or competitive. This point is raised with full knowledge of the fact that China has become a leading power globally, and especially in North America.

IV

Globalization and restructuring: models for the integration of two emerging economies, China and Mexico, into the world market

By the early 1980s, Mexico showed limited openness to trade. In fact, in 1983, virtually all imports into Mexico were subject to prior permission (non-tariff barriers) and extremely high tariffs. However, since that year, Mexico has restructured its economy in an attempt to achieve three goals: sound public finances, privatization of State enterprises and trade liberalization. Rationalization of trade protection transformed the country from one of the most closed into one of the most open economies in the world. The opening has been such that in 2006 only 4.1% of the value of non-maquiladoras and 2.7% of total imports were subject to prior permission. Moreover, the tariff average, which was 27% in 1982, fell to 5.9% in August 2012 (the weighted tariff in 1982 was 16.4%, but in 2012, it was only 0.56%) (CEFP, 2006; *Gaceta Parlamentaria*, 2012).[5] A clear sign of this process is the increase in the openness ratio from 30% to 81% between 1993 and 2011 (see figure 3).

In short, this illustrates the accelerated liberalization of the Mexican economy, which is reflected in its increasing openness, tariff reductions and the dismantling of non-tariff barriers. In fact, after these changes, the concentration of foreign trade of Mexico with the United States is two-thirds of total trade in Mexico at present (although in some years it has accounted for more than 70%). This concentration deepened under the NAFTA process until the recession of 2001 and the entry of China into WTO in the same year, which had a dampening effect on this phenomenon.
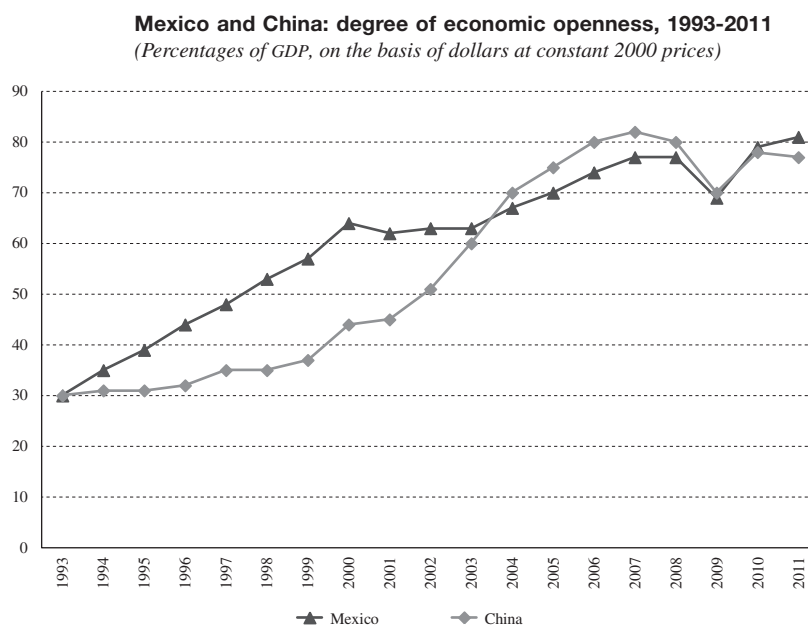
Meanwhile, since 1978, China has implemented a series of reforms that began with the four modernizations advocated by Deng Xiaoping: agriculture, industry, defence and science and technology (Neme, 2006). The open-economy policy led to the adoption of a legal framework to facilitate international economic relations and foreign direct investment, the creation of special economic zones and open cities to modernize domestic industry by establishing foreign companies that manufacture and export products helped by diverse incentives (Neme, 2006, pp. 30-31). A clear sign of this reform process is China's increasing economic openness since 1993, expanding from 30% in that year to 77% in 2011 (see figure 3).

In this context of opening and reform, China and Mexico have become leading players in the global economy, making major advances in exports of manufactures. China became a significant part of the global factory when its share of world exports jumped from 2.8% in 1993 to 15.4% in 2011. Mexico's share, meanwhile, increased from 0.60% in 1993 to 2.0% in 2011, and the country thus became the foremost Latin American exporter of manufactures and an important part of the "global factory".[6]

In recent years, China has become a major player on the world stage and a regional economic power in Asia. Indeed, the country has undoubtedly become a first-order global power. China's share in world manufacturing exports has surpassed that of all the NAFTA countries put together, making it a linchpin of the global factory (see figure 4).

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[5] Gazol (2007) discusses the return to a new phase of protectionism that permitted foreign purchases equivalent to 2.2% in 1995, compared with 10% and 11% in 2005 and 2006, respectively. However, this pattern differs from the one that prevailed in the 1980s.

[6] Calculations based on the World Bank DataBank, in current United States dollars.

FIGURE 3

Mexico and China: degree of economic openness, 1993-2011
(Percentages of GDP, on the basis of dollars at constant 2000 prices)

Source: prepared by the authors, on the basis of data from World DataBank.

FIGURE 4

China and NAFTA[a] signatory countries: manufacturing exports, 1993-2011
(Percentages of world total)
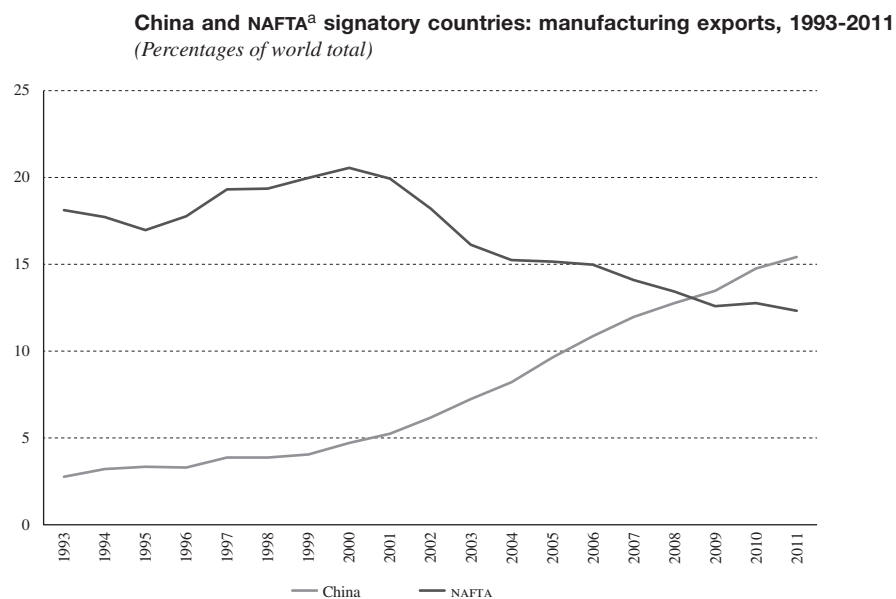
Source: prepared by the authors, on the basis of data from World DataBank.

[a] North American Free Trade Agreement.

V

China's incursion into the North American market and ensuing changes to the NAFTA intra-industry trade model

From an empirical viewpoint, this paper seeks to analyse the pattern of intra-industry trade during a period marked by the integration process in North America (NAFTA) and the emergence of China in this region. Previous studies (Dussel and León González, 2001; OECD, 2002; López and Rodil, 2008; Dussel and Trápaga, 2007; Cárdenas and Dussel, 2011; Rodil and López, 2011; Neme, 2006) showed the growth in intra-industry trade between Mexico and the outside world and particularly with the United States. However, there is disagreement concerning China. Some authors, including Neme (2006), argue that, while real competition between Mexico and China is obvious in some groups of products, there is no clear winner and the Mexican exports to the United States market are not displaced by Chinese exports. By contrast, other authors, including Cárdenas and Dussel (2011) and Dussel and Gallagher (2013), hold that Mexico's trade with the United States and China reflects weak integration with China and greater, albeit decreasing, integration with the United States. Meanwhile, others (De la Cruz and Marín, 2011) argue, on the basis of an analysis of causality, that statistical evidence points to a negative relationship between Chinese and Mexican exports in the United States market, and that Mexico must therefore try to avoid displacement.

Bearing in mind this situation, the present study takes a different approach by exploring the phenomenon of intra-industry trade between China and Mexico in the NAFTA region, complementing the previous analysis in order to gain a better understanding of trends at the aggregate level. In fact, different patterns of trade are studied in this work: North-North (United States with Canada), North-South (United States and Canada with Mexico and China), and South-South (Mexico with China). In this article, we focus on these relations, always taking account of the crucial role played by the United States in the NAFTA region.

Intra-industry trade developed as part of an intensive process of integration between Mexico, the United States and Canada, at a time when China's share in NAFTA imports was increasing. The high growth in trade and the concentration of Mexican and Chinese exports and imports under a small number of chapters with respect to trade with the United States reveals a trade pattern dominated by a small group of sectors and China's emergence in the NAFTA region, both as a supplier and as a customer, but especially the former (see figure 5).

More specifically, China's trade with the NAFTA countries is fairly concentrated under just five chapters. In terms of exports, five chapters account for 63.0% of Chinese exports to the United States, 59.8% to Canada and 77.6% to Mexico. As regards Chinese imports, the five main chapters represent 45.3% of those from the United States, 52.8% from Canada and 81.6% from Mexico (see tables 2 and 3). The trade balance in the five main chapters favours China over the United States and Mexico, but in deficit vis-à-vis Canada.[7] In terms of Chinese exports, China shows a clear surplus over all the NAFTA countries in the five major chapters. In other words, China has a surplus in manufactures, but a deficit in respect of natural resources and primary products.

While the United States is China's main trading partner, Mexico also experienced a significant relative increase in its relations with this Asian country. Some products are of particular importance in the relationship between Mexico and China, such as those under chapters 84 and 85, which account for 49.4% of Chinese exports to the NAFTA region. Meanwhile, Chinese imports from NAFTA show a greater dispersion with these two chapters accounting for only 19%.

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[7] Trade between China and Canada is not analysed in detail in this study. Suffice it to say that it is mostly inter-industry trade, based on classic advantages relating to resourcing. In addition, its impact on Mexico's trade is negligible.

FIGURE 5

China: trade balance with the NAFTA[a] region, 1993-2011

(Millions of dollars)
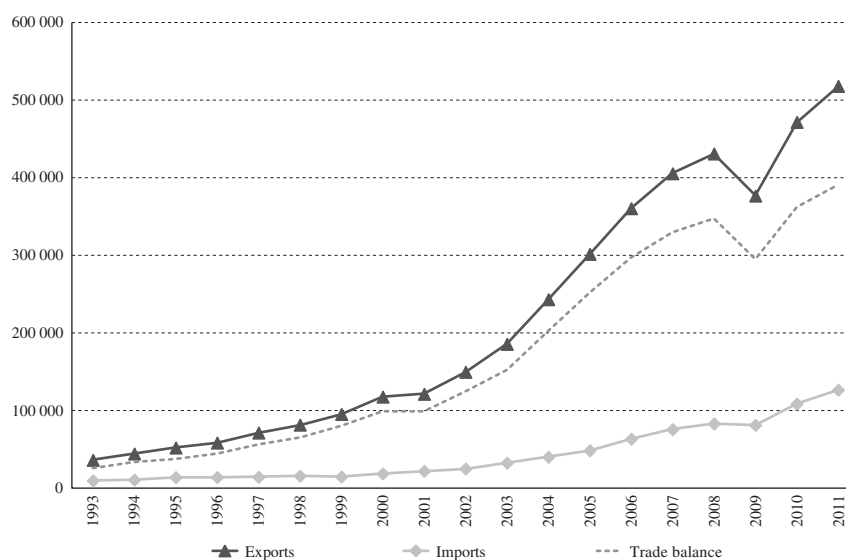
Source: prepared by the authors, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

[a] North American Free Trade Agreement.

TABLE 2

China: products accounting for a larger proportion of exports to Canada, Mexico and the United States, 2011

(Annual average growth rates in percentages)

Chapter	Product	United States		Canada		Mexico	
		2011	1993-2011	2011	1993-2011	2011	1993-2011
84	Mechanical appliances, boilers and parts	23.9	25.7	19.8	28.9	24.8	29.6
85	Electrical machinery and equipment	23.8	18.6	24.3	22.7	43.4	38.5
95	Toys, games and sports requisites	5.7	9.7	5.6	13.3	2.5	26.9
94	Furniture, surgical equipment, not specified elsewhere	5.4	17.6	5.7	20.0	…	…
64	Footwear, gaiters and the like parts	4.2	7.5	…	…	…	…
62	Garments, not knitted	…	…	4.4	11.3	…	…
90	Optical, photographic and medical devices	…	…	…	…	4.4	36.6
76	Aluminium and articles thereof	…	…	…	…	2.5	56.1
	Selected total	63.0	16.5	59.8	20.0	77.6	33.8

Source: prepared by the authors, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

TABLE 3

China: products accounting for a larger proportion of imports from Canada, Mexico and the United States, 2011

(Annual average growth rates in percentages)

Chapter	Product	United States		Canada		Mexico	
		2011	1993-2011	2011	1993-2011	2011	1993-2011
84	Mechanical appliances, boilers and parts	11.8	11.2	…	…	…	…
12	Seeds, oilseeds, grains and fruits	10.3	39.9	5.5	33.9	…	…
85	Electrical machinery and equipment	9.7	14.4	…	…	5.8	30.7
99	Non-specified products	7.0	28.3	…	…	…	…
87	Land vehicles and parts	6.5	12.5	…	…	14.9	∞
26	Ores, slag and ash	…	…	15.5	27.7	26.1	
47	Wood pulp and derivatives	…	…	15.4	20.6	…	…
44	Wood, articles of wood and charcoal	…	…	8.7	23.3	…	…
27	Petroleum and petroleum products	…	…	7.8	26.8	22.4	∞
74	Copper and articles thereof	…	…	…	…	12.3	91.7
	Selected total	45.3	15.3	52.8	24.3	81.6	51.3

Source: prepared by the authors, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

∞: the infinity symbol is used as the growth rate was calculated as starting from 0 in 1993.

As regards the intra-industry trade index (GL index) of China, the destabilizing effect of the trade balance in bilateral relations with the NAFTA countries should be taken into account by calculating the adjusted GL index, as mentioned above (see figure 6). The GL index of China's trade with the United States rose from 0.58 in 1993 to 0.63 in 2011. In the case of China's trade with Mexico, the adjusted GL index dropped from 0.63 in 1993 to 0.41 in 2011. Lastly, the GL index of China's trade with Canada fell from 0.43 in 1993 to 0.29 in 2011.

FIGURE 6

China: intra-industry trade with the NAFTA[a] countries, 1993-2011

(Grubel-Lloyd index)

Source: prepared by the authors, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).
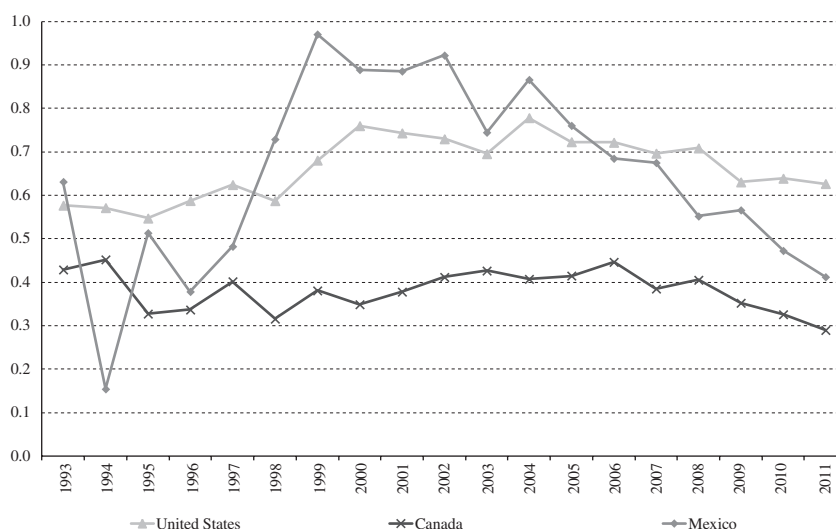
[a] North American Free Trade Agreement.

From figure 6, we can draw at least three key conclusions. First, the levels of intra-industry trade found between China and the NAFTA countries are relatively low, especially compared with the patterns observed in developed economies (where intra-industry trade generally accounts for 60% or 70% of total trade). This evidence shows that the emergence of China in the NAFTA region is linked to the global factory, but without reaching full-industry integration. In fact, intra-industry trade is concentrated in just a couple of sectors. Second, China tends to record greater intra-industry trade with the United States than Mexico or Canada. This illustrates the dominant role played by the United States as a global factory, which intensifies the intra-industry trade flows with most of its trading partners. As a result, the relations between its trading partners take on a secondary role, as is the case for South-South trade between China and Mexico and North-South trade between China and Canada. Third, intra-industry trade between China and the NAFTA countries has been trending downward over the last decade; only in the case of the United States has this decline been contained. This trend emphasizes the consolidation of China's integration into the NAFTA region, pivoting around the central and dynamic role of the United States. In contrast, China relates with the other two countries (Canada and Mexico) under a more complementary strategy, although with intra-industry relations in certain specific sectors.

Regarding trade between China and the United States, there are 32 chapters with a GL index value above 0.5, but these do not include the most dynamic chapters (84 and 85). However, if we analyse the adjusted GL index taking into account the trade imbalance, these chapters do appear with high values. This suggests that most of China's trade with the United States is intra-industry trade, owing largely to the contribution of chapters 84 and 85 (mechanical and electrical machinery and equipment, respectively). Meanwhile, 18 chapters have a GL index over 0.5 in relation to trade between China and Canada. However, between 1993 and 2011, the GL index fell and the adjusted GL index was lower than 0.30, which shows that most of China's trade with Canada is complementary (inter-industry).

China's trade with Mexico seems to be of an inter-industry nature, as only 11 chapters have a GL index exceeding 0.5. Moreover, the adjusted GL index decreased from 0.63 in 1993 to 0.41 in 2011, with a sharp fall after 1999 (see figure 6).

The detailed analysis of the most relevant chapters (84, 85 and 87), conducted at a more disaggregated level (headings) shows more clearly the strong intra-industry character of Mexico's relations with the United States (its main trading partner) and China, as well as trends relating to the emergence of China in the NAFTA region. In particular, the calculation of the adjusted GL index for the bilateral trade between China, the United States and Mexico concerning chapter 84 shows a drastic increase in intra-industry trade between China and Mexico (see figure 7). In fact, in recent years, bilateral trade in these products (mechanical machinery and equipment) between Mexico and China has reached top values of almost 1 (that is, nearly 100% intra-industry trade). The comparison with the trade between Mexico and the United States, which shows a clear stagnation and even a decline with regard to the beginning of the period, raises new questions, in particular, whether the intensification of intra-industry trade with China has halted the intra-industry specialization between Mexico and the United States, which had taken off so vigorously in the late 1990s. The data seem to confirm this hypothesis.

The data for the other important chapter for foreign trade between Mexico and the United States and China, chapter 85 (electrical machinery and equipment), show a consolidation of its strong intra-industry nature (90% in 2011). In contrast, the GL index for the other two bilateral trade relationships (Mexico with China and China with the United States) has stagnated (see figure 8). Nevertheless, the GL index of China with the United States is higher than that of China with Mexico, owing to the leading role played by the United States in intra-industry trade.

Something quite different occurs with the analysis of chapter 87 (motor vehicles), in which the strong intra-industry character of trade between Mexico and the United States reappears, reaching maximum values during the last decade (see figure 9). A more irregular pattern is seen, however, for the other two bilateral trade relationships, with a surprising decline in the GL index at the end of the period. This trend clearly affects trade between Mexico and China, as well as trade between the United States and China, reducing intra-industry trade flows to very low levels (close to 10%). Analysis with a higher level of disaggregation (four digits for vehicles, parts and accessories) suggests that the trends in the import and export of engines and vehicle accessories are attributable to the lower labour costs obtained by transnational corporations in China and to the rise of this sector following the process of opening up the Chinese economy in the early 1970s (Cárdenas and Dussel, 2011; Dussel and Gallagher, 2013).

FIGURE 7

China, Mexico and the United States: intra-industry trade under chapter 84,[a] 1993-2011

(Grubel-Lloyd index)
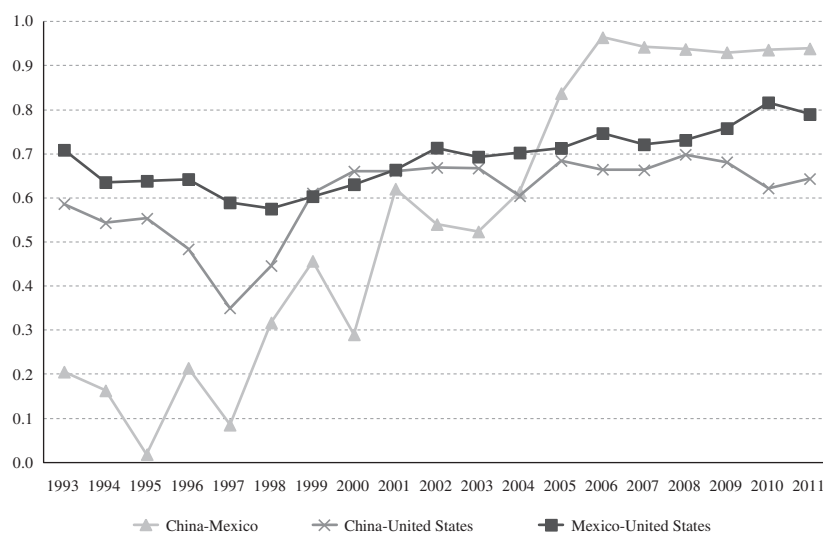
— ▲ — China-Mexico   — ✕ — China-United States   — ■ — Mexico-United States

Source: prepared by the authors, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

[a] Mechanical machinery and equipment.

FIGURE 8

China, Mexico and the United States: intra-industry trade under chapter 85,[a] 1993-2011

(Grubel-Lloyd index)

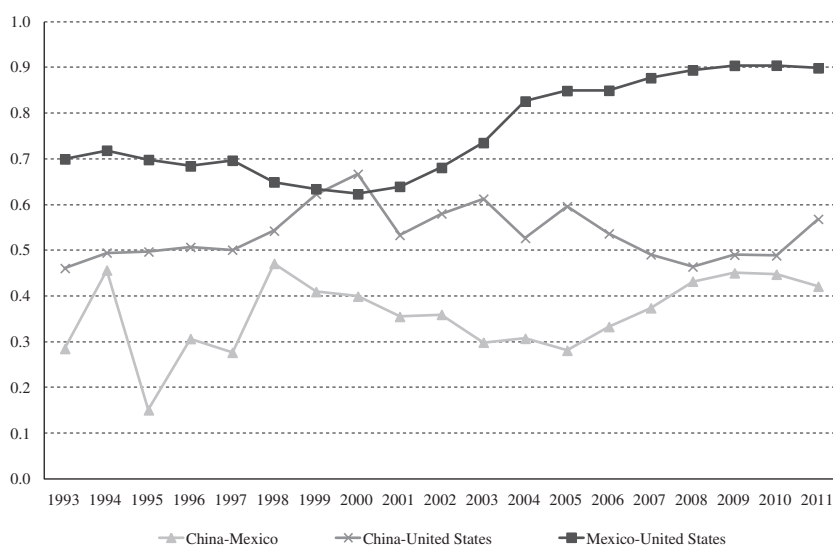— ▲ — China-Mexico   — ✕ — China-United States   — ■ — Mexico-United States

Source: prepared by the authors, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

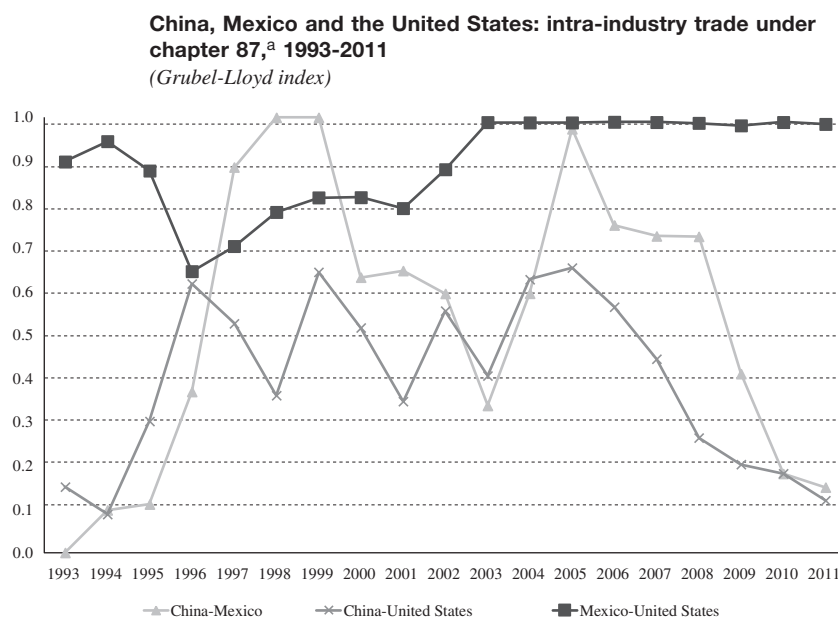[a] Electrical machinery and equipment.

FIGURE 9

China, Mexico and the United States: intra-industry trade under chapter 87,[a] 1993-2011
(Grubel-Lloyd index)

Source: prepared by the authors, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

[a] Vehicles, parts and accessories.

Moreover, it is useful to compare the evolution of United States imports from Mexico and China under each of the relevant chapters (see figures 10, 11 and 12). With the exception of chapter 87 (motor vehicles), imports from China far exceed those from Mexico.[8] In fact, there seems to be a "substitution effect" for products originating in China, although in many cases, imports from Mexico are not falling in absolute terms, which means that China is gaining a larger market share in other countries.

The above finding does not apply to chapter 87 (motor vehicles) since, as shown in figure 12, Mexico remains the top supplier to (and customer of) the United States in this production chain. The high level of intra-industry trade between these two countries in this sector is in part a reflection of the devolution of the American automotive industry. This is clearly indicated by Mexico's share in the global trade of this industry: Mexico rose from 2.4% of world exports and 0.6% of imports in 1993 to 5.3% of world exports and 2.7% of imports in 2011 (WTO, 2013).

These chapters account for over half of Mexican exports to the United States and have a high rate of intra-industry trade, demonstrating Mexico's integration into global value chains, especially with respect to manufactures, which represent the output of the global factory.

The same chapters (84, 85 and 87) of China's exports to the United States are equivalent to 49.8% of total Chinese exports, although the rate of intra-industry trade is lower than in the case of Mexico. China is less integrated, especially in relation to chapter 87, the area where intra-industry trade between Mexico and the United States is predominant. With respect to these chapters, intra-industry trade is more prevalent between Mexico and the United States, while China's trade with the United States tends to be of a more complementary nature (inter-industry trade). However, the exponential increase in intra-industry trade between China and Mexico under chapter 84 (see figure 7), may be a result of a triangular trade process between China, Mexico and the United States.

Furthermore, given the wide variety of items included in these chapters, it is useful to analyse in detail what happens to the principal items they cover. Figure 13 shows the GL index of intra-industry trade
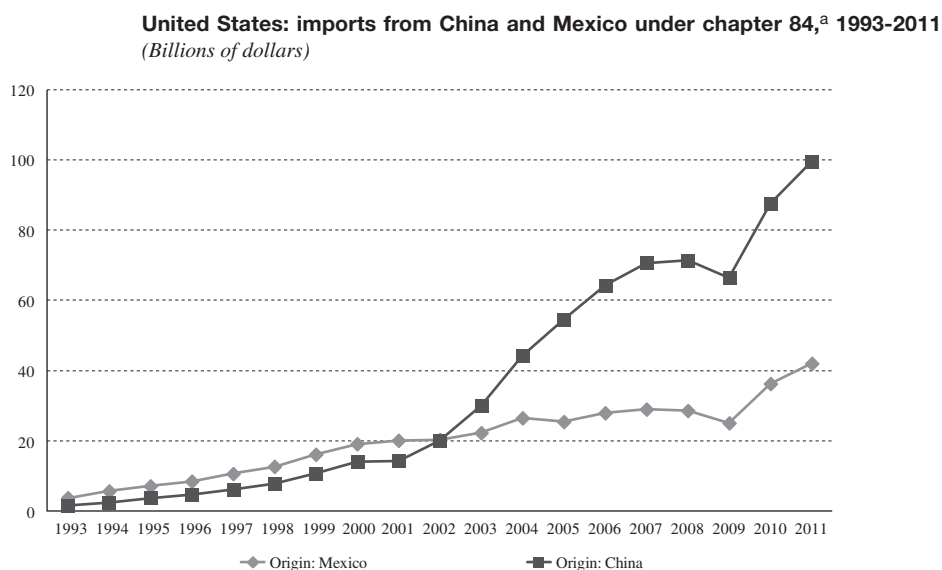
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[8] In some specific items this trend is even more dramatic, as in the case of the headings 8443, 8471, 8473, 8481 and 8525.

FIGURE 10

United States: imports from China and Mexico under chapter 84,[a] 1993-2011
(Billions of dollars)

Source: prepared by the authors, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

[a] Mechanical machinery and equipment.

FIGURE 11

United States: imports from China and Mexico under chapter 85,[a] 1993-2011
(Billions of dollars)

Source: prepared by the authors, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

[a] Electrical machinery and equipment.

FIGURE 12

United States: imports from China and Mexico under chapter 87,[a] 1993-2011
(Billions of dollars)

Source: prepared by the authors, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

[a] Vehicles, parts and accessories.

for the top 13 items (at the headings level, four-digit disaggregation) in Mexico's trade with its main trading partner (the United States). Three bilateral trade pairings were analysed: Mexico-United States, Mexico-China and China-United States. The results show the prevalence of intra-industry trade between Mexico and the United States, exceeding that of the other bilateral pairings for 10 of the 13 items under consideration. These include headings 8536 (electrical switches, connectors), 8708 (parts and accessories for motor vehicles) and 8408 (compression-ignition engines, diesel). The only three headings with a GL index that was lower for this pairing than for the other two bilateral trade pairings are headings 8409 (parts for spark-ignition internal combustion

engines), 8471 (automatic data processing machines, computers) and 8548 (electrical parts of machinery and apparatus).

In addition to the above headings, China's trade with the NAFTA countries includes the following: 8443 (printing and auxiliary equipment), 8473 (parts and accessories, except covers, for office machines), 8504 (electrical transformers, static converters and rectifiers), 8542 (integrated circuits and microstructures), 8711 (motorcycles and cycles fitted with an auxiliary motor) and 8712 (bicycles and other cycles, not motorized). China's trade in these products involves very low levels of intra-industry trade, with flows predominantly in only one direction.

FIGURE 13

China, Mexico and the United States: intra-industry trade for selected headings in chapters 84, 85 and 87, 2011
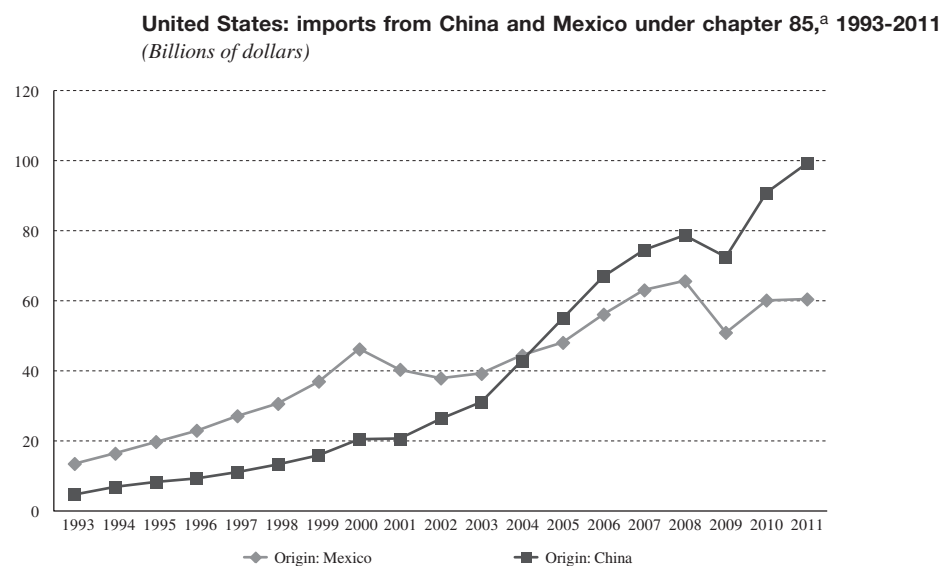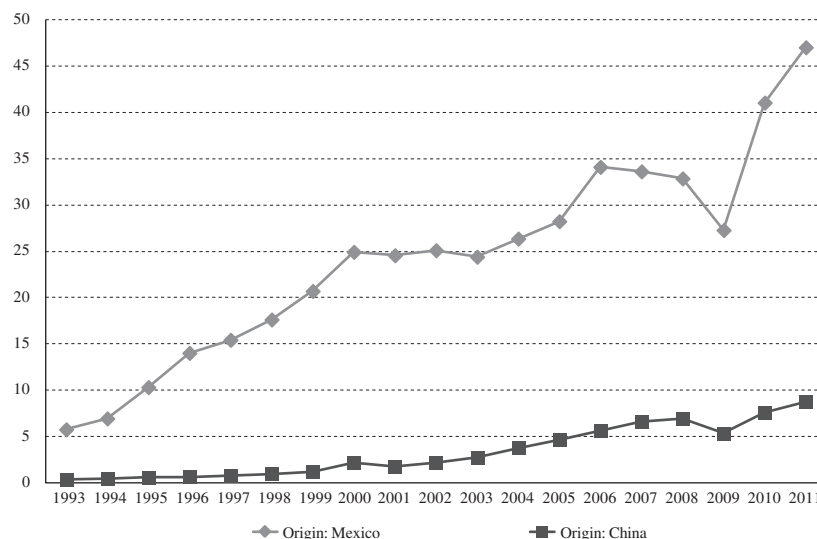*(Grubel-Lloyd index)*

Source: prepared by the authors, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).
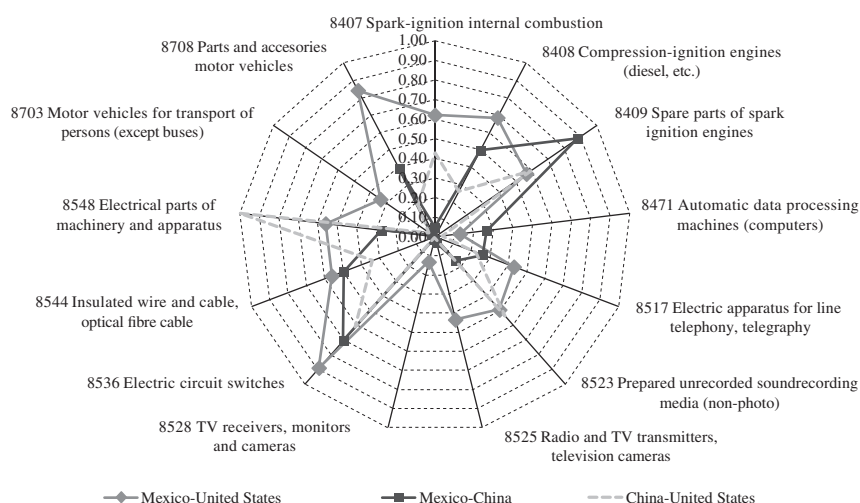
nes: not elsewhere specified.

VI

Conclusions

The results obtained in this study show the main trends and implications for trade in the NAFTA countries arising from the emergence of China in North America. The growing role of China over the last decade confirms its position as the leading supplier of the United States market, pushing Mexico into second place. A similar pattern has been seen regarding trade with Mexico, where China has established itself as the second largest supplier, immediately after the United States. Similarly, China is Canada's second largest supplier after the United States.

These trends are attributable to different factors, including, notably, intra-industry trade. In particular, intra-industry trade between Mexico and the United States grew robustly in the early years of NAFTA, with a slight decline in 2000-2011, due to the 2001 recession in the United States economy, and to China's accession to WTO, which turned it into a major player in this region.

From a sectoral perspective, our results highlight the growth in intra-industry trade relating to vehicles, parts and accessories (chapter 87), mechanical machinery and equipment (chapter 84), and electrical machinery and equipment (chapter 85). These three types of products account for more than 52.0% of Mexico's total exports, which is evidence of the country's growing intra-industry specialization. The United States is Mexico's primary market, absorbing 82.2% of Mexican exports under these chapters.

The fact that the United States' intra-industry trade under these chapters is likely to continue expanding, and to a greater extent in relation to Mexico than China, is no minor issue. Horizontal intra-industry trade is the exchange of similar but differentiated products and vertical intra-industry trade refers to the transfer of a product from one country to another at various stages of development (intra-firm trade). Mexico has the highest rate of intra-industry trade, as it integrates both modalities, while China's intra-industry trade is basically horizontal, except under chapters 84 and 85. The high levels of intra-industry trade with Mexico (chapters 84, 85 and 87) and China (chapters 84 and 85) show that they are part of the global factory whose pivot is the United States. In Mexico, most of this trade is intra-firm, as in the case of the automotive industry, in

which Mexico has become a world power. Interestingly, however, none of the companies constituting that industry is Mexican.

In summary, the findings suggest that intra-industry and intra-firm trade are closely connected in Mexico, appearing to form two sides of the same process: Mexico's participation in NAFTA and the progressive relocation of the United States' production industry. Nevertheless, since China joined WTO in 2001, NAFTA seems to have been unable to create intra-area trade, except in the automotive industry. As shown, China has staged a major breakthrough in the NAFTA region, despite having achieved significant levels of intra-industry trade only with the United States. This may be because joining WTO gave China direct access to the United States market. By contrast, trade between China and Canada is mostly inter-industry and in many cases linked to traditional comparative advantages (resource endowment). In fact, Canada is the only NAFTA country with which China has a trade deficit.

China has become the world's factory and enjoys a trade surplus with all the NAFTA countries with respect to its exports under the top four chapters (primarily manufactures). However, China posts a deficit in trade relating to natural resources (oil) and raw materials and food (some of which are covered under its top five import chapters). China has successfully penetrated NAFTA without any free trade agreements or any recognition as a market economy by the NAFTA countries. That free trade area seems to work as a radiated wheel, in which United States acts as the hub, while China, Canada and Mexico operate as the spokes.

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Work, family and public policy changes in Latin America: Equity, maternalism and co-responsibility

Merike Blofield and Juliana Martínez F.

ABSTRACT

Taking account of the substantial increase in female labour market participation that has occurred throughout the Latin American region, this article describes policies adopted with the aim of reconciling work and family responsibilities between 2003 and 2013, and the implications of their design for socioeconomic and gender equity. We look at the cases of Argentina, Brazil, Chile, Costa Rica and Uruguay, five countries which, on the basis of their track records, are the best placed to implement policies to reorganize time, income and services. The empirical analysis indicates, first, that these changes have contributed to socioeconomic equity more consistently than to gender equity. Second, the scale and type of change was found to vary significantly from one country to another. The article concludes by raising a number of substantive questions about the measures, their implementation and effectiveness, and the variations between countries.

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I

Introduction

Latin America is undergoing a "silent revolution" (Goldin, 2006) at the intersection between work and family. Seven of every 10 women of childbearing age are in the workforce and increasingly live in female-headed —and often single-parent— households. Yet care responsibilities continue to be shouldered primarily by women (ILO/UNDP, 2009; Sojo 2011; Montaño 2010; ECLAC, 2013a). The tensions in gender relations resulting from this combination of change and continuity in work and family are set against a backdrop of deep social inequality (Cornia, 2010; ECLAC, 2011; López-Calva and Lustig, 2010). What have governments done to address these tensions and with what outcomes for inequality? This article explores that question on the basis of policies adopted during the 10 years of economic expansion since 2003 in the five countries in which —as will be discussed later— social policy is, relatively speaking, most developed in the region: Argentina, Brazil, Chile, Costa Rica and Uruguay.

It is worth first discussing the social and policy relevance of addressing tensions between work and family responsibilities. First, the responsibility for care work represents a great barrier to women in terms of accessing the labour market (ECLAC, 2010). In such a highly unequal region as Latin America, this particular gender gap is heavily marked by socioeconomic stratification. The gap in female labour market participation between the richest and poorest quintiles is 30% on average and has not shrunk since 1990, despite the large rise in women's overall labour market participation.[1] Given that the odds of overcoming poverty are proportional to the odds of having more than one income in the household

(ILO/UNDP, 2009), women's absence from the labour market worsens poverty and social inequality. Second, women with income of their own are overrepresented among the self-employed and in domestic work; in the latter occupation three quarters of individuals, almost all of them women, had no pension provisions in 2008 (ILO, 2011). Women in the labour market thus have less protection than their male peers —in urban areas only 36% of women have social security provision, compared with 49% of men (ILO/UNDP, 2009)—. Third, those who shoulder heavier care burdens have less social protection: in 12 Latin American countries, women with incomplete primary schooling have between 2 and 3.5 more children than those who have secondary schooling or more (ECLAC, 2011, p. 85). In female-headed single-parent households, the double burden of singlehandedly providing both care and income worsens the negative consequences of labour informality and lack of social protection.

The situation today enshrines both challenges and opportunities (ILO/UNDP, 2009; Sojo, 2011; Montaño Virreira, 2010; Chioda, 2011). With the right public policies, governments could break the cycle of inequality and promote more inclusive social and economic development. Some measures can achieve more than one objective at a time. For example, it is universally agreed that early education and care services develop human capital and promote equal opportunities. Combined with suitable opening hours and schedules, these services could also support working mothers and fathers. Conversely, without adequate responses to the tensions between work and family responsibilities, socioeconomic and gender inequalities will continue to deepen and work against equity and development in the region.

How much progress has been made in adopting public policies to reconcile work and family responsibilities in those countries that are in the best position to do so? Section II sets forth an analytical framework to examine these changes. Section III explains the methodology and section IV presents the empirical findings. Lastly, section V concludes with a summary and discussion of the findings.

[1] For example, in Brazil, the gap is almost 40%, with only 46.5% of women in the lower-income bracket in the labour force versus 84.4% of women in the higher income quintiles (PNAD/IBGE, 2014; Sorj and Fontes, 2012).

II

Analytical framework[2]

A broad universe of public policies affect the relationship between work and family responsibilities, whether by action or by omission, ranging from urban planning and public transportation, to social policy per se on issues of leave and care (Monge, 2006). Below, we distinguish between different types of social policy that affect work-family tensions,[3] then discuss how these maintain or change socioeconomic and gender relations. The section concludes by presenting examples of specific policies aimed at changing initial socioeconomic and gender inequality.

1. Policies that reconcile work and family

Whether or not they ultimately have positive or negative impacts from the point of view of socioeconomic and gender equality, measures aimed at reconciling work and family responsibilities can function in three ways: by reallocating time, income or services. Specifically, they enable individuals to alternate time spent at work with time spent on caregiving within the family (Durán, 2004), transfer family care to services partly provided by the State, or regulate the purchase of private care by families. These types of State intervention are sequential, "defamilializing" (Martínez Franzoni, 2008; Orloff, 2009) and regulatory, respectively,[4] and often addressing work-family tensions is not in fact their primary purpose; this is the case with preschool childcare services, for example. In addition, as will be illustrated below, each of these types of measure can be addressed from the standpoint of either labour policy or social policy.

- Sequential policies refer to measures that support income during periods —months, weeks or days— spent on caregiving. They include maternity, paternity or parental leave, as well as flextime and part-time work policies. Sequencing can last months and involve many work days (as in maternity

leave) or last hours within a single work day or week (as in part-time or flextime measures). With sequential policies, care remains within the family, performed historically by women, although under more recent measures family responsibilities have increasingly been extended to men through paternity and parental leave.[5]

- Policies that *defamilialize* care refer to transfers and services that shift the responsibility for care provision from families —and specifically from women— to services with some degree of State involvement. These may be provided directly by the State, involve incentives or subsidies for private provision, or mandate employer provision of subsidies, services or both. As with sequential policies, these measures often revolve around mothers and female workers but —as detailed below—have increasingly begun to make men and fathers eligible as well in Latin America (ILO/UNDP, 2009).

- The third category addresses regulations on the hiring of home-based paid care providers specifically, where the household is thus turned into a workplace. These are "regulatory policies on home-based care services". The one-to-one hiring of mostly female personnel for work in familial settings is an alternative to provision in institutional settings, and has different implications for the State's role in measures that defamilialize or commercialize care, since paid domestic work is not usually included in policies for reconciling paid work and family responsibilities.

The main focus of our study regarding the third category is on domestic work that is considered "unskilled",[6] although the analysis can equally be extended to skilled occupations, such as nursing. As with other care occupations, home-based care tends to

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[2] This analytical framework is developed in greater detailed in Blofield and Martínez Franzoni (2014).

[3] This article refers to work-family tension indistinctly as work-family, and work and family responsibilities.

[4] A first approach to changes in these three types of measures in Latin America (although with a different definition of regulatory measures) was developed by Martínez Franzoni and Camacho (2006 and 2007) on the basis of an adaptation of Durán (2004).

[5] Parental leaves were established first in Europe, specifically in Sweden, in 1974. Paternity leaves came later and were created to encourage men to use parental leave. Both maternity leaves and parental and paternity leave are considerably longer in Europe and in English-speaking countries, except for the United States, which lags behind even by comparison with the poorer Latin American countries.

[6] By "unskilled" we mean that these employees rarely have formal training for their occupations, although they provide services that require a broad range of practical but socially undervalued skills.

be overwhelmingly female and penalized by lower pay than that received by workers in comparably skilled occupations. This penalty derives from three factors: care occupations have historically been seen as extensions of "naturally" female roles; they are perceived as intrinsically rewarding; and, as "sacred activities", they are "above" financial recognition (England and Folbre, 1999).

Insofar as caregiving (whether paid or unpaid) involves an emotional connection between caregivers and those who are being cared for, labour market regulations regarding these occupations are critical to the status of the care providers as workers and to the type of service performed (see for example: Folbre, 1995[7] and Williams, 2010). What makes these occupations distinct is that the workplace and the household overlap and that the bonds between caregivers and care-receivers tend to be more personal, challenging the regulation of these occupations in general, and those based in the employer's home in particular. With caregiving historically associated with a servant culture in many countries, discrimination has been rooted in laws and labour codes, with long working hours and very limited labour protections and benefits.

Domestic or home-based work is, precisely, one of the main ways of resolving the tensions between family and work in Latin America: around 15% of the economically active female population is employed in domestic services, with a similar percentage of households as employers (ECLAC, 2013b; ILO 2012, pp. 59-60). Weak regulation of this occupation by the State has, in practice, allowed high-income families to reconcile work and family responsibilities at the expense of such reconciliation by these female workers (Blofield, 2012).

Another, more collective form of home-based care (also referred to as family day care) is care in the caregiver's household. While such care has no doubt existed informally throughout time, in the past few decades it has become an object of government funding and regulation as part of social service extension to low-income families.

There are examples of all three types of measure in both labour and social policy. In all three cases, the State may have an impact by action or by omission, leaving the solutions to work-family tensions to family strategies and informal solutions by women, through unpaid, poorly paid or voluntary work, or by promoting the provision of services through trained professionals hired under formal conditions of employment.

Sequential, defamilializing and regulatory policies are all qualitatively distinct and complementary in work-family reconciliation. For this reason, more policy in one dimension cannot be expected to make up for less policy in another dimension. Empirical analysis must therefore consider them simultaneously.

2. Implications for socioeconomic and gender equity

Depending on how they reallocate time, income support and services, whether by design or through implementation, sequential, defamilializing, and regulatory measures can entrench or alter socioeconomic and gender inequality —as produced by the labour market and the sexual division of labour between women and men—. This work does not evaluate how these measures change the social structure —if indeed they do— but focuses rather on their design.

Let us start by looking at gender inequality. The literature on welfare states and gender relations distinguishes "maternalist" policies from those that promote "social co-responsibility" in caregiving (ILO/UNDP, 2009). Maternalist measures (Orloff, 2006) recognize the importance of caregiving and exalt "women's capacity to mother" (Koven and Michel, 1993, in Orloff, 2006, p. 4), and thus reward women as the primary and main providers of care.[8] Here, there is a social recognition of care, but the gender gap in its provision remains intact. Extended maternity leave, tax incentives or monetary transfers for stay-at-home mothers are examples of maternalist measures. They are used as alternatives to greater participation by fathers, the use of services, or both.

We distinguish maternalist policies from policies that establish a "maternalist floor", acknowledging the specific role of women in gestation, giving birth, breastfeeding and establishing early routines and bonds. These are analytical categories, but also thresholds that

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[7] Folbre (1995) defines care work, whether paid or unpaid, as work that involves connecting to other people and trying to help people meet their needs. Folbre argues that the intrinsic motivation involved in care labour as something people do for a third party poses challenges for markets to organize and pay for care work.

[8] Historically, maternalist movements "made arguments for gender justice: women should be recognized and compensated by the State for their unique contribution to society —through maternity and childrearing" (Orloff, 2006, p. 10)—. Maternalist arguments can lose ground to a view of care that involves but transcends women. Orloff argues that in European and North American countries, maternalist claims have lost elite and popular support over time, although not always in the direction of more gender equity but rather in the direction of less social equity.

have changed over time. For example, the demarcation of what the International Labour Organization (ILO) considered a minimum maternity leave —and which is taken here to define what we call the maternalist floor— has changed over time. In 1952, ILO set maternity leave at 12 weeks in Convention 103, but by 2000 this had increased to 14 weeks (Convention 183).

A maternalist floor is essential to protect women in their role as mothers. Maternalist policies, however, can affect equity in contradictory ways. Although these policies publicly recognize and support motherhood as a central dimension of women's lives and can thus elevate the status of mothers, they can also reinforce the notion that care is women's sole responsibility. It is an empirical matter to establish which maternalist policies also promote gender equity by levelling the playing field rather than reinforcing the sexual division of labour.

In contrast to maternalism, co-responsibility redistributes care responsibilities, both from families to the State (State co-responsibility) and from women to men (paternal co-responsibility).

State co-responsibility in work-family reconciliation policies not only produces defamilialization through publicly provided or subsidized provision of early childhood education and care (ECEC), but also, and very importantly, requires the provision of full-time care, thus allowing for the use of services by working parents. Public social investment in early childhood education and care services that do not correspond to a typical full-time workday, may promote state co-responsibility in child education but not in work-family reconciliation.

Paternal co-responsibility policies promote sharing of caregiving by incentivizing fathers' involvement. This makes it possible to alternate income-generating and caregiving responsibilities between women and men (Fraser, 1997). This "feminization of the male life cycle" (Esping-Andersen, 2009, p. 99) generally takes the form of sequential policies that enable the reorganization of gender roles between mothers and fathers, without undermining pay or job continuity.

By shifting more responsibility for care to the State and to fathers, co-responsibility policies have the capacity to reduce gender inequities in the burden of care. The extent to which they actually do so is a matter for empirical analysis. The Swedish experience shows that paternity leave which is not transferable to the mother promotes fathers' involvement in childcare more than does parental leave, for which both fathers and mothers are eligible. Both paternity leave, consisting of a few days to support the mother, and parental leave, have been established very recently in Chile and Uruguay, so

knowledge of their effects in terms of reducing gender inequality is still very incipient.

In terms of socioeconomic equity we follow Esping-Andersen's (1990) distinctions between eligibility based on needs, contribution, or citizenship. The implications of these criteria vary depending on the point of departure: relative social equality, low poverty rates and basically formal labour markets, or the opposite, as in Latin America, where highly informal labour markets limit the scope of contribution. Here eligibility mechanisms must be more heavily based on citizenship and need than in developed countries.[9]

Furthermore, it may be observed that policies based on contributions through formal employment tend to restrict benefits to those making regular contributions as well as their dependents —often even segmenting benefits between the former and the latter—. This mode of eligibility applies primarily to middle- and upper-income groups of the population, therefore reinforcing socioeconomic inequities.[10] These policies also tend to reinforce inequities between groups within the formal labour force; for example, workers on fixed-term contracts and paid domestic workers may not legally have access to the same rights.

Taking into account the prominence of informal relations in Latin American labour markets (in temporary and domestic work, for example), the question is whether policies extend protections beyond formal employment to a broader scope of wage workers, self-employed workers, or both.[11] We also assess whether policies move beyond an individual's formal labour status to a basis in citizenship or need. We thus evaluate whether work-family policies —whether sequential, defamilializing or regulatory, and maternalist or pro-co-responsibility— alter or reproduce the initial, labour-market stratification and therefore also enhance socioeconomic equity.[12]

Second, informality pervades care arrangements, either through the informal hiring of domestic workers or through female unpaid work. Without government

[9] Nevertheless, contributory social protection has more relative coverage and social investment than non-contributory programmes.

[10] For a discussion of the relevant cases where universalism has been built around contributory policy, see Martínez Franzoni and Sánchez-Ancochea (2013).

[11] In Latin America labour and social protections reach workers in various degrees, so that there is a continuum from the most formal to the most informal arrangements among wage workers as well as the self-employed. Rather than making up an informal "sector", informality thus cuts across the labour market.

[12] See Pribble (2013) for a broader discussion of equity-enhancing social policies.

intervention, the care burden tends to fall particularly heavily on low-income women. In other words, degrees of familialization in care (Martínez Franzoni, 2008; Orloff, 2009) differ by income levels. The higher the family's income, the greater the capacity to transfer much of the burden of domestic work to lower-income women hired for that purpose and avoid women having to negotiate the sharing of care responsibilities with their male partners. Conversely, the lower the household income, the fewer the options to outsource domestic and care work.

Given the interactions between socioeconomic and gender inequalities, it would be wrong to subsume one type of inequality under another; we must instead examine their interaction across distinct policy initiatives. The three types of policy —sequential, defamilializing, and regulatory— may have various implications for socioeconomic and gender stratification. Empirically speaking, in terms of gender equity we attempt to establish whether specific measures promote a maternalist floor, maternalism, or co-responsibility. Regarding socioeconomic equity, we address whether or not protection extends beyond wage work and contributory mechanisms to cover own-account or temporary workers, or on the basis of need or citizenship.

III

Methodology

Below, we analyse types of paid leave for birth, full-time childcare services and the levelling of the rights of paid domestic workers with the rest of the workforce. These policies do not, of course, represent the entire universe of sequential, defamilializing and regulatory policies, but are nevertheless emblematic.

The cases examined correspond to five Latin American countries that are in the best position, relatively speaking, to respond to changes in families and labour markets in the region: Argentina, Brazil, Chile, Costa Rica and Uruguay. This is the group of countries with modest social gaps (Filgueira, 2011), comparatively formal labour markets and greater social investment. Accordingly, they are generally considered to have the same social policy regime-Statist (Martínez Franzoni, 2008) or advanced (Huber and Stephens, 2012). They have highly institutionalized political systems and greater State capacity (Pribble, 2013), and have reached a more advanced stage of the demographic transition (ECLAC, 2010).

We compare federal policies in place in 2003 and 2013 across these countries and over time. It is important to be aware that a large gap can exist between measures formally in place and their implementation. Nevertheless, the adoption of these measures is in itself indicative of existing policy priorities, and understanding the gap calls for more comprehensive assessments that include the degree of implementation of the changes in question. Legislation and executive measures that have been discussed but not adopted are not included, nor are collective agreements (which are important in Uruguay, Brazil and Argentina, in particular) or state-level legislation —which is particularly prominent in the two federal countries analysed (Argentina and Brazil)— that goes beyond the federal minimum.

The empirical evidence used comes from primary and secondary sources. The first include laws, executive decrees and policy papers, executive committee or congressional reports and interviews, as well as press articles. Secondary sources include country analyses, several of which take a sociological approach or are intended to provide assessments or policy inputs.[13]

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[13] There is an interesting and growing body of literature on the subject for the five countries. For example, for Argentina, see Faur (2011); Faur, Esquivel and Jelin (2012); Gherardi, Pautassi and Zibecchi (2012) and Rodríguez and Pautassi (2014); for Brazil, see Hirata and Araujo Gimarães (2012), and Sorj (2013); for Chile, see Bentancor and De Martini (2012), and Staab (2012) (the latter with an explicit focus on policymaking); for Costa Rica, see Román and Morales (2010); Sauma (2012); for Uruguay, see Aguirre and Ferrari (2014) —focusing strictly on policy adoption—; Batthyany, Genta and Perrotta (2012), and Salvador (2013).

IV

Empirical evidence: work-family policies
in 2003 and 2013

Below, we examine the empirical evidence on paid leave for childbirth, early childhood care and education and the rights of paid domestic workers, as cases of sequential, defamilializing and regulatory policies, respectively. The findings show that more changes have occurred in care services and the regulation of paid domestic work than in leave associated with paid employment.

The broadest legal changes in this last category have occurred in Chile and Uruguay, and affect both eligibility and length of leave. In the other three countries, groups of female workers have gained eligibility for maternity leave, either through legal rulings (Brazil and Costa Rica) or legislative reform (Argentina).

Early childhood care and education services have undergone changes to varying extents in all the countries. In general, more progress has been made in promoting socioeconomic equity than in paternal co-responsibility.

1. Sequential measures: increased maternalism and socioeconomic equity

How much have employment-based paid leaves changed and how? Figure 1 shows the duration in weeks of paid maternity, paternity and parental leaves in the five countries in 2003 and 2013. All the leaves analysed correspond to a full salary —although sometimes with a ceiling, as in Chile— but they differ in the source of financing (from social security in Argentina, Brazil and Uruguay; from a combination of social security and employers in Costa Rica; and from the national budget in Chile). The best scenario for socioeconomic and gender equity is when leaves do not carry a direct cost for employers.[14]

Paid maternity leave was established in the countries' labour codes in earlier decades, and by 2003 ranged from 12 weeks in Uruguay to about 18 weeks in Chile. In 2003, paternity leave was zero in Costa Rica and Uruguay, 1 day in Chile, 2 days in Argentina and 5 days in Brazil (enshrined in the Constitution of 1988). Except

for Argentina, in all the countries women continue to accumulate pension entitlements during maternity leave.

Figure 1 distinguishes between measures corresponding to the maternalist floor (equivalent to the ILO threshold of 14 weeks, shown by a line), maternalist measures (above the line), and measures that promote co-responsibility either through non-transferable leave for fathers (paternity leave), or through leaves that are shareable between mothers and fathers (parental leave).

In 2003 maternity leaves were at least the length of the maternalist floor, except in Uruguay and Argentina. Uruguay provided two weeks less, and Argentina —with a leave of 90 days— slightly more than a week under the 14 weeks established by ILO.

During this period, leaves changed considerably in Chile and Uruguay. Already by 2003 Chile had the longest maternity leave of the five countries and the reform of 2011 (Law 20.545) added a further three months. That reform also extended paternity leave (from 3 days to 5) and allowed fathers to use up to half of the final three months of postnatal leave. The reform accordingly promoted a combination of marked maternalism with timid progress in paternal co-responsibility.[15]

In Uruguay various changes were made to the leave scheme and November 2013 brought a comprehensive reform for the private sector (Law 19.161). As a result, in the private sector maternity leave increased from 12 to 14 weeks. Paternity leave was extended as well, from 3 consecutive days in the private sector and 10 working days in the public sector to a further 10 consecutive days in the private sector, for both wage workers and independent workers paying into Uruguay's Social Security Bank (Banco de Previsión Social, BPS).[16] The extension took effect immediately for maternity leave, but more gradually for paternity and parental leave.

Previously, public sector paternity leave had been 3 days since the reform of 1989 (Law 16.109) and 10 days from 2008 (Law 17.930), when private sector workers also gained another 3 days of paternity leave. To the

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[14] Leaves that do represent a direct cost for employers not only discourage the hiring of women, but also affect smaller firms more and so are regressive in terms of the production structure. For data and analysis on this point for the region overall, see Pautassi and Rico (2011).

[15] See Lupica (2013) for an analysis of the process by which the proposal was prepared.

[16] Self-employed in the formal sector who pay social contributions through profession-related funds are not included.

FIGURE 1

Leave for childbirth and gender equity by country, 2003 and 2013
(Weeks)

Maternity leave ▪ Paternity leave ▪ Shareable parental leave ── Maternalist floor
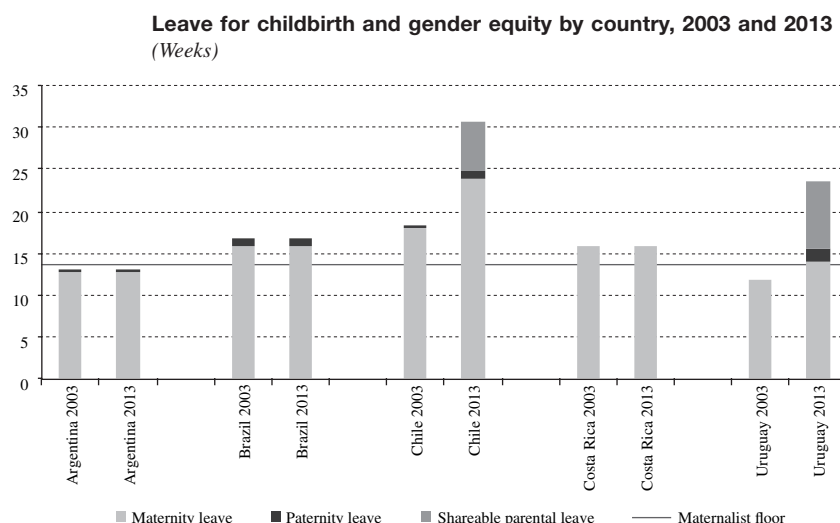
Source: prepared by the authors, on the basis of legislation in the respective countries and data from R. Ray, J. Gornick and J. Schmitt, "Who cares? Assessing generosity and gender equality in parental leave policy designs in 21 countries", *Journal of European Social Policy*, vol. 20, No. 3, Sage, 2010.

Note: the duration of paternity leave was registered in relation to a unit of a 7-day week. For Uruguay, paternity leave was estimated on the basis of an 8-week maternity leave (Law 19.161, article 2).

3 consecutive days financed by the employer, the 2013 reform added 3 more days in 2014 financed by the Social Security Bank, increasing to 7 more in 2015 and 10 more in 2016. Accordingly, the 13 consecutive days in the private sector are more or less equivalent to the working days of leave in the public sector (depending on whether public holidays occur during the leave).[17]

In 2016, parental leave will allow the mother or the father to work a half-day after the 8-week maternity leave is over, until the child is six months old. This part-time leave will last for up to 4 months or, for comparison purposes, 8 weeks full-time, as shown in figure 1 (following Ray, Gornick and Schmitt, 2010).

The reforms adopted in Chile and Uruguay have different implications for gender equity. Maternity leave was extended beyond the maternalist floor in Chile, and brought up to that threshold in the private sector in Uruguay. Paternity leave is twice as long in Uruguay as in Chile, and in Uruguay it is financed mainly by social security and to a lesser extent by the employer, while in Chile and Brazil it is financed by the employer. In sum, the change favours parental co-responsibility more in Uruguay than in Chile, in principle. At the other extreme, Argentina was the only one of the five countries that

had yet to reach the ILO standard maternalist floor in 2014. What is more, apart from the cases of Chile and Uruguay, and despite draft legislation aimed at extending paternity leave to between 2 and 4 weeks in Argentina, Brazil and Costa Rica, paternity leaves continue to be minimal.

Given the prevalence of labour informality, employment-based leaves have been particularly unequal from a socioeconomic perspective. Since maternity leave is by far the more substantial, figure 2 shows eligibility criteria in each country in 2003 and 2013. Specifically, it shows whether only some female wage workers, all female wage workers or all female workers, including the self-employed, are eligible.

In 2003, in Chile and Argentina only some female wage workers were eligible for maternity leave, leaving out precisely those who were socioeconomically more vulnerable. In Chile only those with employment contracts were eligible, which were mostly those in the upper income quintiles (Pribble, 2006, p. 90), although domestic workers with contracts were included in 1998. Domestic workers were excluded in Argentina (where they represent 17% of the female urban workforce). In Brazil, Costa Rica and Uruguay all female wage workers were eligible, including, in the case of Brazil, independent and rural seasonal workers. This last group does not need to show social security contributions to qualify for maternity leave with benefits equivalent to the minimum

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[17] See Salvador (2013) for an estimate of the costs of the reform in Uruguay, which is also methodologically useful for the other countries.

FIGURE 2

Maternity leaves and socioeconomic equity: eligibility by country, 2003 and 2013
(By labour status)
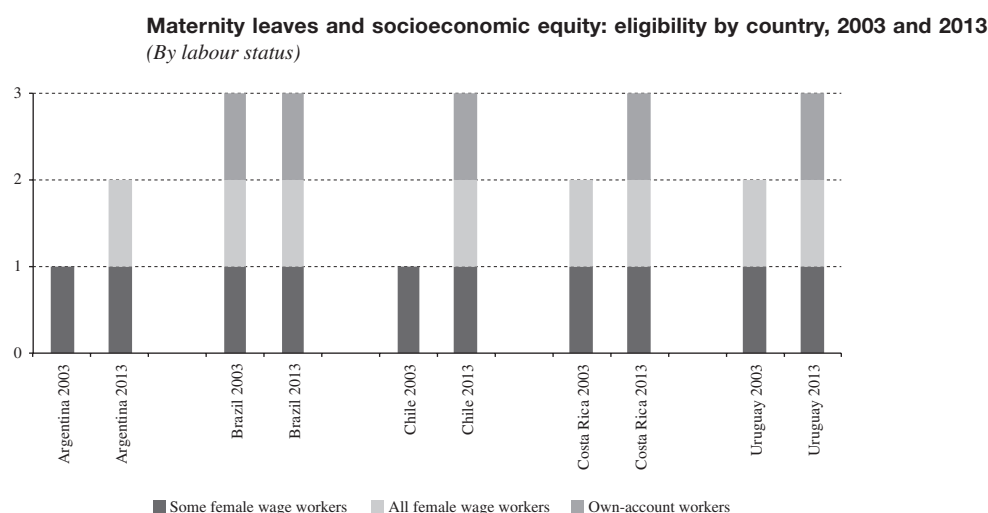
Source: prepared by the authors, on the basis of legislation in each country.

wage. Since 2003, all five countries have changed the eligibility rules towards greater socioeconomic equity; in Costa Rica and Brazil through legal action and in the other three countries by legislative reform.

In Argentina, a legal reform adopted in 2013 (with implementing regulations adopted in April 2014) extended maternity leave to domestic workers, making all female wage workers eligible.[18] In Brazil, a 2012 ruling by the supreme labour court extended the right to maternity leave to workers on temporary contracts. In Chile, the 2011 parental leave reform extended maternity leave to all female wage workers, seasonal and independent workers. Costa Rica made insurance mandatory for independent workers as part of a deal on pensions between the government, chambers of commerce, unions and other organizations.[19] Although the agreement initially included only the services sector, in 2004 a ruling by the Constitutional Court extended it to monetary transfers and, accordingly, to maternity leave. Seasonal workers are considered wage workers, and hence their insurance is mandatory. However, there have been obstacles to adapting the conditions of insurance, for example, for seasonal rather than monthly contributions. In Uruguay,

the legislature extended maternity leave to some insured self-employed women in 2013.[20]

Informal female workers who do not contribute to social security —generally a large proportion of the lower-income quintiles— are excluded from these eligibility criteria, except for rural workers in Brazil.[21]

2. Defamilializing measures: advances towards State co-responsibility with socioeconomic equity in early childhood care and education

Below we examine national policies on early childhood care and education, principally for children aged 0 to 3 years, and tangentially for those aged between 4 and 5 —the two age groups targeted by early childhood care and education services and preschool education—. Depending on their opening hours and coverage of low-income sectors, care services can promote both State co-responsibility and socioeconomic equity.

Preschool education tends to reflect concerns of human capital formation more than early childhood care

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[18] Law 26.844 with implementing regulations in executive decree 467 of 2014.

[19] In 2008, a pension reform recognized and provided compensation for time mothers devote to raising children, increasing their probability of eligibility for an old-age pension in the future.

[20] As pointed out by Soledad Salvador (2014), in fact all benefits (paternity and parental) are extended to men and women who pay into the Banco de Previsión Social (not independent funds such as profession-related funds), business-owners with up to one dependent, and the self-employed. Those with dependent workers are reported as employers.

[21] Women in this position can be eligible for other cash transfers as mothers rather than as workers, mainly through conditional cash transfer schemes for children, pregnant women or both.

services. Services for children aged 0-3 give a closer picture of governments' commitment to work-family balance —i.e. State co-responsibility— through services that partially defamilialize care and provide full-time service coverage. This is also the age group for which there is greatest social reticence regarding mothers combining motherhood and paid work and, in general, any outsourcing of care outside the household.

Argentina, Brazil and Chile have had legislation obliging large firms to provide some childcare arrangements since before 2003.[22] These arrangements depend on the number of female workers in the firm, are limited to mothers (fathers are not eligible) and were created to allow for breastfeeding during the legally established period. In Chile, employers with 20 or more female workers must provide a day-care service for children under age 2. In Brazil, companies with 30 or more female workers must provide day care for babies up to 6 months old (i.e. for two months, between the end of the obligatory maternity leave and the end of the six-month breastfeeding entitlement). In Argentina, employers with 50 or more female workers have been legally obliged to provide a day-care service since 1970. However, although this law is nominally in force, compliance is difficult to oversee because implementing rules have not been adopted for it.

This legislation has not changed in the period under consideration. Insofar as having a facility is better than having none, the legal framework of workplace childcare is indicative of some degree of State (if not paternal) co-responsibility. However, since the services are limited to a small group of working mothers in the formal sector, they are not particularly favourable for socioeconomic equity. In addition, as maternalist measures targeting only female workers, they can disincentivize the hiring of women of childbearing age, or of more women than the legal threshold above which the law obliges firms to provide workplace childcare facilities.

The changes we see in public service provision have to do with extending early childhood care and education services. Table 1 provides an analysis of the extent of full-time care in the framework of national programmes for children aged 0-3 years. In each case we determine eligibility criteria (fundamental for socioeconomic equity), and the existence of coverage goals and data. The last two indicators serve to assess governments' commitment to State co-responsibility in childhood care

and education services for children aged 0-3 years, and whether they promote socioeconomic equity.

With the exception of Argentina, in 2003 the countries included here all had national programmes for early childhood care and education for children aged 0-3. In Brazil, Chile and Uruguay these programmes —which will be discussed in more detail later (childcare centres, National Board for Nursery Schools (JUNJI), Fundación Integra and Child and Family Assistance Centres (CAIF), respectively)— had explicit eligibility criteria. By contrast, in Costa Rica children were eligible for Education and Nutrition Centres/Integrated Centres for Childcare (CEN-CINAI) on the basis of economic need, but this criterion was applied fairly discretionally and varied depending on the demand at each centre, becoming more targeted where demand was heavier. Brazil and Uruguay had set coverage targets, quite ambitious ones in the first case. In socioeconomic terms, eligibility criteria for early childhood care services varied widely from no standard criteria in Costa Rica to universal eligibility in Brazil based on the 1988 Constitution.

By 2013, Argentina had established a national programme of Child Development Centres (CeDIs) under Law 26.233 of 2007. By this time, none of the national programmes in the five countries restricted children's eligibility on the basis of the mother's employment status. However, several programmes afforded priority, in different ways, to the children of full-time working mothers. This was the case of Chile's Crece Contigo (ChCC) scheme, and the expansion of coverage for 0-3-year-olds in Uruguay. In addition, in the five countries examined, a high proportion of services operated part-time.[23] Clearly, these programmes' contribution to State co-responsibility is conditioned by the opening hours of facilities: full-day services that are compatible with formal working hours and that provide greater social protection represent greater State co-responsibility.

Looking at the situation by country, in Argentina, a reform to education legislation in 2006 established services from the age of 3 years as well as kindergartens for children aged between 45 days and 2 years (Law 26.206), but these services were not implemented. However, Child Development Centres (CeDIs) were established for children from low-income households, provided by the State itself and by non-governmental organizations (NGOs) (Faur, 2011).

In Brazil, the constitutional right to early education has been guaranteed since 1988, including for children

[22] Law 20.744 (1974) in Argentina; article 389 of the Labour Process Code, in Decree-Law 229 of 1967 in Brazil; and article 203 of the Labour Code, in Law 19.408 in Chile.

[23] Empirical evaluation of centres and users by full-time or part-time provision exceeds the scope of this analysis.

TABLE 1

State co-responsibility: adoption of a full-time national programme for early childhood care and education,[a] between 2003 and 2013

Country	Programme	Eligibility criteria	Existing coverage, goal and hours around 2010[b]
Argentina	National Education Law (2006)	Children aged 45 days or over (services outside the formal education sector are recognized) For children aged 0-3 there were no specific measures until the creation of CEDIs with need-based criteria	30% at age 3; 67 141 children aged 0-2, equivalent to 3.5% of this age group
	Child Development Centres (CEDIs) (2007)	Economic need	No data; target unknown
Brazil	Education Guidelines and Bases Law (1996, financing since 2007)	Universal (in the framework of the education system) Expansion of childcare centres known as "créches"	In 2010, 18.4% of children were covered, with an average of 8 hours per day (of the target set in 2001 of 50% of children aged 0-3, which was renewed in 2010)
Chile	Chile Crece Contigo (CHCC)	60% most vulnerable of the population (in the framework of care services outside the education system) Takes the form of the CHCC programme	In 2010, coverage was 212 000 children, meeting the target of creating 113 000 additional places
Costa Rica	Day Care and Integral Development Centres (CECUDI) (2010)	Need-based, aiming for universal coverage (in the framework of care services outside the education system) CECUDI scheme expanded with new and existing services	Coverage increased from 7 500 children aged 0-6 in 2010 to 15 000 children in 2013; in keeping with target to increase coverage by 8 000 children
Uruguay	National Care System (2011)	Need-based aiming for universal coverage (can be outside the education system) Expansion of Child and Family Assistance Centres (CAIF) and supply-side subsidies	In 2009 coverage was 13% for children under 1 year, 26% for 1-year-olds, 29% for 2-year-olds and 47% for 3-year-olds (a total of 41 216 places in 2008 of the target of 43 000 for 2009)

Source: Argentina: Ana Malajovich, "La exclusión de los más vulnerables: Deudas educativas con la primera infancia", Voces en el Fénix, No. 3, Buenos Aires, University of Buenos Aires, 2014; Lea Waldmann and others, *Servicios de atención a niños y niñas de 45 días a 36 meses*, Buenos Aires, United Nations Children's Fund (UNICEF), 2011; Brazil: National Education Plan 2001 and 2011-2020; Costa Rica: Government of Costa Rica, "Plan Nacional de Desarrollo 2010-2014", María Teresa Obregón Zamora, San Jose, December 2010; Chile: Ministry of Planning/Ministry of Health (MIDEPLAN/MINSAL), *Cuatro años creciendo juntos. Memoria de la Instalación del Sistema de Protección Integral a la Infancia Chile Crece Contigo 2006-2010*, Santiago, Chile, 2010; Uruguay: Comité de Coordinación Estratégica de Infancia y Adolescencia, "Estrategia Nacional para la Infancia y la Adolescencia (ENIA) 2010-2030. Plan de Acción 2010-2015", *Working Paper*, Montevideo, 2010; Ana Cerutti and others, *Plan CAIF, 1988-2008*, Montevideo, October 2008; and Soledad Salvador, "Hacia un Sistema Nacional de Cuidados en Uruguay", Montevideo, Economic Commission for Latin America and the Caribbean (ECLAC), 9 December 2010.

[a] For children aged 0-3 years.

[b] Where hours are not indicated, the proportion correspond to full-time services is unknown.

under age 1, and in 1996 this right became law. However, what has progressed during the period under analysis is the fulfilment of this legal framework: in 2006, responsibility for early childhood care and education services passed from the Ministry of Social Development and Hunger Alleviation to the Ministry of Education, while implementation remained the responsibility of municipalities. The main challenge since then has been getting the various levels of government to enforce this right and, from the point of view of work-family reconciliation, getting centres to provide full-day services. Current coverage is far from guaranteeing that sort of provision: in 2001, the National Education Plan set a coverage target of 50% for children aged 0-3 for 2010. However, in 2010 coverage was less than 20% and the 10-year plan set the 50% target again, this time for 2020. The State performed better in terms of hours of service in childcare centres (créches); in 2012 daily hours averaged eight, compared with less than five in preschools (for children aged 4 and 5) (Ministry of Education (MEC)/ National Institute for Educational Studies and Research (INEP)).

In 1994, Chile had a relatively limited programme for low-income working mothers, who had to show formal contracts and document their low income to qualify for JUNJI/Integra services (Pribble, 2006, p. 91). In 2006, the Administration of Michelle Bachelet created the programme Chile Crece Contigo (ChCC) to coordinate and broaden existing services for children of preschool age, especially among the lower income quintiles. In 2009, Law 20.379 enshrined "the right to a full-time créche and kindergarten place for the children of mothers who are working, studying, or looking for work; and the right to a part-time kindergarten place with no further requirements regarding parents' activities" (Staab, 2012, p. 313) for the 60% most economically vulnerable proportion of the population.

Between 2006 and 2010, places in ECEC centres under the ChCC umbrella more than doubled, from almost 97,000 to over 210,000 (MIDEPLAN/MINSAL, 2010, pp. 59-60). With the change in government in 2010 the expansion of coverage came to a halt and there were no longer clear goals for increasing coverage.

In Costa Rica, the Education and Nutrition Centres/Integrated Centres for Childcare (CEN-CINAI) programme was formalized in the 1970s and had changed little by 2010. Since then, the Government of Laura Chinchilla has created the universal National Childcare and Development Network, which brought together existing care modalities (Sojo, 2011) and created a new municipal facility, Day Care and Integral Development Centres (CECUDI). This network provides universal services for children aged 0-12, but channels public subsidies in a targeted manner (IMAS, 2013). In 2013 the system had explicit eligibility criteria, as well as coverage expansion targets —relatively modest ones, to include 8,000 children in full-time services (Government of Costa Rica, 2010)— including for the 0-3 age range.

In Uruguay, Child and Family Assistance Centres (CAIF) have provided services to 0-4-year-olds from low-income households since 1988 (Pribble, 2006; Salvador, 2010, p. 32). Families qualify on the basis of social vulnerability and children's ages (CAIF, 2008). In 2011, the Government of José Mujica announced the creation of a National Integrated Health System for children, the older adult population and persons with disabilities. After solid progress in defining the system's main components, the project is currently in a budgetary and implementation hiatus. Under this system, the government plans to broaden eligibility criteria for early childhood care and education services, first by completing coverage for all children from the lowest income quintile. In the meantime, the work of the CAIF

centres has been complemented with public subsidies from the Ministry of Social Development, to enable children to attend existing private kindergartens.

Broadening public preschool services has taken place in parallel with changes in provision for early childhood in schools. As in the case of primary education, this has been mainly on a part-time basis. Successive expansions at the preschool level have occurred by lowering both the age at which children can start, and the age at which they must start. All the countries have taken steps towards universalizing access. However, the increase in coverage has come about chiefly in part-time facilities and has thus not expanded co-responsibility in work-family reconciliation, although it has increased co-responsibility in preschool education per se.

Preschool education from the age of 3 has been a right in Uruguay since 1995, but was initially obligatory only from the age of 5, and later from age 4 (Pribble, 2013, p. 89; Mancebo, 2012; Salvador, 2014). Costa Rica legislated on the gradual lowering of universal preschool education from age 5 to age 4 in 1997, although it was still not obligatory until age 5. In Argentina, attendance in preschool education from age 5 has been obligatory since 1993 (Pautassi and Zibecchi, 2010, pp. 18-19). In 2006, a reform legislated that free public preschool education would be made gradually available from the age of 4 (Faur, 2008, pp. 56-57), although still not obligatory until age 5. In Chile, universal preschool education has begun at age 4 since 1997, but is not obligatory until the age of 5. In Brazil, preschool education begins at age 4 and in 2009 it was established that attendance from that age would become obligatory in 2016.

3. Regulatory measures: bringing the rights of paid domestic workers into line with the rest of the workforce

Throughout the region, paid domestic work is a key strategy for women and families to reconcile paid work and family responsibilities (ECLAC, 2013b), and is therefore a useful proxy for examining the way governments regulate occupations associated with care in general. Historically, social and labour regulation has legally discriminated against domestic workers. Since most of them are women who are socioeconomically vulnerable, more equitable treatment of paid domestic workers is an indicator of greater socioeconomic equity. In turn, since two of the rights at stake are working hours and maternity leave, the analysis also shows progress in State co-responsibility.

In particular, it is useful to establish what reforms have been implemented to ensure that domestic workers have the same rights as the rest of the employed population (Blofield, 2012). Figure 3 depicts the labour rights of domestic workers enshrined in national labour legislation in 2003 and 2013. The comparison includes social protection (social security and maternity leave) and labour regulation (minimum wage, vacation and a category referring to other discriminatory clauses). A value of 6 denotes legislation that affords domestic workers the same rights as the rest of the employed population.

As shown in figure 3, in 2003 the labour codes of all five countries discriminated against domestic workers: their working day and week were both longer than in other occupations. In Uruguay in 2006, in Costa Rica in 2009 and in Argentina and Brazil in 2013, these rights were brought into line with the general labour code.[24] As of mid-2014 —and despite a draft reform in the executive— only Chile maintains discriminatory clauses.

The length of the working day has been the most difficult right to bring into line under the law, reflecting a combination of discriminatory attitudes, both gendered and socioeconomic in nature. On the one hand, domestic and care work is seen as an activity that women perform because they are women. Since it is not considered real work, and even less, work that requires qualifications, it is often thought that the regulations can dispense with the standards and limits that exist for other occupations. On the other hand, women who perform these tasks are supposed to be available unconditionally to attend to the high-income families who hire them. Domestic workers' own family responsibilities are not taken into account in their condition as "servants" (Blofield, 2012).

Figure 4 compares the legal working week for domestic workers with that of the rest of the economically active population in 2003 and 2013. The columns show the differences in the hours of each occupation. In 2003, the difference averaged more than 20 hours in all the countries.[25] In 2006 in Uruguay and in 2009 in Costa Rica, these working hours were equalized. In 2013, Argentina and Brazil did the same. In 2005, the gap in the working week of Chilean domestic workers widened with respect to other workers, from 24 to 27 hours (with working weeks of 72 hours in comparison with a reduction from 48 to 45 hours for other workers).

From the perspective of work-family reconciliation, a stronger guarantee of domestic workers' labour and social rights is indicative of greater State co-responsibility

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[24] These latest reforms took place after ILO adopted a convention on the matter in 2011.

[25] In Brazil and Uruguay maximum working hours are not specified. The regulation suggests that these workers are expected to be available except for meal and rest times. Accordingly, their daily hours have been calculated at 16.

FIGURE 3

Co-responsibility and socioeconomic equity: changes in labour rights of domestic workers in labour codes, 2003 and 2013
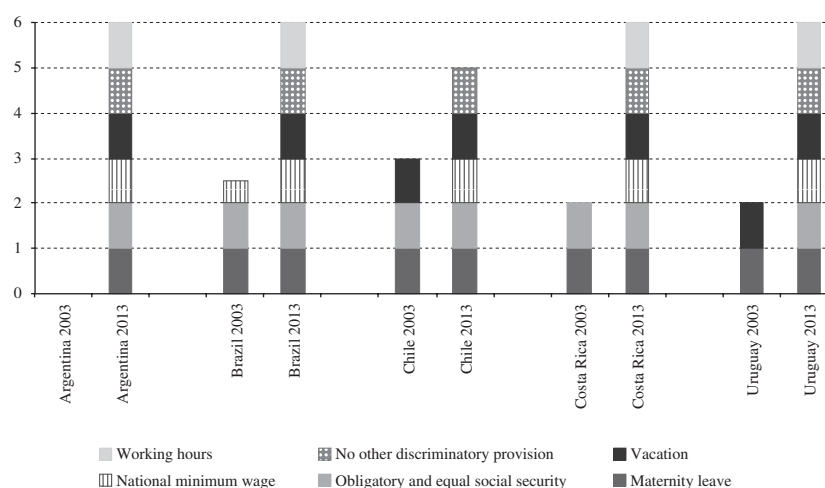
Legend:
- Working hours
- No other discriminatory provision
- Vacation
- National minimum wage
- Obligatory and equal social security
- Maternity leave

Source: prepared by the authors, on the basis of Merike Blofield, *Care Work and Class: Domestic Workers' Struggle for Equal Rights in Latin America*, University Park, Pennsylvania, Penn State Press, 2012, and updated as of 2013 on the basis of the national legislations of the respective countries.

FIGURE 4

Difference in maximum weekly hours between domestic workers and workers in general, 2003 and 2013
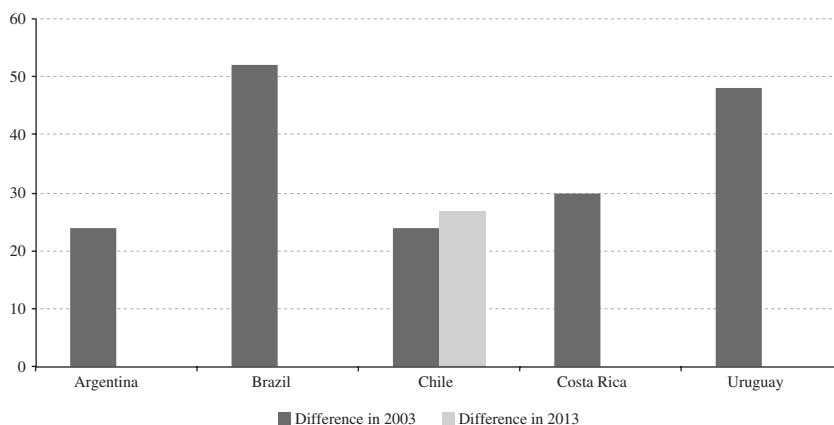
■ Difference in 2003   ▨ Difference in 2013

Source: prepared by the authors, on the basis of Merike Blofield, *Care Work and Class: Domestic Workers' Struggle for Equal Rights in Latin America*, University Park, Pennsylvania, Penn State Press, 2012, and updated as of 2013 on the basis of the national legislations of the respective countries.

in service procurement, with direct effects on work-family reconciliation for the workers themselves. The socioeconomic status and gender of domestic workers, the great majority of whom are women, are inevitably intertwined, so the way in which the State addresses their labour conditions indicates the value it affords to the two types of equity. Any measure that improves conditions for domestic workers promotes both dimensions of equity.

Because guaranteeing domestic workers' rights makes this means of work-family reconciliation more expensive for families who pay for this still highly informal work, it can worsen work-family tensions for those families in the short term. Yet, in the medium and long term, formalizing domestic workers' labour conditions can foster collective efforts towards more institutionalized sequential and defamilializing measures.

V

Analysis and conclusions

Socioeconomic inequalities have eased slightly in Latin America in the past 10 years. However, the gap in labour participation between poor and non-poor women changed little between the start and the end of the first decade of the 2000s. Because socioeconomic and gender inequalities are closely linked, reducing any type of inequality necessitates tackling the work-family balance through public policy. Also, not all policies can promote socioeconomic and gender equality simultaneously. In order to establish how much and what type of progress has been made, this article discussed changes in employment-based leaves, care services and the labour protection of domestic workers as indicators of sequential, defamilializing and regulatory policies, respectively. This

article's main contribution has been to break down and analyse these types of reconciliation policies to show in a simple and comparative manner how much and what type of change has occurred between 2003 and 2013 in the five countries examined, and what the implications are —from the perspective of policy design rather than policy implementation— for inequality.

The evidence on policy adoption shows varying degrees of change in the different countries and policy types. In the national comparison, in 2003 Argentina and Chile had less inclusive work-family policies, comparatively speaking. By 2013, Chile and particularly Uruguay had made reforms to all three types of policy, whereas Argentina, at least with regard to the policies

examined and by comparison with the other countries, had made no changes. Both in 2003 and in 2013, Brazil and Costa Rica show a mixed performance between policy types.

The comparative analysis also shows the type of change that countries have sought to achieve. In the five countries measures have been taken to extend maternity leave to the most vulnerable groups of workers, broaden expectations of early childhood care and education services as a right for children, and regulate paid domestic work. These are very important measures for lower-income women and thus positive from the point of view of public policymaking for socioeconomic equity.

The greater protection of paid domestic work indicates to increased State co-responsibility in work-family reconciliation insofar as the State acts upon the conditions in which paid care services are procured within the household. Over the long run, from the point of view of the families hiring this type of labour, such measures should also create the conditions to push the State to design better sequential and defamilializing measures.

Early childhood education and care services have expanded State co-responsibility in work-family reconciliation where they are provided on a full-time basis. It is notable that in all five countries employers' obligation to provide childcare services has remained unchanged.

Lastly, reforms in employment-based leave have been mixed. The governments of all the countries have adopted measures aimed at increasing socioeconomic equity. Two countries, Chile and Uruguay, have taken steps towards paternal co-responsibility by extending paternity leave (which, although still short, is twice as

long in Uruguay as in Chile) and creating parental leave (though with different modalities in the two countries). At the same time, the Chilean reform is comparatively maternalist, insofar as its maternity leave reinforces the idea that children are mainly a maternal responsibility. In the other three countries paternity leaves have been on the agenda, but have not been adopted.

Measures aimed at guaranteeing a maternalist floor beyond maternity leave include the child benefits established in Chile and the contribution to pensions for each live birth in Uruguay, which by recognizing the differentiated role of women aim to level their socioeconomic status with that of their male peers.

The analysis conducted here indicates that, as a general rule, policies continue to treat the care of small children as the responsibility of mothers. Sequential measures (such as maternity leaves), defamilializing measures and the regulation of care work have all tended to make more progress in promoting socioeconomic equity than in promoting paternal co-responsibility, although the recent reforms in Chile and Uruguay indicate a small but qualitative change in this direction. Although the need for full-day early childhood care services is increasingly on the agenda in most of the countries, performance in terms of State co-responsibility is still hard to assess.

The foregoing comparative analysis of change and continuity has left three types of questions still to be addressed. First, how effective are these measures at the implementation stage? Second, what capacity do they have over the medium and long term to change initial inequality and the balance between work and family? And, third, what are the social and policy determinants that drive variations between countries and policies?

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A first approach to the impact of the real exchange rate on industrial sectors in Colombia

Lya Paola Sierra and Karina Manrique L.

ABSTRACT

Much has been said about possible symptoms of Dutch disease in Colombia in the wake of a marked upsurge in commodity prices and the significant real appreciation of the national currency. This paper examines whether the real effective exchange rate had an impact on industry during the period 2000-2010. Specifically, it evaluates the effect of the appreciation of the real exchange rate on the value added of 63 industrial sectors in Colombia using the Arellano and Bond (1991) generalized method of moments (GMM) estimator. Overall, our results confirm a negative relationship between real exchange rate appreciation and industry. The analysis showed that real exchange rate appreciation had a significant impact on the value added of 21 sectors: a negative effect for 18 sectors and a positive effect for 3 sectors.

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I

Introduction

In 2003, the Colombian currency began one of the most marked periods of real appreciation in the country's recent history. Apart from the decrease recorded during one year owing to the global financial crisis, the real exchange rate appreciated by 51% in the period 2003-2011. This is the seventh highest rate of real appreciation out of a group of 95 countries, according to a World Bank index of real exchange rates.

One factor that contributed to the appreciation was the dramatic increase in oil prices during the period. Since oil makes up about half of the country's total exports, the 275% rise in real oil prices resulted in windfall profits and pushed up the nominal exchange rate.

The real exchange rate can influence the competitiveness of industrial products in international markets. As the Colombian peso appreciates in real terms it drives up the prices of local goods with respect to those from the rest of the world. This makes Colombian products less competitive than their overseas competitors and may have a negative impact on output and employment in sectors that produce tradable goods. In response to

this problem, newspapers and journals, encouraged by the industrial sector, have recently issued warnings about the possible contagion of the Dutch disease in Colombia. The possible effects on manufacturing of this real appreciation of the exchange rate in Colombia have motivated this research, which sets out to determine the effect of the real exchange rate on industrial value added for the period 2000-2010.

We used data for 63 sectors from the Annual Manufacturing Survey, along with macroeconomic data, to conduct estimations using the Arellano and Bond (1991) generalized method of moments (GMM) estimator. We used cross-departmental, cross-sectoral information to evaluate the impact of real appreciation on each of the industrial sectors in Colombia.

The rest of the paper is organized as follows: in the next section, we briefly review the relevant literature; in section III we review the data and the econometric approach used in the study; in section IV we present the results of the model; and lastly, conclusions are drawn in section V.

II

Literature review

The real appreciation of the peso against the dollar since 2003 (see figure 1) has raised fears among politicians and the industrial sector of de-industrialization in Colombia. As the period of appreciation coincided with the great upsurge in real oil prices (see figure 2) —a major export for Colombia— national newspapers started to debate whether Colombia was already suffering from symptoms of Dutch disease.[1] Many economic analysts have written columns on this subject and the President of Colombia even made a reference to the topic in a

keynote speech given at the headquarters of the Economic Commission for Latin America and the Caribbean (ECLAC) in Chile:

> "We are trying to attract investors to sectors other than oil and mining because we are now facing a prelude to the Dutch disease owing to the concentration of investment in these sectors."

President Juan Manuel Santos, 17 August 2011.

However, despite the media interest in the subject, few articles have been written on the possible symptoms of Dutch disease caused by the recent real appreciation of the currency in Colombia.

Dutch disease refers to the fallout caused by windfall profits from a resource discovery (Corden and Neary, 1982; Corden, 1984; Beverelli, Dell'Erba and Rocha, 2011), a resource price boom (Egert and Leonard, 2008; Algieri, 2011; Poncela, Senra and Sierra, 2012), an

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[1] Other possible causes of the real appreciation of the exchange rate could have included the positive trends in foreign direct investment, the increased privatization of State agencies and, externally, excess liquidity in the United States and Europe.

FIGURE 1

Colombia: real effective exchange rate index, 1990-2011
(Index 2005 = 100)
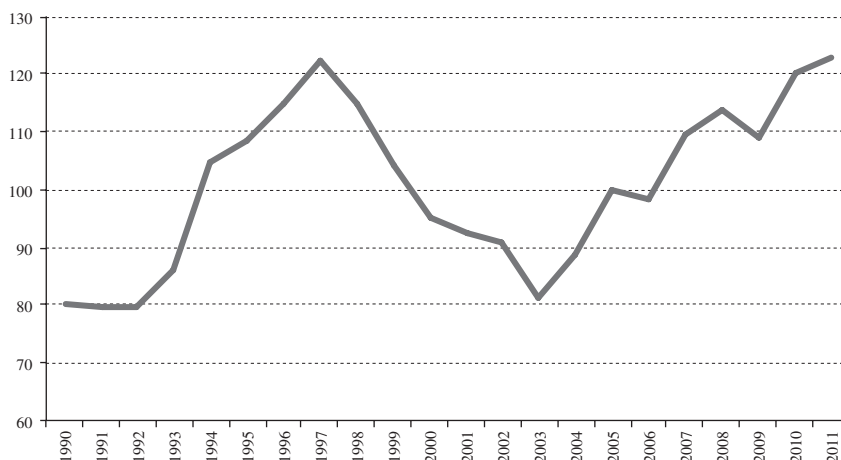
Source: World Bank.

FIGURE 2

Annual average Brent crude oil spot prices, 1990-2010
(Dollars per barrel)
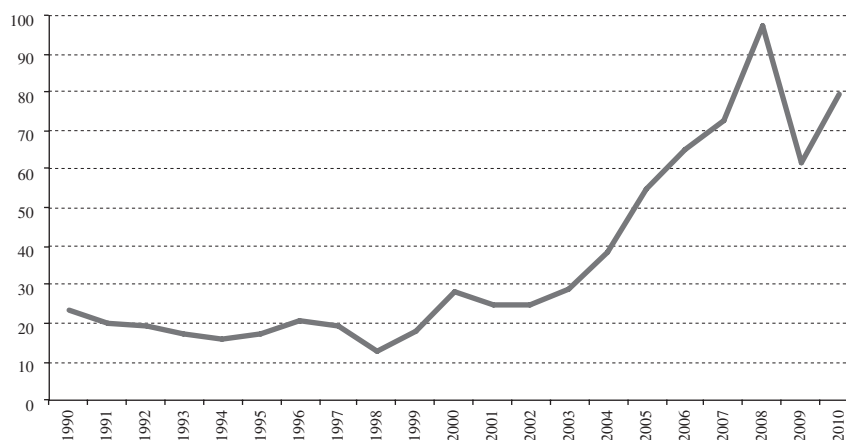
Source: Energy Information Administration.

upsurge in remittances (Acosta, Lartey and Mandelman, 2009; Guha, 2013) or higher capital inflows in the form of foreign aid or foreign direct investment (Lartey, 2011; Arellano and others, 2005; Prati and Tressel, 2005).[2] The term "Dutch disease" is attributed to an article in

The Economist in 1977, which described the detrimental impact on the industrial sector in the Netherlands following the discovery of major gas deposits in the North Sea. Corden and Neary (1982) formulated the core theoretical model of Dutch disease. They used a Salter-Swan framework (Salter, 1959; Swan, 1960) to describe how windfall profits in a country can cause real appreciation followed by reductions in competitiveness and output in the non-resource tradable sector. A resource boom may lead to a real appreciation through two channels. First,

[2] Buiter and Purvis (1983) examine the relative importance of different shocks as causes of de-industrialization, by looking at the impact on the real exchange rate of factors including higher oil prices, a domestic oil discovery and monetary disinflation.

newfound wealth can lead to higher rates of national absorption, through spending either by the government or directly by the owners of the factors. This increase in demand drives up the prices of non-tradable goods, forcing real appreciation. Second, the nominal exchange rate can appreciate in a flexible exchange rate regime owing to burgeoning inflows to the country. Given the traditional real exchange rate equation (see equation (1)), where the real exchange rate (Q) is represented in the equation as the price of domestic goods (P) relative to those from abroad (P*) adjusted by the nominal exchange rate (S), both forces lead to real exchange rate appreciation. Corden and Neary (1982) referred to this as the "spending effect".

$$Q = S * \frac{P}{P^*} \qquad (1)$$

Taking logs, the real exchange rate is also denoted as:

$$q_t = s_t + p_t - p_t^* \qquad (2)$$

Here, s_t is the log of the foreign currency price of domestic currency (United States dollars per Colombian peso), p_t and p_t^* are the logs of the national and foreign country price indices, respectively. In this definition of the real exchange rate, an increase in q_t means a real appreciation of the local currency and a decrease in q_t reflects a real depreciation.

Apart from the "spending effect", Corden and Neary (1982) describe a "resource movement effect", referring to the reallocation of factors, especially labour, from the manufacturing sector to the booming resource sector. The reduction of labour in the manufacturing sector contributes to the de-industrialization process.

The literature seems to point to a clear causal link between a resource boom and a real appreciation of the national currency. However, the subsequent link between real appreciation and relative de-industrialization remains unclear (see Magud and Sosa (2010) for a judicious review of the literature on Dutch disease). In fact, a theoretical article by Buiter and Purvis (1983) posits that a resource boom might have a positive effect on manufacturing on the basis of the coexistence of real appreciation and an upsurge in growth. Manufacturing is thus contemporaneously influenced by appreciation, which shrinks international competitiveness, and local demand for manufacturing, which pushes up sales. Since Colombia, which is a small economy, takes the world price of manufactures as a constant, manufacturing

output could be maintained through the higher domestic demand associated with the resource boom. That is, losses in competitiveness would be compensated by gains in domestic demand.

Moreover, real appreciation can potentially increase competitive pressures and force industrial restructuring, which can in turn boost productivity. The effect of the real exchange rate on manufacturing output depends on the exposure of industries to international markets. Industries that export most of their output, for example, might see their profits fall as they lose competitiveness in periods of real appreciation. Whereas industries that import most of their intermediate inputs could benefit from local currency appreciation, since real appreciation tends to make these inputs cheaper. To summarize, a real appreciation shock has an ambiguous effect on profitability and industrial performance. Some of the papers that examine the real exchange rate and industrial performance include Burgess and Knetter (1998); Campa and Goldberg (1995 and 2001); Goldberg, Tracy and Aaronson (1999); Goldberg (1993); Campbell and Lapham (2004); Ekholm, Moxnes and Ulltveit-Moe (2012), and Berman, Martin and Mayer (2012).

Although the relationship between the real exchange rate and industrial output remains unclear, there appears to be strongly supported cross-country statistical evidence that overvalued currencies are associated with slow growth, especially in less developed countries (Rajan and Subramanian, 2011; Rodrik, 2008, and Berg, Ostry and Zettelmeyer, 2012). Tradable sectors, particularly those in manufacturing, seem to be the link between the real exchange rate and economic growth. Rodrik (2008), for example, shows that the bigger a tradable industrial sector is in a less developed country, the more overvaluation hurts growth.

In the case of Colombia, there are few articles that examine the real exchange rate in relation to manufacturing performance. The article bearing the closest resemblance to this study is Echavarría and Arbeláez (2003), who measured the effect of the exchange rate on investment, sales and profits in Colombian companies in 1994-2002. Unlike our article, however, Echavarría and Arbeláez (2003) took into account a devaluation period in a firm-level analysis, which included only manufacturing firms. Carranza and Moreno (2013) analysed the vertical industrial chain of Colombia for the period 1990-2010, evaluating possible industrialization, but did not specifically assess the effect of the exchange rate on industry. Other studies addressing the subject include Clavijo (1990), which evaluated the effect of the real exchange rate on

productivity, and Rhenals and Saldarriaga (2007), which explored the relationship between the real exchange rate and Colombia's economic growth. In this paper we concentrate exclusively on the effects of the Colombian real exchange rate on manufacturing value added. Further research should be carried out to evaluate the potential impact of a resource boom on economic growth in Colombia.

III

Econometric approach and data

1. Data

We used annual data from the Annual Manufacturing Survey conducted by the National Administrative Department of Statistics (DANE) of Colombia. The survey contains information on 63 industrial sectors in 23 departments (geographical areas) in Colombia from 2000 to 2010. The names of the sectors are listed in annex 1. We used variables from the Annual Manufacturing Survey such as employment, number of firms per industry and wages paid to personnel.

In addition, we used data on macroeconomic variables such as the real effective exchange rate from the International Monetary Fund, the per capita income for each department from DANE and the lending rate from the central bank of Colombia. We constructed the ratio of imported intermediate goods, which takes into account the ratio of industrial intermediate imports to total intermediate goods, with a view to controlling for each industry's openness to foreign markets.[3]

As a first look at the evolution of the sectors from 2000 to 2010, we grouped the data using the two-digit numerical codes of the International Standard Industrial Classification of All Economic Activities (ISIC) adapted for Colombia by DANE (see annex 2). According to this information, the sector with the greatest value added in 2000 was the manufacture of food products and beverages, followed by the manufacture of chemicals and chemical products; the manufacture of coke, refined petroleum products and nuclear fuel; the manufacture of furniture; and the manufacture of other non-metallic mineral products. From 2000 to 2010, the top two sectors, food and chemicals, saw their share in the total value added slide from 28% to 27% and from 16% to 14%, respectively. Likewise, the contribution to total value added of the manufacture of other non-metallic mineral

products contracted from 7.5% to 7.2%. By contrast, the manufacture of furniture and the manufacture of coke and refined petroleum products increased their share in total value added between 2000 and 2010. The furniture sector accounted for 7.7% of total value added in 2000, increasing to 8.7% in 2010, and the manufacture of coke and refined petroleum products saw the largest increase in the whole sample of sectors, from 7.9% to 12.8%.

As we can see from this information, industrial value added is concentrated in a small number of sectors in Colombia. The top five sectors accounted for 67% of total value added in 2000, and by 2010 their share had risen to 70%.

2. The model

We propose the following model:

$$y_{dst} = \beta_0 + \beta_1 w_{dst} + \beta_2 i_t + \beta_3 q_t + \beta_4 IIR_{dst} + \varepsilon_{it} \quad (3)$$

$$\begin{aligned} y_{dst} = \alpha_0 &+ \beta_2 q_t D_s + \beta_3 rgdp_{dt} + \beta_2 i_t \\ &+ \beta_4 w_{dst} + \beta_6 IIR_{dst} + \varepsilon_{it} \end{aligned} \quad (4)$$

where $D_s = \sum_1^{23} D_i$.

The variable y represents the value added of industrial sector s in department d, in year t. The real exchange rate is represented by the variable q_t and D_s is a dummy per industry. The rest of the variables are: real per capita income for each department, $rgdp_{dt}$, real wage per industry w_{dst}, real interest rate, i_t, and the variable IIR_{dst} representing the intermediate input ratio. In equation (3) we aim to measure the overall impact of the real exchange rate on the industry in general. The marginal effect of fluctuations in the real effective exchange rate, whether real appreciation or depreciation, on each industry is captured by parameter β_2 in equation (4).

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[3] All data have been log-transformed.

We are aware of some known identification problems regarding the estimation, such as the multi-causality of industrial value added and the real exchange rate, as well as the possibility of multicollinearity between dependent variables. In order to address these problems, we estimated a dynamic linear panel data model, using the Arellano-Bond GMM estimator. The advantage of this model is that it relaxes the strong exogeneity assumption, allowing the explanatory variables to be correlated with the error term. The strategy is to use the lags of the variables as instruments. A brief analysis of the characteristics and assumptions of this model is shown below.

Consider a model that includes the lag of the dependent variable, Y_{it} as a regressor (the dynamics introduced in the model are given by this feature). The basic dynamic autoregressive model panel data can be represented as follows:

$$Y_{it} = \alpha Y_{i,t-1} + X'_{it}\beta + \eta_i + u_{it} \qquad (5)$$

where t = 1,…,T.

X'_{it} is the row vector of observed explanatory variables for individual i at time t; β is the vector of parameters to be estimated; η_i represents the time invariant individual effect and u_{it}, represents the idiosyncratic errors.

In equation (5), as in equations (3) and (4), lags of the dependent variable are taken as explanatory variables. This fact introduces bias to the estimation by ordinary least squares (OLS), since these violate the strict exogeneity assumption. To tackle this issue Anderson and Hsiao (1981) and Arellano and Bond (1991) suggested differencing the model and then using instrumental variables estimations.

$$\Delta Y_{it} = \alpha \Delta Y_{i,t-1} + \Delta X'_{it}\beta + \Delta v_{it} \qquad (6)$$

By transforming the regressors by first-differencing, as shown in equation (6), the fixed specific effect, η_i, is removed, because it does not vary with time. We follow Arellano and Bond (1991) and use the GMM estimator, which takes into account the passing information from Y and X as instruments.

As a robustness check, we also estimated the Arellano and Bover (1995) system GMM estimator. According to these authors, if the autoregressive process is persistent, or when T (number of years) is small, then the lagged levels are weak instruments. They proposed using additional moment conditions in which lagged differences of the dependent variable are orthogonal to levels of the disturbances.

IV

Estimation results

Before looking at the results disaggregated by industrial sector, we first show the results for equation (3), which give an initial overview of the effect of the real exchange rate on industry.[4]

We obtained estimates of equation (3). We report the results for the two-step GMM estimator for both the first-differenced equation and the system equation. We take as instruments the lagged levels dated t-2 and earlier. As additional instruments, we take the lagged differences dated t-1. The estimation results are reported in annex 3. Annex table A.3.1 provides estimates for equation (3) using the first-differences GMM and the system GMM estimator. The results in column (2) are controlled

for departmental per capita income, whereas those in column (1) are not. The lower part of table A.3.1 includes the results of the Sargan test and Arellano-Bond test used to evaluate the overidentifying conditions and the serial correlation in the first-differenced disturbances.

The results show that fluctuations in the real exchange rate significantly affect the industrial sector in general. In fact, a 1% appreciation of the real exchange rate produces a 0.29% decrease in value added, ceteris paribus, in both the first-differences and system GMM estimations. The real appreciation of the Colombian peso creates a loss of competiveness in international markets since local prices are higher than those of international competitors. Also, domestic consumers replace expensive national goods with cheaper imports.

When departmental per capita income is controlled for, the results of the estimations for equation (3) show that the real exchange rate has slightly less of an

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[4] In this section we refer to the sectors listed in table A.1.1 of annex 1, disaggregated at the three-digit level of the International Standard Industrial Classification of All Economic Activities (ISIC), Rev. 3, adapted for Colombia by DANE.

impact on the value added of the industrial sector. An appreciation of 1% generates a reduction in the value added of 0.26% in both the first-differences and system GMM estimations (columns numbered (2) in table A.3.1). Interestingly, even though there is a negative effect of an appreciation in the same year, we found that industrial value added is affected significantly and in a positive way by the lag of the real exchange rate.

With respect to the results disaggregated by industrial sector corresponding to equation (4), as with previous estimations, we report results for the two-step GMM estimator for the first-differenced equation, using as instruments the lagged levels dated *t-2* and earlier. We evaluated two models: the first (in column (1) in table A.3.2) does not take into account the variable of departmental per capita income, while the second model (in column (2)) does control for the $rgdp_t$ variable.[5]

We found that the real effective exchange rate had significant marginal effects in 21 industries. Real appreciation generated a reduction in the value added of 18 of those industries. The manufacturing sectors that were hit hardest were: television and radio receivers, veneer sheets, finishing of textiles not produced in the same production unit, rubber products, non-metallic mineral products, and sugar mills and refineries. In contrast, appreciation generated positive effects in the value added of only three sectors: manufacture of optical instruments and photographic equipment, publishing and the manufacture of insulated wire and cable. Annex table A.3.3 contains a summary of the sectors that are significantly affected by fluctuations in the real exchange rate (only the sectors significantly affected by the variable q_t in equation (4)).

It is striking that most of the sectors that are negatively influenced by the real exchange rate are those that account for the largest share in industrial value added. The exception is the manufacture of furniture, which is not significantly affected by real exchange rate fluctuations. Surprisingly, the value added of the manufacture of refined petroleum products has a negative relationship with q_t, that is, a real appreciation of 1% leads to a loss in the value added of this sector of about 1.13%.

The specification tests do not produce evidence against any model. The Sargan test leads to non-rejection of the null hypothesis of that model and overidentifying conditions are correctly specified. Furthermore, the autocorrelation tests c1 and c2 (see notes to tables A.3.1 and A.3.2) are consistent with the structure that we proposed for the idiosyncratic error term.

In sum, the 18 sectors that are hit by appreciation account for approximately 53% of total value added, on average, between 2000 and 2010. Conversely, the three sectors that benefit from appreciation represent 4% of total value added (see annex table A.3.4). Our results show, therefore, that real appreciation is detrimental to the sectors representing more than half of total manufacturing value added; however, for the 38 sectors that account for 44.8% of total manufacturing value added, the real exchange rate does not have a significant effect. This non-significance may have to do with the degree of openness of the Colombian economy: from 2000 to 2010, trade accounted for a 35% share in total gross domestic product (GDP) on average. An appreciation of the real exchange rate erodes the competitiveness of domestic firms in the international market, which reduces net exports and shifts part of domestic demand from domestic goods to foreign goods. As a consequence, according to the Dutch disease hypothesis, this leads to a drop in production and employment. However, when the degree of openness of the economy is not large, as is the case in Colombia, these effects do not necessarily spread to all the manufacturing sectors. Moreover, for manufacturing, the domestic market is more important than the external market. For the period 2000-2009, for example, domestic sales represented about 83% of total manufacturing sales, according to DANE. A further avenue for research would be to evaluate the long-term impact of the real exchange rate on manufacturing as the country becomes increasingly open to trade. This paper should persuade policymakers to consider the possible impacts of real exchange rate fluctuations on manufacturing in an economy that is wide open to trade.

It is important to note that the share of manufacturing in GDP for the period 2000-2010 was only 15.4% on average, while services accounted for 59.3%. Therefore, we cannot be conclusive about the effects of the real exchange rate on Colombia's GDP. In fact, as shown in figure 3, there was a huge decline in the contribution of industry to Colombian GDP in the 1990s, coinciding with the introduction of trade liberalization policies. In our period of analysis, from 2000 to 2010, industry recovered to some extent. According to some authors, such as Echavarría and Villamizar (2006), the de-industrialization process in Colombia started in 1960, with the decrease in industry's share of employment, and in 1970, with the decrease in its share of overall production. Echavarría and Villamizar (2006), as well as Poncela, Senra and Sierra (2012), did not find evidence of de-industrialization related to Dutch disease in the long term.

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[5] We also estimated the system GMM model in this equation, however, the Sargan statistic rejected the different models we proposed.

FIGURE 3

Colombia: share of services and industry in gross domestic product, 1965-2011
(Percentages)
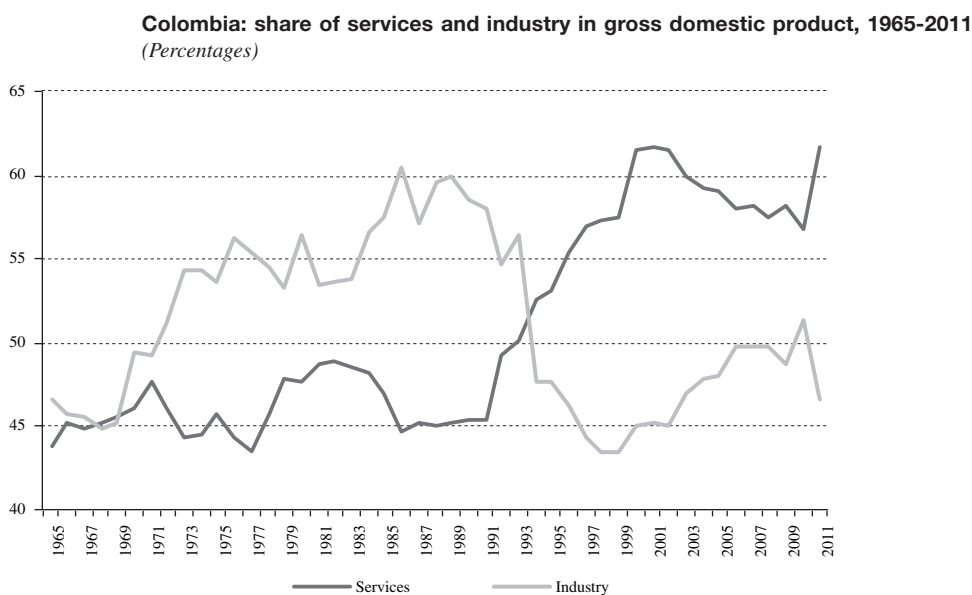
Services — Industry

Source: Data Service & Information, [online] http://www.dsidata.com/default/page/slug/about.

V

Conclusions

In view of the national interest in the possible impact on industry of real appreciation caused by the upsurge in oil prices after the year 2000, we sought to evaluate one of the symptoms of the Dutch disease by analysing the impact of the appreciation of the real effective exchange rate on the value added of 63 industrial sectors in Colombia during the period 2000-2010.

We used the annual panel data set of the Annual Manufacturing Survey carried out by DANE, and conducted estimations using the first-differenced GMM estimator of Arellano and Bond (1991).

Our results suggest that the real exchange rate had a significant impact on the industrial sector in general. We found that the effect was negative: that is, a 1% appreciation of the real exchange rate produced a decrease in industrial value added of between 0.26% and 0.29%.

The estimation results for individual industrial sectors showed that real exchange rate appreciation had a negative impact on 18 sectors and a positive impact on 3 sectors. It is striking that the real exchange rate had no significant impact on most of the sectors (38) during the period 2000-2010. The sectors that were affected

most markedly were those with a larger share in total industrial value added. Overall, the sectors that suffered as a result of the real appreciation of the Colombian peso accounted for 53% of total manufacturing value added, 39% of all manufacturing employees and 36% of firms in the manufacturing sectors.

The results in this paper provide initial insight into the effects of the real exchange rate on the industrial sectors in Colombia. Although this article cannot confirm an acceleration of the de-industrialization process in the period of study because a large number of sectors were not affected by the real exchange rate, it gives a list of sectors that are potentially sensitive to fluctuations in the real exchange rate. Government policy should focus special attention on these sectors, which are potentially harmed in periods of appreciation. Measures such as tax breaks or credit facilities could provide temporary relief to those sectors. Further research is needed to examine how the real exchange rate affects other important variables such as industrial employment, productivity and number of firms per sector in order to evaluate the total impact of the real exchange rate on manufacturing.

ANNEX 1

Table A.1.1

Sectors included in the study

Sector	International Standard Industrial Classification of All Economic Activities (ISIC) Rev. 3 adapted for Colombia
Production, processing and preservation of meat and fish	151
Processing of fruits, vegetables, oils and fats	152
Manufacture of dairy products	153
Production of grain mill products, starches and starch products, and prepared animal feeds	154
Manufacture of bakery products, macaroni, noodles, couscous and similar farinaceous products	155
Manufacture of coffee	156
Sugar mills and refineries	157
Manufacture of other food products	158
Manufacture of beverages	159
Manufacture of tobacco products	160
Preparation and spinning of textile fibres	171
Weaving of textiles	172
Finishing of textiles not produced in the same production unit	173
Manufacture of other textile products	174
Manufacture of knitted and crocheted fabrics and articles	175
Manufacture of wearing apparel, except fur apparel	181
Tanning and preparation of leather	191
Manufacture of footwear	192
Manufacture of travel goods, handbags and similar articles	193
Sawing, planing and impregnation of wood	201
Manufacture of veneer sheets, manufacture of plywood, laminboard, particle board and other panels and boards	202
Manufacture of builders' carpentry and joinery	203
Manufacture of wooden containers	204
Manufacture of other products of wood, manufacture of articles of cork, straw and plaiting materials	209
Manufacture of paper, cardboard and paper and cardboard products	210
Publishing	221
Printing	222
Service activities related to printing	223
Manufacture of coke oven products	231
Manufacture of refined petroleum products	232
Manufacture of basic chemicals	241
Manufacture of other chemical products	242
Manufacture of synthetic and artificial fibres	243
Manufacture of rubber products	251
Manufacture of plastics products	252
Manufacture of glass and glass products	261
Manufacture of non-metallic mineral products n.e.c.	269
Manufacture of basic iron and steel	271
Manufacture of basic precious and non-ferrous metals	272
Manufacture of structural metal products, tanks, reservoirs and steam generators	281
Manufacture of other fabricated metal products and related metalworking service activities	289
Manufacture of general purpose machinery	291
Manufacture of special purpose machinery	292
Manufacture of domestic appliances n.e.c.	293
Manufacture of office, accounting and computing machinery	300
Manufacture of electric motors, generators and transformers	311
Manufacture of electricity distribution and control apparatus	312

Table A.1.1 (conclusion)

Sector	International Standard Industrial Classification of All Economic Activities (ISIC) Rev. 3 adapted for Colombia
Manufacture of insulated wire and cable	313
Manufacture of accumulators and electrical batteries	314
Manufacture of electric lamps and lighting equipment	315
Manufacture of other electrical equipment n.e.c.	319
Manufacture of electronic valves and tubes and other electronic components	321
Manufacture of television and radio receivers, sound or image recording or reproducing apparatus, and associated goods	323
Manufacture of medical appliances and instruments and appliances for measuring, checking, testing, navigating and other purposes, except optical instruments	331
Manufacture of optical instruments and photographic equipment	332
Manufacture of motor vehicles and their engines	341
Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	342
Manufacture of parts and accessories (auto parts) for motor vehicles and their engines	343
Building and repairing of ships and boats	351
Manufacture of aircraft and spacecraft	353
Manufacture of other transport equipment n.e.c.	359
Manufacture of furniture	361
Manufacturing n.e.c.	369

Source: prepared by the authors, on the basis of the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3) adapted for Colombia, as included in the Annual Manufacturing Survey conducted by the National Administrative Department of Statistics (DANE) of Colombia.

n.e.c.: not elsewhere classified.

ANNEX 2

Industrial sector data

TABLE A.2.1

Colombia: value added of industrial sectors, 2000-2010
(Thousands of Colombian pesos and percentages)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Share 2000 (percentages)	Share 2010 (percentages)
Manufacture of food products and beverages	7 608 895	8 381 305	9 470 550	9 957 251	10 880 544	11 951 754	13 761 894	15 224 634	18 001 494	19 627 647	124 865 969	28.5	27.1
Manufacture of tobacco products	1 420	1 134	1 535	0	3 274	3 280	4 421	4 809	5 326	3 258	28 457	0.0	0.0
Manufacture of textiles	1 242 219	1 280 019	1 295 873	1 430 800	1 594 966	1 659 680	1 869 509	1 951 739	1 846 630	1 693 138	15 864 573	4.7	3.4
Manufacture of wearing apparel; dressing and dyeing of fur	1 215 924	1 360 344	1 443 904	1 626 685	1 816 660	1 938 674	2 143 461	2 088 167	2 218 742	2 018 181	17 870 744	4.6	3.9
Tanning and dressing of leather; manufacture of footwear; manufacture of travel accessories, luggage, handbags, saddlery and harness	271 280	285 223	284 834	346 945	360 758	392 524	468 904	524 803	519 861	512 624	3 967 757	1.0	0.9
Processing of wood, manufacture of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	55 213	34 478	44 587	41 910	53 138	56 619	66 181	73 609	84 705	134 435	644 875	0.2	0.1
Manufacture of paper, paperboard and paper and paperboard products	1 350 012	1 438 933	1 567 476	1 711 585	1 929 763	1 829 561	2 008 245	2 205 896	2 359 955	2 268 686	18 670 111	5.1	4.1
Publishing, printing and reproduction of recorded media	849 054	931 382	1 067 624	1 229 704	1 275 004	1 557 755	1 559 679	1 850 557	2 219 561	2 170 731	14 711 050	3.2	3.2
Manufacture of coke, refined petroleum products and nuclear fuel	2 121 031	2 482 134	2 761 632	3 642 836	5 291 157	6 612 653	8 579 633	9 413 412	10 001 524	8 318 727	59 224 740	7.9	12.8
Manufacture of chemicals and chemical products	4 285 615	4 574 087	5 065 855	5 711 664	5 920 572	6 081 515	6 851 308	7 215 348	8 472 098	8 781 966	62 960 026	16.0	13.7
Manufacture of rubber and plastics products	1 187 576	1 385 012	1 546 592	1 700 688	1 930 744	2 231 217	2 485 124	2 780 749	2 766 491	2 990 309	21 004 502	4.4	4.6
Manufacture of other non-metallic mineral products	2 004 414	2 250 868	2 551 045	3 055 937	3 208 584	2 903 819	3 776 549	4 535 001	4 590 775	4 442 766	33 319 757	7.5	7.2
Manufacture of basic metals	538 232	574 607	578 345	808 361	1 158 038	1 254 836	1 351 551	1 296 366	1 631 329	1 369 326	10 560 992	2.0	2.3
Manufacture of fabricated metal products, except machinery and equipment	617 062	559 232	644 992	747 463	832 751	932 479	1 120 715	1 245 303	1 462 750	1 549 845	9 712 592	2.3	2.1
Manufacture of electrical machinery and apparatus n.e.c.	424 112	498 740	517 303	580 462	684 379	754 396	864 007	957 309	983 698	1 138 936	7 403 344	1.6	1.6
Manufacture of motor vehicles, trailers and semi-trailers	345 235	367 440	387 859	366 266	464 979	585 253	556 724	545 196	719 666	812 536	5 151 153	1.3	1.1
Manufacture of radio, television and communication equipment and apparatus	32 597	37 065	47 318	47 995	47 234	10 380	13 509	27 181	27 414	18 493	309 188	0.1	0.1
Manufacture of medical, precision and optical instruments, watches and clocks	58 053	74 692	80 937	88 549	102 238	103 450	114 961	121 966	109 493	142 964	997 303	0.2	0.2
Manufacture of motor vehicles, trailers and semi-trailers	371 644	539 818	645 634	586 952	913 087	1 131 345	1 429 111	1 887 402	1 371 686	1 272 541	10 149 219	1.4	2.2
Manufacture of other transport equipment	72 707	145 158	106 687	161 908	286 143	413 447	551 619	540 087	493 701	540 704	3 312 162	0.3	0.7
Manufacture of furniture; manufacturing n.e.c.	2 055 458	2 271 306	2 601 694	3 171 306	3 834 319	4 053 404	5 614 699	6 888 757	4 968 192	4 730 273	40 189 407	7.7	8.7

Source: prepared by the authors, on the basis of the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3) adapted for Colombia, as included in the Annual Manufacturing Survey conducted by the National Administrative Department of Statistics (DANE) of Colombia.

Note: share 2000 and share 2010 correspond to the sector's share of value added in the total industrial value added for 2000 and 2010, respectively.

n.e.c.: not elsewhere classified.

ANNEX 3

Estimation results

TABLE A.3.1

Colombia: estimation results for equation (3) showing the aggregate impact of the real effective exchange rate on industrial value added

	Generalized method of moments (GMM) estimates			
	First-differences		System	
	(1)	(2)	(1)	(2)
y_{t-1}	0.603 (0.055)[a]	0.689 (0.062)[a]	0.615 (0.040)[a]	0.658 (0.038)[a]
y_{t-2}	0.023 (0.019)	0.047 (0.023)[b]	0.029 (0.017)	0.049 (0.020)[b]
w_t	0.732 (0.043)[a]	0.758 (0.047)[a]	0.727 (0.041)[a]	0.744 (0.045)[a]
w_{t-1}	-0.402 (0.063)[a]	-0.439 (0.067)[a]	-0.39 (0.051)[a]	-0.395 (0.050)[a]
i_t	-0.102 (0.038)[b]	-0.126 (0.039)[a]	-0.087 (0.034)[b]	-0.118 (0.037)[b]
i_{t-1}	-0.295 (0.056)[a]	-0.361 (0.060)[a]	-0.286 (0.052)[a]	-0.360 (0.061)[a]
q_t	-0.297 (0.087)[b]	-0.269 (0.0893)[a]	-0.297 (0.084)[a]	-0.261 (0.088)[b]
q_{t-1}	0.05 (0.067)	0.165 (0.081)[b]	0.011 (0.064)	0.138 (0.076)[c]
IIT_t	-1.00E-08 (6.49E-09)[a]	-1.14E-08 (6.71E-09)[c]	-1.12E-08 (0.00)[a]	-1.11E-08 (6.37E-09)[c]
$rgdp_t$		0.022 (0.024)		0.02 (0.023)
$rgdp_{t-1}$		-0.529 (0.176)[b]		-0.484 (0.154)[b]
cons	1.806 (0.416)[a]	7.084 (1.786)[a]		6.565 (1.622)[a]
Number of observations	2 906	2 906	3 355	3 355
Observations per group (average)	7.21	7.21	7.712	7.712
Sargan test p-value	0.1404	0.380	0.3047	0.638
c1 (p-value)	0.000	0.000	0.000	0.000
c2 (p-value)	0.2184	0.354	0.2907	0.502

Source: prepared by the authors.

[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.1$.
Note: standard errors in parentheses. Sargan test for overidentifying restrictions. c1 and c2 tests for first and second order correlation in first-differenced residuals.

TABLE A.3.2

Colombia: estimation results for equation (4) showing the disaggregate impact of the real effective exchange rate on the industrial sectors

	(1)		(2)	
	Coefficient	Standard error	Coefficient	Standard error
y_{t-1}	0.579	(0.054)[a]	0.661	(0.061)[a]
y_{t-2}	0.018	(0.018)	0.039	(0.021)[c]
w_t	0.762	(0.041)[a]	0.765	(0.045)[a]
w_{t-1}	-0.390	(0.059)[a]	-0.429	(0.062)[a]
$rgdp_t$			0.027	(0.023)
$rgdp_{t-1}$			-0.344	(0.208)[c]
$rgdp_{t-2}$			0.062	(0.199)
i_t	-0.109	(0.037)[b]	-0.110	(0.038)[a]
i_{t-1}	-0.313	(0.057)[b]	-0.331	(0.066)[a]
IIT_t	-1.160E-08	(6.62E-09)[a]	-1.340E-08	(6.870E-09)[a]
$q_t\,D_s$				
Production, processing and preserving of meat and fish	0.224	(0.482)	0.256	(0.478)
Processing of fruits, vegetables, oils and fats	-0.013	(0.340)	0.006	(0.324)
Manufacture of dairy products	-1.142	(0.482)[b]	-0.984	(0.482)[b]
Production of grain mill products, starches and starch products, and prepared animal feeds	0.118	(0.328)	0.240	(0.350)
Manufacture of bakery products, macaroni, noodles, couscous and similar farinaceous products	-0.085	(0.170)	-0.075	(0.199)
Manufacture of coffee	0.420	(0.383)	0.618	(0.417)
Sugar mills and refineries	-1.151	(0.401)[a]	-1.203	(0.412)[a]
Manufacture of other food products	-0.279	(0.289)	-0.247	(0.262)
Manufacture of beverages	-0.045	(0.366)	0.154	(0.379)
Manufacture of tobacco products	0.299	(0.354)	0.143	(0.473)
Preparation and spinning of textile fibres	-0.825	(0.521)	-0.836	(0.537)
Weaving of textiles	-0.822	(0.329)[b]	-0.839	(0.343)[b]
Finishing of textiles not produced in the same production unit	-1.789	(0.625)[a]	-1.916	(0.703)[a]
Manufacture of other textile products	-0.107	(0.494)	-0.041	(0.553)
Manufacture of knitted and crocheted fabrics and articles	0.424	(0.299)	0.459	(0.313)
Manufacture of wearing apparel, except fur apparel	0.506	(0.435)	0.544	(0.455)
Tanning and preparation of leather	-0.179	(0.288)	-0.172	(0.277)
Manufacture of footwear	-0.538	(0.195)[a]	-0.545	(0.226)[b]
Manufacture of travel goods, handbags and similar articles	-0.583	(0.558)	-0.603	(0.610)
Sawing, planing and impregnation of wood	0.228	(0.802)	0.205	(0.802)
Manufacture of veneer sheets, manufacture of plywood, laminboard, particle board and other panels and boards	-3.681	(0.214)[a]	-3.810	(0.184)[a]
Manufacture of builders' carpentry and joinery	0.803	(0.509)	0.835	(0.534)
Manufacture of wooden containers	-1.258	(0.364)[a]	-1.335	(0.287)[a]
Manufacture of other products of wood, manufacture of articles of cork, straw and plaiting materials	-0.357	(0.228)	-0.386	(0.180)[b]
Manufacture of paper, cardboard and paper and cardboard products	-0.912	(0.385)[b]	-0.850	(0.398)[b]
Publishing	0.679	(0.359)[c]	0.717	(0.381)[c]
Printing	-0.582	(0.257)[b]	-0.675	(0.306)[b]
Service activities related to printing	-0.536	(0.955)	-0.685	(0.981)
Manufacture of refined petroleum products	-1.137	(0.542)[b]	-1.125	(0.519)[b]
Manufacture of basic chemicals	-0.337	(0.551)	-0.146	(0.567)
Manufacture of other chemical products	-1.033	(0.507)[b]	-0.962	(0.533)[c]
Manufacture of rubber products	-1.326	(0.389)[a]	-1.352	(0.332)[a]
Manufacture of plastics products	-0.143	(0.168)	-0.128	(0.155)
Manufacture of glass and glass products	0.428	(0.420)	0.515	(0.441)
Manufacture of non-metallic mineral products n.p.c.	-1.278	(0.308)[a]	-1.227	(0.315)[a]
Manufacture of basic iron and steel	-0.726	(0.335)[b]	-0.791	(0.325)[b]
Manufacture of basic precious and non-ferrous metals	-0.636	(0.868)	-0.726	(0.955)

Table A.3.2 (conclusion)

	(1)		(2)	
	Coefficient	Standard error	Coefficient	Standard error
Manufacture of structural metal products, tanks, reservoirs and steam generators	-0.770	(0.378)[b]	-0.819	(0.413)[b]
Manufacture of other fabricated metal products and related metalworking service activities	-0.336	(0.382)	-0.348	(0.396)
Manufacture of general purpose machinery	0.529	(0.425)	0.604	(0.428)
Manufacture of special purpose machinery	0.123	(0.285)	0.175	(0.270)
Manufacture of domestic appliances n.p.c.	0.048	(0.506)	-0.010	(0.547)
Manufacture of electric motors, generators and transformers	0.218	(0.891)	0.233	(0.944)
Manufacture of electricity distribution and control apparatus	-0.588	(0.728)	-0.645	(0.748)
Manufacture of insulated wire and cable	2.953	(0.148)[a]	3.013	(0.153)[a]
Manufacture of accumulators and electrical batteries	0.244	(0.561)	0.330	(0.352)
Manufacture of electric lamps and lighting equipment	-1.033	(0.310)[a]	-1.036	(0.340)[a]
Manufacture of other electrical equipment n.p.c.	0.398	(0.340)	0.405	(0.262)
Manufacture of electronic valves and tubes and other electronic components	0.931	(0.615)	0.996	(0.681)
Manufacture of television and radio receivers, sound or image recording or reproducing apparatus, and associated goods	-4.076	(0.280)[a]	-3.831	(0.323)[a]
Manufacture of medical appliances and instruments and appliances for measuring, checking, testing, navigating and other purposes, except optical instruments	-0.981	(0.891)	-1.042	(0.972)
Manufacture of optical instruments and photographic equipment	0.320	(0.110)[a]	0.380	(0.094)[a]
Manufacture of motor vehicles and their engines	0.702	(0.646)	0.668	(0.823)
Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	0.643	(0.704)	0.622	(0.736)
Manufacture of parts and accessories (auto parts) for motor vehicles and their engines	-0.349	(0.388)	-0.406	(0.450)
Building and repairing of ships and boats	-3.440	(3.111)	-3.409	(3.203)
Manufacture of aircraft and spacecraft	0.212	(0.412)	-0.272	(0.318)
Manufacture of other transport equipment n.p.c.	0.357	(0.261)	0.274	(0.301)
Manufacture of furniture	0.338	(0.396)	0.360	(0.408)
Manufacturing n.p.c.	-0.825	(0.318)[a]	-0.809	(0.330)[a]
_cons	1.812	(0.425)[a]	4.344	(1.618)[a]
Number of observations	2 906		2 906	
Observations per group (average)	7.210		7.210	
Sargan (p-value)	0.074		0.144	
c1 (p-value)	0.000		0.000	
c2 (p-value)	0.096		0.133	

Source: prepared by the authors.

[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.1$.
Note: standard errors in parentheses. Sargan test for overidentifying restrictions. c1 and c2 tests for first and second order correlation in first-differenced residuals.
n.p.c.: not previously classified.

TABLE A.3.3

Colombia: estimation results for equation (4) for the sectors significantly affected by the variable

$q_t\,D_s$	(1)		(2)	
	Coefficient	Standard error	Coefficient	Standard error
Manufacture of television and radio receivers, sound or image recording or reproducing apparatus, and associated goods	-4.076	(0.280)[a]	-3.831	(0.323)[a]
Manufacture of veneer sheets, manufacture of plywood, laminboard, particle board and other panels and boards	-3.681	(0.214)[a]	-3.810	(0.184)[a]
Finishing of textiles not produced in the same production unit	-1.789	(0.625)[a]	-1.916	(0.703)[a]
Manufacture of rubber products	-1.326	(0.389)[a]	-1.352	(0.332)[a]
Manufacture of non-metallic mineral products n.p.c.	-1.278	(0.308)[a]	-1.227	(0.315)[a]
Manufacture of wooden containers	-1.258	(0.364)[a]	-1.335	(0.287)[a]
Sugar mills and refineries	-1.151	(0.401)[a]	-1.203	(0.412)[a]
Manufacture of dairy products	-1.142	(0.482)[b]	-0.984	(0.482)[b]
Manufacture of refined petroleum products	-1.137	(0.542)[b]	-1.125	(0.519)[b]
Manufacture of other chemical products	-1.033	(0.507)[b]	-0.962	(0.533)[c]
Manufacture of electric lamps and lighting equipment	-1.033	(0.310)[a]	-1.036	(0.340)[a]
Manufacture of paper, cardboard and paper and cardboard products	-0.912	(0.385)[b]	-0.850	(0.398)[b]
Manufacturing n.p.c.	-0.825	(0.318)[a]	-0.809	(0.330)[a]
Weaving of textiles	-0.822	(0.329)[b]	-0.839	(0.343)[b]
Manufacture of structural metal products, tanks, reservoirs and steam generators	-0.770	(0.378)[b]	-0.819	(0.413)[b]
Manufacture of basic iron and steel	-0.726	(0.335)[b]	-0.791	(0.325)[b]
Printing	-0.582	(0.257)[b]	-0.675	(0.306)[b]
Manufacture of footwear	-0.538	(0.195)[a]	-0.545	(0.226)[b]
Manufacture of optical instruments and photographic equipment	0.320	(0.110)[a]	0.380	(0.094)[a]
Publishing	0.679	(0.359)[c]	0.717	(0.381)[c]
Manufacture of insulated wire and cable	2.953	(0.148)[a]	3.013	(0.153)[a]

Source: prepared by the authors.

[a] $p<0.01$.
[b] $p<0.05$.
[c] $p<0.1$.
Note: we present in this table the significantly estimated results for the parameter β_2 in equation (3). Standard errors in parentheses. The shaded rows correspond to the sectors that have been affected positively by the real appreciation of the Colombian peso.
n.p.c.: not previously classified.

TABLE A.3.4

Colombia: share of value added, employees and firms of the sectors that saw a significant impact on value added as a result of real exchange rate appreciation

Sectors significantly impacted by real exchange rate appreciation	Percentages of total		
	Value added	Number of employees	Number of firms
Negative effect	52.7	38.7	35.9
Positive effect	4.0	2.1	5.7

Source: prepared by the authors.

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Global integration, disarticulation and competitiveness in Mexico's electromechanical sector: A structural analysis

Raúl Vázquez López

ABSTRACT

This article analyses the dual functioning of the Mexican electromechanical sector between 1994 and 2008, as distinct from other globalized activities. An estimation of labour productivity in 52 industrial classes finds that structural heterogeneity increased particularly in the 1994-2001 subperiod, alongside technical and organizational improvements that were increasingly concentrated in a small number of subsidiary companies of transnational automotive-assembly enterprises. The application of a shift-share technique also revealed the absence of any significant structural change. Lastly, an extension of the methodology to evaluate competitiveness —developed by the Economic Commission for Latin America and the Caribbean (ECLAC)— and its application to a second database that reclassifies 1,345 foreign trade products, makes it possible to contrast these changes with the dynamism of the global production networks in which the leading firms of the sector in Mexico are engaged.

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I

Introduction

Since the 1980s, Mexico and several other Latin American countries have been implementing an economic-development strategy based on open trade and deregulation of the economy. The objectives of the measures thus adopted —inspired in an orthodox vision that believes the market has autonomous capacity to allocate resources efficiently— include promoting structural change in the productive system by integrating the model's leading activities into global value chains. Backdropped by a sophisticated international division of labour, the strategy based on productive specialization assumes that freely functioning markets, supported by the adopted measures, enable jobs to be created and factors to be reallocated towards the most productive uses.

Three decades on, the results obtained have called the validity of this argument into question. In Mexico, public policy has adhered to orthodox guidelines in exemplary fashion. Trade liberalization and economic deregulation have continued apace, while maquila activity has experienced an unprecedented boom. Capitalizing on the advantages afforded by geographical proximity to the United States market and the signing of the North American Free Trade Agreement (NAFTA), large transnational corporations have invested in the country; and the growth of exports of Mexican-assembled products has outpaced world trade as a whole. Nonetheless, the external competitiveness of the model's leading industries has been unable to counteract the deindustrialization process in non-globalized subsectors of the economy, which have to compete in the domestic market with imports that benefit from the adopted measures.

From the standpoint of the theoretical tradition of Latin American structuralist thinking, the spillover effects from the most efficient industries in terms of transferring technological capacities, modes of organization, and demand for inputs, are fundamental for achieving a major transformation of the productive sector. This would underpin not only on economic growth but also development in a broader sense (when considering the historical experience of the developed countries in 1970, Aníbal Pinto proposed as a key development objective for modern industries, which he defined as those of higher productivity, that they should transmit their progress to the rest of the economy, and thus help to "lift up" backward populations, areas or sectors (Pinto, 1970, p. 97)). This same historical experience shows that structural change based on the development of complementarities between the different activities requires participation by a complex institutional fabric.[1]

Pursuing these ideas, the present article seeks to analyse the structural evolution of the Mexican electromechanical sector, leader of the country's manufacturing export profile, highlighting the dualism that exists between globalized and non-globalized activities. For this purpose, two databases were constructed at the highest possible level of disaggregation for the period 1994-2008. The first refers to levels of labour productivity in 52 classes of activity in the sector; and the second relating to the exports and imports of the different sector activities (see annex) —resulting from the reclassification, nonexistent at the time, of 1,345 foreign trade products defined by the 1992 Harmonized System (HS92) in terms of the Mexican Activities and Products Classification (CMAP). The core of this study presents the results of different statistical exercises based on these information sources.

The first part of section II, which is theoretical, discusses the role played by public policy in integrating the leading Mexican manufacturing industries into global production networks; and the second part documents how the different activities' shares in the output and employment of the electromechanical sector have become more concentrated. Section III considers the heterogeneous pattern of change in disaggregated levels of labour productivity, while section IV uses a generic shift-share technique to distinguish the main determinants of the changes observed. Lastly, after section V has evaluated the sector's external competitive performance in dynamic terms, along with its constraints, section VI sets forth the main conclusions.

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[1] José Antonio Ocampo, former Executive Secretary of ECLAC, defines the concept of complementarities extensively, referring not only to the role of the backward and forward linkages identified by Hirschman, but also to the role played by public, private, or mixed institutions created to reduce information costs (Ocampo, 2005).

II

Public policy in Mexico and global production networks

Arndt and Kierzkowski (2001) relate the international fragmentation of production to the emergence of assembly or maquila activities in less developed countries; and they characterize this phenomenon in terms of previously integrated productive processes being split into one or more components, the manufacturing of which migrates geographically, thereby giving rise to intra-industry and intra-product trade. Yamashita (2008) makes clear that this cross-border division of the productive process leads to activity segments that make intensive use of low-skill labour being relocated towards developing countries, while tasks with a high knowledge content or those involving sophisticated technologies are kept in advanced countries.

The above results in a highly hierarchical and rigid global form of organization, in which the benefits are unequally distributed, entailing a twofold specialization of the national economies. As capital-intensive productive segments would thus fall outside the "specialization cone" of labour-abundant developing countries, tasks that involve higher technology and knowledge content not only do not migrate towards these countries, but actually disappear from them if they previously existed (Deardoff, 1979). By testing the theory against empirical evidence for the Mexican manufacturing sector, Puyana and Romero argue that this phenomenon would explain the reduction in the national content of certain activities —in the automotive sector for example— which occurred after the Mexican economy was liberalized in the wake of the debt crisis (Puyana and Romero, 2006, p. 72).

By introducing elements of geographical political economy into the analysis of global production networks, MacKinnon (2012) finds that the role of institutions has been to ensure strategic coupling[2] between locally existing potentials and the needs posed by the firms that drive these international networks. Coe and others (2004) also mention the role of these institutions in moulding

those local capacities to complement the strategies defined by transnational actors located within these global production networks. In short, the transnationals condense a systemic power which they exercise under profit-maximization criteria, so as to transform the national and subnational regulatory frameworks and, definitively, the productive structures they subordinate (Dawley, 2011). Some discussions of this even define "corporate capture" as the potential for transnational enterprises to harness institutional capacities to the detriment of the interests of national firms and workers (Phelps, 2008).

1. Integration of the leading Mexican manufacturing industries into global production networks

The foregoing is relevant mainly in terms of the role of public institutions in developing countries, such as Mexico, which are specialized in tasks involving the assembly of manufactured goods. The promotion of duty-free importation of components, intermediate goods and inputs, along with the acceptance by the national authorities of a value-added tax imposed on the product to be re-exported to the country of origin, have aimed to underpin the organizational strategies of these global production networks to the detriment of local productive linkages and income levels (Yeats, 2001). In reality, the public-policy measures implemented by developing countries, to attract foreign investment and maquila activities, have mostly served as a disincentive to national content in the manufacturing process; and they are ultimately the result of needs created by the competitive pressures experienced by the parent companies of large transnational enterprises in advanced countries (Arndt, 2001).

In the case of Mexico, Puyana and Romero (2006) document a maquila "bonanza" stemming from the tax incentives provided by the governments of Mexico and the United States, which aimed at reducing costs of production, enhancing profitability, and simulating investments in maquila activity, with a consequent shift of productive factors towards that activity. Under this

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[2] Yeung (2009, p. 213) defines strategic coupling as the dynamic process through which economic agents in either cities or regions, or both, coordinate, mediate, and arbitrate strategic interests between local stakeholders and their counterparts in the global economy.

arrangement, the small proportion of national value-added incorporated in the exported goods is explained by the combined effect of the incentives for duty-free importation of components, the charging of a tax on Mexican value-added in the United States, the global rationale underlying the fragmentation of productive processes that restricts the development of capital and knowledge-intensive activities, and exchange-rate revaluation which raises the relative cost of domestic inputs.

In this sense, public policy has been heavily biased in favour of the interests of transnational players, pursuant to a neoliberal economic strategy founded on financial deregulation and trade liberalization. In 1996, the Industrial Policy and Economic Deregulation Programme was absorbed by the Foreign Trade and Export Promotion Programme, in the belief that promotion measures in a context of globalization should not be separated from those related to international trade (Hernández, 2000). The resulting programme, which provided a frame of reference for national industrial policy, then favoured the export sector ahead of the manufacture of nontradable goods, with the specific central aim of enhancing the competitiveness of the productive structure and helping it to integrate into global production networks.

A trustworthy indication of the authorities' responsibility in the transformation of manufacturing industry was the implementation of specific promotion programmes centred on two main lines of action: export promotion (ECEX and ALTEX)[3] and the development of maquila activity (PITEX, INMEX and DRAWBACK).[4] Key provisions of these latter programmes include tax exemptions on the temporary importation of intermediate goods and inputs used in the manufacture, processing or repair of export merchandise (general import duty, value added tax and, where appropriate, countervailing duties). The industrial specialization pattern defined by the adopted measures thus favoured a subordinate role for the national productive apparatus in globalized sectors controlled by the "governance" of global production networks (Vázquez, 2012).

In the automotive sector, which is a pillar of the growth strategy, the State progressively dismantled legislation which had hitherto proven successful in terms of its capacity to encourage exports and develop

the domestic autoparts industry. The suppression of the Automotive Decree eliminated the following regulatory provisions: the upper limit on foreign capital in enterprises making vehicle parts (originally 49%); the domestic value-added requirement in the output of assembly plants (set at 60% prior to 1998); and the minimum export value required for every dollar of imports (prior to NAFTA, US$ 1.75 of exports was required for every dollar of imports) (Hernández, 2000). Deregulation thus meant a significant reduction in the number of tasks undertaken, as determined by the productive needs of the integrated global system and consisting of greater specialization in the final assembly-related manufacturing segments.

2. Concentration and disarticulation in the Mexican electromechanical sector

In the case of the Mexican electromechanical sector, strategic coupling between the manufacturing structure and the needs of global production networks, as defined by the parent companies of transnational enterprises, has mainly manifested itself since trade liberalization in a growing divergence between the characteristics of industries serving the domestic market and those that are integrated into international chains generating exports. In order to obtain an initial differentiated approach to the sector's evolution, a database was constructed primarily to estimate labour-productivity levels, separating the surveyed classes into two groups (see annex). An initial group covers activities associated with the automotive industries and those relating to the electrical-electronic subsector and the manufacture of domestic and office equipment, hereinafter identified as the "globalized group"; whereas the second group encompasses other activities and is referred to as "non-globalized."

In general, the data for the period under analysis (1994-2008) show that the total sector shares of both groups stagnated, both in terms of output value and in terms of man-hours worked. This would suggest that open trading arrangements failed to generate any significant structural change that increased the weight of activities involved in international chains in the domestic manufacturing structure. Nonetheless, a more disaggregated analysis calls this statement into question, since a single activity "Manufacture and assembly of cars and trucks" (class 384110), which has the highest level of global integration, increased its share of output value from 40.8% in 1994 to 50.4% in 2008. In this

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[3] Foreign Trade Enterprises Programme (ECEX) and Highly Exporting Enterprises Programme (ALTEX).

[4] Temporary Import Programme for Export (PITEX); Programme of the Manufacturing, Maquila and Export Service Industry (IMMEX), and the Programme of Import Duty Refunds to Exporters (DRAWBACK).

latter year it accounted for half of the sector's total output, significantly more than offsetting the fall in the share of its main input supplier, "Manufacture of motors and their parts for automobiles and trucks" (class 384122), from 10.6% in 1994 to 6.6% in 2008 (see table 1).

TABLE 1

Share of the industry groups in the total gross production of the sector and Herfindahl-Hirschman indices (HHIn), 1994 and 2008
(Percentages)

Groups	1994	2008
Globalized group	80.1	81.8
Activity class 384110	40.8	50.4
Activity class 384122	10.6	6.6
Non-globalized group	19.9	18.3
Sector total	100	100
HHIn globalized group	41.3	52.9
HHIn non-globalized group	7.5	12.1
HHIn total sector	34.1	43.8

Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), "Encuesta Industrial Mensual (EIM). Clasificación Mexicana de Actividades y Productos (CMAP), 205 clases de actividad económica", 2013.

The diametrically opposing trends experienced by the two main classes of the sector, integrated into the same subsector and value chain, reflect the fact that imports have displaced locally supplied vehicle parts, thereby breaking domestic productive linkages headed by the industry leaders engaged in global production networks. On this point, in the context of the globalization of the automotive sector, Álvarez states that "local firms have ceased to be suppliers of the assembly plants, deferring to the new foreign firms or else engaging in the importation and distribution of autoparts" (Álvarez, 2002, p. 46). This hypothesis is confirmed by comparing the results obtained from a calculation of the coefficients of articulation and integration of the globalized and non-globalized groups: whereas the first indicator is 16.9% lower for the globalized group, the second is 11% lower (see table 2).[5]

[5] Following a review of the information available in the various statistical sources, the coefficient of articulation is defined in this study as the value of domestic raw materials and auxiliary inputs consumed, as a percentage of the total value of those inputs consumed. The coefficient of integration was calculated as the sum of value-added and the value of national raw materials and auxiliary inputs consumed in relation to

TABLE 2

Coefficients of articulation and integration of the industry groups in 2003[a]
(Percentages)

Groups	Coefficient of articulation[b]	Coefficient of integration[c]
Globalized group	44.6	56.7
Non-globalized group	61.5	67.8
Total sector	46.6	58.5

Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), "Encuesta Industrial Anual. Clasificación Mexicana de Actividades y Productos (CMAP), 205 clases de actividad económica", 2013.

[a] The data were calculated for 2003 because this was the last year for which the necessary information exists under the CMAP classification.

[b] Coefficient of articulation: national raw materials and auxiliary inputs consumed/total raw materials and auxiliary inputs consumed.

[c] Coefficient of integration: (value-added + national raw materials and auxiliary inputs consumed)/total gross production.

In this regard, the process of disarticulating local value chains in the sector goes hand-in-hand with a progressive concentration of production, mainly in a single activity controlled by the subsidiaries of large foreign transnational enterprises (the labour-intensive assembly of automobiles and trucks).[6] This is corroborated by calculating the normalized Herfindahl-Hirschman index (HHIn),[7] since the indicator rises in all cases, and by a considerable amount particularly in the globalized group, from 41.3% in 1994 to 52.9% in 2008 (see table 1). Thus

total gross production, with respect to each of the 53 activity classes in the sector, and for the groups considered. The information source used in this case was the Annual Industrial Survey, 205 activity classes (CMAP), conducted by INEGI (2013b).

[6] The total output of Mexico's automotive sector in 2008 amounted to 2,180,294 units, of which 76.4% were destined for the international market. In the case of automobiles, production in that year totalled 1,387,913 units, of which 79.5% were exported; 32.4% were produced by the German Volkswagen assembly unit, 28.3% by the Japanese firm Nissan, and 19.7% and 14.8% by the United States Enterprises Ford and General Motors, respectively (INEGI, 2010).

[7] The normalized Herfindahl-Hirschman index was separately calculated for production values and man-hours worked in the 23 activity classes of the globalized group and in the 30 classes in the non-globalized group, and also for all 53 classes of the sector. The formula used was:

$$HHIn = \frac{\left[\sqrt{\sum_{i=1}^{n} P_i^2} - \sqrt{\frac{1}{n}} \right]}{1 - \sqrt{\frac{1}{n}}} \times 100$$

where $P_i = X_i/X_t$ indicates the share of class i in the total production value or man-hours worked of the group in question (formula normalized on the basis of Durán and Álvarez, 2008).

there is evidence of a strong correlation between a trade liberalization process, driven by a public policy aimed at integrating the national productive system into global production networks, and a productive specialization trend that concentrates activity in a small number of industries and firms within those networks.

It should also be noted that, owing to the high technological level of manufacturing processes in the globalized activity classes (as exemplified by the automotive sector), both the increase in these classes' total sector shares, and their degree of concentration, are smaller in terms of man-hours worked. Comparing the situation in 2008 with that prevailing in 1994, the share of the globalized group in total time worked in the sector increases by just 2.2%, whereas the group's index of concentration shows a residual growth of 1.6% (see table 3). Consequently, an element that would explain the lack of spillover from exports to economic growth and employment is the inability of these globalized firms to generate jobs on a scale that reflects their standing in the productive structure. This contradicts the orthodox theoretical claim that liberalization and the market alone can reallocate labour towards the most profitable

uses. This feature would therefore imply that it would be impossible for such firms to drive any significant structural change —a hypothesis that will be evaluated in the following sections by analysing trends of labour productivity and its determinants.

TABLE 3

Share of the industry groups in man-hours worked in the sector and normalized Herfindahl-Hirschman indices (HHIn), 1994 and 2008

(Percentages)

Groups	1994	2008
Globalized group	60.2	62.4
Activity class 384110	12.5	13.2
Activity class 384122	8.3	8.0
Non-globalized group	39.8	37.6
Sector total	100	100
HHI globalized group	12.2	13.8
HHI non-globalized group	5.6	6.7
HHI total sector	7.8	9.3

Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), "Encuesta Industrial Mensual (EIM). Clasificación Mexicana de Actividades y Productos (CMAP), 205 clases de actividad económica", 2013.

III

Trend of labour productivity and structural heterogeneity

In general, the estimations made from the constructed database show labour productivity in the period (1994-2008) growing at very similar rates in the two industry groups (globalized and non-globalized), and in line with the trend of that indicator both with respect to the sector total and for manufacturing as a whole (see table 4). In the case of the globalized group, seven of the 23 classes report a reduction in their labour-productivity level from 1994 to 2008, particularly in the classes "Manufacturing, assembly and repair of communication, transmission and signaling equipment" (383201) and "Manufacture and assembly of radios, television receivers and audio equipment" (383204), which have substantial export activity in a national electronics industry that relies heavily on the functioning of global production networks. Despite the competitive success of these activities, which generated external sales of US$ 14,407 million and US$ 24,999 million, respectively, in 2008

and jointly accounted for 23.2% of the sector's total exports,[8] their labour productivity declined sharply at rates of 32.5% and 47.3% between 1994 and 2008 (see table 4). Consequently, the aggregate performance of the globalized group is not visibly superior to that of the non-globalized group, and there are signs of a "spurious" competitiveness that is not based on technological and organizational improvements in certain highly-exporting activities.

The sector's key activity, class 384110 (Manufacture and assembly of cars and trucks), records both the highest level of labour productivity of the sample in 2008, and a well-above- average rise in that indicator between

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[8] Exports in class 383201 correspond to a combination of the following HS92 categories: 8517+8521+8525+8526+8530+8531-851790-853090-853190. In the case of class 383204, the identity is 8518+8519+8520+8527+8528-851850 (see annex).

1994 and 2008. In contrast, the labour productivity of the sector's main input supplier, "Manufacture of car and truck motors and their parts" (class 384122), represents just 21.4% of the productivity level of the terminal industry having weakened further in the period studied (see table 4). On this point, the analysis of all the estimations performed points to widening efficiency gaps both between the leading and backward activities of the sector, and also within industries that are integrated into global production networks, and especially between those grouped in the input-supplier classes and assembly industries located in the final phases of the value chain.

TABLE 4

Trend of labour productivity by industry groups, 1994 and 2008

(Mexican pesos at December 2003 prices and percentages)

Groups	1994	2008	Growth rate
Globalized group	691.8	990.2	43.1
Activity class 384110	1 697.7	2 892.4	70.4
Activity class 384122	664.0	619.4	-6.7
Activity class 383201	744.7	502.5	-32.5
Activity class 383204	699.3	368.5	-47.3
Non-globalized group	259.1	366.1	41.3
Sector total	519.4	755.3	45.4
Manufacturing total	446.1	625.0	40.1

Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), "Encuesta Industrial Mensual (EIM). Clasificación Mexicana de Actividades y Productos (CMAP), 205 clases de actividad económica", 2013.
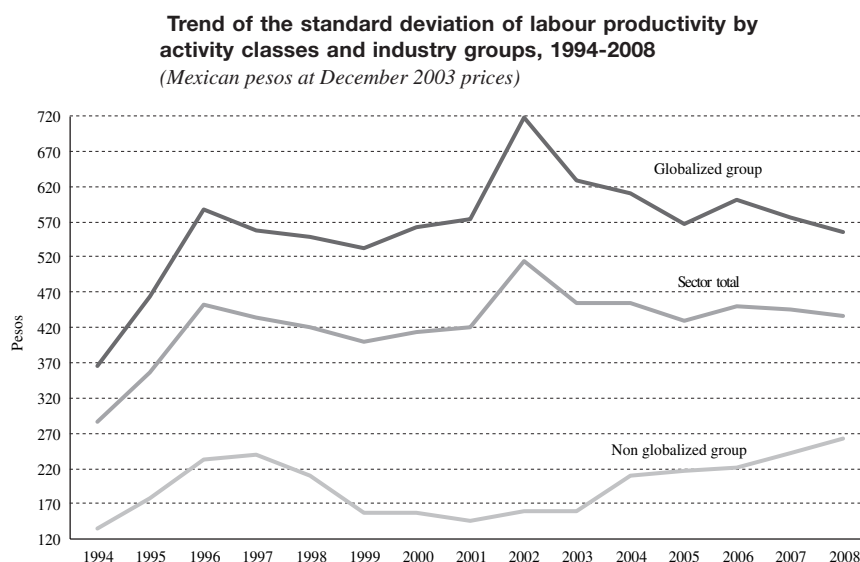
According to the theoretical approach adopted in this study, a structural homogenization process is a pre-requisite for advancing towards a more mature forms of industrialization (Furtado, 1967; Pinto, 1965 and 1970), so the widening of productive gaps within the leading industries of the export specialization profile entails an involution of the manufacturing structure. An initial approach to the topic of structural heterogeneity in the Mexican metalwork and machinery sector seems to confirm this hypothesis. The traditional dispersion statistics for the indicator, calculated both by activity class and with respect to the groups defined above (globalized and non-globalized), rise all cases. The largest increase occurs in the non-globalized group as result of a wide variety of patterns of investment and technological change, and where there is a predominant phenomenon of obsolescence and deindustrialization (in 16 of the 30 classes considered, output declines in

real terms; and, although time worked decreased in 10 of the group's activities, 10 classes recorded declining labour productivity during the period studied).

Meanwhile the standard deviation of the indicator for the globalized group and for the whole sector rises by 52.2% when comparing 2008 with 1994, whereas the coefficient of variation rises by 23.2% for the globalized group and by 20.6% for the sector. Nonetheless, there are two clearly differentiated subperiods. In the first one (1994-2002), following the entry into force of NAFTA and a rapid process of trade and financial liberalization in the Mexican economy, structural heterogeneity in the sector increases quickly, but to a greater extent within the globalized group, which includes the export industries that are privileged by the new public-policy measures (annual average growth rates of the standard deviation and coefficient of variation are 8.3% and 6.4%, respectively, for the sector as a whole; 9.7% and 6.7% for the globalized group, and 3.7% and 3.3% for the non-globalized group). In a second period of relative stabilization, and following the shakeout of much of the national productive apparatus, the trend, once again led by the globalized firms, reverses after peaking in 2002 to post negative annual average of rates growth of the standard deviation and coefficient of variation are negative between 2002 and 2008 (-4.1% and -4.4 respectively for the sector as a whole, and -2.6% and -4.5 for the globalized group (see figures 1 and 2)).

Various factors help explain the widening gaps in labour productivity between the activity classes of the electromechanical sector and their timings in Mexico. Firstly, following trade liberalization, the global integration process in the leading industries of the sector specialization pattern generated higher degrees of structural heterogeneity, particularly within the globalized group. The entry or takeoff of a few large and technically advanced exporting firms, mostly subsidiaries of foreign multinationals, coexisted with the incapacity of many other local industries to be competitive internationally, and with the aforementioned displacement of local supplies by imports. This was stimulated and protected by national export-promotion programmes that facilitated the purchase abroad of the parts and inputs to be incorporated into the exported goods. On this point, Unger stated that "Mexican industry consolidates increasingly concentrated oligopolistic structures, owing to the influence of the large transnational enterprises, and large export-oriented domestic conglomerates" (Unger, 2001, p. 100).

FIGURE 1

**Trend of the standard deviation of labour productivity by
activity classes and industry groups, 1994-2008**

(Mexican pesos at December 2003 prices)

Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), "Encuesta Industrial Mensual (EIM). Clasificación Mexicana de Actividades y Productos (CMAP), 205 clases de actividad económica", 2013.

FIGURE 2
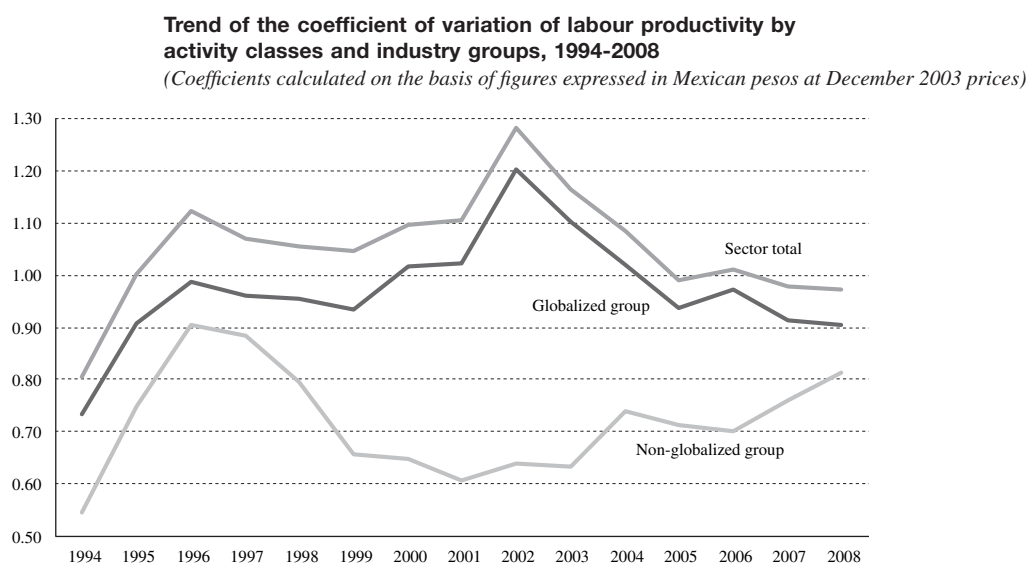
**Trend of the coefficient of variation of labour productivity by
activity classes and industry groups, 1994-2008**

(Coefficients calculated on the basis of figures expressed in Mexican pesos at December 2003 prices)

Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), "Encuesta Industrial Mensual (EIM). Clasificación Mexicana de Actividades y Productos (CMAP), 205 clases de actividad económica", 2013.

Similarly, some activity branches were restructured to meet the requirements defined by the "governance" of global production networks, and to be able to undertake tasks with different factor contents and essentially assembly work. As a result of competition from imports on the local market, most of the small and medium-sized enterprises (SMEs) and entire industrial segments collapsed and disappeared, leading to a shakeout of the national productive apparatus. In a synthesis of this transformation, Capdevielle notes that "the composition of manufacturing output changed, partly because the economic sectors that produced for export were specialized

in certain segments of the value chain, and, at the same time, local production was displaced by imports, thanks to liberalization and the availability of foreign exchange obtained from the new form of participation in trade" (Capdevielle, 2005, p. 108).

It is in this new context of high market concentration, and in a second period (2003-2008), that degrees of heterogeneity within the globalized group decrease, with the presence of limited dissemination of technology and capacities within the leading activities. At the same time, as there was no flow of knowledge outside the global network, nor any significant positive externalities, and no generalized organizational learning, the efficiency gaps continued to widen. This happened even more quickly in the residual industries of the non-globalized group, which were undergoing a genuine de-industrialization process. It should be noted that this periodization is consistent with the findings of previous studies for Mexican manufacturing as a whole, albeit with contrasting trends in the subperiods considered (Vázquez, 2013).

IV

Deindustrialization and structural change

In the context of the deindustrialization of activities serving the domestic market, two elements tend to corroborate the hypothesis put forward above in relation to the absence of a reinvigorating change in the overall structure of the Mexican metalwork and machinery sector: firstly, greater heterogeneity in terms of technologies and capacities; and, secondly, increased concentration of productive capacity, both in a small number of classes (especially those related to assembly activities) and, within those classes, in a few large firms that are integrated into global production networks and benefit from the public-policy measures implemented in the wake of trade liberalization. Consequently, this section seeks to evaluate the determinants of the labour-productivity trends observed in the different activities, to confirm the concentration of efficiency gains in a few globalized classes and the very weak role played in the improvements by the migration of labour towards more efficient uses.

A standard methodology of the shift-share type, a descriptive technique commonly found in this type of study, was used to identify the components of productivity changes (total effect) at two points in time. The first component was an effect related to the structural change, in other words the migration of productive factors towards more efficient uses (structural effect); and the second identified an effect linked to the changes that occurred within each activity, which can be associated with technical progress (intrinsic effect). Using the information base described in the first section of this article, the following paragraphs break down the increases in labour productivity that occurred in the sector between 1994 and 2008. Needless to say, the effects may be negative when factors of production shift towards lower-productivity activities (structural effect), or when labour productivity declines owing to technological obsolescence or outdated modes of organization within the different activities (intrinsic effect).

The mathematical formulation of this decomposition, which is applied to compare the indicator values for the 53 classes at two points in time (1994 and 2008) is as follows:

$$\left(P^{2008} - P^{1994} \right)$$
$$= \sum_{i=1}^{n} \left[\left(P_i^{2008} - P_i^{1994} \right) . \left(S_i^{1994} + S_i^{2008} \right) \big/ 2 \right] \quad (1)$$
$$+ \sum_{i=1}^{n} \left[\left(S_i^{2008} - S_i^{1994} \right) . \left(P_i^{1994} + P_i^{2008} \right) \big/ 2 \right]$$

where P_i is productivity in activity i ($i = 1, 2, ...n$) and S_i is the share of the activity i ($i = 1, 2, ...n$) in the total active population employed in the sector. The first term on the right-hand side of equation (1) represents the variation in labour productivity caused by changes in the intrinsic productivity of the n activity classes (intrinsic effect). The second term identifies the contribution made by the recomposition of the labour force (structural effect) (ECLAC, 2007).

The results of the exercise are consistent with the analysis performed previously. In the subperiod 1994-2008, the growth of labour productivity in automotive assembly (class 384110) represents 83.7% of that recorded in the globalized group altogether, and 71.4% of the increase in the indicator for the entire sector. Of the contribution made by this activity, the intrinsic

effect, attributable to technological and organizational improvements within the class, explains 90.9% of that improvement, while the structural effect on the progress achieved is residual. Meanwhile, in activities related to the manufacture of inputs for automotive assembly, the modernization process is weak to say the least (the sum of the intrinsic effects amounts to 23 Mexican pesos at December 2003 prices in the period considered).[9] Moreover, in class 384122 (supply of motors and parts), the two effects as calculated are actually negative, thereby denoting a lack of technology diffusion and capacities

within the activity segment, leading to a widening of efficiency gaps between the terminal industry and its potential local suppliers (see table 5).

The non-globalized group makes only a small contribution to labour-productivity growth in the sector during the period, accounting for just 14.6% of the total sector effect valued at 235.9 Mexican pesos at December 2003 prices. Within this group, however, efficiency improvements are highly concentrated. The sum of classes 381412: "Electroplating of metal parts", and 382206: "Manufacture of air-conditioning machines and refrigeration and heating equipment", accounts for 59.8% of the rise in the indicator in the non-globalized group. Within this group, the results of the activity "Manufacture of containers and products made of tin,

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[9] Results from the sum of the intrinsic effects relating to classes 384121, 384122, 384123, 384124, 384125 and 384126.

TABLE 5

**Determinants of the trend of labour productivity by
activity classes and industry groups 1994-2008**
(Mexican pesos at December 2003 prices)

Non-globalized group				Globalized group			
Activity class	Intrinsic effect	Structural effect	Total effect	Activity class	Intrinsic effect	Structural effect	Total effect
381100	5.1	-0.1	5.0	384110	153.1	15.3	168.5
381201	3.9	-3.7	0.2	384121	12.2	-2.5	9.8
381202	-0.4	-0.8	-1.2	384122	-3.6	-1.8	-5.4
381203	1.5	-0.3	1.2	384123	7.2	4.3	11.5
381300	-0.1	-0.7	-0.8	384124	1.6	0.5	2.1
381401	-0.6	0.1	-0.5	384125	1.7	-0.1	1.5
381404	0.4	1.3	1.7	384126	3.8	5.8	9.6
381405	-0.3	-0.4	-0.7	382302	-3.3	-4.3	-7.6
381407	9.7	-6.3	3.4	383101	5.6	5.2	10.8
381408	0.3	-1.6	-1.2	383102	0.6	0.1	0.7
381409	0.6	-0.2	0.4	383103	0.5	5.7	6.2
381410	-0.1	0.3	0.2	383107	6.7	-5.8	0.9
381412	8.2	4.1	12.3	383108	-0.1	0.2	0.1
382101	2.2	1.1	3.3	383109	8.9	-8.8	0.1
382102	0.5	-0.7	-0.1	383110	-1.0	0.0	-1.0
382103	0.7	2.3	3.0	383201	-2.0	-3.1	-5.1
382104	0.1	-0.2	0.0	383204	-2.4	1.0	-1.4
382106	0.2	-1.3	-1.1	383205	0.9	-4.2	-3.3
382202	0.7	-1.3	-0.6	383206	0.1	-0.6	-0.5
382203	0.0	-0.3	-0.3	383301	0.2	2.1	2.3
382205	1.4	-0.3	1.1	383302	2.4	1.5	3.8
382206	2.9	5.4	8.3	383303	-0.2	-0.7	-0.9
382207	-0.2	0.1	0.0	383304	0.7	-1.9	-1.2
384201	0.4	-0.3	0.1	Total globalized	193.5	7.8	201.4
384202	0.6	0.7	1.3				
384203	-0.8	0.2	-0.5				
385001	-0.2	0.0	-0.2				
385002	0.0	0.0	0.0				
385004	-0.1	0.7	0.6				
385005	-0.2	-0.1	-0.3				
Total non-globalized	36.5	-2.0	34.5				
Total sector	230.0	5.9	235.9				

Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), "Encuesta Industrial Mensual (EIM). Clasificación Mexicana de Actividades y Productos (CMAP), 205 clases de actividad económica", 2013.

metal sheet and aluminium" (381407) are symptomatic, because, like other classes and despite recording an increase in its labour productivity during the period, it experiences efficiency losses owing to labour layoffs (man-hours worked in class 381407 declined from 19,458 in 1994 to 11,082 in 2008).

In this regard, there is overwhelming evidence that structural change (understood here as the shift of labour towards more efficient uses) contributes absolutely nothing to the trend of the indicator, both at the level of the 53 classes and in respect of the two groups defined. Of the total increase in labour productivity, the structural effect explains only 5.9 pesos of the 235.9 pesos in the sector as a whole; it is responsible for 7.8 pesos of the 201.4 pesos in the globalized group; and is actually negative in the non-globalized group (see table 5). In fact, the structural effect is negative in 29 of the 53 classes considered. In the case of automotive assembly, which accounts for most of the sector's technological and organizational

improvements, labour attraction contributes less than 10% of the increase in labour productivity in the period studied (9.1%). This corroborates the inability of the leading industries to create new jobs to compensate for those destroyed in uncompetitive activities, as noted above.

In general, these findings contradict one of the main theoretical arguments for implementing a trade liberalization strategy, namely the existence of a creative-destruction process, in which jobs lost in non-export activities, damaged by the public-policy measures implemented, are offset by new job creation in the leading industries of the specialization pattern. A review of the data base used effectively shows that the electromechanical sector, which encompasses the pillar industries of Mexico's manufacturing export model, shed 370,631 workers in net terms between 1994 and 2008, in other words a reduction of 58,251 man-hours worked.
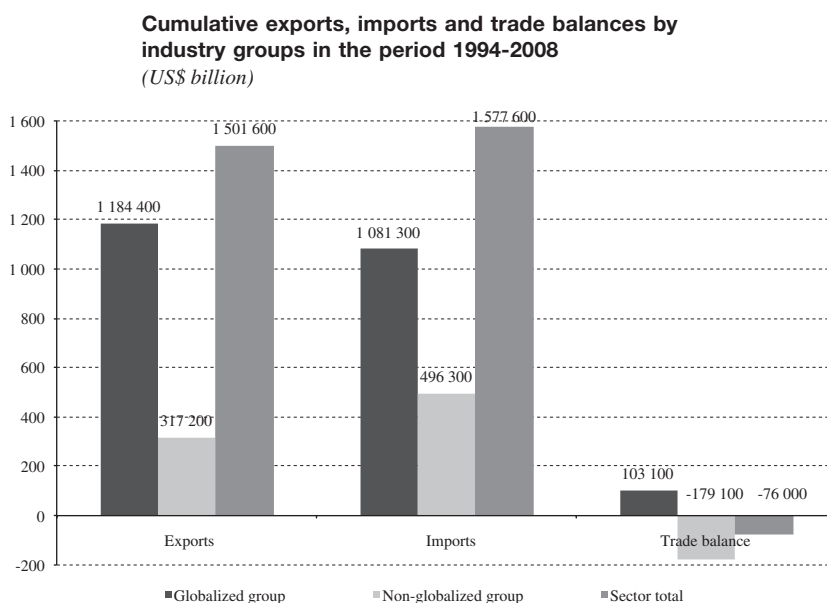
V

Productive specialization and dynamic competitiveness

In terms of export development, the foreign sales of Mexico's electromechanical sector grew vigorously by 380.2% between 1994 and 2008. As a counterpart, however, the sector's imports grew by a very similar amount (358.7%). In fact, in the 15 years of the period indicated, the sector's cumulative trade balance posted a deficit of US$ 76 billion (see figure 3). In 2008, for example, the sector's exports amounted to US$ 169.6 billion: US$ 131.9 billion in the globalized group and US$ 37.7 billion in the non-globalized group. As a result of the liberalization dynamic, however, the sector as a whole reported an external deficit of US$ 9.9 billion in that year, resulting from a trade surplus in the globalized group and a deficit in the non-globalized group. Deindustrialization in the latter group, and the consequent gain of domestic-market shares by imports, thus combined with an organizational rationale of the leading industries of the specialization pattern operating in global production networks, under which most of the inputs included in the exported products are imported.

To evaluate the trend of competitiveness in Mexico's electromechanical sector from a dynamic perspective, a second database was created, in which 1,345 products identified as part of the sector in the HS classification were reclassified according to the Mexican Activities and Products Classification (CMAP) maintained by the National Institute of Statistics and Geography (INEGI) (see annex). Based on this input, an extension of the methodology prepared for the MAGIC programme by the ECLAC Subregional Office in Mexico, was applied to 1,199 of these products.[10] This exercise made it possible to characterize the sector's foreign sales by their performance (dynamic or stalled) and based on the change in each product's relative share of global demand in total goods trade (growing or declining) (ECLAC, 2006). The MAGIC program thus establishes a typology that classifies exports in terms of rising

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[10] As the necessary statistical information was not available for 146 products, the exercise was performed for 1,199 of the 1,345 products present in the database prepared.

FIGURE 3

Cumulative exports, imports and trade balances by industry groups in the period 1994-2008
(US$ billion)

Source: prepared by the author, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

stars (RS), waning stars (WS), lost opportunities (LO), and regressions (R).[11]

The results of the exercise, which compared the years 1994 and 2008, are presented in table 6, where the total value of exports for each typology was calculated with respect to 2008. The sector total confirms the leadership of the electromechanical sector within the Mexican export specialization pattern and its integration into global production networks through the sale of dynamic goods, which, in the period studied, increased their share in world merchandise trade. Of the 1,199 goods considered, Mexico increased its international market share in 710, representing 82.8% of the sector's

total sales abroad in 2008.[12] Of these products, 215, representing 45.5% of total exports in that year, were classified as RS —in other words goods with growing trade in global markets in which Mexico increased its relative share—. The statistical evidence thus reveals a sustainable competitiveness of the global production networks into which these leading industries of the Mexican manufacturing sector are integrated, and an export dynamism that is heavily concentrated in a small number of goods.

In terms of the groups constructed, the exports of the non-globalized group display high levels of both diversification and dynamic competitiveness. In 2008, despite being responsible for just 22.3% of the sector's total exports, this group had foreign sales in 881 of the 1,199 products registered. Of these sales, 78.8% of the value corresponds to merchandise in which these industries increased their global market share, and 38.5% of their value was obtained from "Rising stars" (RS). As table 6 shows, some of these relative figures are similar in the case of the globalized group (318 products of the 1,199 registered, representing the

[11] "Rising star" means that imports of the product in question increased in the United States market and that the country in question gained a larger share of total imports of the product in the United States market. "Waning star" means that imports of the product in question decreased in the United States market, and that the country in question gained a larger share of the total imports of that product in the United States. "Lost opportunity" means that the imports of the product in question grew in the United States market but the country in question accounted for a smaller share of total imports of that product in the United States. "Withdrawn" means that the imports of the product in question decreased in the United States and that the country in question obtained a smaller share of total imports of that product in the United States market (Cordero, 2010, p. 26). The exercise was based on the world market instead of being restricted to the United States, and the comparison of export values was made for 1994 and 2008.

[12] Hereinafter the sector totals are obtained from the sum total of exports of the 1,199 products considered, so as to keep the exercise consistent.

TABLE 6

Typology of products exported by industry groups in 2008
(Number and US$ million)

Groups		Rising star	Waning star	Lost opportunity	Regression	Total
Globalized group	Number of products	54	128	40	96	318
	Value	61 917 400	47 432 600	12 067 700	8 750 500	130 168 200
Non-globalized group	Number of products	161	367	100	253	881
	Value	14 377 500	15 046 800	4 725 200	3 200 800	37 350 300
Sector total	Number of products	215	495	140	349	1 199
	Value	76 294 900	62 479 400	16 792 900	11 951 300	167 518 500

Source: prepared by the author, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

sum of RS (47.6%) and WS (36.4%) and 84% of the value of total exports of the group). This would suggest that certain industries which are not integrated into global production networks, but in some cases have a presence on the domestic market, still have the organizational and technological capacities to be able to compete in the global domain.

An analysis of the leading export products in 2008 confirms both the heavy concentration of the activity in a few tasks and also the restricted aspect of export dynamism achieved. The 50 leading export products represent 71.5% of the sector's total exports; the top 10, all relating to the manufacture of electrical-electronic and computer equipment, or else related to the automotive industry, account for 43.3%; and just three[13] of the 1,1,99 products considered explain 28.4% of the sector's sales abroad. Moreover, when these 50 products are shown in a diagram on the basis of the established typologies, the results do not differ greatly from those seen for the information from the entire database. As would be expected given the leadership of those products in the Mexican manufacturing specialization pattern, the figures are slightly higher in the RS category, which means an increase in global market shares in dynamic goods during the period studied. In terms of the value of foreign sales of these 50 products, 50.4% are classified

as RS (19 products), 34.3% as WS (16 products), 6.9% as LO (eight products) and 8.4% as R (seven products) (see figure 4).

A final note concerns the characteristics of the methodology used and features that are often present calculation of the indicators that exist to evaluate competitiveness. In the case of Mexico, the rapid trade-liberalization process implemented by public policy from the 1980s onwards fuelled a generalized increase in national exports that outpaced the average expansion of international trade generally. This partly explains the increase in the global-market shares of the "leading" products in the Mexican specialization profile. Another trend in the global context reveals the results obtained: dynamic goods, by definition, increase their share in international trade over time, so there is a bias in the methodology used that makes it more likely that the country being analysed will seem to evolve towards more competitive structures. In the case of the methodology developed by ECLAC, the established typologies are constructed by ECLAC trade in goods that are made from a whole series of components and inputs produced in different parts of the world. As it was impossible to consider the domestic value-added content of the goods, the methodology measures trade by the final price of the goods, imprecisely attributing capacities, capital investment, and hours worked to the trade shares. In the case of countries that have maquila-type productive structures, such as Mexico, the exercises tend to overstate the evolution of the export structure, as shown both by negative trade balances of the activity and the relative absence of spillover effects documented above.

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[13] In the HS International Classification these goods are: 852810, Television receivers, including video monitors and video projectors; 870323, Other vehicles, with spark-ignition internal combustion reciprocating piston engine, with cylinder capacity between 1,500 cc and 3,000 cc; and 852520, Transmission apparatus incorporating reception apparatus, etc.

FIGURE 4

Typology of the 50 main products exported by the Mexican electromechanical sector, 2008

(Percentage differences in 2008 with respect to 1994)[a]
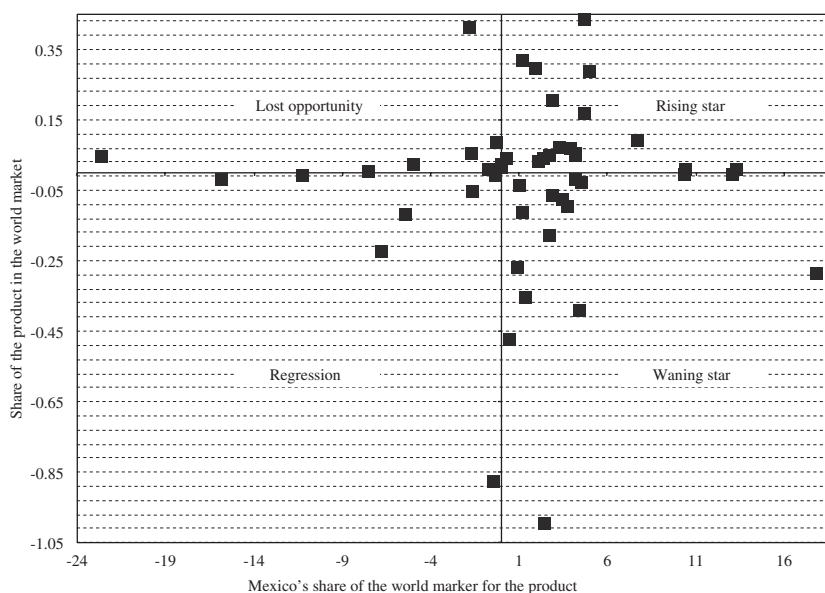
Source: prepared by the author, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

[a] In category 870422 the 1995 value was used because there were no data for 1994 in the information source.

VI

Conclusions

The calculation of different indicators and statistical exercises, based on an extensive compilation of data from different information sources, confirms a number of trends observed in the structural evolution of the Mexican electromechanical sector, which is a pillar of the nation's export specialization profile. Firstly, efficiency improvements and supply have both become increasingly concentrated in a small number of firms that are subsidiaries of transnational automotive assembly enterprises; and this has led to the breakdown of local value chains. Secondly, the leading industries of the export model have been unable to create jobs on a sustained basis or generate substantial technological and organizational spillover and diffusion effects.

The structural analysis also confirms the hypothesis that intrasectoral heterogeneity initially increases within the globalized activities following trade liberalization, and then, once the productive apparatus has been

rationalized, in classes that are not engaged in global production networks. The latter, in some cases maintain the capacity to be competitive on the world stage, despite being immersed in a group that is undergoing obsolescence and deindustrialization. There is also overwhelming evidence of the absence of a significant structural effect that would allow labour to migrate towards more productive uses, thereby partially negating the orthodox theoretical argument used to defend the capacity of the market to assign resources efficiently in the economy.

In terms of global competitiveness, the impossibility of obtaining a long and consistent statistical series that quantifies international trade in terms of the value-added present in the goods, is one of the factors making it harder to comprehensively evaluate the sector's export performance. The results obtained with these constraints provide evidence of sustainably dynamic activity of the

global production networks in which firms resident in Mexico operate, as leaders of the model. Nonetheless, the exports of industries that are not involved in global production networks are also highly diversified and dynamic; and some eminently globalized classes of the electronics subsector display a phenomenon of "spurious" competitiveness, characterized by growing foreign sales accompanied by an adverse trend in labour productivity.

The role and results of the public policy implemented in Mexico as from the 1980s, under orthodox theoretical guidelines, thus seem to confirm the theses that several authors have presented in introductory fashion. As claimed by Coe and others (2004), the measures established have moulded local capacities according to the competitive requirements of global production networks, resulting, among other things, in a twofold specialization of the leading industries in labour-intensive tasks (Deardoff, 1979). Nonetheless, the incapacity of the strategy to generate a significant structural change in terms of national productive development calls the chosen guidelines into question. An alternative proposal, aimed at developing the strategic structural complementarities needed to increase the density and degrees of diversification in the productive system, could therefore be centred on boosting the domestic market and, initially, on satisfying the population's basic needs.

ANNEX

TABLE A.1

Characteristics of the database on the productive structure of the Mexican electromechanical sector

Units	Variables	Time coverage	Sector coverage	Sources
Mexican pesos at December 2003 prices. The data were deflated using the National Producer Price Index (INPP) of the manufacturing sector, calculated by Banco de México (BANXICO) (2011).	Production, man-hours worked and its quotient, the labour- productivity indicator.	Monthly and annual. Period 1994-2008.	13 subsectors and 53 classes of activity[a] 28 620 data items in total.	The need to obtain lengthy and time-consistent series that could reflect possible transformations linked to structural change processes, meant that the only viable data source was the INEGI Monthly Industrial Survey (EIM) (INEGI, 2013a) under the Mexican Activities and Products Classification (CMAP).

Source: prepared by the author.

[a] The globalized group contains 23 activity classes forming part of the following subsectors: 3841, "Automotive industry" (7 classes); 3823, "Manufacture and/or assembly of office, calculation, and information technology processing machines" (1 class); 3831, "Manufacture and/or assembly of electrical machinery, equipment and accessories, including for electric power generation" (7 classes); 3832, "Manufacture and/or assembly of electronic equipment for radio, television, communications and medical use" (4 classes); 3833, "Manufacture and/or assembly of appliances and accessories of domestic use. Excludes electronic appliances" (4 classes). The non-globalized group includes 30 activity classes forming part of the following subsectors: 3811, "Smelting and moulding of metallic pieces, ferrous and nonferrous" (1 class); 3812 "Manufacture of metallic structures, tanks and industrial boilers. Including blacksmith work" (3 classes); 3813, "Manufacture and repair of metallic furniture" (1 class); 3814, "Manufacture of other metallic products. Excludes machinery and equipment" (8 classes); 3821, "Manufacture, repair and/or assembly of machinery and equipment for specific purposes, with or without an integrated electric motor. Includes agricultural machinery" (5 classes); 3822, "Manufacture, repair and/or assembly of machinery and equipment for general uses, with or without an integrated electric motor. Includes mountings" (5 classes); 3842, "Manufacture, repair and/or assembly of transport equipment and parts. Excludes automobiles and trucks" (3 classes); 3850, "Manufacture, repair and/or assembly of precision instruments and equipment. Includes surgical instruments. Excludes electronic instruments" (4 classes). Activity classes 382301, 383202, 384204 and 385006 were not considered because there was no information on them in the survey as from 2003.

TABLE A.2

**Characteristics of the database on the external performance
of the Mexican electromechanical sector**

Units	Variables	Time coverage	Sector coverage	Sources
U.S. dollars at current prices and percentages.	- Exports from Mexico to the rest of the world by product and group. - Imports into Mexico from the rest of the world by product and group. - Share of Mexican exports of each product in the national total. - Mexico's share in the world market for the product. - Total world exports by product and group. - Share of each product in world exports. - Change in Mexico's market share by product. - Change in the share of world exports by product. - MAGIC typology by product.	Annual. Period 1994-2008	1 345 products identified as part of the sector under the Harmonized System (HS 92). 161 400 data items in total.[a]	United Nations Commodity Trade Statistics Database (COMTRADE).

Source: prepared by the author.

[a] To estimate the value of the exports of activity classes regrouped in the CMAP for the period 1994-2008, products manufactured by the electromechanical complex were differentiated under the HS 92 classification. As there are no official disaggregating equivalences between the Mexican Industrial Classification System and those commonly used for international trade, the 1,345 products at the six-digit level identified in HS 92 were reclassified according to the activity classes of the Mexican Activities and Products Classification (CMAP).

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Technological capacity-building in unstable settings: Manufacturing firms in Argentina and Brazil

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ABSTRACT

From the 1970s onward, the macroeconomic context in Argentina and Brazil was characterized by drastic economic changes and instability. Numerous studies have documented the generally negative effect of this environment on the innovation capacities of the manufacturing sector. This paper, however, analyses the possible emergence of new innovation capacities in the period, bringing two important phenomena to light. First, a quite substantial number of firms, even in unstable settings, redoubled their innovation efforts. Second, these firms are mainly found in a small group of sectors associated with the countries' static advantages or in sectors favoured by specific sectoral regimes. The findings, although exploratory, are a contribution to the debate on the development of innovative capacities in unstable macroeconomic contexts and the ability of sectors associated with the two countries' static advantages to generate spaces of innovation and value creation.

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I

Introduction

This paper studies the experience of Argentine and Brazilian manufacturing firms with the accumulation of innovative capacities over the past two decades. The time frame chosen coincides with a context of economic instability and changing economic policies in both countries. This is unusual in studies of innovative capacity-building in emerging countries, which have tended to analyse long periods of continuous accumulation covering two, three or more decades.[1] Such studies reveal long-term continuity on two levels. First, they usually show capacity development at the microeconomic level progressing without complications through successive stages of ever "deeper" innovation activities. Second, in the relatively few Asian countries where most of the knowledge about the long-term technological behaviour of industrial firms in emerging countries has been generated, institutional and political contexts evolved continuously and were fairly stable. Although there were changes in the main policy emphases and some political and economic shocks, crises were not far-reaching or damaging enough to destroy and disperse existing innovation capacities. Consequently, the main lines of technological development were rarely disrupted, let alone cut short or reversed.

The Latin American experience has been very different. Following a period of cumulative firm-level capacity-building in the context of the relatively stable regimes and policies of the import substitution industrialization (ISI) period between the 1950s and 1970s, instability and fluctuations in the business cycle became recurrent. Not only have most of the region's countries been affected by acute economic and financial crises, but they have implemented far-reaching changes in the orientation of economic policy in the last few decades. Between the 1980s and 1990s, trade and finance were liberalized, State involvement in the economy was reduced, currencies appreciated and foreign investment was favoured. Thereafter, the State gradually recovered its influence on the economy and neoliberal policies began to retreat.

These fluctuations and sudden shifts in the political and economic context are at the centre of the present study on technological capacity-building in the region, which takes manufacturing industry in Brazil and Argentina as its case studies.[2] Many earlier works have characterized the innovation pattern of firms in the Latin American countries over the past few decades, including Katz (2001 and 2007), Cimoli and Katz (2003), Chudnovsky, López and Pupato (2006), Baer (1970 and 1972), Teitel and Thoumi (1987) and Erber, Guimarães y Tavares Araújo Jr. (1974). Most of these studies have analysed the generally negative repercussions of the economic reforms of the 1980s and 1990s for the innovation capacity of the manufacturing sector.[3] However, this study adopts a rather different perspective. The question needs to be asked as to whether there has been any process of new innovation capacity-building in the manufacturing sector during this period of drastic economic change and macroeconomic instability (when the prevailing effect on firms' innovation capacities has been negative), what the sectoral ecology of this process is, and in what types of firms these capacities have arisen. The focus of the present research is on the new clusters of innovative firms created following the structural transformations in these countries during the 1990s. It should be pointed out that the approach is dynamic and relative, not static or absolute. The focus is not on individual cases of successful firms at a given point in time but rather on the way the technological efforts and outcomes of the main clusters of innovating firms have evolved.

The empirical analysis is based on evidence from innovation surveys. In Argentina, the surveys available cover the period from the early 1990s to the mid-2000s, while in Brazil they cover a shorter period in the 2000s. The analysis centres on firms that were in the vanguard of innovation in the countries and periods analysed. These firms were identified by taking those that claimed to have introduced a product or process innovation (or

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[1] For example, Amsden (1989) in the Republic of Korea between the 1960s and 1980s; Kim (1997) on accumulation processes in the Republic of Korea; Hobday (1995) in Singapore, Taiwan Province of China and the Republic of Korea in the 20 to 30 years after the 1970s; and Mathews and Cho (2000) in their study of the development of the semiconductor industry in Asian countries.

[2] A forerunner of this study is Marín and Bell (2012), centring on Argentina in 1992-2001.

[3] Although some innovation activities were carried out with positive results, particularly productivity increases and a narrowing of the efficiency gap with leading countries as a result of technology investment in several areas of the economy, especially industries associated with the exploitation and processing of natural resources.

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both) that was new to the world economy at the start of the period studied. This innovation outcome indicator, while subjective, does make it possible to identify the most significant end of the innovative firms distribution.

The evidence analysed reveals some striking (or not wholly foreseeable) facts. First, new clusters of innovative firms seem to have been emerging despite the crises and far-reaching changes in economic policy orientation that have characterized these countries in recent decades. This evidence, although preliminary, goes against a pessimistic view in the region that has mainly identified negative results. It is interesting to note, however, that these clusters of innovators are found in a small number of sectors protected by static location advantages (such as traditional sectors or those associated directly or indirectly with natural resources) and indeed some sectors favoured by public policies, such as the automotive sector, which benefits from a special protection regime in both Brazil and Argentina. Lastly, and once again challenging pessimistic notions about the innovation intensity and potential dynamism of sectors protected by static advantages (such as natural resource-linked and traditional sectors), it can be seen that firms in these sectors have been making substantial, above-average efforts to improve their innovation and technology performance, albeit from very low levels.

This research is wholly exploratory. No attempt is made to give definitive answers to all the questions

raised, the intention being rather to bring new empirical evidence to the debate about the generation of innovation advantages in the region's countries. The information analysed does not cover the past few years, since innovation surveys are unavailable from 2005 onward. However, that does not take away from the main conclusions of this study, since to a large extent the phenomena identified have longer-term repercussions. Lastly, it should be stressed that the purpose of this paper is to present Argentina and Brazil as two case studies, but not to draw a comparison between them. The difficulty of comparing lies in the fact that different samples of dissimilar firms are taken for different periods, and that the indicator used to identify innovative firms, being subjective, could be influenced by national biases in the way the information employed in it is interpreted and understood.

The article is structured as follows. Section II briefly describes the context of instability in which manufacturing firms in Argentina and Brazil have operated since the relatively stable period of protection during ISI. Section III lays out the data and methodology. Section IV presents the first set of findings, identifying the sectors to which the most innovative firms belong. Section V concentrates on characterizing particularly innovative firms, identifying their origins and history and their patterns of technological behaviour. Section VI presents the implications of all this and provides some reflections based on the findings.

II

The context: from protection to exposure in a setting of profound instability

1. The beginnings of industry: the protectionist stage

The industrial and technological development of manufacturing in Argentina and Brazil began almost spontaneously in the late nineteenth century, when the agricultural export model was dominant in both countries. In the 1930s, however, the State began to actively promote industrialization by implementing policies to protect the domestic market (i.e., tariff barriers), creating State institutions (lending institutions and development banks) and providing infrastructure. As a result of these policies, four decades later Argentina and Brazil had developed a

diversified and fairly sophisticated manufacturing sector that had begun to act as a driver of their economies.

However, industrialization in Argentina and Brazil was heavily dependent on imported inputs and capital goods from the start. This characteristic, combined with weak export growth, led to recurrent balance-of-payments deficits which fed through to the main macroeconomic variables, creating regular crises, instability and inflation.

Many authors saw the inability of the manufacturing sector to generate exportable growth, reduce import dependence and secure steady as opposed to stop-start growth as being due particularly to certain limitations and imbalances that characterized technological learning and

industrial capacity-building (Katz, 1972, 1987, 2001 and 2007; Katz and Kosacoff, 1989 and 2000; Dahlman, 1984; Dahlman and Fonseca, 1987; United Nations, 1969). It has been argued that there was substantial growth in the manufacturing sector during the period, accompanied by steady increases in aggregate productivity and significant technological learning, particularly in some low- and medium-technology sectors (Teitel and Thoumi, 1987).

However, there were two major constraints. First, excessive vertical integration and limited specialization in engineering, combined with an abundant supply of skilled labour, resulted in an excessive domestic focus on adapting and incrementally improving technologies at the expense of investment in incorporated technological change or research and development (R&D) aimed at significantly reducing costs and developing more "radical" innovations and new products (Teitel, 1981; López, 1996). Indeed, the evidence is that spending on R&D, royalties, patents and franchises was low by international standards for the time (Katz, 1972). Second, inward technology transfer within sectors was very limited (Dahlman and Frischtak, 1990). In each sector, a small set of firms that had succeeded in attaining global standards of productivity through innovation efforts in engineering, quality, design and organization usually coexisted with a mass of firms characterized by low productivity, little innovation effort, obsolete equipment and products that were of low quality by international standards. It has been argued that the lack of external competition was a decisive factor in discouraging technological modernization and innovation across much of the production spectrum.

2. Structural reforms: destruction and resurgence

The progressive industrialization that took place, with fluctuations, throughout the twentieth century came to a sudden halt in the mid-1970s as economies were opened up and regulations and subsidies protecting the industrial sector were removed (Katz and Kosacoff, 2000). The economic instability and debt crisis of the 1980s further entrenched the process of economic and industrial stagnation. In consequence of these contextual and policy changes, manufacturing in Argentina and Brazil underwent the deepest crisis in the history of the industrial sector in the late 1970s and early 1980s. This crisis manifested itself, among other things, in the exit of firms from the market, a sharp fall-off in investment and the increasing obsolescence of capital equipment (see, among others, Katz, 2001; Kosacoff, 1996; Ferraz, Kupfer and Serrano, 1999; Baer, 2001).

In the 1990s, the liberalization and deregulation process initiated in the mid-1970s was carried further, although some novel elements also emerged: the privatization of most public-sector enterprises, price stabilization[4] and currency appreciation. These elements imposed a new competition environment on industry. Studies carried out in the late 1990s and early 2000s identified the following trends as a consequence of the transformations wrought in the 1990s:

(i) A slowdown in industrial growth: in Argentina, the contribution of the industrial sector to gross domestic product (GDP) fell from 19% in 1990 to 16% in 2000, while in Brazil industry grew at a slower rate even as it maintained its GDP share at a similar level throughout the 1990s (Barros de Castro, 2003; Ferraz, Kupfer and Iootty, 2004).

(ii) Changes at the sectoral level: some industries shrank,[5] some new ones were added to the industry mix and others disappeared. Industrial and natural resource-based commodities increased their presence (Cimoli and Katz, 2003; Ferraz, Kupfer and Iootty, 2004).

(iii) Increased heterogeneity and concentration: some firms, mostly large ones and subsidiaries of multinationals, substantially raised their productivity and matched international best practices by investing in equipment and implementing organizational changes (introducing process automation, for example). However, a great many firms, particularly small and medium-sized ones (SMEs), were unable to implement these changes and disappeared, while others simply hung on, improving their productivity essentially by shedding employees (Kosacoff, 1996, 2000a and 2000b; Ferraz, Kupfer and Iootty, 2004; Katz and Bercovich, 1993).

(iv) The closing of the productivity gap: in many sectors, modernization was carried out by rationalizing costs and acquiring technologies from abroad. Tie-ups with international suppliers, licensing and online technical assistance became the preferred channels. At the same time, local equipment suppliers, engineering firms and R&D laboratories lost ground (Katz, 2001; Ferraz, Kupfer and Haguenauer, 1996; Ferraz, Kupfer and Iootty, 2004).

(v) Transnationalization: Argentina and Brazil became the main destinations for foreign direct

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[4] Price stabilization following enactment of the 1991 Convertibility Act in Argentina and the 1994 Real Plan in Brazil.

[5] In Argentina, the metallurgy and chemical industries, the two most dynamic during the ISI period, contracted in the 1990s.

investment (FDI) in Latin America. In Argentina, the foreign share of total sales by the 200 largest manufacturing firms increased from 43% in 1994 to 69% in 1998 (Kulfas, Porta and Ramos, 2002). In Brazil, multinationals increased their share of sales by the country's 300 largest firms from 14.8% to 36.4% (Rocha and Kupfer, 2002). Incoming capital was used mainly to acquire existing assets via privatization, mergers and acquisitions. Thus, the incorporation of foreign capital tended to take

the form of takeovers of existing firms rather than an increase in gross fixed capital.

These characteristics arose in a context of great macroeconomic instability: periods of stabilization and growth followed by others with negative growth rates, shocks from international crises and external vulnerability. The main focus of the present analysis is on the generation of innovative capacities in the manufacturing sector from the 1990s to the mid-2000s.

III

Data and methodology

1. Data

The data used are from innovation surveys carried out among manufacturing firms in Argentina and Brazil. In the case of Argentina, surveys covering the periods 1992-1996 and 2002-2004 were used, while for Brazil surveys from 2000 and 2005 were analysed. Because the samples of firms altered between one survey and the next,[6] the data are based on a subsample of firms featuring in every survey considered in each country. This subsample contains 608 firms in Argentina and 3,890 in Brazil.

2. Methodology: selecting innovative firms

The study aims to identify firms in the vanguard of innovation activity in the Argentine and Brazilian manufacturing sectors over recent decades, i.e., the subgroup of the 608 firms surveyed in Argentina and the 3,890 in Brazil that can in some way be categorized as "particularly innovative". It was not considered appropriate to employ for this purpose either of the two indicators most commonly used to measure firms' innovation capacity, namely patents and R&D spending.

- Results indicators based on patents usually have limitations, as they reflect invention rather than innovation, and because they have a strong sectoral bias (Scherer, 1983; Harabi, 1995; Levin and others, 1987). Furthermore, indicators based on patents

are particularly inappropriate in contexts such as those of Argentina and Brazil, where firms rarely use patents to protect their new knowledge. This is mainly for two reasons: (i) firms are usually adopters of technologies at or close to the frontier; (ii) there is a sectoral bias in the region towards process industries, where there is usually less of a tendency to patent. In Argentina, for example, according to data from the National Institute of Statistics and Censuses (INDEC), the Secretariat of Science and Technology (SECYT) and the Economic Commission for Latin America and the Caribbean (ECLAC), between 1998 and 2001 just 10% of innovators patented (Chudnovsky, López and Pupato, 2006). In this study, the concern is to capture the general characteristics of all innovative firms, not just those that patent, meaning that indicators of this type are not wholly suitable.

- Indicators based on R&D reflect the efforts made by firms to create knowledge, but do not show how effective this activity is and, more importantly in this context, tend to reflect differences in R&D intensity between industries rather than specific differences in innovation intensity between firms. Furthermore, these indicators tend to underestimate innovation activities closely related to production and information processing (Patel, 2000).

As innovation surveys have spread in many countries, different measures have begun to be used in the past 15 years to evaluate the innovativeness of firms. The most popular, when the aim is to measure outcomes rather than efforts, has been the percentage of sales accounted for by innovative products. In principle, this

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[6] In Argentina, the 1992-1996 innovation survey covered 2,430 firms and the 2002-2004 survey 1,690. In Brazil, the 2000 and 2005 innovation surveys covered 10,328 and 12,172 firms, respectively.

is a good direct measure of innovation outcomes, but it discriminates against process innovation (which is particularly important in Argentina and Brazil). This is why a different measure was chosen for the present study. Following the standard distinctions of the Oslo Manual (OECD, 1997), innovation surveys ask manufacturing firms about the degree of novelty entailed in innovations to products or processes, or both, introduced by them into the market during the survey period. When firms are asked about their innovation performance, four possible answers are available:

(i)   no product (or process) innovations were introduced;
(ii)   product (or process) innovations new to the firm were introduced;
(iii) product (or process) innovations new to the local economy were introduced; or
(iv)   product (or process) innovations new to the world economy were introduced.[7]

Firms answering yes to the last of these options in the first innovation survey carried out in each country were taken to be the most innovative. An obvious constraint is that the answers are subjective. Answers by firms claiming to have introduced this category of innovation may not be a very accurate reflection of what innovations actually are "new to the world market". However, this kind of accuracy is not the main issue here, as the main concern is with the relative innovation capacity of firms within each country, rather than with the identification of global leaders. The firms surveyed have the option of selecting less novel forms of innovation, and it would seem that, at least in relative terms, this category does adequately capture the most significant end of the innovative firms distribution.

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[7] See the latest version of the Oslo Manual (OECD, 2005, pp. 46-47) for an explanation of these categories.

To avoid confusion, the term "significantly innovative firms" will be used in the rest of the analysis for firms replying that they had introduced product or process innovations or both that were new to the global economy. The rest will simply be termed "non-innovative firms", even though the latter group includes firms claiming to have introduced innovations that were new to the firm or the country. In the samples analysed, 68 Argentine firms (11%) and 167 Brazilian firms (4.3%) were found to be significantly innovative. Of these, most innovated only in products (60% in Brazil and 67% in Argentina). A larger share of firms in Brazil (28.1%) than in Argentina (7.4%) introduced only process innovations into the market. Those introducing both product and process innovations amounted to 12.6% of the total in Brazil and 25% in Argentina (see table 1).

It should be pointed out that the subjective character of the indicators used means that the findings for Argentina and Brazil ought not to be compared, as they could reflect national biases in the way the question is interpreted.

TABLE 1

Types of innovative firms in Argentina and Brazil
(Numbers and percentages)

Type of firm	Argentina	Brazil
Non-innovative	540 (88.8)	3 723 (95.7)
Significantly innovative	68 (11.2)	167 (4.3)
Process innovation only	5	47
Product innovation only	46	99
Product and process innovation	17	21
Total	608 (100)	3 890 (100)

Source: prepared by the authors, on the basis of the Survey on Technological Behaviour of Argentine Industrial Firms (1992-1996) and the National Survey of Firms on Innovation, Research and Development and Information and Communication Technologies (2002-2004) in Argentina, and the Survey on Technological Innovation (PINTEC) (2000 and 2005) in Brazil.

IV

Analysis I: sectoral distribution of significantly innovative firms

This section studies the sectoral ecology of firms identified as significantly innovative. In particular, the aim is to establish whether there is a set of sectors where these firms cluster, as this will reveal areas of dynamic comparative advantages. With this in view, manufacturing sectors were

classified into two groups using the three-digit International Standard Industrial Classification of All Economic Activities (ISIC): sectors including at least one significantly innovative firm, and sectors with no such firms. The latter were discarded for the purposes of the analysis.

There are 31 sectors with at least one significantly innovative firm in Argentina and 70 in Brazil. It should be stressed, however, that the distribution of significantly innovative firms between sectors is far from homogeneous. There are sectors with many more significantly innovative firms than others (see column 3 of tables 2 and 3). To identify the sectors where significantly innovative firms cluster, the sectoral distribution of these firms was considered and sectors were classified into two groups: (i) those where the concentration of firms is equal to or greater than the median of the distribution ("sectors with clusters of significantly innovative firms"), and (ii) those where the concentration of firms is below the median of the distribution ("sectors without clusters of significantly innovative firms").[8] From here onward, firms in the first group of sectors will be referred to as "clustered innovative firms" and those in the second group of sectors as "isolated innovative firms".

Tables 2 and 3 show that clustered innovative firms are concentrated in a small set of sectors within manufacturing industry: five sectors in Argentina and seven in Brazil. These sectors account for 42% and 31% of firms of this type in Argentina and Brazil, respectively.

Some further observations should be made about the intrasectoral composition of the group of sectors with clusters of significantly innovative firms. Clustered innovative firms represent 18% of all firms in these sectors in Argentina and 7% in Brazil (see the fourth column in tables 2 and 3), i.e., 82% and 93% of firms in sectors with clusters of innovative firms are not significantly innovative in Argentina and Brazil, respectively. This suggests that the selection in this study encompasses a fairly small group at the upper end of the corporate innovativeness distribution.

In terms of sectoral ecology, one important characteristic to highlight is that four of the five sectors with clustered innovative firms in Argentina and four of the seven with the same characteristics in Brazil are associated via input-output links with natural resource-based industries[9] (see table 4). Argentina accounts for the bulk of innovative firms clustered in a group of sectors directly and indirectly linked to natural resources. The sectors directly linked to the exploitation and processing of natural resources are those that process agricultural and livestock products, while the sectors indirectly linked to the exploitation and processing of natural resources are those supplying inputs for agricultural production (fertilizer and machinery). These sectors involve the type of production activity for which Argentina has a historical competitive advantage. It should also

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[8] The list of sectors without clusters of significantly innovative firms is available from the authors on request.

[9] See annex for the methodology.

TABLE 2

Distribution of significantly innovative firms between sectors in Argentina
(Three-digit ISIC categories)

Sector		Significantly innovative firms in the sector as a share of all significantly innovative firms	Significantly innovative firms in the sector as a share of all firms in the sector
(1)	(2) Firms *(number)*	(3) *(percentages)*	(4) *(percentages)*
Clustered innovative firms	29	42	18
Manufacture of pesticides and other agrochemical products	9	13	17
Production, processing and preservation of meat, fish, fruit, vegetables, oils and fats	7	10	18
Manufacture of agricultural and forestry machinery	5	7	45
Manufacture of other food products	4	6	13
Manufacture of parts and accessories for motor vehicles and their engines	4	6	24
Isolated innovative firms	39	58	9
Total	68	100	11

Source: prepared by the authors, on the basis of the Survey on Technological Behaviour of Argentine Industrial Firms (1992-1996).

ISIC: International Standard Industrial Classification of All Economic Activities.

TABLE 3

Distribution of significantly innovative firms between sectors in Brazil
(Three-digit ISIC categories)

Sector	Firms *(number)*	Significantly innovative firms in the sector as a share of all significantly innovative firms *(percentages)*	Significantly innovative firms in the sector as a share of all firms in the sector *(percentages)*
(1)	(2)	(3)	(4)
Clustered innovative firms	50	31	7
Manufacture of pharmaceuticals and medicinal chemicals	12	7	13
Manufacture of footwear and parts of footwear	8	5	4
Manufacture of parts and accessories for motor vehicles and their engines	7	4	6
Manufacture of basic chemicals, fertilizers, nitrogen compounds, plastics in primary forms and synthetic rubber	6	4	17
Manufacture of agrochemical products	6	4	24
Manufacture of pumps, compressors, taps and valves	6	4	12
Manufacture of plastic products	5	3	3
Isolated innovative firms	97	69	3
Total	167	100	4

Source: prepared by the authors, on the basis of the Survey on Technological Innovation (PINTEC) (2000 and 2005) in Brazil.

ISIC: International Standard Industrial Classification of All Economic Activities.

be emphasized that a large part of the rationale for the ISI regime was to shift production specialization away from sectors of this type, in part because they were regarded as "low-technology" sectors that did little to further the incorporation of more important innovative activities within the economy (especially in the case of the industries most directly linked to natural resources).

In Brazil, sectors with clustered significantly innovative firms are more diversified between sectors connected and unconnected to activities based on the exploitation and processing of natural resources. Nonetheless, more than half of all clustered innovative firms (60%) are involved with natural resource-based activities, typically as suppliers. Particularly prominent among sectors linked to natural resources as suppliers are those involved in the "manufacture of basic chemicals, fertilizers, nitrogen compounds, plastics in primary forms and synthetic rubber", "manufacture of agrochemical products", "manufacture of pharmaceuticals and medicinal

chemicals" and "manufacture of pumps, compressors, taps and valves". It is important to clarify that while the sectors just mentioned are linked via input-output relationships to activities based on natural resource processing (see annex), it would be a mistake to think that the whole set of firms belonging to these sectors are necessarily related. For example, the "manufacture of pharmaceuticals and medicinal chemicals" sector may include both innovative firms supplying inputs to natural resource-based activities and others not connected to natural resources (such as pharmaceutical firms working in the area of human health).

Other sectors in which innovative firms cluster but which are not connected to natural resources are traditional ones such as "manufacture of footwear and parts of footwear" and "manufacture of plastic products". Clustered innovative firms that are not linked to natural resources also appear in Argentina and Brazil in sectors connected with automotive production (sectors 343 and 344). These reflect what

TABLE 4

Classification of sectors with clusters of significantly innovative firms in Argentina and Brazil

| | Sectors linked to natural resource-based industries | | Sectors not linked to natural resource-based industries |
	Directly	Indirectly	
Argentina	- Production, processing and preserving of meat, fish, fruit, vegetables, oils and fats (151) - Manufacture of other food products (including bread, biscuits, sugar, cocoa, tea and maté, among others) (154)	- Manufacture of pesticides and other agrochemical products (242) - Manufacture of agricultural and forestry machinery (292)	- Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers (343)
Brazil		- Manufacture of basic chemicals, fertilizers, nitrogen compounds, plastics in primary forms and synthetic rubber (241) - Manufacture of agrochemical products (242) - Manufacture of pharmaceuticals and medicinal chemicals (245) - Manufacture of pumps, compressors, taps and valves (291)	- Manufacture of footwear and parts of footwear (193) - Manufacture of parts and accessories for motor vehicles and their engines (344) - Manufacture of plastic products (252)

Source: prepared by the authors, on the basis of input-output matrices for Argentina and Brazil.

remains of the flourishing automotive metallurgy industry that was nurtured during the ISI period and that since the early 1990s has been at the centre of a system of sectoral policies which includes a special trading regime between the two countries and incentives for producers.

Sectors with clusters of innovative firms were deemed more innovative, since firms of this type represent a larger percentage of all firms in these sectors than in sectors without such clusters (see the fourth column of tables 3 and 4). It must be stressed, however, that among the latter are a number of sectors where significantly innovative firms represent a larger proportion of the total than in the group of sectors where significantly innovative firms cluster. However, these sectors contain very few firms, and they appear rather to be isolated instances of innovation than areas of sectoral clustering. Some sectors with these characteristics are the "processing of nuclear fuel" sector in Argentina and Brazil (100%), the "manufacture of insulated wire and cable" sector in

Argentina (50%) and the "service activities incidental to oil and gas extraction excluding surveying" sector in Brazil (33%).

In summary, it transpires that firms identified as significantly innovative in the countries analysed are clustered in a small group of sectors. In Argentina, four of the five sectors concerned are directly or indirectly linked to natural resource exploitation and processing activities. There is more variability in the case of Brazil, with none of the sectors being directly connected to natural resources as customers, but there are some sectors that are clearly associated with natural resources as suppliers and, strikingly, some traditional sectors too. Featuring in both countries is the automotive sector, which has a special protection regime. Since both natural resource-linked activities (particularly those identified as having a direct link) and traditional ones are regarded as low-innovation and low-value added activities, this result, taken by itself, is surprising. The next section goes into this in depth.

V

Analysis II: characterization of clustered innovative firms

This section looks more closely at the characteristics of clustered innovative firms. The first aim is to understand the structural characteristics of these firms, such as the origin of their capital, their size and their patterns of innovation behaviour. To this end, clustered innovative firms are compared with other groups of firms such as isolated innovators, non-innovators, firms in "high-technology" industries,[10] the subsidiaries of foreign companies and the whole manufacturing establishment in general. This is followed by an exploration of the way firms' innovation behaviour changed over the period studied, with their technological behaviour being evaluated using two types of innovation effort indicators:

(i) the intensity of firms' R&D spending (R&D spending as a share of total sales), and

(ii) the intensity of investment in capital goods for innovation (spending on capital goods as a share of total sales).

The evidence is presented first for Argentina and then for Brazil. It is important to clarify that the data on firms' innovation behaviour in the two countries are not comparable, as they cover different years and were collected from different samples. The greatest difference is that in Brazil the averages are calculated with reference to a sample of innovative firms (firms replying that they have not innovated during the period are excluded), while in Argentina the averages are calculated from the total sample of firms interviewed, innovative or otherwise.

1. Clustered innovative firms in Argentina

The majority of clustered innovative firms connected to natural resources in Argentina[11] are independent (52%), while smaller proportions are subsidiaries of international companies (31%) and local business groups (17%) (see table 5). The composition of this set of firms differs from that of the whole set of Argentine manufacturing firms in that it includes a smaller share of independent firms (71% of the manufacturing sector is composed of

independent firms) and a larger share of subsidiaries of foreign companies and local business groups (accounting for 17% and 11% of the manufacturing total, respectively). As regards size, clustered innovative firms are larger than the mean for the manufacturing sector (see table 6), with 48% of clustered innovative firms having over 200 employees, as against just 39% of the whole set of manufacturing firms.

In terms of innovation behaviour, in the early 1990s clustered innovative firms in Argentina as a group made greater efforts in capital investment (1.33%) than in R&D (0.10%). The pattern observed for firms of this type was also seen for the other types of firms considered (see categories 2 to 6 of table 7). However, the difference between the intensity of spending on capital goods for innovation and spending on R&D was smaller for clustered innovative firms (taken all together) than for the other groups of firms. Another interesting point to come out of the analysis is that clustered innovative firms, together with those in high-technology sectors, are the ones that invested most in R&D as a proportion of sales, although it might be noted that levels of R&D spending were generally quite meagre.

When innovation behaviour is analysed separately between the different groups of clustered firms, there are found to be substantial differences between them that are worth highlighting. The innovation activity of clustered firms linked to natural resources as customers was mainly based on investment in new technologies already incorporated into capital goods. Internal R&D spending, on the other hand, ranked among the lowest, along with that of non-innovative firms. Conversely, clustered firms indirectly linked to natural resources, along with high-technology firms, were among the types of firms investing most in R&D in the early 1990s. They spent 0.17% of sales on R&D activities, whereas manufacturing firms as a whole invested 0.06% of sales in the period.

As for innovative firms clustered in industries linked directly to natural resources, the pattern almost exactly matches the observations made in earlier studies of innovation activity in the 1990s. Innovation largely consisted in investments that were intensive in

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[10] Using the high-technology firms classification of the Organization for Economic Cooperation and Development (OECD).

[11] In Argentina, the focus is essentially on firms clustered in natural resource-linked sectors, as they account for the bulk of the total.

TABLE 5

Firms in Argentina by ownership type
(Numbers and percentages)

	Innovative firms clustered in natural resource-linked industries	Isolated innovative firms	Non-innovative firms in all industries	Manufacturing sector total
Local business groups	5	7	57	69
	(17)	(18)	(11)	(11)
Independent local firms	15	24	395	433
	(52)	(62)	(73)	(71)
Subsidiaries of multinationals	9	8	88	105
	(31)	(21)	(16)	(17)
Total	29 (100)	39 (100)	540 (100)	608 (100)

Source: prepared by the authors, on the basis of the Survey on Technological Behaviour of Argentine Industrial Firms (1992-1996) and the National Survey of Firms on Innovation, Research and Development and Information and Communication Technologies (2002-2004).

TABLE 6

Firms in Argentina by size
(Numbers and percentages)

	Innovative firms clustered in natural resource-linked industries	Isolated innovative firms	Non-innovative firms in all industries	Manufacturing sector total
SMES	15	27	327	369
	(52)	(69)	(60)	(61)
Large firms	14	12	213	239
	(48)	(31)	(40)	(39)
Total	29 (100)	39 (100)	540 (100)	608 (100)

Source: prepared by the authors, on the basis of the Survey on Technological Behaviour of Argentine Industrial Firms (1992-1996) and the National Survey of Firms on Innovation, Research and Development and Information and Communication Technologies (2002-2004).

Note: small and medium-sized enterprises (SMES) are those with 200 employees or less and large enterprises those with at least 200 employees.

TABLE 7

Argentina: innovation behaviour in the manufacturing sector, 1992

Types of firms	R&D intensity	Capital investment
	Average values per firm *(percentages)*	
1. Innovative firms clustered in sectors:	0.10	1.33
- directly linked to natural resources	0.01	1.49
- indirectly linked to natural resources	0.17	1.23
- not linked to natural resources	0.12	-10.16
2. All other innovative firms	0.09	1.97
3. Firms in "high-technology" industries	0.20	1.57
4. Subsidiaries of foreign multinationals	0.06	3.17
5. Non-innovative firms	0.01	1.47
6. All firms	0.06	1.81

Source: prepared by the authors, on the basis of the Survey on Technological Behaviour of Argentine Industrial Firms (1992-1996) and the National Survey of Firms on Innovation, Research and Development and Information and Communication Technologies (2002-2004).

R&D: research and development.

technologies already incorporated into capital goods, and production capacity was substantially enhanced as a result. However, there was virtually no sign of R&D within firms themselves, and innovative knowledge creation capacity was hardly in evidence. In the case of firms clustered in sectors indirectly linked to natural resources, on the other hand, the findings suggest that even in the darkest periods of innovation capacity destruction in the late 1980s and early 1990s, the agricultural sector sustained a group of chemical and machinery suppliers that formed a locus of clustered innovative firms in the vanguard of innovation activity as creators of knowledge within the Argentine manufacturing sector.

It is also interesting to supplement the above data with others that reflect developments in firms' innovation behaviour during the period analysed from 1992 to 2004. Table 8 shows the findings for the indicators analysed. Over more than a decade, innovative firms clustered in sectors both directly and indirectly linked to natural resources were distinguished by the growing intensity of R&D investment. In particular, firms in the former sectors increased the intensity of this spending almost three times as fast as the manufacturing sector average, i.e., by considerably more than non-innovative firms, which, along with this group of firms, were the ones that invested least in R&D at the start of the period. As regards innovative firms clustered in sectors indirectly linked to natural resource-based activities, these increased the intensity of R&D spending more quickly than other groups with a comparable intensity of R&D expenditure at

the start of the period (such as firms in high-technology sectors). Clustered firms not linked to natural resources, conversely, were the only ones to show negative rates of increase in R&D spending.

In 1992-2004, investment in capital goods for innovation fell in all the groups of firms considered. However, innovative firms clustered in sectors linked to natural resources were the ones that reduced their investment in this area least as a percentage of sales. In particular, innovative firms clustered in sectors directly linked to natural resources were alone in practically maintaining their investment in capital goods for innovation at the levels of the start of the period, even though their sales increased substantially.

In summary, taken together for the whole period analysed, the two groups of innovative firms clustered in sectors linked to activities based on the exploitation of natural resources constituted, by virtue of their relative efforts in innovation activities, an important locus of knowledge creation and usage capacity in Argentine manufacturing industry. This was a substantial and potentially important contribution, particularly at a time of great instability and upheaval like the one considered.

2. Clustered innovative firms in Brazil

Among clustered innovative firms in Brazil, whether or not linked to natural resource-based activities, local business groups are more heavily represented and

TABLE 8

Argentina: changes in innovation behaviour in the manufacturing sector, 1992-2004

Types of firms	R&D intensity	Capital investment
	Average values per firm *(percentages)*	
1. Innovative firms clustered in sectors:	17.12	-4.29
- directly linked to natural resources	31.84	-0.38
- indirectly linked to natural resources	16.25	-8.96
2. All other innovative firms	8.69	-7.40
3. Firms in "high-technology" industries	10.83	-10.59
4. Subsidiaries of multinationals	11.02	-14.95
5. Non-innovative firms	23.41	-7.50
6. All firms	11.57	-7.34

Source: prepared by the authors, on the basis of the Survey on Technological Behaviour of Argentine Industrial Firms (1992-1996) and the National Survey of Firms on Innovation, Research and Development and Information and Communication Technologies (2002-2004).

R&D: research and development.

independent local firms less so than in the manufacturing sector as a whole. However, the composition of the group of innovative firms differs substantially depending on whether or not they are linked to natural resource-based activities. Among those so linked, 44% are subsidiaries of foreign companies, a relatively strong presence, while among those that are not, foreign firms are not heavily represented (5%). In addition, local business groups and independent local firms are more to the fore among natural resource-linked firms (45% and 40%, respectively) than among firms not linked to natural resource-based activities (23% and 33%, respectively), as can be seen in table 9. In terms of size, clustered innovative firms are larger on average than manufacturing firms generally, isolated innovative firms and non-innovators, and 87% of innovative firms clustered in natural resource-linked industries and 100% of clustered firms not linked to natural resources have over 200 employees. Firms of this size represent 56% of all firms in the manufacturing sector (see table 10).

As regards innovation behaviour, the figures presented in table 11 show that clustered innovative firms as a group made greater R&D efforts relative to sales (0.91%) than none-innovative firms (0.36%) and the subsidiaries of multinationals (0.79%) in 2001, but made less of an effort than other innovative firms (1.30%) and high-technology firms (2.06%). It should be noted that innovative firms clustered in sectors indirectly linked to natural resource-based activities made more than twice

as large an R&D effort as clustered firms not linked to natural resource-based activities (1.17% and 0.52%, respectively). In addition, clustered innovative firms linked to natural resources as suppliers rank alongside high-technology firms as those making the greatest R&D efforts relative to sales in the year analysed.

Observing the evolution of firms' innovation activity indicators brings some other interesting findings to light. Between 2000 and 2005, in a context where R&D investment intensity generally declined in the Brazilian manufacturing sector, clustered innovative firms were the only ones to increase their R&D effort year by year (see table 12). Clustered innovative firms not linked to natural resource-based activities made most progress, increasing R&D investment intensity by 16.15%. Other innovation efforts, such as the acquisition of knowledge incorporated into capital goods, were generally negative during the period analysed. However, clustered innovative firms linked to natural resources showed the smallest decline in capital investment of any type of firm (4.64% a year).

In summary, according to the indicators analysed, clustered innovative firms in Brazil (whether or not linked to natural resource-based activities through input-output relationships) form an important locus of innovation in the Brazilian manufacturing sector. It is interesting to note that these firms stand out throughout the period studied as the ones making the greatest innovation effort (such as R&D), of which there is little in the manufacturing sector of the region's countries.

TABLE 9

Brazil: innovative firms by ownership type
(Numbers and percentages)

	Innovative firms clustered in natural resource-linked industries	Clustered innovative firms not linked to natural resources	Isolated innovative firms	Non-innovative firms in all industries	Total
	Number of firms and proportions of column totals *(percentages)*				
Local business groups	7	9	29	486	522
	(23)	(45)	(25)	(13)	(13)
Independent local firms	10	8	43	2 677	2 730
	(33)	(40)	(37)	(72)	(71)
Subsidiaries of multinationals	13	3	45	559	617
	(44)	(5)	(38)	(15)	(16)
Total	30	20	117	3 722	3 889
	(100)	(100)	(100)	(100)	(100)

Source: prepared by the authors, on the basis of the Survey on Technological Innovation (PINTEC) (2000 and 2005).

TABLE 10

Brazil: firms by size
(Numbers and percentages)

	Innovative firms clustered in natural resource-linked industries	Clustered innovative firms not linked to natural resources	Isolated innovative firms	Non-innovative firms in all industries	Total
SMES	4 (13)	0 (0)	17 (15)	1 680 (45)	1 701 (44)
Large firms	26 (87)	20 (100)	100 (85)	2 042 (55)	2 168 (56)
Total	30 (100)	20 (100)	117 (100)	3 722 (100)	3 889 (100)

Source: prepared by the authors, on the basis of the Survey on Technological Innovation (PINTEC) (2000 and 2005).

Note: small and medium-sized enterprises (SMEs) are those with 200 employees or less and large enterprises those with at least 200 employees.

TABLE 11

Brazil: innovation behaviour in the manufacturing sector, 2000

Types of firms	R&D intensity	Capital investment
	Average values per firm *(percentages)*	
1. Clustered innovative firms:	0.91	2.09
- indirectly linked to natural resources	1.17	1.74
- not linked to natural resource-based industries	0.52	2.61
2. All other innovative firms	1.30	3.56
3. Firms in "high-technology" industries	2.06	2.01
4. Subsidiaries of multinationals	0.79	6.03
5. Non-innovative firms	0.36	4.72
6. All firms	0.97	3.89

Source: prepared by the authors, on the basis of the Survey on Technological Innovation (PINTEC) (2000 and 2005).

R&D: research and development.

TABLE 12

Brazil: changes in innovation behaviour in the manufacturing sector, 2000-2005

Type of firm	R&D intensity	Capital investment
	Average values per firm *(percentages)*	
1. Clustered innovative firms:	5.72	-12.99
- indirectly linked to natural resources	1.50	-4.64
- not linked to natural resource-based industries	16.15	-26.95
2. All other innovative firms	-14.84	-10.80
3. Firms in "high-technology" industries	-1.22	-8.66
4. Subsidiaries of foreign multinationals	-3.89	-7.34
5. Non-innovative firms	-2.14	-27.32
6. All firms	-8.23	-12.72

Source: prepared by the authors, on the basis of the Survey on Technological Innovation (PINTEC) (2000 and 2005).

R&D: research and development.

VI

Discussion and final reflections

This paper has studied the evolution of innovation capacity in the Argentine and Brazilian manufacturing sectors during a period characterized by great economic instability and changes in economic policies in both countries. Many studies have documented the destruction of firms and technological capacities that prevailed at this juncture in the region. What has been investigated here, though, is the possible resurgence of innovation capacities and their sectoral distribution. The analysis has used intertemporal data from innovation surveys in Argentina and Brazil covering the period from 1992 to 2004 in the former and from 2001 to 2005 in the latter. The findings are not definitive because they are based on analysis of such evidence as exists, which is imperfect and fragmented. Nonetheless, they provide grounds for some reflections and suggestions that are potentially important for future research. Two in particular are worth mentioning and discussing.

First, a substantial number of clustered firms are found in a small group of sectors, which were identified as being at the vanguard of innovation and which greatly increased their innovation efforts during the period under study. The evidence analysed does not suggest that these firms are world leaders, one indication of this being their low levels of R&D expenditure, which is well below global standards; in relative terms, however, they stand out from other firms in each country, and it is thus interesting to analyse their characteristics.

Second, it should be stressed that the activities many of these innovative firms are clustered in are not the ones which would typically be expected. Firms clustered in sectors that are users of natural resources performed particularly well in Argentina, while this was true of firms clustered in traditional sectors in Brazil and of firms linked to natural resources as suppliers and clustered in sectors protected by special regimes in both countries. It is worth reflecting on the first two types: (i) firms clustered in sectors linked to natural resources, particularly as users, and (ii) firms clustered in traditional sectors.

(i) Connection to natural resources: industries connected to natural resources are usually regarded as having few technology opportunities. Since the 1950s, the development literature has argued that activities based on the exploitation and processing of natural resources have characteristics that do not make it easy

for firms to exploit the advantages of technological change and add value, in comparison with other activities such as industrial manufacturing (Prebisch, 1950; Singer, 1950; Nurske, 1958). Similarly, the innovation literature has identified manufacturing industries closely linked to natural resources as having few technology opportunities; indeed, they are classified as "low-technology" industries in industrial classifications (OECD, 1997). Consequently, the typical policy recommendation for countries with a marked specialization in natural resources has been that they should foster the development of other sectors associated with greater opportunities to add value, such as those activities grouped into the so-called "high-technology" segments. Recently, though, some authors have begun to stress that sectors based on the exploitation of natural resources are intensifying their use of knowledge and thus opening up opportunities for greater learning and innovation, and thence for the development of dynamic, innovative sectors associated with them (Marín, Navas-Alemán and Pérez, in press; Pérez, 1999, 2001 and 2010; Kaplinsky and Fitter, 2004). This is largely because of fundamental changes in historical conditions, together with demand shifts and the spread of new technological paradigms. The demand for foodstuffs, raw materials and energy has intensified in recent years due to the growing globalization of markets (and the incorporation of China into the world market), with a concomitant increase in the demand for variety and quality (such as the increase in demand for gourmet foods and safer or more environmentally friendly products). This is opening up opportunities that did not formerly exist to invest in knowledge and generate variety in conjunction with natural resources. Meanwhile, the spread of new technologies such as biotechnology and nanotechnology is multiplying the potential for innovation and differentiation, just as information and communication technologies (ICTs) are favouring and facilitating the incorporation of far-flung production zones into the global market (Von Tunzelmann and Acha, 2005; Marín, Navas-Alemán and Pérez, in press). The findings presented here may be beginning to capture these phenomena.

(ii) Traditional sectors: in the case of Brazil, areas of competitive advantage creation can also be seen in sectors that are not closely linked to natural resources but are traditional, such as the manufacture of footwear and plastic products. This may also be due to the penetration of new technologies in what are usually considered low- and medium-technology sectors (Von Tunzelmann and Acha, 2005) and to other emerging phenomena that the literature has begun to identify. Recent studies have shown, in fact, that traditional or low- to medium-technology sectors are not necessarily clusters of non-innovative firms (Kirner, Kinkel and Jaeger, 2009; Hirsch-Kreinsen, 2008). This is because products typically manufactured with old or mature technologies are beginning to be produced with technologies that are radically new or characteristic of some other industry (Kirner, Kinkel and Jaeger, 2009). The application of biotechnology to food processing is a clear example of how a sector regarded as being non-technology-intensive has begun to adopt what are identified as high-technology solutions and become increasingly dynamic. It is argued that this horizontal spread of technology between sectors will tend to blur the identification of industries with products and technologies and reduce the usefulness of certain sectoral classifications that are very widespread and heavily used.

Taken all together, these findings suggest that existing sectoral classifications may not be entirely relevant, or are not capturing recent phenomena such as intensified innovation in what are traditionally considered low-technology sectors, such as traditional ones and those linked directly to natural resources. They also suggest that industrial development policies that involve picking winners and are centred on identifying and strengthening isolated sectors may not be the most appropriate in the current context. On the contrary, in industrial policy terms it seems more promising to consider the interaction and interdependence between sectors (Hansen and Winther, 2010). It is known, for example, that firms in what are usually deemed low- and medium-technology industries are not only the most substantial in terms of output, employment and investment, but are the largest consumers of high-technology innovations (Robertson, Pol and Carroll, 2003). Consequently, the growth of high-technology activities largely depends on the growth of other associated activities that are usually less intensive in R&D (Hauknes and Knell, 2009; Robertson and Patel, 2007). This interaction needs to be considered in the region's development strategies, avoiding excessive bias towards incentives for high-technology sectors that fail to take account of their links to and interactions with other production sectors.

Lastly, some questions, limitations and suggestions for future research may be noted:

The indicators used have some limitations. First, those measuring innovation focus almost exclusively on the manufacturing sector, preventing investigation of innovation patterns in other activities that are important to the region, such as primary activities and the service sector. Again, the innovation outcome indicators available present limitations when it comes to accurately capturing the innovation dynamic in these countries. Patents are a widely used and accepted indicator in more developed countries, but they have their limits, since the bulk of the innovation process in the region's firms consists of innovations that are incremental and adaptive or have a low degree of novelty, which means that the patenting system cannot be used to protect them. Other innovation outcome indicators available, such as the one used in this study, are based on subjective answers given by the firms surveyed as to whether they innovated or not in a given period and what degree of novelty was involved. The literature recognizes that this may lead to overstatement of firms' innovativeness. Consequently, the limitations of the indicators used and of the data available require caution when it comes to interpreting the findings and making hard and fast generalizations.

Second, this paper speaks of a resurgence, but the indicators of innovation efforts such as R&D are extremely low in some unexpected cases. It must be asked, then, whether they are low because the indicators available were unable to identify genuine innovators, or because the most significant innovators are in natural resource and traditional sectors where innovation is done differently (incremental and process innovation and engineering efforts are most important). More needs to be known in future about the characteristics of innovation in each sector, with a view to identifying indicators that serve to capture differences in the intensity of efforts and outcomes irrespective of sectoral characteristics. This will certainly enable more light to be shed on the questions raised in this study.

Identifying natural resource-related sectors

Two types of industries related to the production of natural resources are identified: consumers and suppliers. The classification was carried out using indices that measure the degree of connection to activities based on the exploitation of natural resources.[12] These indices use information on the value of transactions between industries drawn from each country's input-output matrix (IOM).

Because the activities in the IOM do not unequivocally match the three-digit International Standard Industrial Classification of All Economic Activities (ISIC), each sector's transactions were weighted by the sum of the value of production in the three-digit sectors corresponding to a given activity in the IOM.

The first index is the proportion of purchases from natural resource sectors made by each manufacturing industry as a share of the sector's total purchases. The larger the proportion, the greater the direct connection to natural resources.

The following procedure was applied for each sector j:

$$Index\ natural\ resources\ Cons_j = \frac{sum\left(IOM_{m\ =\ natural\ resources, n\ =\ j}\right)}{sum\left(IOM_{m,n\ =\ j}\right)}$$

An analogous procedure was applied to create the second index for natural resource sector supplier industries. The greater the index value, the greater their indirect connection to natural resources:

$$Index\ natural\ resources\ Sup_j = \frac{sum\left(IOM^T_{m\ =\ natural\ resources, n\ =\ j}\right)}{sum\left(IOM^T_{m,n\ =\ j}\right)}$$

The sectors identified as directly related to natural resources are those whose index values as consumers of these resources display above-average values, while sectors classified as indirectly related to natural resources are those whose index values as natural resource sector suppliers are above average. Sectors with above-average values in both groups were placed in the one for which they recorded the highest value.

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[12] On the basis of the input-output matrix (IOM), natural resource sectors are: growing of cereals, oilseeds and fodder; growing of vegetables, flowers and ornamental plants; growing of fruit and nuts; growing of industrial crops; seed production; stockbreeding and production of milk, wool and hides; farm production; agricultural services; hunting; forestry and timber extraction; fishing; oil and gas extraction and coal and uranium mining; mining of metal ores; mining of other minerals.

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Index of political instability in Brazil, 1889-2009

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ABSTRACT

This article aims to develop an index of political instability (INS) in Brazil between 1889 and 2009, reflecting a wide-ranging set of multiple phenomena that represent conflicts between the different social groups. By presenting different definitions of what is understood by political instability in the economics literature and by using multiple historical events —*coups d'état*, civil conflicts, constitutional or unconstitutional overthrow and changes in the composition of 50% of the ministerial cabinet— different indicators are obtained which are then synthesized into a single index using the principal component technique, to obtain an INS for Brazil between 1889 and 2009.

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I

Introduction

To gain a better understanding of the economic development process in individual countries, the economics literature generally uses theoretical and empirical models that do not have a clear definition of the important role of political instability in the development process. Moreover, no account is taken of the historical role of instability, and the empirical studies rely on ceteris paribus-type assumptions to analyse their results.

It is extremely important not only to find ways to make studies of economic development more realistic, but also to provide stronger support to the empirical analyses undertaken, with theoretical, empirical and data models that fill the shortcomings in question —in particular the difficulty of incorporating institutional and historical variables into the analyses—. Such variables can manifest themselves in the country's political stability, or instability, which merely reflect processes of institutional change over time —processes that simultaneously affect and are affected by economic variables.

Economists are very keen to understand the relations that exist between political instability and economic activity in individual countries. There has been much theoretical and empirical research on the economic effects of instability, and the main studies can be summarized in terms of three approaches.

The first approach studies the effects of political instability on the economy by explaining fiscal-policy cycles. Studies of this type include those of Rogoff and Sibert (1988); Alesina and others (1992); Alesina and Tabellini (1990); Edwards and Tabellini (1991); Cukierman, Edwards and Tabellini (1992), and Bohn (2003). These highlight three main effects of political instability on the economy: (i) political instability generates suboptimal public policies since policymakers are uncertain of their own permanency in the government and they manipulate the macroeconomy as a tool in the struggle for power; (ii) entrepreneurial investment decisions are hampered by a climate of political instability in which governments implement suboptimal policies, and (iii) this instability causes interruptions in production, which reduces total factor productivity (TFP).

The second approach investigates the relations that exist between political instability and economic growth, by modelling power conflicts between the social classes and the effects of such conflicts on capital accumulation. Research in this category includes Annett (2001); Devereux

and Wen (1998), and Woo (2005), who apply economic theory to study the effects of power conflicts in societies that are unequal and ethnically polarized or divided.

The third approach involves empirical research. The key studies in this category include those of Barro (1991 and 1996), who used panel-data techniques to study the effects of political instability on economic growth in samples of countries. Several recent studies use the generalized method of moments (GMM) to deal with endogeneity problems, including Aisen and Veiga (2011) who attempt to identify the channels through which political instability manifests itself in the economic structure.

Other empirical studies are of a regional type and analyse the topic in relation to a set of countries. The leading examples include Solimano (2003), who analysed political instability in Andean countries, using a variety of variables (change of constitution, presidential crises and volatility of democracy) to explain the deficient performance of their institutions. There are also national studies, such as Evia, Laserna and Skaperdas (2008) on the effects of social protests in the Bolivian economy, which caused a drop in output of several percentage points, and Muñoz (2009), who found that political instability is one of the main causes of the declining trend of economic activity in the Bolivarian Republic of Venezuela.

The aim of the present study is to fill some of the gaps mentioned above, by calculating an index of political instability (INS) in Brazil between 1889 and 2009. An index of this type will make it possible to analyse the main trends of political instability in Brazil's history, and to relate political phenomena to those that are strictly in the economic domain. The index could be used in a variety of future studies to gain a better understanding of the Brazilian development process, because it embraces the political, social, historical and institutional dimensions as well as the economic one.

This article is organized into six sections including the introduction. Section II discusses the different definitions of political instability and appropriate methods for measuring it. Section III describes the historical context of political instability in Brazil, and section IV presents the methodology used. Section V includes the results and the time series of political instability in Brazil between 1889 and 2009, while the last section contains the final thoughts of the article.

II

What does political instability mean?

The specialist literature contains the two definitions of political instability. The first of these sees instability as the propensity for the government to be replaced before the end of its legal mandate, whether through constitutional or unconstitutional means. This definition is applied by Cukierman, Edwards and Tabellini (1992).

The second definition, used by Annett (2001) and Aisen and Veiga (2011), among others, views political instability as resulting from a set of multiple phenomena representing conflicts between different social groups. The phenomena in question could be civil wars, *coups d'état*, violent protests or new constitutions, or other events; and they are generally measured as categorical variables. This definition of political instability offers a better representation of the country's political evolution, because it reflects a complex process determined by a broad and diverse set of phenomena that affect that instability.

Episodes of political instability in Brazil have often been linked to social and political changes such as those that occurred in the so-called Vargas Era. In such cases, the elements of political instability are associated with a varied set of multiple political and social phenomena, which makes the second definition of political instability more appropriate.

When political instability is related to multiple factors, statistical techniques need to be applied to develop a single variable representing the political instability of the set of factors in question. The appropriate statistical technique for that purpose is principal component analysis, which has been applied by Annett (2001) and Aisen and Veiga (2011).

III

Historical context of political instability in Brazil between 1889 and 2009

At the close of the nineteenth century, Portuguese colonialism had bequeathed four organizational legacies that were to prove very persistent and would characterize the profile of institutions in Brazil:

(i) The delegation of significant functions to the local-authority level (Fausto, 1996), thereby perpetuating the pragmatism of the colonial power in the Brazilian empire. Article 66 of the Constitution of 24 February 1822 expressly authorized the states to borrow, organize their own military forces, and impose taxes by decree on their merchandise exports.

(ii) A high concentration of land ownership, structured in large extensive areas,[1] an institution that originated in the later colonialism of the hereditary "sesmaria"-based and "capitanias" (colonial land management districts) or land grants to the colonists.[2]

(iii) Colonialism and mercantilism as the defining characteristics of Brazil's international engagement. The colonies had to contribute to the economy of the metropolis in certain areas, with the exclusion of other colonial powers.[3] Surpluses for export came from forced labour obtained from the indigenous population and, later, from negro slavery. The cycles of mercantilism were associated with certain regions of Brazil and specific export products, such

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[1] According to Fausto (1996, pp. 24-26), although the discovery of Brazil by Pedro Álvarez Cabral occurred in 1500, colonization as such began in 1549; and it was consolidated in 1763 with the foundation of the first capital in the city of Salvador, Bahia.

[2] The creation of the *sesmarias* gave rise to the *latifundio* or estate system, which concentrated political power and a governing class in the economy in a way that would have lasting effects in Brazil.

[3] In the case of Brazil, colonial exclusiveness was less strict because of the impossibility of imposing it and the fact that the trade centres were outside Portugal. In the sixteenth century, the Netherlands participated in the colonial benefits, and, in the seventeenth century, England also entered the colonial scheme.

as Pernambuco (in the sixteenth century); exports of sugar from the North-East (in the sixteenth century, supported by the Netherlands); or the State of Minas Gerais with exports of gold and diamonds (in the seventeenth and eighteenth centuries, as a key development for Portugal).[4] Other commodities (tobacco and rubber) became alternative crops; and coffee production began in the mid-nineteenth century, initially in Rio de Janeiro and later in São Paulo, which would trigger major transformations in Brazil.

(iv) A tradition of forced labour from Indians and Afro-descendants, which came to an end in 1880, so the Brazilian power elites had to encourage immigration by foreigners for coffee growing. According to Maddison (2008), between 1880 and 1913, a total of 2.7 million foreigners arrived in Brazil (half of them Italians, 700,000 Portuguese and 400,000 Spanish, in addition to smaller numbers of other nationalities). For a country that had 17 million inhabitants at the turn of the twentieth century, those migration figures are highly significant.

1. The First Republic and the Oligarchic Pact between 1889 and 1929

The concentration of land ownership, in conjunction with the presence of a skilled immigrant labour force and opportunities for coffee production in São Paulo, fuelled the desire to establish a political power structure that favoured the interests of the power elites. Another factor was the new Liberal Constitution of 1891, which gave the states autonomy from federal power, thereby making it possible to introduce measures to enhance coffee growing, which was fundamental for the State of São Paulo.

The oligarchic pact between the political elites was based on coffee and the spread of urbanization in São Paulo, Rio de Janeiro, Belo Horizonte, Bahia and Porto Alegre. Politically, the elites of São Paulo and Minas Gerais held national power alternately, under the so-called "*café com leite*" politics based on the interests of coffee-growers and dairy farmers, respectively.

The preponderance of coffee-grower interests in defining the economic policy of the time gave an unorthodox economic orientation to public affairs, owing to the expansionary effects on public expenditure of policies to sustain the coffee price. Nonetheless, the international bankers that participated in the plan to defend the coffee price demanded greater rigour in the management of public resources to guarantee credit solvency. Moreover, the states that did not participate in the oligarchic pact had different interests than those of the coffee growers of the state of São Paulo. Consequently, during that period, unorthodox economic policies alternated with more liberal ones, reflecting the concern for fiscal balance, inflation, and the viability of the balance of payments.

Management of the oligarchic pact was rendered more complex by the emergence of both economic and political problems. The most significant economic problem was the crisis of 1929, which had effects on two fronts. As from 1926, Brazil found it more difficult to obtain the external credits needed to maintain the coffee price, owing to the restrictive policies that had been implemented in the United States to control the speculative bubble on Wall Street. In 1932, coffee prices were 30% lower than in 1929, and coffee represented about 70% of Brazil's exports. The political problem was the breakup of the oligarchic pact which enabled the leader of the State of Rio Grande do Sul, Getúlio Vargas, to seize power with a military coup.

2. Economic changes between 1930 and 1964

In 1930, under Vargas' leadership, a reform process was launched in the political organization of Brazil, which would last 15 years. The fundamental element of the reforms in question involved the centralization of government power, which brought the states' high level of autonomy to an end. The reforms gave rise to conflicts that led to the outbreak of the Constitutionalist Revolution (or *Paulista* war) of 1932. The structure of the state was reformed by expanding its sphere of action in the economy, and numerous public institutions were created. The new laws gave broader recognition to workers' rights, and the minimum wage was established; but the right to strike was heavily restricted. The role of industry in the economy was highlighted with the creation of the National Iron and Steel Corporation (*Compañía Siderúrgica Nacional*) in Volta Redonda, and tools were created to promote industrialization through the Brazilian Development Bank (BNDES). The authoritarian rule of Getúlio Vargas between 1937 and 1945, consolidated changes that would have lasting effects in Brazil. During the World War II, difficulties in obtaining goods and raw materials from abroad provided favourable conditions for an import substitution policy, which contributed to the country's modernization.

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[4] Portugal's trade deficit with England was paid with gold that came from Minas Gerais.

With the end of the Vargas government, the Third Republic was inaugurated along with the period of populist democracies that would last from 1945 to 1964. During that period, the Vargas legacy was consolidated in the form of pro-industrialization policies with robust state support. Between 1945 and 1961, the economy grew rapidly thanks to a positive international context (Abreu, 2000). Nonetheless, economic trends changed[5] during the government of João Goulart (1962-1964); and in that period, various political problems arose, which culminated in the military coup of March 1964.

3. Military rule between 1964 and 1985

The historical context of the different governments that succeeded each other in power between 1964 and 1985 can be divided into three stages: (i) the first, between 1964 and 1967, was characterized by the attempt to achieve basic equilibrium in the economy (mainly in terms of inflation); (ii) the economic-miracle period from 1967 to 1979, and (iii) a period of stagnation between 1979 and 1985.

The Government's Program of Economic Action (PAEG), between 1964 and 1967, was an inflation control plan to correct the balance of payments deficits. During those years, inflation was brought under control gradually, as GDP grew moderately. In the economic-miracle years from 1967 to 1979, per capita GDP grew by 6.2% per year, despite external problems caused by the rise in oil prices, and an aggravation of the situation after 1982 when high international interest rates made it difficult to finance the balance of payments. During this period, deep domestic imbalances were compounded by high domestic inflation and a perception of fragility in the alliances that provided the political underpinning for military rule. As a political response, a democratic transition process was launched, starting with the government of President Geisel in 1979. This would culminate in the handover of power to a civilian government under an indirect electoral system introduced by the last military president, João Baptista Figueiredo, in 1985.

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[5] Gross domestic product (GDP) grew by 8.6% in 1961; but in 1963 growth was just 0.63%, and industrial output shrank by 0.2%. Inflation, measured by the General Price Index-Domestic Supply (IGP-DI)/ Getúlio Vargas Foundation (FGV), was 30.5% in 1960 and 47.8% in 1961, and it reached a level of 92.1% in 1964.

4. Democratic government since 1985

The transition to democracy was a complex and lengthy process, owing to at least three challenges among the issues included on the political agenda. The economic problem was one of these and seemed to be the most urgent. The second was the need perceived by large segments of society for a new constitution to replace the existing one, whose clearly authoritarian characteristics were the legacy of military rule. The third challenge was to address the heavy social debt in terms of income distribution, which had resulted from the economic policies applied in the two decades of military rule —a debt that needed to be resolved to smooth the harsh contours of Brazil's social reality—. It should be noted that the working class played a major role in promoting the democratic process, thanks to its high degree of organization and power, which could not be ignored by the Brazilian political class.

Although the Brazilian political system in 1985 involved the main leaderships and political powers in the country and had democratic institutions, it was unable to address these three challenges rapidly and simultaneously. Describing the paths of the solutions implemented for each challenge goes beyond the scope of this article, but the solutions finally adopted by Brazilian society are briefly summarized below.

In 1988, a new democratic Constitution was approved, which reclaimed the legacy of the Vargas Era. A major role was given to the State both in the economy and in society; and equity criteria were established in relation to gender, income and regional differences.

The process of solving the country's economic problems was long and tortuous; and there were six failed economic stabilization plans before Brazil found the way to overcome the problem of inflation in 1994 with the Real Plan. This solution was ultimately consolidated in President Fernando Henrique Cardoso's second term of office. Nonetheless, even with democracy, output growth remained unsatisfactory, because, between 1980 and 2008, per capita GDP grew by just 0.77% per year, which suggests the presence of obstacles to rapid growth in Brazil.

In the social domain, significant progress was made, thanks to government policies that reduced extreme poverty; but progress on income distribution was limited, and public policies still have a long way to go. Major investments are also required in the areas of health, education, infrastructure and security; and the historical need for reforms in both the political and tax systems still persists.

IV

Methodology

The methodology applied includes definition of the variables, information sources, the resulting databases, and the statistical techniques used to synthesize political instability in Brazil in a single index.

1. Definition of the variables

Political instability is measured through several indicators and is considered to exist in a given year if any of the following conditions are fulfilled:

(i) Interruption of the President's constitutional mandate (*nc*). In any given year, the constitutional mandate is not fulfilled, owing to the resignation, constitutional or otherwise, of the President of the Republic. In this situation, the president-elect does not take office owing to an unconstitutional act or some other event. It occurs when the president-elect dies before taking office, or owing to a *force majeure* event that prevents the President from taking office, or when the President is unable to fulfil his or her mandate because of a coup.

(ii) A change in 50% the ministerial cabinet (*mg*). This variable represents the number of times in the year that the head of government changes half of the ministerial cabinet.

(iii) Change of constitution (*mc*), owing to the approval of a new constitution or constitutional reforms.

(iv) Civil wars or organized acts of violence for political purposes (*gc*). Violence is deemed to be organized if more than 100 citizens participate in it. This is a variable measured dichotomously: $gc = 1$ in the event of a civil war, acts of violence, or irregular military forces; otherwise $gc = 0$.

(v) Labour strikes (*greve*). This is measured as the number of strikes, normalized on the interval [0.1]. This article makes an innovation with this variable compared to the main known indices, which are generally based on the number of political strikes. The innovation reflects the fact that workers' rights in Brazil were restricted for many years (during the Vargas Era as from 1937 and, in recent times, between 1964 and 1973). After those periods, there were many strike movements in which it is hard to differentiate the political and economic factors.

To determine the value of the five indicators mentioned, information is needed on the constitutional mandate, the taking of office of the president-elect, changes in the cabinet, the approval of new constitutions and reform of existing ones, civil wars, and the number of strikes. The annex includes a detailed list of the information sources used.

2. Basic concepts of the principal component technique

Using data on the variables defined above (*nc, mg, mc, gc* and *greve*), the multivariate principal component technique is applied to obtain a synthetic vector of political instability in Brazil in the period 1889-2009.

According to Gurmu, Rilstone and Stern (1999), the principal component technique is a multivariate statistical approach that reduces a large number of variables to fewer dimensions. It is particularly useful when the variables considered are correlated. The principal component method creates uncorrelated indices. From a mathematical point of view, with an initial set of *n* correlated variables, the principal component technique creates uncorrelated components, each of which consists of a weighted linear combination of the initial variables. For example, for a set of variables $X_1, \ldots \ldots, X_n$, the following components are defined:

$$CP_1 = a_{11}X_1 + a_{12}X_2 + \ldots + a_{1n}X_n \qquad (1)$$

$$CP_2 = a_{21}X_1 + a_{22}X_2 + \ldots + a_{2n}X_n \qquad (2)$$

$$CP_n = a_{n1}X_1 + a_{n2}X_2 + \ldots + a_{nn}X_n \qquad (3)$$

where a_{mn} represents the weight of the principal component *m* of the variable *n*. Each principal component (CP) is weighted by the auto-vector of the correlations matrix if the original data are normalized. The variance of each CP is the eigenvalue corresponding to each eigenvector. The components are ranked from the first component CP_1 (1), which explains most of the original value, subject to the constraint that the sum of the squares of the weights must be equal to one, in other words, $a^2_{11} + a^2_{12} \ldots + a^2_{1n} = 1$. The second principal component CP_2 (2), explains a smaller proportion of the variation of the original value and is not correlated with (1). Each CP captures a smaller proportion of the principal. This makes

it possible to reduce to a single index, using the eigenvalues of the corresponding eigenvector as the weighting factor.

Technically, as the principal component describes a set of variables in terms of another smaller set of variables, the method identifies "n" linear combinations of the "n" columns of the $X^T X$ matrix (X^T is the transposed matrix), which are mutually orthogonal and have the property that the first principal component p_1 minimises $tr(X - p_1 a_1)^T (X - a_1 p_1)$, where tr denotes trace and a_1 is the eigenvector of $X^T X$ associated with the eigenvalue. The second principal component p_2 is obtained by minimising $tr(X - p_1 a_1 - p_2 a_2)^T (X - a_1 p_1 - p_2 a_2)$, where a_2 is the eigenvector associated with the second eigenvalue. This second component represents the factors that are not represented by the first one. Following this logic, each CP captures the variance of the previous one, which will be represented by its eigenvalue. It can be shown that the contribution to reducing the variability of the CP is $tr(X)^T (X) - \delta_1$, where δ_1 is the highest eigenvalue.

The following section describes the application and analysis of the technique to produce an indicator of political instability for Brazil.

V

Results

This section presents the descriptive statistics of the database used, the analyses made of the results of the principal component and, lastly, an analysis of the behaviour of Brazilian political instability.

1. Descriptive statistics

The results include preparation of the matrix of the values of the variables for all years considered (see annex A.6). The correlations matrix shown in table 1 serves as an illustrative indicator to analyse the relations between the indicators used.

Brazil: matrix of correlations between the variables related to political instability, 1889-2009

	mg	nc	mc	gc	greve
mg [a]	1				
nc [b]	0.0065	1			
mc [c]	0.1587	0.3115	1		
gc [d]	-0.0038	-0.0804	0.1059	1	
greve [e]	0.1608	0.0252	-0.0901	-0.2416	1

Source: prepared by the authors.

[a] *mg* indicates changes of 50% of the composition of the ministerial Cabinet.
[b] *nc* refers to interruption of the President's constitutional mandate.
[c] *mc* reflects changes in the Constitution.
[d] *gc* refers to civil wars and organized acts of violence.
[e] *greve* refers to strikes.
Note: the total number of observations is 120 and the significance level is 5%.

The data show a significant positive correlation between the interruption of the constitutional mandate (*nc*) and changes in the Constitution (*mc*). This finding may indicate that changes to existing constitutions and the creation of new constitutions in Brazil were preceded by changes of government outside of a legal mandate. It could also mean that constitutional reforms are seen as acts that create a new order, owing to political movements that use force, the main exception to this being the 1988 Constitution. There is a negative correlation between episodes of organized violence (*gc*) and strikes (*greve*) As noted above, strikes tended to be recurrent when workers rights were not fully upheld in previous periods.

Table 2 reports the results of the application of the principal component method in the decomposition of the eigenvalues and eigenvectors. The eigenvectors are presented in their orthonormal form, uncorrelated and normalized, with a dimension that is compatible with the five variables used.

It can be seen that CP_1 explains a major share of the sample variance. In terms of the eigenvectors, the most important variables are the creation of new constitutions and constitutional reforms, and the interruption of constitutional mandates.

The first principal component was used to obtain the political instability index (INS), giving rise to the following system:

$$INS = 0.2781*mg + 0.5982*nc + 0.7260*mc + 0.1712*gc - 0.1352*greve \qquad (4)$$

From the result of the estimations, an INS is obtained for each year (see table A.6).

Figure 1 shows the trend of this index between 1889 and 2009.

TABLE 2

Brazil: correlation of the principal components of political instability, 1889-2009

Component	Eigenvalue	Difference	Proportion	Cumulative
Component 1	1.35551	0.04836	0.27110	0.27110
Component 2	1.30714	0.27947	0.26140	0.53250
Component 3	1.02768	0.31784	0.20550	0.73800
Component 4	0.70984	0.11000	0.14200	0.88000
Component 5	0.59983	-	0.12000	1.00000

Principal components (eigenvectors)						
Variable	CP_1	CP_2	CP_3	CP_4	CP_5	Not explained
mg [a]	0.2781	0.3575	0.7532	-0.3190	0.3594	0
nc [b]	0.5982	0.1967	-0.4888	0.2140	0.5703	0
mc [c]	0.7260	-0.0246	0.0400	-0.0819	-0.7812	0
gc [d]	0.1712	-0.6031	0.4217	0.6371	0.1524	0
$greve$ [e]	-0.1353	0.6849	0.1200	0.6632	-0.2417	0

Source: prepared by the authors.

[a] *mg* indicates changes of 50% in the composition of the ministerial Cabinet.
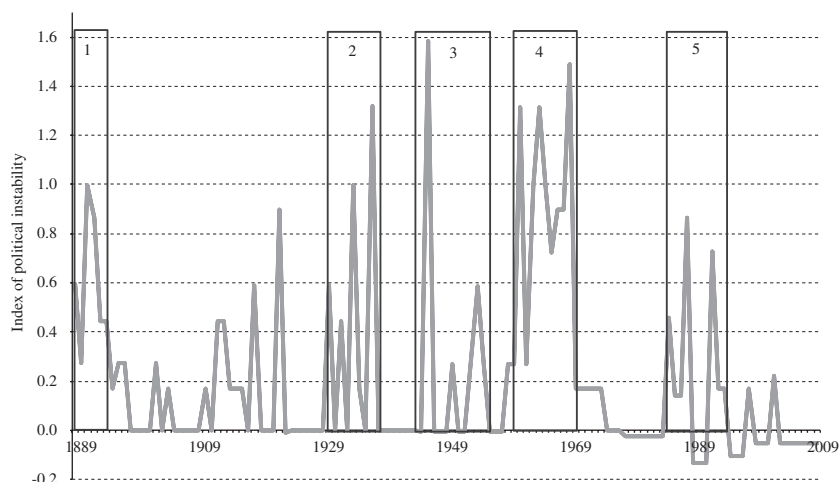[b] *nc* refers to interruption of the President's constitutional mandate.
[c] *mc* reflects changes in the Constitution.
[d] *gc* refers to civil wars and organize acts of violence.
[e] *greve* refers to strikes.
Note: the total number of observations is 120; components = trace = 5.

FIGURE 1

Brazil: index of political instability (INS), 1889-2009

Source: prepared by the authors (see annex A.6).

Note: periods of high political instability are highlighted, numbered from one to five.

Figure 1 shows the INS for Brazil between 1889 and 2009. The higher the index value, the greater is political instability. The INS index was smoothed using the three-year moving average to identify the major trends in political instability in Brazil, and periods of major instability are highlighted.

The analysis of figure 1 shows that Brazil had periods of great political instability but those years were not predominant in the country's history.

2. Analysis of political instability

Figure 1 indicates five periods of political instability in Brazil, which are analysed in the following paragraphs.

1889-1894. The First Republic was initially accompanied by a period of major political instability. President Marechal Deodoro da Fonseca dissolved Parliament, in violation the Constitution that had just been promulgated in 1891. This measure was the result

of disagreements between Deodoro da Fonseca and the coffee-growing elite. In the end, the President resigned to avoid a civil war, and Vice President Floriano Peixoto, another military man, took office as the second President of Brazil in 1892. Under the Constitution of 1891, elections should have been convened nine months later, but this did not happen. As a result, President Peixoto faced several organized military uprisings, but managed to overcome all rebellions until March 1894, when his term of office came to an end.

At the same time as these conflicts were unfolding, the Federalist Revolution occurred in the southern state of Rio Grande do Sul, which caused much bloodshed and ended in 1895. Lastly, between 1895 and 1897 the War of Canudos also caused a large number of fatalities.

The economic context in that period was characterized by a significant downward trend in the price of rubber (then the country's main export product).

Following a period of political instability, the military gave up power and recognized the electoral victory of Prudente de Morais, a coffee grower from São Paulo, thereby launching the period of "café com leite" politics, in which the political leaders of São Paulo and Minas Gerais alternated in power.

These phenomena together make it possible to identify a period of high political instability at the start of the First Republic. The index prepared records a mean of 0.601, with a standard deviation of 0.271 and a maximum of 0.997.

1895-1930. These years are not highlighted as a period of extreme political instability in figure 1, despite quite intense instability related to certain economic factors. From the standpoint of those factors, the start of the new century heralded a recovery in the international economy, which had a positive effect on Brazil. Castelar and others (2001) show that the investment rate in Brazil rose from 4.9% of GDP in 1901 to 17.8% in 1909. Much of that investment was channelled into infrastructure and manufacturing industry. Between 1901 and 1914, the railway network expanded by 4%, and electric power generation capacity grew by 13 times. During the World War I, however, investment retreated and the terms of trade declined. Then, between 1918 and 1922, that situation was reversed, when Brazilian exports doubled in two years. In 1923, global business cycles changed again, and Brazil faced a balance of payments crisis and high inflation (31% per year), which led to orthodox economic policies being implemented throughout the presidency of Artur Bernardes.

At the same time, dissatisfaction among middle-ranking military officers was reflected in events such as

the Copacabana Fort revolution in 1922 and, subsequently, the Coluna Prestes revolt. A state of siege prevailed throughout the Bernardes presidency, with the consequent restrictions on political freedoms.

The Vargas Era (1930-1945). The changes that occurred in Brazil during this period represented a response to "café com leite" politics by the elites of certain states (particularly Rio Grande do Sul and Paraíba), which were competing for power. The period known traditionally as the Vargas Era encompassed the following administrations: (i) the provisional government of 1930-1934, which emerged from the civil and military uprising of 1930 and gave rise to the new Constitution of 1934; (ii) the government of President Vargas between 1934 and 1937, of democratic type, resulting from popular election; (iii) the *Estado Novo* (New State) dictatorship from 1937 to 1945, during which a new constitution was approved in 1937, and which ended in a *coup d'état* in 1945, and (iv) the constitutional government of Getúlio Vargas, which began in 1951 and ended with his suicide in 1954. The Vargas Era was based on a centralized state and strong executive, which profoundly changed the "oligarchy pact" of the First Republic, and constituted a significant source of conflict. President Vargas used the new Constitution of 1937 as a mechanism to institutionalize that change, while closing down Congress and decreeing that governors would be subject to the President's authority.

There were episodes of instability throughout that period, including the civil and military uprising of 1930, the constitutional Paulista War of 1932, the installation of the *Estado Novo* dictatorship in 1937, the military overthrow of Getúlio Vargas in 1945, and his subsequent suicide in 1954.

Political instability between 1945 and 1964. These years are known as the period of populist democracy, owing to the succession of governments that maintained the legacy of the Vargas Era involving development supported by the State, in an international scenario that was propitious for policies of that type. This enabled Brazil to achieve a per capita GDP growth rate of around 4.5% per year, along with a substantial degree of industrial diversification. At the end of the government of Juscelino Kubitschek, signs of economic imbalance appeared in the form of high inflation rates, and in 1961 Brazil entered a process of political instability that intensified in the ensuing years.

1961-1970. This was the longest-lasting period of political instability in Brazil, in which the Brazilian Constitution was changed five times. Although there were phases of rapid economic growth, the profound

difficulties in dealing with the major economic imbalances in Brazil were also clear to see. Political instability began with the resignation of Jânio Quadros in 1961, and his replacement by Vice President João Goulart. The government of President Goulart suffered from internal instability and continuous changes in its ministerial composition. At the same time, there was growing popular urban and rural mobilization in the struggle to reform the structure of the Brazilian State in favour of the less privileged classes. Conservative groups and the middle-class resisted the changes and supported the military uprising of 1964. The military government phase began in 1964 with a provisional project, but it subsequently defined long-term policies as from 1969. During many of the military governments of that period, there was organized resistance in the form of guerilla movements which, despite not putting military rule at risk, represented a factor of political unrest. During the mandate of Ernesto Geisel, the military began a lengthy and costly process of transition to democracy.

Democratic transition (1985-1994). This period was complex. The death of President-elect Tancredo Neves and the swearing-in of Vice President José Sarney meant that, from the outset, the New Republic displayed great fragility in facing the economic problems inherited from the last military government. In addition to economic difficulties, the new government had to implement reforms to democratize the State. In 1988, Brazil's seventh constitution was approved, the most democratic of its history, which incorporated the "Getulista

ideal" and protected Afro-descendants and women from discrimination. Between 1985 and 1995, ministers of finance were very unlikely to still be in their post one year after taking office. As a result, Brazil had 11 finance ministers[6] in 10 years. The political instability in 1992 was caused by the constitutional overthrow of President Fernando Collor following an impeachment process.

Between 1995 and 2009, Brazil experienced the longest period of political stability in its modern history, largely thanks to the macroeconomic equilibrium achieved by the government of President Fernando Henrique Cardoso and consolidated during the mandate of President Luís Inácio da Silva.

Table 3 provides a summary of the results obtained with the INS, indicating the periods of greatest instability (1889-1894, 1895-1930, 1931-1945, 1961-1970 and 1985-1994) and the respective means and standard deviations of the INS. This shows that the greatest instability occurred between 1961 and 1970, followed by the period 1889-1894, and the process of democratic transition. Thus, apart from the period of the First Republic, political instability is a characteristic of modern Brazil.

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[6] The 11 finance ministers were: Francisco Oswaldo Neves Dornelles, Dílson Domingos Funaro, Luiz Carlos Bresser Gonçalves Pereira and Maílson Ferreira da Nóbrega (in the government of José Sarney); Zélia Maria Cardoso de Mello and Marcílio Marques Moreira (in the government of Fernando Collor), and Paulo Roberto Haddad, Eliseu Resende, Fernando Henrique Cardoso, Rubens Ricupero and Ciro Ferreira Gomes (in the government of Itamar Franco).

TABLE 3

Brazil: values of the political instability index (INS) during the main episodes of instability, 1889-1994

Period	Mean/standard deviation of the INS	Episodes of instability
1889-1894	0.600/0.278	• Deodoro da Fonseca dissolved Parliament • Floriano Peixoto took office and did not call new elections • Constitutional military uprisings against Floriano Peixoto
1895-1930	0.132/0.217	• Federalist War in Rio Grande do Sul • War of Canudos • Copacabana Fort Revolution • Coluna Prestes revolt
1931-1945	0.194/0.413	• Civil and military coup led by Getúlio Vargas • Constitutions of 1934 and 1937 • Dissolution of Congress and declaration of the *Estado Novo* • Paulista War of 1932 • Military coup against Getúlio Vargas in 1945
1961-1970	0.906/0.430	• Resignation of Jânio Quadros • João Goulart took office • Frequent changes of more than 50% of the Cabinet • Public demonstrations for and against the reforms of the State • *Coup d'état* of 1964 • Amendment of the Constitution (five times) • Promulgation of Institutional Act No. 5 (*AI-5*) • Presence of armed insurgent movements

Table 3 (conclusion)

Period	Mean/standard deviation of the INS	Episodes of instability
1985-1994	0.359/0.536	• Death of President-elect Tancredo Neves • Impeachment of President Fernando Collor • Continuous changes of Finance Minister • Six failed economic stabilization plans

Source: prepared by the authors.

3. Statistical correlation between the INS and a selection of economic variables

This subsection describes the indicators of statistical correlation between the INS and certain economic variables, with the aim of assessing whether each indicator is related to other variables in the logically expected direction. In addition, the intensities of the calculated correlations are evaluated.

The economic indicators chosen were the level of GDP, investment, the terms of trade, inflation, international crises, the fiscal deficit, and population. As the indicator produced spans a lengthy time series, covering the period 1889-2009, various sources of information were used, with series covering a large number of years.

For the output series, the study by Maddison (2008) was used, which contains Brazilian GDP data from 1870 to 2007. GDP data were also obtained from the Brazilian Geographical and Statistical Institute (IBGE)-Histórico, which contains data between 1900 and 2007. Apart from that information, IBGE-Histórico provides data on investments and the terms of trade in those periods. Another information source was the study by Heston, Summers and Aten (2008), which includes data on output and investments from 1950 to 2007, identified in table 4 as *Penn World Tables (PWT)*. Data on inflation and international crises was taken from Rogoff and Reinhart (2011) on Brazil as from 1830. In the case of the fiscal deficit, the 1900-2007 series available on the Ipeadata website was used. The original sources of those data are the Ministry of Finance. The fiscal deficit indicator was used to calculate the deficit as a percentage of GDP estimated by IBGE-Histórico.

Having different sources for a given variable, as in the case of output, made it possible to compare the different estimations and thus obtain more robust conclusions.

Table 4, below, shows the correlation coefficients and highlights the different information sources. As the Heston, Summers and Aten (2008) data start in 1950, it was decided to present the correlation coefficients from the other sources, particularly those of Maddison (2008), IBGE-Histórico, and Rogoff and Reinhart (2011) in comparable periods.

The analysis of table 4 was performed in decreasing order of the indicators chosen. A negative relation was found between political instability and output. In the case of longer periods, that correlation does not seem very significant. Nonetheless, considering the period since 1950, the correlation is significant, and the three information sources display similar results. The difference in correlation between the two periods shows that, in the years of Brazil's modernization, political instability had more pronounced effects in terms of reducing output. A more detailed and in-depth analysis of that phenomenon would go beyond the scope of this article; but it should be noted that the phenomenon is reflected in the three information sources.

A negative correlation can also be discerned between investment and political instability, which is almost nonexistent in the IBGE-Histórico series considering almost the entire period; but that situation changes when only the more recent period between 1950 and 2009 is considered. The behaviour of investment in Brazil in the two subperiods is interesting. From 1900 to 1950, the average investment rate was 10.5% of GDP, with a maximum of 20.3% of GDP and a minimum of 4.21%. Between 1950 and 2007, the average investment rate was 18.4%, with extreme values of 12.8% and 26.9% of GDP. In the most recent period, investment represented a major share of aggregate demand and, therefore, its behaviour should more closely match variations in output and the domestic and external shocks to the Brazilian economy. This possibly explains the higher correlation that exists between investment and political instability in more recent periods.

It is interesting to evaluate the correlation between the international terms of trade and political instability, because negative shocks on the international markets for Brazil's export products serve as one of the channels through which political instability is transmitted. That assessment was made using an indicator of changes in the terms of trade in a given year in relation to the previous one. Account was also taken of the volatility of the terms of trade, which, for a given year, is equal to the standard deviation of the terms of trade index in the five previous years, divided by the average terms of

TABLE 4

Brazil: correlation coefficient between the INS and a selection of economic variables, 1889-2007

Sources/variables	Years	Number of years	Correlation coefficient
	GDP		
Maddison	1889-2007	118	-0.1771**
IBGE-Histórico	1901-2007	106	-0.1431***
Penn World Tables (PWT)	1950-2007	57	-0.4475*
Maddison	1950-2007	57	-0.4698*
IBGE	1950-2007	57	-0.4611*
	Investment		
IBGE-Histórico	1901-2007	106	-0.0154
IBGE-Histórico	1950-2007	57	-0.2447
PWT	1950-2007	57	-0.1315
	Terms of trade		
Terms of trade variation	1905-2007	102	-0.0403
Terms of trade volatility	1905-2007	102	-0.1848***
Terms of trade volatility	1950-2007	57	-0.1619
World output	1889-2007	118	-0.147***
World output	1950-2007	57	-0.4124*
	Inflation		
Variation in prices	1889-2007	118	-0.045
Variation in prices	1950-2007	57	-0.073
	Financial crises		
Financial crises	1889-2007	118	0.1371***
Financial crises	1950-2007	57	0.2109***
	Federal fiscal deficit		
Federal fiscal deficit	1900-2007	107	-0.0807**
Federal fiscal deficit	1950-2007	57	-0.0691
Government income	1900-2007	107	-0.2271*
Government income	1950-2007	57	-0.3717*
Government expenditure	1900-2007	107	-0.2082*
Government expenditure	1950-2000	57	-0.3596*
	Population		
Population	1889-2007	118	-0.148***
	1950-2007	57	-0.412*

Source: prepared by the authors, on the basis of A. Maddison (2008), *The World Economy: Historical Statistics*, Paris, OECD Development Centre, 2008 [online] http://www.ggdc.net/maddison/; A. Heston, R. Summers and B. Aten, "Penn World Tables Version 6.1", Center for International Comparisons at the University of Pennsylvania, 2008 [online] http://pwt.econ.upenn.edu/, and K. Rogoff and C. Reinhart, "From financial crash", *American Economic Review*, vol. 101, No. 5, Nashville, Tennessee, American Economic Association, 2011.

INS: political instability index.
*Statistical significance at 1%; **statistical significance at 5%; ***statistical significance at 10%.

trade of the five previous years. Thus, terms-of-trade volatility in a given year reflects the variability of the terms of trade in the five preceding years, for which reason the volatility series begins in 1905. The definition of volatility and the data were obtained from the IBGE-Histórico database. Another measure considered as an alternative indicator of Brazil's international economic situation is the level of economic activity in the most important countries, namely the average GDP per capita of the United States, Germany, the United Kingdom and Japan. This indicator was obtained from the Maddison (2008) database. All of the indicators suggest that the variation in the international terms of trade is only weakly correlated with the INS. In contrast, terms-of-trade volatility has a more significant effect; and, doubtless, the economic activity level of the most important countries is also clearly correlated with political instability.

The correlation between the INS and inflation has the expected sign, but it is small in value and not statistically significant. As the Brazilian economy has a very long track record of living with inflation, it would be somewhat risky to assert that the Brazilian economy displayed political instability in the years of highest inflation. It would be more appropriate to say that a political crisis was caused by inflation in years containing hyperinflationary episodes, in other words, in the period 1988-1994 in the Brazilian case.

The indicator of financial crises produced by Rogoff and Reinhart (2011) refers to four types of financial crisis: a crisis of the exchange rate and high inflation, cessation of payment on the government's external and domestic debts, stock market crashes and banking crises. Each of these crises is evaluated as a categorical variable, taking the value 1 when the phenomenon is present in a given year and zero otherwise. Lastly, the authors establish a synthesis variable by adding together the different types of crises defined. Table 4 uses that synthesis variable which summarizes the four types of financial crisis. In principle, there should be a positive correlation between the financial crisis indicator and the INS index, the results of which are shown in table 4. As is the case with other indicators used in table 4, the effects of financial crises are more closely correlated with political instability since 1950. The average of the financial crises between 1889 and 2007 is 1.44. The most significant feature of the Rogoff and Reinhart (2011) series is that the series average rises from 0.95 in the period 1889-1950 to 1.96 in the subsequent period. This means that financial crises in Brazil have been far deeper in more recent years. The maximum value of the financial crisis indicator was 6 in 1986, according to the financial crisis index estimated by Rogoff and Reinhart (2011). In that year, all types of crisis defined by the authors were present in Brazil. It is highly significant that, in the period running from the external debt crisis in Mexico in 1982 to the launch of the Real Plan in Brazil in 1994, the financial crisis indicator was 3.9, the highest level in Brazil's financial history for more than a century.

Another indicator used was the correlation between the INS and the fiscal deficit as a percentage of GDP.

If there was a deficit, the fiscal deficit indicator was negative. Bearing in mind that the greater the political instability the greater is the estimated index, there should be a negative relation between the two indicators. Table 4 reports a negative correlation between the fiscal deficit and political instability, which weakened slightly between 1950 and 2007. The variation between the two periods reflects the fact that Brazil systematically recorded fiscal deficits from 1900 to 1950. Fiscal balance was only attained in nine of those years, and there were deficits in the other 41 years. Between 1950 and 2009, however, the opposite was the case: only 20 deficits in that period, and just three since 1976. This was the result of the counterinflationary policies applied in those years, based on fiscal rigour. The correlations between public expenditure and government income, on the one hand, and political instability, on the other, are clearer.

Lastly, the correlation between population and the INS is calculated, to analyse whether population growth in the country, with all of the phenomena that that implies, is related to political instability. The result is that there is in fact a negative correlation between population and the INS.

The calculation of the correlation indicators presented above leads to the following conclusions: (i) the estimated index and the chosen economic variables are correlated, and in the expected direction; (ii) those results are robust, because the indicators calculated using data from different sources produce similar results, and (iii) the correlation is stronger since 1950, which was the period in which the country began a modernization process and acquired greater productive complexity.

VI

Final thoughts

In the various lines of research, it is important to take account of the interaction that exists between social, economic and political variables. When seeking to understand a country's political and economic trajectory, this kaleidoscopic view may be particularly necessary to explain the causes of the successes (and the failures) of its development process.

As many studies on the Brazilian economy ignore this complex historical interaction, mainly because there is no single variable that encompasses all of these dimensions consistently, the present study set out to

construct an INS for Brazil for the period 1889-2009, based on the principal component statistical technique.

The index produced is deemed to capture the main cycles of political instability in Brazil's history. Moreover, the analysis of the series shows that those cycles correspond only to certain years, so, Brazil is a country with a low level of political instability.

The authors consider that this research makes a positive contribution by constructing an INS for Brazil for the first time, which could be used in various studies to fill a historical and empirical gap in the literature.

Sources of information on the variables

A.1 Variable: Interruption of constitutional mandate (*nc*)

To quantify this variable, the following criteria and information sources were used:

(i)   Characteristics of the period of the constitutional mandate for the President and rules on his replacement, set out in detail in annex A.3.

(ii) Different events that represent the interruption of the President's constitutional mandate (*nc*).

- 1889: *coup d'état* by Deodoro da Fonseca against the Emperor Dom Pedro II.
- 1892: *coup d'état* by Floriano Peixoto against Deodoro da Fonseca.
- 1918: death of President-elect Rodríguez Alves, who never took office.
- 1930: civil and military uprising of Getúlio Vargas.
- 1937: Getúlio Vargas declares himself dictator.
- 1946: Getúlio Vargas is deposed.
- 1954: suicide of Getúlio Vargas.
- 1961: resignation of Jânio Quadros.
- 1964: military coup.
- 1969: death of Costa Silva and his unconstitutional replacement by a military junta.
- 1985: death of President-elect Tancredo Neves.
- 1992: constitutional overthrow of President Fernando Collor de Mello.

A.2 Change of 50% of the composition of the cabinet (*mg*)

To generate quality statistics with this variable, it is necessary to know the number of ministers in all periods studied and their names; in addition to the number of times those changes exceeded half of the number of ministers in a given year.

To establish the number of ministries, a list was prepared in creation date order, indicating changes in name and the year of extinction. This information is shown in table A.2.

These data were used to prepare a list of the number of ministries that operated under each President of Brazil from 1889 to 2009, in other words the 34 people who officially took office as President of the Republic. The list does not include the governmental juntas of 1930 and 1969, or the three presidents-elect who never took office (Júlio Prestes, Rodríguez Alves and Tancredo Neves), the first of these because of the military uprising in 1930, and the other two because they died.

No account was taken of changes in the ministerial cabinet of the following provisional governments:
- Governmental Junta (1930), from 24 October 1930 to 3 November 1930.
- José Linhares (1945), from 29 October 1945 to 31 January 1946.
- Carlos Luz (1955), from 8 November 1995 to 11 November 1955.
- Nereu Ramos (1955), from 11 November 1955 to 31 January 1956.
- Provisional governments of Ranieri Mazzilli of 1961 (25 August 1961) and 1964 (from 2 April 1964 to 15 May 1964).
- Provisional governmental junta (1969), from 31 August 1961 to 30 October 1969.

For each government, the name of the ministers was determined and the date on which they began and ended their functions, as well as a number of ministers there have been since the foundation of the Republic. For example, Rui Barbosa was the first Minister of Finance of Brazil, in the government of Deodoro da Fonseca, and was thus assigned No. 1, whereas Guido Mantega, Finance Minister in the government of President Luís Inácio Lula da Silva is No. 71. This listing made it possible to precisely identify all of the ministers and ministries existing during each presidential term. The list of ministries excluded the Ministry of De-bureaucratization, which was short lived, created on 18 July 1979 and abolished on 14 February 1986. Nor did it include the Ministry of Administrative Reform created during the mandate of President Fernando Collor de Mello, which was discarded by his successor, President Itamar Franco.

If the number of changes of minister in a given year exceeded half of the total number of ministries, a situation of political instability was inferred to exist in that year. For the purposes of this study, replacement by an interim minister was not considered as a change of ministers. If, in any one ministry, there were two or more changes in a given year, those changes are counted as separately. In the cases of President Fernando Henrique Cardoso and President Luís Inácio Lula da Silva, both of whom served a second term, the changes in each mandate were considered separately. In other words, in the year in which the President took office for a new mandate, the change of minister between the end of the first mandate and the start of the second was not considered as a change of minister for the purposes of this study.

Lastly, changes in secretariats and other institutions of ministerial status were not counted. The only exception

TABLE A.2

Brazil: ministries with creation dates between 1808 and 2009

	Ministry	Year of creation
1	Ministry of Finance (MF)	1808
2	Ministry of Justice (MJ)	1822
3	Ministry of Foreign Relations (MRE)	1852
4	Ministry of Agriculture and Food Supply (MA)	1909
5	Ministry of Transport [a] (MT)	1861
6	Ministry of Marine Affairs [b] (MM)	1891
7	Ministry of the Army [b] (ME)	1891
8	Ministry of Work and Employment (MTE)	1930
9	Ministry of Aeronautics [b] (MAER)	1941
10	Ministry of Health (MSAU)	1953
11	Ministry of Development, Industry and Foreign Trade [c] (MD)	1960
12	Ministry of Mines and Energy (MME)	1960
13	Ministry of Planning (MPL)	1962
14	Ministry of Communications (MC)	1967
15	Ministry of the Environment (MMA)	1973
16	Ministry of Social Welfare (MPS)	1974
17	Ministry of Culture (MCUL)	1985
18	Ministry of Science, Technology and Innovation (MTCT)	1985
19	Ministry of Tourism (MTUR)	1992
20	Ministry of Sports (MES)	1995
21	Ministry of National Integration (MINT)	1999
22	Ministry of Agricultural Development (MDA)	1999
23	Ministry of Defence (MD)	1999
24	Ministry of Cities (MCIDADES)	2003
25	Ministry of Aquaculture and Fisheries (MPESC)	2003
26	Ministry of Social Development Fight against Hunger (MFOME)	2004

Source: prepared by the authors.

[a] This ministry has had several names. 1860-1891: State Secretariat of Agribusiness, Commerce and Public Works; 1891-1906: Ministry of Industry, Roads and Public Works; 1906-1967: Ministry of Roads and Public Works; 1967-1990: Ministry of Transport; 1990-1992: Ministry Infrastructure; 1992-1992: Ministry of Transport and Communications; and 1992-2012: Ministry of Transport.
[b] Abolished under a Complementary Law 97 of 10 June 1999, which created the Ministry of Defence.
[c] Ministry abolished between 1990 and 1992.

to that rule was the Ministry of the *Casa Civil* (Office of the Chief of Staff of the Presidency of the Republic), which was created on 3 November 1930 as the Secretariat of the Presidency of the Republic and became the *Casa Civil* on 1 December 1938. This decision was taken because the *Casa Civil* Minister is an institution of great political importance in Brazil, with functions similar to those of prime minister in a parliamentary regime.[7]

A.3 Changes in the Constitution (*mc*)

The analysis of this point is relevant for deciding whether the presidential mandate has been interrupted in accordance with the Constitution. Brazil has had seven constitutions: 1822, 1891, 1934, 1937, 1946, 1967 and 1988; and there have been eight constitutional reforms: 1927, 1961, 1963, 1964-1967, 1967, 1968, 1969 and 1979.

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[7] The result of this uprising is shown in a 70-page annex which, owing to space restrictions, is not included in this article, but is available on request.

The key points in each Constitution or constitutional amendment were as follows:
• Presidential mandate according to the Constitution, in number of years.
• Processes for replacing the President if the President-elect cannot fulfil the constitutional mandate owing to death or constitutional dismissal.
• The rules through which regimes of exception, arising as a result of the use of force, regulated its presidential succession system. In particular, this was the case of the military governments of 1964 to 1985.

In relation to the issues mentioned, the situation depended on each Constitution:
• Constitution of 1891: the presidential term lasted four years, and the elected president could not stand for a new mandate. In the event of death or resignation of the President, the Vice President took office only until a new vote was held, instead of competing the mandate, as happens now (Brazilian Constitutions of 1891 and 1957).

- Constitution of 1934: the mandate of the President was four years, and the replacement lasted long enough to organize new elections (Arruda and Caldeira, 1986).
- Constitution of 1937: the mandate was six years with the possibility of re-election (Arruda and Caldeira, 1986).
- Constitution of 1946: the presidential mandate was five years (Montellato, Cabrini and Catelli Jr., 2000).
- Constitution of 1966: the presidential mandate was five years (Montellato, Cabrini and Catelli Jr., 2000).
- Constitutional amendment of 1961: thange from a presidential to a parliamentary system.
- Constitutional amendment of 1963: thange from a parliamentary to a presidential system.
- Constitutional amendment of 1969: treation of a military junta which replaced President Costa Silva.
- Institutional Act No. 1: tonducted a purge of opposition politicians and citizens; governed elections between 1964 and 1967.
- Institutional Act No. 2: dissolved the existing parties and in practice established the two-party system between 1964 and 1967.
- Institutional Act No. 3: instituted the holding of direct elections for the state governments. The mayors (*prefeitos*) of capital cities and "municipalities of the national security area" where henceforth appointed by the governors in 1964.
- Institutional Act No. 4: compelled Congress to vote on the draft Constitution of 1967.
- Institutional Act No. 5: dissolved Congress, suspended constitutional guarantees and authorized the executive to legislate on all matters in 1969.
- Constitutional amendment: repeal of Institutional Act No. 5, 1979.
- Constitution of 1988: four-year presidential term: in the event of the death of the President, the vice president took office until the end of the mandate.

Source: http://www.duplipensar.net/dossies/historia-de las-eleicoes.

A.4 Civil wars and acts of organized political violence recorded in the history of Brazil (*gc*)

The civil wars or acts of organized violence recorded in Brazilian history are as follows:
- War of Canudos between 1896 and 1897.
- Federalist Revolution between 1893 and 1895.
- Vaccine Revolt of 1904.
- Revolt of the Lash of 1910.
- Contestado War between 1912 and 1916.
- Copacabana Fort Revolution of 1922.

- Paulista Revolution of 1922.
- Constitutionalist Revolution of 1932.
- Communist Uprising (*Intentona*) of 1935.
- Caparão guerrilla war of 1967.
- Araguaia guerilla war between 1967 and 1974.

Source: J. Schulz, *O Exército na política: origens da intervenção militar*, 1850-1894, São Paulo, Editora da Universidade de São Paulo (EDUSP), 1994; and E. Seidl, "A formação de um exército à brasileira: lutas corporativas e adaptação institucional", *História*, vol. 29, No. 2, São Paulo, 2010.

The following events referred to earlier were excluded:
(i) The Vaccine Revolt: excluded because it did not have a defined political objective. It represented popular resistance to the methods of application and generalization of immunization in the city of Rio de Janeiro. This initiative involved the destruction of homes and shanty towns, which caused a climate of popular resistance.
(ii) The Revolt of the Lash: excluded because it involved acts of indiscipline in the Brazilian navy, in response to the brutalities imposed by that institution's hierarchy.

A.5 Strikes (*greve*)

Statistics on strikes are based on Noronha (2009) for the years 1978-2007, and on Simão (1981) for earlier years.

TABLE A.5

Brazil: number of strikes, 1888-2002

Period	No. of strikes per year
1888-1890	2
1901-1914	9
1914-1929	8
1930-1936	12
1937-1944	1
1945-1964	43
1965-1968	13
1969-1977	0
1978-1984	214
1985-1989	1 102
1990-1992	1 126
1993-1994	842
1995-1998	865
1999-2002	440

Source: E.G. Noronha, "Ciclo de greves, transição política e estabilização: Brasil, 1978-2007", *Lua Nova*, No. 76, São Paulo, 2009; A. Simão, *Sindicato e Estado. Suas relações na formação do proletariado de São Paulo*, São Paulo, Editora Ática, 1981.

To evaluate the effect of the strikes, this variable was normalized on the interval [0.1], using the value of each year in relation to the maximum value in the period 1990-1992.

A.6. Data and results

TABLE A.6

Matrix of data and results, 1889-2009

Year	mg^a	nc^b	mc^c	gc^d	$greve^e$	INS^f	Year	mg	nc	mc	gc	greve	INS	Year	mg	nc	mc	gc	greve	INS
1889	0	1	0	0	0.002	0.593	1910	0	0	0	1	0.008	0.170	1931	0	0	0	1	0.011	-0.001
1890	1	0	0	0	0.002	0.272	1911	0	0	0	0	0.008	-0.001	1932	1	0	0	0	0.011	0.442
1891	1	0	1	0	0.002	0.998	1912	1	0	0	1	0.008	0.442	1933	0	0	0	0	0.011	-0.001
1892	1	1	0	0	0.002	0.864	1913	1	0	0	1	0.008	0.442	1934	1	0	1	0	0.011	0.996
1893	1	0	0	1	0.002	0.443	1914	0	0	0	1	0.008	0.170	1935	0	0	0	1	0.011	0.170
1894	1	0	0	1	0.002	0.443	1915	0	0	0	1	0.007	0.170	1936	0	0	0	0	0.011	-0.001
1895	0	0	0	1	0.002	0.171	1916	0	0	0	1	0.007	0.170	1937	0	1	1	0	0.001	1.319
1896	1	0	0	0	0.002	0.272	1917	0	0	0	0	0.007	-0.001	1938	0	0	0	0	0.001	0.000
1897	1	0	0	0	0.002	0.272	1918	0	1	0	0	0.007	0.592	1939	0	0	0	0	0.001	0.000
1898	0	0	0	0	0.002	0.000	1919	0	0	0	0	0.007	-0.001	1940	0	0	0	0	0.001	0.000
1899	0	0	0	0	0.002	0.000	1920	0	0	0	0	0.007	-0.001	1941	0	0	0	0	0.001	0.000
1900	0	0	0	0	0.002	0.000	1921	0	0	0	0	0.007	-0.001	1942	0	0	0	0	0.001	0.000
1901	0	0	0	0	0.008	-0.001	1922	0	0	1	1	0.007	0.896	1943	0	0	0	0	0.001	0.000
1902	1	0	0	0	0.008	0.271	1923	0	0	0	0	0.078	-0.011	1944	0	0	0	0	0.001	0.000
1903	0	0	0	0	0.008	-0.001	1924	0	0	0	0	0.007	-0.001	1945	0	0	0	0	0.038	-0.005
1904	0	0	0	1	0.008	0.170	1925	0	0	0	0	0.007	-0.001	1946	1	1	1	0	0.038	1.585
1905	0	0	0	0	0.008	-0.001	1926	0	0	0	0	0.007	-0.001	1947	0	0	0	0	0.038	-0.005
1906	0	0	0	0	0.008	-0.001	1927	0	0	0	0	0.007	-0.001	1948	0	0	0	0	0.038	-0.005
1907	0	0	0	0	0.008	-0.001	1928	0	0	0	0	0.007	-0.001	1949	0	0	0	0	0.038	-0.005
1908	0	0	0	0	0.008	-0.001	1929	0	0	0	0	0.007	-0.001	1950	1	0	0	0	0.038	0.267
1909	0	0	0	0	0.008	-0.001	1930	0	1	0	0	0.011	0.591	1951	0	0	0	0	0.038	-0.005

Table A.6 (conclusion)

Year	mg[a]	nc[b]	mc[c]	gc[d]	greve[e]	INS[f]
1952	0	0	0	0	0.038	-0.005
1953	1	0	0	0	0.038	0.267
1954	0	1	0	0	0.038	0.588
1955	1	0	0	0	0.038	0.267
1956	0	0	0	0	0.038	-0.005
1957	0	0	0	0	0.038	-0.005
1958	0	0	0	0	0.038	-0.005
1959	1	0	0	0	0.038	0.267
1960	1	0	0	0	0.038	0.267
1961	0	1	1	0	0.038	1.314
1962	1	0	0	0	0.038	0.267
1963	1	0	1	0	0.038	0.993
1964	0	1	1	0	0.038	1.314
1965	1	0	1	0	0.012	0.996
1966	0	0	1	0	0.012	0.724
1967	0	0	1	1	0.012	0.896
1968	0	0	1	1	0.012	0.896
1969	0	1	1	1	0.000	1.490
1970	0	0	0	1	0.000	0.171
1971	0	0	0	1	0.000	0.171
1972	0	0	0	1	0.000	0.171

Year	mg	nc	mc	gc	greve	INS
1973	0	0	0	1	0.000	0.171
1974	0	0	0	1	0.000	0.171
1975	0	0	0	0	0.000	0.000
1976	0	0	0	0	0.000	0.000
1977	0	0	0	0	0.000	0.000
1978	0	0	0	0	0.190	-0.026
1979	0	0	0	0	0.190	-0.026
1980	0	0	0	0	0.190	-0.026
1981	0	0	0	0	0.190	-0.026
1982	0	0	0	0	0.190	-0.026
1983	0	0	0	0	0.190	-0.026
1984	0	0	0	0	0.190	-0.026
1985	0	1	0	0	0.979	0.460
1986	1	0	0	0	0.979	0.139
1987	1	0	0	0	0.979	0.139
1988	1	0	1	1	0.979	0.865
1989	0	0	0	0	0.979	-0.132
1990	0	0	0	0	1.000	-0.135
1991	0	0	0	0	1.000	-0.135
1992	1	1	0	0	1.000	0.729
1993	1	0	0	0	0.748	0.171

Year	mg	nc	mc	gc	greve	INS
1994	1	0	0	0	0.748	0.171
1995	0	0	0	0	0.768	-0.104
1996	0	0	0	0	0.768	-0.104
1997	0	0	0	0	0.768	-0.104
1998	1	0	0	0	0.768	0.168
1999	0	0	0	0	0.391	-0.053
2000	0	0	0	0	0.391	-0.053
2001	0	0	0	0	0.391	-0.053
2002	1	0	0	0	0.391	0.219
2003	0	0	0	0	0.391	-0.053
2004	0	0	0	0	0.391	-0.053
2005	0	0	0	0	0.391	-0.053
2006	0	0	0	0	0.391	-0.053
2007	0	0	0	0	0.391	-0.053
2008	0	0	0	0	0.391	-0.053
2009	0	0	0	0	0.391	-0.053

Source: prepared by the authors.

[a] *mg* indicates changes in 50% of the ministerial cabinet.
[b] *nc* refers to interruptions of the President's constitutional mandate.
[c] *mc* reflects changes in the Constitution.
[d] *gc* refers to civil wars and organized acts of violence.
[e] *greve* refers to strikes.
[f] INS: index of political instability in Brazil.

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