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SUMMARY

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.

Financial regulation and oversight:

lessons from the crisis for Latin America and the Caribbean

Filipa Correia, Luis Felipe Jiménez and Sandra Manuelito

Filipa Correia

Economic Affairs Officer

Office of the Executive Secretary,

ECLAC

➥ **filipa.correia@cepal.org**

Luis Felipe Jiménez

Economic Affairs Officer

Economic Development Division,

ECLAC

➥ **felipe.jimenez@cepal.org**

Sandra Manuelito

Economic Affairs Officer

Economic Development Division,

eclac

➥ **sandra.manuelito@cepal.org**

The analysis of the financial crisis that broke out in the United States in mid-2008 gave rise to a vigorous debate about the role of financial regulation and oversight. The present article briefly analyses the crisis with a particular emphasis on these subjects, with the goal of suggesting some lessons that can be drawn from it for Latin America and the Caribbean. Accordingly, it describes the economic conditions and major changes that occurred in the financial system of the United States during the 1990s and the current decade, identifying the contribution of these factors to the crisis. The initial lessons drawn from this analysis are the need to: (i) consider macroprudential risk in the regulatory framework, (ii) reduce the procyclical bias of the system, (iii) widen the scope of regulation and (iv) deal with the conflicts of interest that prevent prompt and reliable disclosure of the risk taken on by financial institutions.

I

Introduction

Historical evidence shows that crises originating in financial systems have been an inseparable part of the process of economic development. The immediate effect of such crises has been to wreak considerable social and economic damage as a result of reduced activity and employment, increased poverty and additional burdens on the public exchequer, with significant effects on programmes aimed at improving social conditions for the lower-income population. Removing any possibility of financial crises occurring would mean greatly inhibiting risk-taking, which is inseparable from progress, innovation and growth. Consequently, the regulatory authority needs to strike a delicate balance between fostering those aspects of financial development that are positive for economic growth and controlling the build-up of risks that could lead to systemic crises.

Underlying this whole debate are four key aspects of financial systems: their high leverage makes them intrinsically fragile or vulnerable; their failure affects public faith (particularly in the case of institutions that take deposits from the public or issue securities in public markets, or both); they behave procyclically, with a tendency to expand in upturns and contract in downturns; and their influence is systemic, as the failure of certain major institutions may not only threaten the whole financial system but can (and usually does) also affect the rest of the economy.

In the case of banks and specialized institutions such as investment and mutual funds, debt-to-capital ratios are high and there is a maturity (and sometimes currency) mismatch between the loans and financial investments they make and the deposits they receive, which obviously makes them vulnerable to sudden market shifts. Nonetheless, risk-taking is essential to the term transformation function, with what are usually short- or medium-term financial savings being used to make longer-term loans and, particularly, long-term investments. Requiring an absolute match between the characteristics of financial saving and investment would result in inadequate levels of investment and

economic development. Accordingly, risk-taking by some economic agents is an essential prerequisite for growth.

At the same time, if the financial authorities allow and encourage the public to channel savings into investment through essentially fragile institutions they are implicitly backing those institutions and may compromise public faith. Consequently, the authorities must take steps to ensure that these savings are not affected by successive losses and that such events have as few negative consequences as possible when they do occur. This is particularly true in the case of small savers who, given the inevitable information asymmetries, are not in a position to inform themselves fully about the uses their money is being put to and the risks being taken on by financial institutions. Prudential solvency regulation is thus indispensable if a balance is to be struck between the use of savings for growth and the preservation of public faith in the system.

This dilemma is compounded by certain features of financial systems and by the formation of expectations that systematically characterize the behaviour of savers, investors, borrowers and intermediaries, i.e., the market in general. For one thing, expectations of a boom tend to become self-fulfilling as they feed back into behaviour, while negative events create recessionary expectations and behaviour. The same happens with risk tolerance, which increases during booms and diminishes during recessions.

Meanwhile, the characteristics and behaviour of financial systems (unlike other organisms) mutate constantly as they innovate in search of potential returns. Their innovativeness and their swiftness to exploit any advantage in unregulated segments make them similar to a virus that is capable of adapting to its environment, with all the benefits and costs and the positive and negative externalities for growth and stability that ensue from this. As a result, regulation will inevitably lag behind changes in the financial system. For the reasons given earlier, though, it cannot be abandoned but must be continually renewed.

The influence of practically all the characteristics mentioned above can be detected in the origins of the current crisis in the financial system of the United States, along with factors connected to the economic cycle and serious supervisory failings. There now

follows a brief analysis of how macroeconomic events in the United States helped to create the conditions for this crisis and what role the financial sector has played. After that, the crisis will be considered from the perspective of financial systems in Latin America and the Caribbean to see what main lessons can be learned for financial regulation and oversight in the region. Because this debate is only just beginning, the intention of the authors is not so much to arrive at definite conclusions as to point out the areas on which they believe the coming regulatory reforms in these countries ought to focus.

II

Elements for the analysis of the current financial crisis

Examination of the current financial crisis reveals a combination of different factors. First, economic conditions in the United States are of particular importance. Beginning in the late 1980s, the country went through a period of high economic growth, interrupted only in 1991 with the Gulf War and in 2001 with the fall in the technology stocks index (NASDAQ), and then as a result of the economic upheaval caused by the attack on the Twin Towers of 11 September 2001.

During the 1990s, economic activity expanded on the basis of higher investment and rapidly rising consumption. This dynamism was sustained by a large increase in liquidity in the money market and a significant reduction in interest rates. From 2001 onward, rapid growth in private-sector demand was combined with a swelling fiscal deficit, the result of higher public spending due to burgeoning military outlays and the economic stimulus programme.[1]

The steady growth of domestic demand translated in turn into a large rise in goods and services imports, taking the balance-of-payments current-account deficit from 1.7% of GDP in 1998 to 6.2% in 2006.[2] The financing needs of the United States led to strong growth in sales of Treasury securities and thence in the quantity of international reserves invested in these instruments by emerging countries. In 2007, about half of all investment in these securities was held by non-residents.[3]

Falling interest rates, readily available funding and steady economic expansion created a climate of optimism which fed back into strong growth in both consumer and mortgage lending by banks. House prices rose vigorously on the back of strongly expanding demand, driven in turn by the easier availability of credit.[4] A circle was thus created in which more lending generated more demand, which in turn drove lending steadily higher. Interest rate cuts spread to other economies, resulting in leading stock market indices and house prices behaving similarly in a number of the world's capitals.[5]

A second factor was that major changes were afoot in the workings of the United States financial system: (i) the growing importance of derivatives markets from 2000 onward; (ii) financial sector deregulation in the 1990s and 2000s; (iii) the appearance of the "originate and distribute" model and new derivative instruments; and (iv) the strong growth of subprime mortgage lending.

In the United States, very large sums came to be traded through derivatives contracts. These totalled US$ 182 trillion in the second quarter of 2008, the equivalent of 12 times the country's GDP (OCC, 2008). Worldwide, the total value of over-the-counter (OTC) derivatives contracts rose from US$ 95.2 trillion in December 2000 to US$ 683.725 trillion by the end of the first half of 2008.[6] Within this overall

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[1] See Manuelito, Correia and Jiménez (2009) for a more detailed discussion of the macroeconomic factors that influenced the crisis. In particular, see Machinea (2009) on the role played by monetary policy.
[2] The current-account deficit fell back to 5.2% and 4.7% of GDP in 2007 and 2008, respectively.
[3] Other interpretations of the origins of the crisis emphasize the

role of the United States dollar as a reserve currency and the reaction of the country's economy and economic authorities to the build-up of reserves by emerging economies. See Greenwald and Stiglitz (2008) and Financial Services Authority (2009).
[4] The S&P/Case-Schiller house price index rose by 85% between January 2000 and December 2007.
[5] London and Madrid are good examples.
[6] Over-the-counter derivatives are traded through financial

increase, the value of credit default swaps underwent an extraordinary rise from US$ 6.396 trillion to US$ 57.894 trillion. Their share of all outstanding OTC derivatives contracts by value worldwide rose from 2% to 10% (see table 1).

Where financial sector deregulation is concerned, in the early 1990s the United States Federal Reserve System allowed commercial banks to pay interest on current accounts. This meant that these banks could start competing with savings and loan institutions as deposit-takers, but it also meant that the latter would have to start taking on the same risks as commercial banks. In the late 1990s, the Federal Reserve abolished the requirement for banks to specialize as commercial banks, investment banks or saving banks, allowing them to carry out all kinds of operations. While this measure meant that the country's financial system could carry on developing, it was taken in a context where banks had to learn about businesses of which they had no previous experience. Lastly, financial deregulation limited the power of the Federal Reserve to control the credit supply, leaving the federal funds rate and the discount rate as the sole monetary policy instruments.

In recent years, there has also been an important change in the way the financial market works, away from an "originate and own" model and towards an "originate to distribute" one. The new business model allowed the lending process to be split into

different components or phases, from origination to ultimate financing (Bernanke, 2008). Thus, bank lending operations shifted their focus more towards the assessment of risk transfer and arbitrage.

This business model emerged in a context of strong growth in credit default swaps over a short period. These instruments were originally conceived as mechanisms for dispersing credit risk across the financial system. The idea was that they would increase liquidity and transparency in that market and foster the emergence of new risk management tools (Kroszner, 2007) so that the financing of credit could be separated from the allocation of the risk associated with it, a characteristic that made them very attractive to financial institutions. In this context, these securities encouraged greater risk-taking as they opened the way to operations that were not profitable before they existed, the assumption being that, while operations might be riskier, the individual risk taken on by financial agents would potentially be lower, as the risk would be spread more widely in the financial market (Eichengreen, 2008; Financial Services Authority, 2009). It was recognized, however, that the complexity of some of these instruments made it hard to value and measure them and to manage the associated risk.

Consequently, there was a move away from a system in which financial institutions granted loans (they continued to generate lending), evaluated the risk of lending operations and then diversified that risk by transferring some of it to other institutions or through portfolio management operations, to a system in which they did not retain any of the risk associated with their own lending. Thus, the traditional banking

institutions and are usually unstandardized, unlike those traded on organized markets (chiefly stock markets), which are generally standardized.

TABLE 1

Over-the-counter (OTC) financial derivatives: amounts outstanding worldwide, by derivative type
(Billions of dollars, end of period)

	2000	2001	2002	2003	2004	2005	2006	2007	June 2008
Currency	15 666	16 748	18 469	24 475	29 289	31 364	40 239	56 238	62 983
Interest rate	64 668	77 568	101 699	141 991	190 502	211 970	291 582	393 138	458 304
Equity-linked bond	1 891	1 881	2 309	3 787	4 385	5 793	7 488	8 469	10 177
Commodity	662	598	923	1 406	1 443	5 434	7 115	8 455	13 229
Credit default swaps	...	...	...	...	6 396	13 908	28 650	57 894	57 325
Unassigned	12 313	14 384	18 337	25 508	25 879	29 199	39 740	71 146	81 708
Total	*95 200*	*111 179*	*141 737*	*197 167*	*257 894*	*297 668*	*414 845*	*595 341*	*683 725*

Source: Bank for International Settlements (BIS), *Quarterly Review*, various issues.

system became one whose business model was based on trading risk in the financial market, so that risk itself became a source of extra profits for financial institutions as it was sold on to investors willing to diversify their portfolios by accepting exposure to sectors and risk-return profiles not previously available to them.

In this context, the banks no longer had incentives to assess, mitigate and protect themselves against the risk associated with operations of this type, as they were transferring it to buyers of securities in the form of collateralized debt obligations (CDOs). These were created through structured investment vehicles (SIVs) which, being separate from the banks, enabled the latter to keep these operations off their balance sheets. This made it possible to evade the solvency and liquidity regulations and risk controls applicable to banks and meant there were still fewer incentives to measure risk properly.[7] The result was that the great majority of those purchasing these securities did not know exactly what they were buying.

The subprime market had also developed strongly over the previous years, particularly for mortgages, on the basis of high property prices. This market consists of loans granted to individuals who have a higher credit risk (or are not considered creditworthy) and would only receive loans at higher interest rates and on stricter terms if the usual internal risk control standards and procedures were applied.

Given the opportunity to securitize such loans and transfer the risk associated with them to other agents in the market, financial institutions bundled these mortgages into securities that were then traded in the market as high-quality credit instruments, since the risks were supposedly diversified and backed by real-estate collateral. In addition, there was a general feeling of optimism about the performance of the economy, so that property assets became overvalued and the possibility of price falls was underestimated. Nonetheless, these new instruments included bundles of mortgages with different levels of risk, and there was significant correlation between them as regarded the likelihood of default. In short, there were serious shortcomings in risk measurement and the risk of default was underestimated or simply unknown (Bernanke, 2008; Rudolph and Scholz, 2008).

A number of factors have been blamed for the failures of risk measurement, reporting and management. First, these instruments were relatively new, which meant that the statistical information available on their behaviour covered only periods of economic growth. Second, the stress tests applied to the models were not extreme enough, so that liquidity requirements were inadequate for periods of difficulty (Bazinger, 2008). Again, the pricing models for these assets worked on the premise that markets would provide continuous price signals and maintain a degree of liquidity, which in the event proved to be wrong (Eichengreen, 2008; Financial Services Authority, 2009). All this was compounded by an extraordinary lack of transparency in the system, with inadequate reporting of risks incurred, which made it very difficult to know how much risk had actually been taken on by financial institutions and investors in instruments of this kind. The situation was further complicated by the incentive schemes implemented by upper management and the role of risk rating agencies and of the potential conflicts of interest arising from their work.

In this context of strong credit growth, inadequate regulation and poorly measured or simply unquantified risk, alarm bells began to sound in the United States financial system in mid-2007. The unemployment rate, after dropping substantially, began a steady climb. The heavy borrowings of families and the perception that people were having difficulties meeting the repayments on their mortgages weighed on the prices of securities based on these. Rising mortgage arrears in the subprime market led to an increase in judicial auctions of mortgaged homes. As lower demand for housing met an abundant supply, property prices began to fall. The vicious circle that had artificially inflated property values, financial wealth, credit and profit growth and the balance sheets of numerous financial institutions (banks and non-banks) was abruptly halted and then reversed, triggering the crisis.

This sequence of events showed that the banks had been lending on the basis of overinflated asset prices. Consequently, when the values of bank assets (loans and financial investments) began to collapse, capital also diminished and in many cases disappeared because of extremely high levels of leverage, particularly in the case of investment banking, an activity that virtually ceased to exist in the space of less than a month. A number of the institutions that stood behind the affected mortgages had large market shares and were bailed out (Bear Stearns, AIG, Fannie Mae, Freddie

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[7] Off-balance-sheet operations, as the name implies, are not recorded among either the assets or the liabilities of the financial institutions originating them.

Mac). These successive rescues fuelled speculative behaviour and the authorities judged that there had been a worsening of moral hazard on the part of failing institutions. Consequently, following arduous negotiations to prevent the collapse of the investment bank Lehman Brothers, they changed tack and decided not to intervene. This precipitated the failure of the bank and unleashed panic, as expectations of an implicit bail-out guarantee vanished.

The strong likelihood of contagion and bankruptcies due to the loss of confidence and uncertainty associated with the spread of the subprime mortgage crisis eventually materialized in late September 2008. As a result, liquidity contracted in international markets, interest rates in the interbank market rose sharply and there was a general deflation in the prices of financial assets in international markets over the early weeks of October, with large falls in share and commodity prices. Not knowing the risk exposure of other financial agents, banks preferred not to lend, and this led to a severe liquidity drought in national and international interbank markets and thence to the credit crunch. At this point the financial crisis finally reached the real sector and developing countries.

III

Some lessons of the current financial crisis for Latin America and the Caribbean

The historical evidence, and an appreciation of the essential fragility of financial systems, indicate that crises originating in these are an inseparable part of growth. To abolish them completely it would be necessary to inhibit the risk-taking that is an essential part of progress, innovation and economic development. What lessons for Latin America and the Caribbean can be drawn from this crisis to reduce the frequency with which they occur and limit the fall-out when they do?

The region's financial systems are by no means as sophisticated as those of the countries where the current crisis originated, and bank penetration is considerably lower. In particular, the complex system for raising and allocating financing that is characteristic of developed countries, with a multiplicity of agents intervening between savers or financial investors and the actual investor or final borrower, is not a feature of our countries, although some components are present in certain cases (Chile, Brazil, Mexico and, to a lesser extent, Colombia) (see figure 1). Thus, capital markets, and the market segments in which derivatives and securitized instruments in particular are traded, are underdeveloped or non-existent.

This generalization is not altogether applicable to countries where institutional investors (such as pension funds and life insurance companies) have developed significantly as a result of pension system reforms. The development of credit securitization firms, for their part, is very recent.

The region's financial system therefore continues to be dominated by commercial banks that retain in their portfolios a substantial portion of the risk from their investments and employ a funding system based essentially on deposits, standardized bond issues and, in some cases, access to resources from the international financial system. Although it may perhaps result in a lower degree of efficiency when it comes to turning saving potential into financing for growth and development, this lesser complexity has helped to ensure that under present conditions the region's financial systems have not suffered to anything like the same extent from the symptoms and failings that led to the current crisis in a number of developed-country markets. Probably the most palpable direct impact on the region's banks arose in cases where their funding relied heavily on short-term financing from abroad.

Meanwhile, there has been clear progress with banking regulation, particularly since the adoption by several countries of the recommendations of the Basel Committee on Banking Supervision, known as the Basel I Agreement, although implementation has been patchy.[8] This progress is partly due to the past experience of financial crises in Latin America and the desire to avoid the high costs these entailed,

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[8] The United States has not adhered fully to these recommendations.

FIGURE 1

Latin America: domestic lending to the private sector
(Year-end balances as a percentage of GDP)
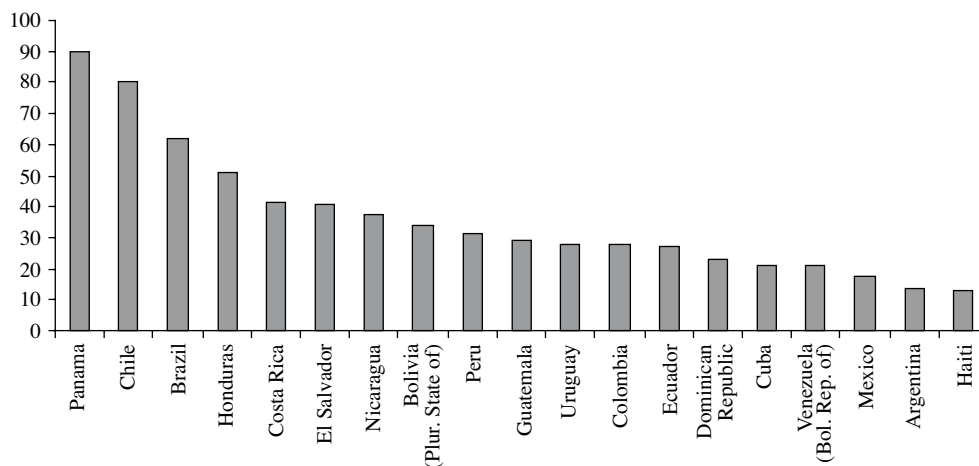
Source: ECLAC, on the basis of official figures.

in terms both of lost economic activity and of the large amounts of fiscal resources committed to bank rescue operations. Thus, in relation to earlier crises, the region's banking institutions find themselves in principle on a better footing of solvency to deal with fluctuations in economic activity.

Nonetheless, the emphasis of regulation is on capital adequacy, loss provisions and rules on liquidity and currency and maturity mismatches for individual banks. This emphasis does not address the very aspects that have characteristically underlain systemic crises, including the present one: the steady growth of overall lending and constantly rising asset prices, and the concentration of credit in certain market segments, all of which is indicative of an enormous build-up of systemic risk.[9] Recently, both the Basel Committee itself and the authorities responsible for the stability of national financial systems have brought out proposals to address just these aggregate issues underlying systemic financial crises, thereby opening up the new field of macrofinancial prudential

regulation.[10] Implicitly or explicitly, different regulatory and government authorities have accepted the need for a new approach.[11] Nonetheless, there is still a need to work out how best to implement the kind of financial indicators this type of regulation requires and the rules to be applied in cases where a sector poses a risk to the system as a whole even though individual institutions are within their risk limits.

Where the region is concerned, four areas of debate are yielding tentative but important results: (i) macroprudential measures for crisis prevention, (ii) improved prudential regulation of financial institutions to make their behaviour less procyclical, (iii) broader scope for regulation and (iv) certain conflicts of interest that interfere with the timely and reliable disclosure of the levels of risk taken on by financial institutions.

1. Macroprudential measures

A number of financial crises have been preceded by strong credit growth and steady increases in certain asset prices, and this has given rise to a debate about the role of monetary policy when there are growing signs that a bubble is forming. The central issue has been the extent to which monetary policy ought to be

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[9] By systemic risk we mean the likelihood that when a financial institution encounters difficulties or fails, there will be severe disruption to markets and payment systems leading to the failure of other institutions, both in the financial world and in the rest of the economy. The systemic importance of an institution is not determined solely by its size (e.g., market share) but also depends on the role it performs, for example, in the payment chain or in the lending process as a whole.

[10] See, for example, White (2008) and Borio and Shim (2007).
[11] See Financial Services Authority (2009) and the proposals of the United States government for reforming financial regulation.

oriented towards deactivating the mechanisms driving the asset price boom and the manner in which this new policy orientation is to be integrated with the conventional goals of maintaining employment and controlling inflation.[12] Some authors have argued that one situation which would justify intervention by the monetary authority in the asset market is when there is evidence of reciprocal causality and feedback between asset price booms and lending, but that even so monetary policy ought to intervene only if this vicious circle affects the goals of controlling inflation and achieving a sustainable level of employment. This approach considers that the goal of preventing financial market developments from turning into systemic crises is better suited to the characteristics and tools of regulatory policy (Mishkin, 2008).

Because Latin America and the Caribbean have less sophisticated financial systems, systemic financial crises there have usually had different origins to those identified in the case of more highly developed financial systems, so that the debate has to be approached from a different perspective. The type of credit growth that has led to financial crises in the region has more to do with persistent macroeconomic imbalances leading to excessive expenditure (both public and private), inconsistencies between macroeconomic policies and exchange-rate regimes, and permissive regulatory regimes that have opened the way to excessive risk-taking. All this has sometimes been compounded by lax lending to customers connected to the ownership or management of banks.

In a number of cases, lending growth has originated in large inflows of external capital in a context of fixed exchange-rate regimes and high local interest rates. The implicit guarantees provided by an exchange-rate regime of this type can lead to external overborrowing by banks and other agents and thus to a build-up of currency mismatches and overspending that places pressure on domestic prices and leads to an overvalued real exchange rate and a deteriorating external balance, ultimately forcing devaluation. From then on, events follow much the same course as in a crisis induced by an asset price bubble: devaluation exposes the mismatches between the values of assets and liabilities held by banks and other agents who were

relying on the guarantee provided by the exchange-rate regime, and the result is bankruptcies among financial institutions and a credit crunch.

Associated with this, although without necessarily reflecting macroeconomic imbalances, the exposure of local banks to the risk of sharp fluctuations in external liquidity because of maturity or currency mismatches between their assets and liabilities has also been a source of financial crises and has exacerbated crises originating in domestic imbalances, external shocks or both (see figure 2).

Again, just as with the current crisis, the experience of the region and other developing countries suggests that one harbinger of an imminent crisis is a significant concentration of credit in certain segments of the market, particularly property (residential and commercial), leading to overinvestment in these sectors and thus sowing the seeds of collapse there and among banks. This behaviour is partly explained by the inability of individual financial agents to assess the market risks caused by credit concentration at an aggregate level, as their interest is focused almost exclusively on the risks of their own lending portfolios. Underlying this is excessive optimism about their ability to unwind portfolio positions if difficulties arise, as discussed further on.

Credit concentration has three further dimensions that have been the source of many systemic crises and bankruptcies among financial institutions. The first is the existence of banking institutions that are too big for the economies they operate in and that can represent a systemic threat if they go bankrupt. The second threat of this type arises when banks are highly exposed to the risk of certain major customers going bankrupt. Lastly, crises have also been caused in Latin America by lending to related parties involved in the ownership or management of banks. Policies to prevent crises of this type are obviously not to be sought in the monetary sphere in the narrowest sense of the term. Rather, there will need to be some combination of policies to correct macroeconomic imbalances, establish prudential or regulatory measures and promote market competition.

Thus, a number of countries have opted for exchange-rate regimes that do not provide implicit guarantees, so that agents will internalize the risk of their external exposure and unsustainable spending behaviour thus be prevented. This is perhaps one of the most important measures for preventing crises originating in excessive optimism about the availability of external resources. It may not be an adequate

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[12] A number of the region's countries have tended to make price stability the only goal of monetary policy. According to Mishkin (2008), the United States Congress has laid down a threefold mandate for monetary policy: price stability combined with full employment and moderate long-term interest rates.

FIGURE 2

External liabilities of emerging-market banks towards banks reporting to the Bank for International Settlements (BIS)

(Millions of dollars)

Legend: Africa and the Middle East; Asia and the Pacific; Developing Europe; Latin America and the Caribbean
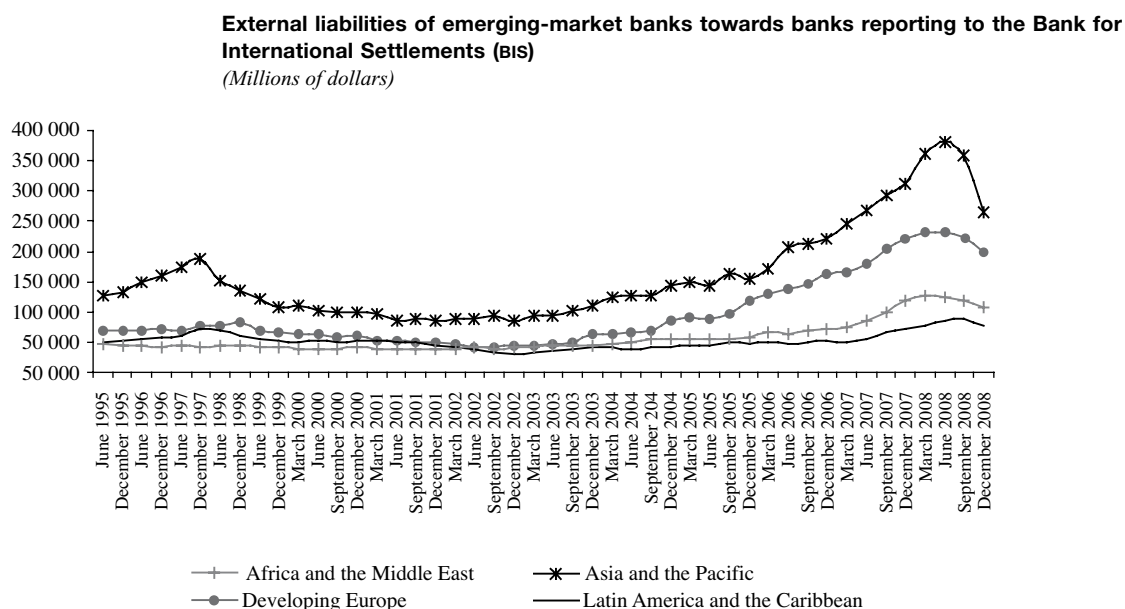
Source: ECLAC, on the basis of figures from the Bank for International Settlements (BIS).

deterrent, however, in situations of great external liquidity and low interest rates in the leading global financial centres, as seen until recently. Greater risk tolerance, and a possible relaxation of regulatory rigour during periods of strong economic growth and global liquidity, may cause agents to underestimate the likelihood of favourable external circumstances reversing.[13]

Thus, while the exchange-rate regime may not provide implicit guarantees, the external overexposure of banks, firms and other agents can rise to unsustainable or risky levels. The responsibility of the relevant regulatory authority (the banking regulator or the regulator responsible for supervising institutions that carry out public securities offerings) consists in this case in making the risks incurred by these institutions more transparent, both individually and for the system as a whole, and in creating awareness of risk, for example by requiring that periodic reporting should include the results of stress tests that use recognized methodologies to estimate the effects on assets and the liquidity and capital needs that would arise in less favourable scenarios.

Again, recognition that sustained credit growth has been one of the factors behind financial crises has recently led to a new interest in measures to oversee financial institutions' global leverage, on top of capital requirement regulations. These are discussed in the next section.

A sustained increase in credit concentration in particular market segments increases systemic risk because, even if each individual institution can show levels of liquidity and provisions that are apparently sufficient to cover expected losses, they may not be adequate for all of them as a group since there is an underlying fallacy of composition. In the event of a shock in that market, a number of institutions will require liquidity simultaneously to meet their liabilities (such as deposits). If this increased demand for liquidity also leads banks to sell off some of their investments in other instruments and restrict their lending, losses of value could spread to other market segments, making the original liquidity and provision levels inadequate. It is therefore advisable for the regulator to carry out stress tests for the market as a whole based on total exposures and, when this indicates a level of potential liquidity demand that is considered high, to use prudential rules to restrain lending growth in that market.

Prudential rules have recognized the risk posed to financial institutions by exposure to large

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[13] Borio and Zhu (2008) explore the relationship between the economic cycle and risk perception and argue that this procyclical relationship has recently played a greater role in the genesis of financial crises.

borrowers and related parties involved with their ownership, management or both, and quantitative limits have accordingly been placed on such lending. Unfortunately, no empirical diagnosis is available to show how effectively these rules or other risk reduction provisions have been applied in Latin America. In any event, much remains to be done in terms of periodic public reporting of the risk level embodied in the portfolios of banks and other systemically important institutions. This is a serious deficiency, given that the ability of financial systems to mobilize savings effectively depends critically on agents' knowledge of the risks incurred when these savings are deposited with banks or when securities issued by them (bonds and shares or other instruments) are purchased. Furthermore, this transparency acts as an extra discipline for banks, encouraging more cautious lending behaviour on penalty of their depositors and investors losing confidence in them if they take very risky positions. Thus, prompt, regular and reliable reporting is the least that can be asked both in this case and for all portfolio risks so that depositors and investors are aware of the risks they are taking on, with market discipline thereby promoted.

Lastly, pro-competition rules and those relating to the granting and withdrawal of banking licences, the entry of foreign banks and mergers of financial institutions, among other regulations dealing with market concentration, are some of the other aspects that are underdeveloped in the region when viewed from the standpoint of financial system stability.

2. Reducing the procyclicality of the financial system

The procyclical behaviour of financial systems has been widely acknowledged as both a cause of crises and a factor aggravating them. There are two main orders of problems for regulators here: the risk attitudes of market agents over the cycle and the extent to which certain prudential rules might accentuate the procyclical character of the system.[14]

Financial markets are governed by evolving expectations of future returns, which have proved too optimistic in upturns as agents' risk tolerance increases and too pessimistic and risk-averse during market downturns. Consequently, lending and liquidity tend to behave in ways that heighten cyclical fluctuations.[15] Although other factors undoubtedly come into play, one of the areas of failure is the risk perception of agents. As has often been pointed out, by failing to take due account of the systemic effects of excessive credit growth and the eventual bursting of the bubble, agents overestimate their ability to change their risk exposures (i.e., their ability to transfer risk to others before the bubble bursts) and underestimate their liquidity needs, as they do not consider systemic crisis scenarios. The fallacy of composition is obvious and is manifested in deep falls in asset prices and intense demand for liquidity when a crisis breaks out. In turn, the effects of rising risk tolerance during upturns are aggravated by incentive systems that reward short-term profitability, encouraging emulation of risky behaviour and tending to undermine corporate governance as internal controls that ought theoretically to restrain risk-taking are relaxed.

Particular regulations that may heighten procyclicality include requirements for risk to be measured on the basis of short-term portfolio behaviour for the purpose of loss provisioning, and application of the ratio between effective capital and risk-weighted assets as a measure to ensure regulatory capital adequacy.[16, 17]

Under the rules applied in a number of the region's countries, provisions (which are imputed costs affecting the result or yield of the portfolio) must be set aside in accordance with the performance category lending falls into. For example, a loan that has been non-performing for more than a given period of time must be set down as irrecoverable and provisioned for, with a write-down of 100% of its value. Conversely, loans with no current or previous arrears do not generate additional portfolio costs, i.e., expected losses, and so are not provisioned for. Of course, there are intermediate credit performance categories giving rise to provisions of between 0% and 100%

[14] See, for example, Rochet (2008), Bikker and Metzemakers (2002), Gordy and Howells (2004) and Taylor and Goodhart (2004).

[15] In fairness, it should be pointed out that this euphoric/depressive behaviour does not only affect private agents. The behaviour of public spending and wage expectations also tends to display procyclical characteristics.

[16] Effective capital is defined as capital and reserves + junior (subordinated) bonds + provisions – investment in companies – capital allocated to subsidiaries abroad. The denominator is the weighted sum of all assets. The weightings are fixed and are defined (in Basel I) by general risk categories, ranging from 0% for risk-free liquid assets to 100% for risky and less liquid assets.

[17] The literature generally distinguishes between this regulatory capital and "economic" capital. The latter is the level of capital actually held by banks, which for precautionary reasons usually exceeds the capital amount laid down by the regulations.

of the loan amount, with another factor sometimes being the quality and amount of collateral, as this affects the prospects of recovery. In the vast majority of cases these provisions are established on the basis of the observed (rather than expected) behaviour of the portfolio, and since the evidence plainly shows that credit performance is procyclical, they tend to fall during upturns and rise in downturns.[18] Thus, because these provisions are meant to reflect portfolio costs incurred (they do not relate to expected costs, for example), bank lending is more profitable in upturns. To the extent that the likelihood of losses over the full cycle is underestimated at this stage, medium- or long-run returns are overestimated and, given an incentive system based on short-term indicators, this reinforces expansionary behaviour and vice-versa. In summary, the cost of generating loans (including provisions) falls in the upswings of the cycle, which spurs lending growth, but rises during the downswings, eventually triggering a credit crunch.

Different analyses have pointed out that the proposed new capital accord currently under discussion (Basel II) would tend to accentuate this procyclical behaviour yet further, as it links regulatory capital more closely to portfolio risk. Other analysts, while accepting this possibility, argue that under the version of the accord that allows banks to use their own credit risk models to determine their capital requirements, these would tend to reflect risk behaviour better over the whole cycle. In the light of experience with the behaviour of risk tolerance and of the internal controls that were supposed to prevent overexposure in the run-up to the present crisis, this claim looks more like wishful thinking than a realistic analysis, particularly in the case of new instruments whose risk characteristics are insufficiently known.

The current crisis revealed the crucial role played by liquidity, both in the build-up of systemic risk and in the outbreak of the crisis and its transmission to the rest of the economy. During the phase of plentiful liquidity, agents could take positions and liquidate them fairly easily, which allowed them to take on larger maturity risks (using short-term funding to maintain long-term positions) in the confidence that if greater liquidity were needed, it could easily be obtained by

selling assets into a large, fluid market.[19, 20] Once again, the fallacy of composition became apparent in the critical phase and a number of markets that were formerly liquid virtually disappeared in a very short time or continued to operate at very low levels, which exacerbated uncertainty and the credit crunch globally. In other words, this episode revealed the procyclical and systemic character of market liquidity.

There have been a variety of proposals for dealing with the procyclicality of certain regulations, the best-known being the "statistical provisioning" introduced by Spain in 2000. This relies on calculations of the likelihood of loan default based on typical behaviour over the full cycle. Thus, in the early stages of a lending boom, when default rates are typically below the average for the full cycle, the lending cost represented by provisions remains constant rather than falling, so that there is no extra stimulus for lending growth. Similarly, this cost remains constant in the downswings of the cycle instead of rising, which helps to prevent an excessive contraction of credit.

Objections have been made to this system, but in any event its effectiveness in reducing the procyclicality of lending can only be assessed once the present crisis is over.[21] An initial observation is that, while it may have done something to reduce this procyclicality, it does not appear to have been sufficient to prevent overlending, given that the mortgage segment of the country's financial system has also been affected by developments similar to those underlying the crisis in other developed countries. The applicability of

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[18] There may be some time lag between the rise of portfolio risk and provisions, as banks could decide to hold excess provisions temporarily. This entails a cost, however.

[19] See Financial Services Authority (2009), which presents evidence of the significant increase in such term transformation in the run-up to the crisis.

[20] In the literature, this strategy for obtaining liquidity is called "liquidity through marketability" to differentiate it from the approach that emphasizes the need for asset portfolios to include safe and highly liquid financial securities such as government bonds or securities issued by the central bank.

[21] Criticisms are based on accounting, tax and corporate governance considerations. From the accounting point of view, provisions are charges against costs *caused* (although not yet paid) in the present. Provisions based on the likelihood of future non-payment are charges for costs that have not yet arisen, and so should not be made. From the standpoint of the tax authority, the reduction in taxable profits that results from setting aside provisions against future non-payments is a device that opens the way to intertemporal tax arbitrage which reduces the present value of tax payment flows. Lastly, from the point of view of shareholders, particularly if ownership if very dispersed, bringing forward provisions reduces dividends and provides a source of funding that managers can use to implement expansion plans without having to raise financing from the market, weakening the discipline this might impose on the institution.

this measure to the region still has to be evaluated, as it has shorter and more variable cycles than developed countries.

With regard to capital, proposals are more diverse. To reduce the procyclicality of the current capital requirement, it has been proposed that current regulations should be supplemented by a leverage limit based on the ratio between core or Tier 1 capital and gross assets, i.e., loans, but this time without risk weighting (Financial Services Authority, 2009).[22] It is argued that this is a more robust measure of a financial institution's solvency and at the same time less procyclical than the criterion currently applied (the ratio between capital and risk-weighted assets). For one thing, the riskiness of many assets rises in situations of crisis; consequently, to restore the ratio between capital and weighted assets the former must be increased or the latter diminished. Because capital is hard to come by in a crisis, the result is a reduction in assets, i.e., a procyclical credit crunch. The supplementary measure proposed, because it discards risk weightings and requires a certain percentage of capital for all assets, could translate firstly into a higher capital requirement (thus strengthening solvency) and secondly into reduced risk sensitivity, thus making the regulations less procyclical.

Before the Basil II Accord was applied by a number of the region's countries, regulatory capital was often determined by employing concepts similar to the measure proposed. This did not completely eliminate procyclical lending behaviour, however, which shows that progress in this area will need to come from a range of policies, some of them regulatory in nature, others relating to the macroeconomic regime.

A second proposal is for dynamic capital requirements, rising during phases of lending growth and falling during phases of contraction. This is a way of acknowledging that it is during the early phases that credit risk accumulates, even if it actually materializes in the downturns of the cycle. Dynamic capital requirements would reduce procyclical lending behaviour because the cost of generating credit (raising new capital) would rise in the upswings of the cycle. Some regard this proposal as highly dangerous, as it is precisely during downswings that a high level of bank capitalization is required, as was demonstrated

by the solution to the banking emergency in Europe and the United States. Otherwise, confidence in system solvency deteriorates severely, potentially leading to paralysis, as happened in the present crisis.

A third set of proposals aims to deal with the uncertainty affecting bank solvency at times of crisis, which exacerbates so-called "counterparty risks" or credit risks.[23] The goal is to reduce that uncertainty and thereby moderate or prevent a disorderly credit crunch at the end of the cycle. Some have suggested establishing capital insurance, so that when particular events indicative of a risk of financial crisis occur, the capital available to banks to cope with losses is supplemented by this insurance; thus, the obligation to comply with capital requirements would not result in a procyclical credit crunch (Kashyap, Rajan and Stein, 2008).

The authors of this proposal have themselves formulated observations similar to those made on the contingent credit lines of the International Monetary Fund (IMF) at the time they were established. An arrangement of this type ought to be made compulsory for all banks of systemic importance, since none would wish to be the first to adopt it given that it could be interpreted by the market as a sign of weakness. Insurance, meanwhile, could give rise to moral hazard, increasing the likelihood of crisis. There is also the question of who would be the insurer, since the amount of resources needed in a systemic crisis can be large.

Lastly, the liquidity debate is only just beginning and regulation is expected to be even more important in this area than for capital, including measures to restrict term transformation by reducing maturity mismatches between assets and liabilities. While this has a cost in terms of the capacity to support long-term ventures, it offers the benefit of shoring up the stability of the financial system, with positive consequences for long-term growth.

In short, finding the best way to deal with procyclicality in the financial system remains an unresolved challenge in the world and the applicability of proposals to the region needs to be carefully evaluated. This is also true of proposals for reviewing liquidity requirements that are aimed at preventing episodes in which disorderly liquidation of financial

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[22] Core capital or Tier 1 capital is the portion of regulatory capital provided directly by shareholders. An approximation to this (since definitions vary from case to case) is effective capital, excluding junior (subordinated) bonds.

[23] This risk particularly affects liquidity during crisis episodes and concerns the likelihood of default in interbank market operations and those with counterparties in financing and investment operations.

assets drives down their prices yet further and exacerbates the credit crunch (Financial Stability Forum, 2008; Bazinger, 2008; Rochet, 2008; Basel Committee on Banking Supervision, 2008). These proposals could entail certain costs for the financial industry (higher capital requirements, for example) and a reduction in its capacity to use short-term resources to finance long-term ventures. Nonetheless, a more stable financial system makes a very important contribution to development. As ECLAC has pointed out on many occasions, economic variability is one of the main factors behind the low growth that characterized the region for a number of years.

3. Extending the scope of regulation and reliable risk disclosure

As already noted, one of the causes of the present crisis lies in inadequate disclosure of banks' risk exposures and the avoidance of regulation by means of off-balance-sheet operations. Thus, one of the lessons that can be learnt is precisely the need for banks to reveal their exposure to the risks entailed in these operations and for regulation to extend to any institution with systemic risk potential.

There is a need to determine the extent to which banking institutions in Latin America and the Caribbean are actually revealing their risk exposure, for both on- and off-balance-sheet operations. As pointed out earlier, periodic reporting of portfolio risk information is, a priori, inadequate in the region. Indeed, the practice of publishing periodic indicators of average bank portfolio risk (such as levels of arrears and weighted portfolio risk) is still not sufficiently widespread, even though this is considered indispensable if depositors are to be properly informed about the risks they are taking on, thus reducing the implicit State guarantee.

In a number of countries, again, financial development has been accompanied by the appearance of new intermediaries that have helped improve the efficiency of the system, but that bring new risks. Thus, there are now institutions that carry out financial investments, manage third-party portfolios or both. These investment companies sometimes carry out public securities offerings, whereupon they become subject to regulation by the authority responsible for this area. In other cases their funding does not rely on resources raised from the public, so that they are regulated very lightly or not at all on the basis that there is no implicit public guarantee. Nonetheless,

the present crisis in the United States has provided dramatic examples of cases where failures in the supervision of some of these institutions after they had grown large enough to pose potential systemic risks worsened the situation yet further.

Like developed countries, the region has seen the emergence of lending institutions in unregulated areas that have grown large enough to become a source of systemic risk. This is the case with credit cards issued by department stores and supermarkets (which are not defined as financial institutions), as these have become a very major source of credit, particularly for lower-income segments. These institutions basically operate as intermediaries for credit lines obtained from banks, but in some cases they also tap local and external capital markets directly for funding via bond issues. The amount of credit issued by them directly does not fully reflect their systemic risk, since their main instrument, the credit card, also tends to be used as a medium of payment in numerous businesses of significantly smaller size. Being retailers, they are usually not covered by financial regulation or subject to special capital or liquidity requirements.

Although their lending is spread among a large number of customers, the portfolio quality of these retailers could be seriously affected during a recessionary episode. This is because of the large proportion of vulnerable borrowers who systematically suffer more from negative fluctuations in economic activity. In this case, having a large number of borrowers is not necessarily equivalent to risk diversification, given the correlations that exist in the payment capacity of the groups most exposed to variations in the cycle.

In summary, the large scale of this type of lending today means that the systemic effects of bankruptcies among institutions of this type are not minor and can affect the capital of lending banks and holders of the paper (short-term securities and bonds) issued by them, although not necessarily the saving public, as they are not usually deposit-takers. The risk centres in this case on the possibility of an interruption in the payments chain, which is more serious the more widely used this instrument is as a payment method. This could lead to a liquidity crisis whose effects might spread to the rest of the system and trigger systemic repercussions.[24]

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[24] This danger has been recognized in Chile, where certain rules have been introduced to regulate the lending operations of department stores and supermarkets. The different nature of these institutions means that two types of rules have been introduced, depending on

Similarly, savings and loan cooperatives have grown large enough in some cases to generate systemic effects, although they would be smaller than those resulting from the failure of a largish bank. Nonetheless, the consequences in such cases are usually felt by low-income groups, which typically account for a larger share of deposits in such institutions, or in certain cities or regions where the penetration of the banking system is lower, and by certain groups in similar categories (agriculture, dairy farming, saving for home ownership, etc.). Traditionally, these financial activities have been much more lightly regulated and bankruptcies have resulted in losses for the groups referred to and in unplanned use of public resources.[25]

The objections raised to increased regulation for institutions of this type are largely based on the fact that these sources of credit are often the only ones available to lower-income groups and that liquidity rules and capital requirements would make them more costly, thereby denying these people access to credit. However, these costs need to be compared with the negative effects that a crisis, whether systemic or confined to particular regions or activities, could have for the whole economy and for lower-income groups in particular.

Lastly, continuing with the subject of reliable disclosure of risk exposures as one of the main measures for preventing systemic crisis, consolidated oversight of financial conglomerates is at a very incipient stage in the region. Thus, it is not possible to state banks' degree of exposure to the risks of firms (financial and non-financial) that are members of a holding company. Likewise, there are few cooperation agreements between different regulatory agencies (for banks, insurers and limited-liability companies), so that the supervisory authority does not have an overview of the systemic risk posed by a particular financial institution.

4. Conflicts of interest associated with risk assessment

As already stated, shortcomings in the way credit risk is dealt with form an essential part of the explanation for the current financial crisis in developed countries. Deficiencies in these areas have combined with lax regulation and changes in the financial system to generate inappropriate incentives where risk is concerned. Although, as already mentioned, the nature of the region's financial systems is quite different from that of the developed countries', there are certain common features that have the potential to lead to a weakening of risk monitoring by the supervisory authorities in less sophisticated systems.

First, there is a clear conflict of interest for rating agencies when these not only help to structure financial instruments, but also have to express an opinion on their credit quality. The same is true of the role played by external auditors, which usually provide a range of services to financial institutions, with obvious conflicts of interest sometimes arising when they come to express their views on their financial statements.

It was the acknowledgement of these conflicts following the crises of major conglomerates in the United States during the early years of the present decade, leading among other things to the disappearance of one of the big four global auditing firms, that gave rise to the Sarbanes-Oxley law. The thrust of this was to make external auditing firms independent of their clients by limiting the functions they could perform vis-à-vis a given firm or group of related firms and by setting limits on how important, commercially speaking, any one client could be to a given auditing firm.

In Latin America and the Caribbean, the lessons from these crises have not been incorporated into regulations governing the role of risk rating agencies and external audit firms. Furthermore, the region has fallen behind in the way it treats transactions between firms with links of ownership or kinship between their owners and leading executives. Given the small size of some economies, then, there is still the potential for the conflict of interest that arises when there is a relationship of one of these two kinds between a financial institution and the firms that should be providing an independent opinion on its financial statements or assessing the risk level of a financial security.

Secondly, it has recently been proposed in the context of the Basel II Accord that banks' internal methods should play a more important role in

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the total volume of credit granted, so that the smallest have been left unregulated. For medium-sized lenders, liquidity requirements only have been established, as the systemic risk they pose is considered to be small but not insignificant. Capital requirements have been introduced in addition for larger institutions, although they are significantly less onerous than those imposed on banks.

[25] A recent example of the risk represented by unregulated financial intermediation activities is provided by the collapse of various "pyramids" in Colombia during the second half of 2008. The crises at these informal saving institutions resulted in losses for lower-income groups, social unrest and public intervention to moderate the impact on these groups. During the liberalization of the financial system in Chile in the 1970s, appropriate regulation and oversight were lacking and informal financing institutions also emerged and then went bankrupt (Held and Szalachman, 1989; Held and Jiménez, 1999).

determining the risk characteristics of particular instruments in order to establish capital requirements and provisions. In the light of recent experience, this is clearly a field where conflicts of interest are acute and the systemic consequences can be very severe, so the opinion of private agents should not be exclusively relied upon. Proper rating of the risks of new and increasingly complex financial instruments will thus require major investment to improve the technical capabilities of those supervising the region's systems.

IV

Conclusions

More than a year on from the outbreak of the current financial crisis in the United States, its causes are starting to become abundantly clear. Analysis of these causes shows that, contrary to the claims of market optimists, the financial markets suffer from serious failings of self-regulation. This is explained by the role played by expectations about future returns, serious information asymmetries and failures and moral hazard, conflicts of interest and inadequate governance, as a result of which financial markets are prone to unsustainable equilibria and to "manias and panics" that can lead to systemic crises.

The current crisis has also brought to light some major fallacies of composition underlying an approach to the operation of financial markets that fails to take account of the systemic aspects of market liquidity and risk. It is precisely on the basis of these systemic and procyclical characteristics that financial system regulation is now undergoing a major reformulation.

Although the region's financial systems differ significantly from those of more developed countries, a number of lessons from this debate, appropriately adapted, are also germane to the effort to create better regulatory frameworks and public policy management in the region.

This article has emphasized lessons that can be learned in the sphere of financial system regulation, but this does not detract from the importance of macroeconomic measures to prevent financial crises and enhance the ability of economies to cope with them. Many of the financial crises experienced in Latin American and Caribbean countries can be traced back to the implementation of macroeconomic policies that were inconsistent or encouraged overborrowing, or both. Nonetheless, regulatory failures and the procyclical and systemic characteristics of the financial system played their part in aggravating imbalances and heightening their effects when these problems arose.

The lessons for financial regulation in the region from the current crisis so far relate to internal regulatory aspects and fall into four main groups: (i) the need for a macroprudential approach to supplement the current regulatory approach, (ii) the need to design mechanisms that can reduce the procyclicality of financial systems, (iii) extension of the traditional scope of regulation and oversight to any institution that poses systemic risks, and (iv) certain aspects of the relationship between risk rating agencies, external auditing firms and financial institutions that result in faulty handling of risk.[26]

Intensive debate is going on in all these areas, but analysis is only just beginning in Latin America and the Caribbean. Given the severe economic and social effects that have stemmed from the present crisis, there is an increasingly compelling need to review the situation of the region in the areas discussed here.

(Original: Spanish)

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[26] The issue of how to handle a crisis once it has begun are part of another discussion that is not broached here.

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Employment dynamics and crises in Latin America

Lucas Navarro

This study presents dynamic labour demand estimates based on information for 15 Latin American countries in the last three decades. It is found that recessions have a direct negative effect on total and wage employment creation. There is also a positive effect of recessions on employment-output elasticity and a negative one on employment-wage elasticity. These results can be interpreted as meaning that policies aimed at reducing labour costs would be of limited effectiveness in combating unemployment during recessions. On the other hand, policies to stimulate aggregate demand would have a stronger positive effect on labour market performance at times of crisis. In all cases, the effects are greater for wage employment than for total employment. This suggests that the increasing flows of workers towards the informal sector during recessions can mitigate the impact of lower economic growth on total employment.

Lucas Navarro

Assistant Professor in Economics

ILADES-Universidad Alberto Hurtado,

Chile

➥ lunavarr@uahurtado.cl

I

Introduction

This paper studies the dynamics of aggregate employment in Latin America from a macroeconomic perspective on the basis of annual data for the past three decades covering 15 countries of the region. The contraction of the world economy as a result of the current financial crisis has undoubtedly affected developing countries, and those of Latin America in particular. The expectation is therefore of a reduction in the growth rate or even the absolute size of many of the region's economies. In this context, it is particularly important to analyse the effects that the anticipated contraction of economic activity might have on Latin American job markets. Some studies have already begun to report the negative impact of the crisis on the region's labour market. Thus, according to ECLAC/ILO (2009), over a million people joined the ranks of the unemployed in Latin America and the Caribbean between the first quarter of 2008 and the first quarter of 2009.

This analysis is considered important from both a business cycle and a structural point of view. During the 1990s, the region's countries implemented reforms that strongly affected the functioning of their labour markets (Weller, 2000; Peres and Stallings, 2000). These reforms were conducted with a view to promoting competition by liberalizing markets and opening up national economies. According to Rodrik (1997), the greater competition resulting from market opening and increased access to imported inputs has not only had a direct effect on employment, but has increased the responsiveness of employment to changes in macroeconomic variables. Labour markets can be expected to become more volatile in this context, with negative effects on output translating into a larger employment response and better wages than before the reforms.[1] These impacts may thus have changed the behaviour of employment over cycles.

According to the traditional theory of the firm, demand for labour depends mainly on the level of activity and labour costs. From an economic cycle perspective, the question arises as to which of the two determinants is most important in a recession like the present one. The answer is important because of its policy implications. In particular, it can reveal the potential relative effectiveness of Keynesian policies to stimulate aggregate demand as compared to policies to reduce labour costs. Thus, if employment-wage elasticity falls during recessions, policies to reduce labour costs will be of only limited effectiveness in a recession like the present one.

Figure 1 presents the simple average of data on annual growth in gross domestic product (GDP), employment and real wages for two years before and after the last year of negative GDP growth in the region's 15 largest countries.[2] In the chart, time 0 is the last year of the recession. For Argentina, for example, this is 2002, while for Chile it is 1999. The chart reveals a high positive correlation in the dynamic of the three variables. In other words, both employment and real wages behave similarly to GDP in the years on either side of recessions. This being so, the dynamic of real wages may be related to that of labour productivity, which the chart shows to be procyclical.[3] It can also be observed that, taking the average for the 15 countries, the dynamics of real wages and GDP were remarkably similar one year before and one year after the last year of recession, with a correlation of 0.85. It seems reasonable to expect that falling real wages would tend to cushion the fall in employment during a recession and rising real wages to limit its recovery. Again, the large contraction of GDP in the recession would have a negative impact on employment, reversed in the subsequent recovery. It is thus difficult to know from the data alone which of the two factors (real wages or economic activity) is the most important for the dynamic of employment during cycles, and recessions in particular. One objective of this paper will be to use econometric estimates to answer this question.

[1] Working with industrial data for Chile, Colombia and Mexico, however, Fajnzylber and Maloney (2004) do not find that trade liberalization in those countries has increased employment-wage elasticities.

[2] Details of the data used are presented in section III of this paper.

[3] This is because, as figure 1 shows, changes in GDP are always larger than changes in employment.

FIGURE 1

Latin America: employment, gross domestic product (GDP) and real wages
(15-country average)

Difference between current year and last year of recession

◆ Employment   ■ GDP   ▲ Real wages
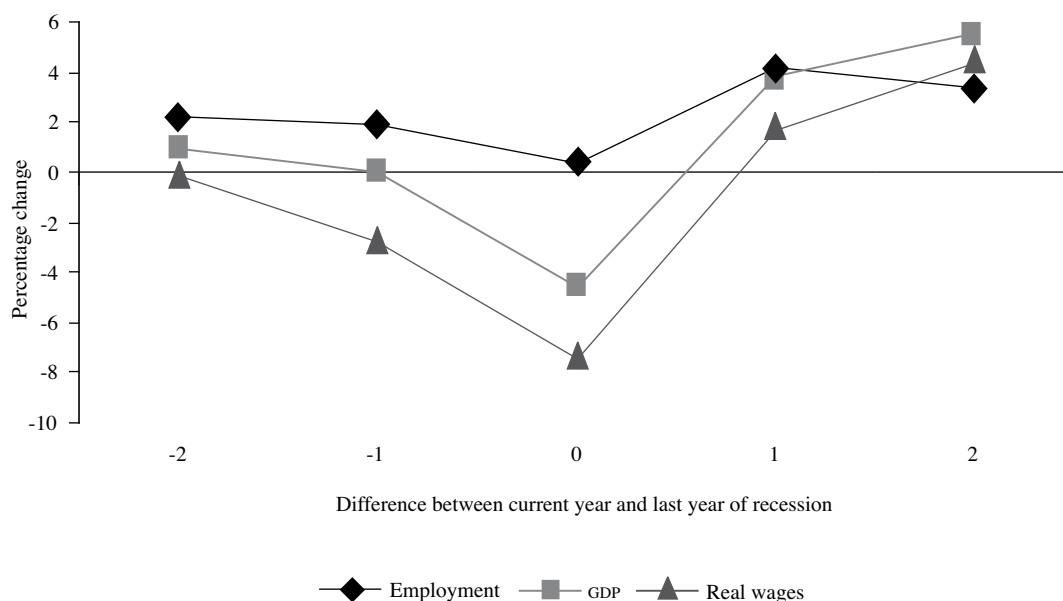
Source: prepared by the author on the basis of data from the Economic Commission for Latin America and the Caribbean (ECLAC).

Accordingly, the first step is to use dynamic panel estimates to calculate traditional labour demand functions. The small size of the sample is a major source of potential bias in the estimates. To mitigate this problem, we use an instrumental variables technique for small samples developed by Hahn, Hausman and Kuersteiner (2007). The results provide signs for the short-term employment-output and employment-wage elasticities that are consistent with international evidence.

Secondly, we analyse the relationship between market opening and employment. The results show real-term exchange-rate depreciations and trade volumes having a positive or nil effect on employment, apparently operating via reductions in real wages.

Lastly, we estimate demand functions for total and wage employment using data from the mid-1990s onward and paying particular attention to the impact of the business cycle. The findings indicate a drop in employment during recessions at every wage level, together with a change in employment-output and employment-wage elasticities. What the estimates in fact show is that changes in wage employment become increasingly responsive to changes in output during recessions, while employment-wage elasticity is lessened. In all cases, the effects on wage employment are greater than the effects on total employment. The reduced responsiveness of total employment to the cycle suggests a growing absorption capacity in the non-wage sector, which consists mainly of informal workers expelled from the formal sector during recessions. Thus, growing employment in the informal sector appears to moderate the aggregate employment impact of lower economic activity.

This paper is structured as follows. The next section briefly presents the theoretical framework for the estimates and discusses the empirical methodology and the specifications to be estimated. Section III then describes the data to be used and Section IV discusses the findings. Lastly, the conclusions are presented (section V). An Appendix is included at the end of the document.

II

Dynamic labour demand estimations

1. Specification

Theoretically, the labour demand function can be derived by solving a firm's cost minimization problem. In other words, an aggregate production function for the economy of type $y = Af(k.l)$ is assumed, where y is GDP, A is a Hicks-neutral technology parameter, k is capital and l is the employment level. It is then assumed that the level of employment is the one that minimizes production costs for the economy, subject to the constraint of a given level of output being achieved. One solution to this problem, derived from the first-order condition expressed in logarithms, implies that

$$ln(l) = c_0 + aln(w) + blny \qquad (1)$$

where c_0 is a constant, $a < 0$ and $b > 0$. Alternatively, (1) could be derived from the price of capital and even from other production factors if we assume a multiple-factor production function. This would consist in considering the first-order conditions for all the production factors and substituting them as appropriate in (1) through y. Thus, for example, the first-order condition for capital, appropriately substituted in (1), would imply that $ln(l) = c_0 + aln(w) + bln(y) + cln(r)$, where r is the cost of capital. Then, both this specification and (1) are correct, although from the econometric standpoint it can be adduced that (1) presents an omitted variables problem, which will be discussed later on.[4]

The four main problems in estimating (1) are aggregation, simultaneity, autocorrelation and measurement errors (Hamermesh, 1993). First, it is recognized that the estimation of aggregate elasticities only reflects the net response of the demand for labour to changes in its determinants, but conceals intrasectoral dynamics. Ideally, one would like to have microdata for each of the countries to reach more reliable estimates of labour demand. Second, it is recognized that wages are not exogenous but are the result of the interaction between labour supply and demand. If wages are assumed to be exogenous as in (1), then the implicit assumption is that the supply of labour is perfectly elastic at least within the range of variation of observed wages. Third, the employment and output series present high serial correlation and may be influenced by a strong trend. Lastly, equation (1) has an omitted variables problem, as the effect of the price of other production factors on the demand for labour is not considered.[5] Limited information is the main constraint when it comes to reducing the impact of these potential problems. Nonetheless, the estimation of the specification of (1) in differences, which will be presented in the following subsection, can help to deal with the drawbacks mentioned. This reduces problems of spurious correlation of series and also simultaneity, since wage variations are less likely to be related to changes in the labour supply in the short term.

A last point to consider is the presence of adjustment costs in employment. Although firms might find it optimal to modify their headcount to a new desired level after a shock, the existence of employee recruitment, training and dismissal costs means that employment will adjust only slowly towards this new level. One way of capturing the partial adjustment of employment is to introduce the lagged dependent variable between the explanatory variables of (1). This specification can be arrived at by introducing the adjustment cost associated with net employment changes $C(dl)$ among the firm's costs and formulating a dynamic problem. When static expectations and quadratic costs are assumed, it transpires that the change in the employment level between two points in time is $dl = \delta(ln(l^*) - ln(l))$, where l^* is the desired long-term employment level and $0 \leq \delta \leq 1$.[6] Thus, the employment adjustment observed is a fraction δ of the desired adjustment.[7] Then, setting out from the expression dl above and for

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[4] Many studies use derivations very similar to (1). Some of the most recent include Bruno, Falzoni and Helg (2004) and Castro and Saslavsky (2008).

[5] After analysing the findings of a great many studies, Hamermesh (1993) concluded that incorporating the prices of other factors in (1) affected the results only slightly.
[6] As in (1), we then have $ln(l^*) = c_0 + aln(w) + blny$.
[7] See Anderson (1993) and Márquez and Pagés (1998) for further details.

an economy i in time t, the specification with partial adjustment of employment is

$$ln(l_{it}) = \delta c_0 + \delta a ln(w_{it}) + \delta b ln(y_{it}) + (1-\delta)ln(l_{it-1}) \quad (2)$$

where δa and δb are short-term elasticities, whereas a and b are long-term elasticities. To simplify the presentation, the rest of this study will employ the notation $a' = \delta a$, $b' = \delta b$ and $c' = 1 - \delta$.

2. Estimation technique

A version of (2) including fixed effects for country p_i is

$$ln(l_{it}) = p_i + a'ln(w_{it}) + b'ln(y_{it}) + c'ln(l_{it-1}) + e_{it} \quad (3)$$

where $i = 1...N$ and $t = 1...T$, with N being the number of countries, T the number of time observations per country and e_{it} a random error term. The introduction of fixed effects by country in (3) allows us to control for the effect of specific unobservable variables in each country that are not captured by changes in output and wages. Nonetheless, including fixed effects means that the estimation of (3) by ordinary least squares (OLS) is inconsistent. In the first place, the assumption of non-correlation between the fixed effects and the explanatory variables is not acceptable, given that both l_{it} and l_{it-1} depend on p_i, which is invariant in time. One way of addressing this problem is to express (3) in differences, as follows:

$$dln(l_{it}) = a'dln(w_{it}) + b'dln(y_{it}) + c'dln(l_{it-1}) + e_{it} \quad (4)$$

where $dln(x_{it}) = ln(x_{it}) - ln(x_{it-1})$ for $x = l,w,y$. The problem that now arises is that differentiating (3) induces a correlation between the lagged dependent variable and the error term. Given that specification (4) comes from a specification in levels, the lagged dependent variable $dln(l_{it-1})$ contains part of e_{it} by construction, since the two elements are correlated. This is because both $dln(l_{it})$ and $dln(l_{it-1})$ include $ln(l_{it-1})$. In consequence, $dln(l_{it-1})$ is endogenous in (4) and as Bond (2002) suggests, the OLS estimation is inconsistent. To solve this problem, many studies suggest instrumenting $dln(l_{it-1})$. One of the techniques most used for this purpose is that of Arellano and Bond (1991), which consists in instrumenting the lagged dependent variable within the framework of the

generalized method of moments (GMM).[8] The problem with this technique is that it is only applicable to large samples and for cases where $N > T$, a condition that is not met with the data in this study. Then, using the Arellano and Bond (1991) technique in small samples would also produce inconsistent and inefficient estimators. This seems to be a particular problem for series in levels where there is high persistence (such as the employment series), and the smaller the sample size and the larger the number of instruments used (among other factors), the worse it becomes. Hahn, Hausman and Kuersteiner (2007) propose a technique for dynamic panels and small samples which, as they demonstrate, minimizes the use of instruments while yielding c' estimators with better properties in terms of accuracy and the reduction of biases. This technique is also a GMM variant, but it differs from that of Arellano and Bond (1991) in that it uses far fewer instruments, but optimally, which is particularly beneficial for small samples.

Albeit in different applications, the technique of Hahn, Hausman and Kuersteiner (2007) has been used in many studies, such as Brock and Franken (2003), Alfaro and others (2004) and Huang and Ritter (2009). The algorithm consists in estimating the coefficient of the lagged dependent variable (c') in an initial stage on the basis of a regression of the remainders of two earlier regressions, which are used as instruments. In fact, Hahn, Hausman and Kuersteiner (2007) suggest the remainders from (3) as valid instruments. In the first instance, all the variables are expressed as deviations from the mean. In this way, the model comes to be expressed in multiperiod differences instead of first differences alone, and the fixed effects are removed. In other words, any variable x_{it} is expressed as $ddln(x_{it}) = ln(x_{it}) - mean(ln(x_{it}))$. The first remainder is obtained from a regression between the dependent variable and the independent variables, i.e.

$$res^1{}_{it} = ddln(l_{it}) - a^{1*}ddln(w_{it}) - b^{1*}ddln(y_{it})$$

where a^{1*} and b^{1*} are estimated coefficients. The second remainder $res^2{}_{it}$ comes from the same regression as before, but with all the variables lagged one period. From the coefficient of the regression between $res^1{}_{it}$ and $res^2{}_{it}$ we can obtain an estimator c'^*[9] to calculate

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[8] See, for example, Vergara (2005) for an application of Arellano and Bond (1991) in employment studies for Chile.
[9] A bias correction such as $c'^* = c^*(T+1)/T + 1/T$ must be applied to the coefficient of regression between the remainders c^*.

the variable $z_{it} = ddln(l_{it}) - c'^*ddln(l_{it-1})$. Lastly, the estimators for the rest of the coefficients, such as a' and b' in (3), are obtained from the regression of z_{it} in the independent variables, i.e.

$$z_{it} = a'ddln(w_{it}) + b'ddln(y_{it}) + e_{it}$$

Although the advisability of using the Hahn, Hausman and Kuersteiner (2007) technique is emphasized, section IV will also present the results of estimating (4) by OLS.

3. Trade and employment

We shall extend specification (4) in two ways. First we shall consider the impact of market opening, measured as the sum of exports plus imports as a percentage of GDP (*open*), and also of the real exchange rate (*RER*). It can be assumed that these two variables will affect (1) via a change in the technology parameter A of the production function (Castro and Saslavsky, 2008), or alternatively that exposure to globalization is a variable that enters into the production function (Bruno, Falzoni and Helg, 2004). Another hypothesis suggested later is that these variables could enter (1), indirectly affecting w_{it}. Then we will be able to estimate the following equation:

$$dln(l_{it}) = a'dln(w_{it}) + b'dln(y_{it}) + c'dln(l_{it-1}) + d'dln(trade_{it}) + e_{it} \quad (5)$$

where *trade = open, RER*. We shall not include *open* and *RER* in the same estimation because of their potentially high correlation, which could skew the estimates for other parameters. Specification (5) can even present the problem of high correlation between $dln(w_{it})$ and the trade variables, which would also create a problem of multicolinearity whose main drawback would be to increase the standard error of the coefficients estimated. This is a particular problem in the case of small samples like those used in this study.

The empirical evidence for the impact of market opening on employment in Latin America is not conclusive (IDB, 2003). Márquez and Pagés (1998), Peres and Stalling (2000) and Weller (2000) have found that market opening affects aggregate employment negatively (albeit variably) while real-term currency

depreciation has a positive effect. Haltiwanger and others (2004), meanwhile, have found a positive relationship between net job creation and real-term currency appreciation. Lastly, Galindo, Izquierdo and Montero (2007), working with disaggregated industrial data, have observed that real-term depreciation tends to raise employment in industries with low levels of dollar borrowings and reduce it in industries with heavy foreign currency borrowings.[10]

4. Cycles and employment

Another useful extension to (4) is one that reflects the differential impact the economic cycle might have on the demand for labour. For this, the following equation will be estimated:

$$dln(l_{it}) = [a'dln(w_{it}) + b'dln(y_{it}) + c'dln(l_{it-1})][1 + f'REC_{it}] + g'REC_{it} + e_{it} \quad (6)$$

where *REC* is a dummy variable taken from Gutiérrez (2007) for a situation in which the country is in an output slowdown phase. Also considered will be an alternative definition of *REC* as a dummy taking the value 1 if GDP growth is negative. As can be seen, specification (6) allows not only a change of position in the aggregate labour demand curve during recessions but also alterations in the short-term elasticities of employment and output. Thus, positive values for $b'f'$ and $a'f'$ will indicate, respectively, an increase in the absolute value of employment-output elasticity and a reduction in employment-wage elasticity during recessions. Then, short-term employment-wage and employment-output elasticities at times of recession are equivalent to $a'(1 + f')$ and $b'(1 + f')$, respectively.

To capture a better lag structure in (4), (5) and (6), while recognizing the constraint on the number of observations, the wage changes, real exchange-rate and trade volume variables are calculated as a simple average of observations between t, $t-1$ and $t-2$ (the last three years).

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[10] This observation is consistent with Cavallo and others (2004) in their analysis of the repercussions of exchange-rate shocks on economic activity.

III

Data

Given the importance of employment information to this study, it needs to be stressed that long, reliable series of aggregate employment figures are not easy to come by for the countries of Latin America and the Caribbean. This study uses employment data obtained in two different ways. First, there are aggregate employment series from household surveys in six countries for the 1985-2008 period. These data are a revised and updated version of those used in table IV.1 of Weller (2000). The countries concerned are Argentina, Brazil, Chile, Colombia, Costa Rica and Mexico. Second, aggregate employment series were estimated for 15 countries covering the 1980-2007 period and using information from the ECLAC Database on Social Statistics and Indicators (BADEINSO) relating to urban unemployment rates (u) and estimates of the economically active population (EAP) from the International Labour Organization (ILO). Then, for each observation, employment l_{it} is obtained as $l_{it} = (1-u_{it}) EAP_{it}$. The rest of the information used is from ECLAC databases. The extended dataset (covering 15 countries) presents some observations of unavailable data.

There are thus two panels, a balanced panel of 132 observations (six countries, 22 years) and an unbalanced one of 365 observations for 15 countries and 26 points in time. To facilitate the exposition, the terms G6 and G15 will refer to the first and second panel, respectively. The Appendix presents the descriptive statistics for each country in the two panels of the main variables used.

Table 1 presents the correlations between the variables of interest in this study. The correlation analysis, while it does not yield information about causality, does give an idea of the relationship between the trends of the variables. It should also be noted that these are unconditional pair correlations, i.e., they are not controlled for the dynamic of other variables, as will be done in the following section.

In all the tables in this study, *dlx* represents the difference of logarithms (percentage change) of x = l, y, w, *open*, *RER*, where l represents aggregate employment and y output. The variables w, *open* and *RER* are the averages of real wages, trade volumes as a percentage of GDP and the real exchange rate (RER), respectively, over the last three years.

TABLE 1

Correlation matrix
(Variables in differences)

	dll	dly	dlw3	dlopen3	dlrer3
G6 panel (1985-2008)					
dll	1				
dly	0.3830[a]	1			
dlw3	–0.0108	0.3373[a]	1		
dlopen3	0.0030	–0.1351	–0.3747[a]	1	
dlrer3	0.1396	–0.2744[a]	–0.2328[a]	0.5231[a]	1
G15 panel (1980-2007)					
dll	1				
dly	0.4749[a]	1			
dlw3	–0.0151	0.2711[a]	1		
dlopen3	0.0318	0.0533	–0.2216[a]	1	
dlrer3	0.0473	–0.0585	0.1138[b]	0.5012[a]	1

Source: prepared by the author.

[a] and [b] indicate statistical significance at 1% and 5%, respectively.

As can be seen, there is a positive and statistically significant unconditional correlation for both panels between changes in employment and changes in GDP. The correlation of employment growth with the other variables is not statistically significant enough to be analysed. Finding zero correlation between wages and employment at this stage of the analysis does not necessarily mean there is no relationship between the variables, as will be seen in the following section.

Meanwhile, the positive and statistically significant correlation between output and real wages in differences can be put down to the fact that the wage dynamic partly reflects increases in labour productivity.

The findings in table 1 also indicate a weak negative correlation for both panels between output growth and real depreciation that is statistically significant in the first panel. Although real depreciation benefits export sectors, it makes imports of goods and inputs more expensive and also increases the value of foreign-currency debts, with a negative impact on economic activity. These last factors seem to dominate the *dly–dltcr* correlation in the table. As was noted earlier, these correlations do not capture the effect of other variables that may affect the variables analysed. Thus, for example, this negative correlation between real depreciation and growth may be influenced by major devaluations and recessions like those of Mexico in 1994 and Argentina in 2002.[11]

For both samples, and at statistically acceptable confidence levels, a negative correlation can also be observed between differences in real wages and the volume of trade. Although the correlation analysis does not yield information about causality, these findings can be interpreted both by the greater competitive pressure on real wages from a larger flow of imports and by the effect on exports of more competitive real wages, as analysed later on.

Where table 1 is concerned, lastly, we can see a statistically significant relationship between changes in real wages and changes in the RER that is negative in the sample of 6 countries, although positive for the larger sample. Both theoretically and empirically, the relationship between real wages and the RER is inconclusive (Campa and Goldberg, 2001; Goldberg and Tracy, 2003). From a microeconomic standpoint, a real-term depreciation can stimulate local output and demand for labour and thus have a positive effect on real wages. On the other hand, by increasing the cost of imported inputs that may complement labour, a real-term depreciation can have a negative effect on wages and the demand for labour.[12]

Where the data presented here are concerned, this correlation may capture, first, a linkage between inflation and real-term currency appreciation in cases where wages are not perfectly indexed to inflation and, as demonstrated in the literature, the law of exchange-rate purchasing power parity (PPP) does not operate. Again, a negative correlation may be explained by the effect of real productivity increases that can translate into higher real wages and an appreciation of the RER. The table 1 results seem to suggest that the second explanation predominates for the sample of 6 countries and the first for the larger sample.

IV

Results

Table 2 summarizes the results of estimating (4) using OLS and the Hahn, Hausman and Kuersteiner technique, denoted as HHK, for the two samples mentioned above. The results differ between the two panels but are fairly similar within them for both estimations. Nonetheless, there is a higher coefficient, statistically significant at 1%, for the lagged dependent variable

in the HHK estimates with both panels. This reflects the better properties of the estimators obtained with this technique. For this reason, only the results of the HHK estimates will be included in the remaining tables of this study.

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[11] See Agénor and Montiel (1996) for a review of the literature on the effects of real depreciations on economic activity.

[12] Furthermore, Mishra and Spilimbergo (2009) consider a positive effect of real exchange-rate depreciation on real wages in countries with a high level of international labour mobility. In this case, depreciation spurs emigration and this can lead to a reduction in the local labour supply and higher real wages.

TABLE 2

OLS and HHK estimates

(Dependent variable: growth in aggregate employment (DLL))

Estimate	OLS	HHK	OLS	HHK
dly	0.336	0.319	0.2746	0.249
	[0.0566][a]	[0.0608][a]	[0.0365][a]	[0.0372][a]
dlw	−0.118	−0.113	−0.0512	−0.046
	[0.0482][b]	[0.0513][a]	[0.0148][a]	[0.0142][a]
dll(−1)	0.185	0.279	0.0797	0.292
	[0.1084][c]	[0.0812][a]	[0.0574]	[0.0495][a]
Observations	132	132	359	359
Countries	6	6	15	15
R-squared	0.21	0.14	0.28	0.22
Period	1985-2008	1985-2008	1980-2007	1980-2007
Long-term effects				
dly	0.412	0.442	0.298	0.352
	[0.073][a]	[0.0844][a]	[0.0373][a]	[0.0526][a]
dlw	−0.145	−0.157	−0.056	−0.065
	[0.0608][b]	[0.0071][a]	[0.0160][a]	[0.0201][a]

Source: prepared by the author.

N.B.: This table reports the results of ordinary least squares (OLS) and Hahn, Hausman and Kuersteiner (HHK) regressions of specification (4), for the G6 (columns 2-3) and G15 (columns 4-5) samples. It also reports the long-term effects derived from the estimates. Robust standard errors are reported in square brackets below each coefficient.

[a], [b] and [c] indicate statistical significance at 1%, 5% and 10%, respectively.

In the first place, as predicted by theory and in line with the literature, the findings reflect positive and negative employment-output and employment-real wage elasticities, respectively. Thus, for both estimates the coefficients of changes in GDP and wages are always statistically significant.[13]

First, the data in the G6 panel (columns 2 and 3) allow us to situate short-term employment-output elasticity between 0.32 and 0.34, while employment-wage elasticity varies between −0.11 and −0.12. The coefficient of the lagged dependent variable presents greater variation between the estimates and is within the range [0.18, 0.28]. The estimators are statistically significant at acceptable confidence levels. The fact

that the coefficients of the lagged dependent variable are relatively small means that the long-term effects are only slightly greater than the short-term ones. In fact, short-term impacts account for 80% of the total effects. Thus, in the case of employment-output elasticity, the average long-term elasticity for the two estimates is 0.33 and 0.43 in the short and long term, respectively. These coefficients are somewhat lower than those reported in Weller (2000), which uses the same database but running up to 1998. Although they are not strictly comparable given that the specification is very slightly different, these results would indicate a tendency for the responsiveness of employment to changes in GDP to diminish over the past 10 years.

Broadly speaking, the results obtained from the sample of 15 countries (columns 4 and 5) are qualitatively similar to those described in the previous paragraph, although the coefficients present markedly lower magnitudes. As can be seen, the coefficient of changes in GDP drops to 0.26 and that of wages to about 0.05 on average. As with the six-country panel

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13 This may seem to contradict the absence of correlation between real wages and employment shown in table 1, but it does not. The table 2 estimates indicate that for a constant level of output, higher real wages tend to reduce employment. In table 1 there are clearly a range of factors that affect the employment-wage correlation and one of these is in fact the dynamic of output which, as we have seen, relates positively to changes in real wages.

estimation, we can once again observe larger differences between the two estimations in the coefficient of the lagged dependent variable, although the short- and long-term effects are similar.

What explains the differences in the elasticities obtained with the two panels? Apart from the fact that the time series are slightly different, it is probable that the group of countries included in G6 have a different production and technology structure from the other countries included in the G15 panel. Following Hamermesh (2004), the differences in elasticities may involve radical differences in the composition of output and even in the technology employed in the countries to produce identical products. Indeed, one striking difference between the characteristics of the two samples of countries is that the G15 panel includes economies in which the rural sector is more preponderant and there is a lower percentage of wage employment. Thus, on the basis of the latest data available from CEPALSTAT, appreciable differences can be observed between the countries in the two samples as regards the composition of the labour employed by occupational category and sector of activity, so much so that, taking data from 2003 to 2007 depending on the country, we find that the wage earners and own-account groups represent, respectively, 67.4% and 24% for the countries making up the G6 panel and 57.6% and 33% for the remaining countries included in the G15 panel. Agricultural sector employment, meanwhile, accounts for 15% and 25.2% of the total in the G6 panel countries and the rest of the countries, respectively.

1. Trade and employment

Specification (5) incorporates the hypothesis that economic opening processes like those undergone by many of the region's countries over recent decades influence the demand for labour. There is no straightforward theoretical or empirical answer to the question of what impact this process has on employment.[14]

Cuts in real wages are one mechanism through which greater competition can influence employment. If this happened, specification (5) would present a multicolinearity problem. As can be seen in table 1, there is also a high correlation between trade volumes and the real exchange rate. Columns 2 to 5 of table 3 thus present the results of regressions for specification (5), but without including the real wages variable.[15]

Columns 3 and 4 look at the differentiated impact that exports (*dlexp*) and imports (*dlimp*) may have on the market opening variable.

In the case of the G6 panel, it transpires that both a deepening of trade and real currency depreciations positively affect net job creation. According to the results of columns 3 and 4, this positive effect of opening on employment is dominated by the positive effect of exports (*dlexp*) and not imports (*dlimp*), which would affect employment negatively. Similar (although not always statistically significant) findings derive from the estimates based on sample G15. As can be seen, inclusion of both the market opening variable and the RER does not seem to greatly affect the coefficients that measure the effect of output growth on employment.

Columns 6 to 9 of table 3, meanwhile, display the results of the estimation for (5), including the real wages variable. There it is observed that the HHK estimation in table 2 using G15 data is not very sensitive to the inclusion of external trade variables. Different results are yielded by the estimation using data from six countries (G6 panel). What stands out there is that including all trade variables along with *dlw* seems to generate problems of colinearity with wages, given that in all cases the wages coefficient becomes statistically indistinguishable from zero. Indeed, as can be seen, even though the real wage affects job creation in estimate (4), the effect becomes statistically insignificant in estimate (5). This suggests that the problem of colinearity is not minor.

This result is not surprising given the discussion in the previous section on the correlations between changes in wages, real exchange rates and market opening. Furthermore, the results of regressions in differences of real wages with trade volume (*dlopen*) and the real exchange rate (*dlrer*) are consistent with the table 1 correlations. In other words, the G6 panel data indicate that greater openness (dominated by the export effect) and, to a lesser extent, real exchange-rate depreciations relate negatively to real wages. These estimates are presented in table A3 of the Appendix. These results, together with those in table 3, suggest that the partial evidence of positive employment effects from market opening could operate via an indirect effect of this process in reducing real wages.

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[14] For a discussion see, for example, IDB (2003).
[15] Because the long-term effects will not be analysed, the coefficients

of the lagged dependent variable are not reported. In any event, the coefficients are quite similar to those of table 2 for the hhk model.

TABLE 3

Employment, market opening and real exchange rates
(Dependent variable: growth in aggregate employment (dll))

	dll	dll	dll	dll	dll	dll	dll	dll
dlopen	0.1044 [0.0486][b]				0.0775 [0.0452][c]			
dlexp		0.1335 [0.0634][b]				0.1101 [0.0672]		
dlimp			−0.0995 [0.0324][a]				−0.09 [0.0314][a]	
dlrer				0.1014 [0.0277][a]				0.0935 [0.0256][a]
dly	0.2853 [0.0578][a]	0.3042 [0.0594][a]	0.3799 [0.0650][a]	0.3561 [0.0654][a]	0.3103 [0.0620][a]	0.3255 [0.0630][a]	0.3984 [0.0653][a]	0.375 [0.0680][a]
dlw					−0.069 [0.0515]	−0.066 [0.0568]	−0.0715 [0.0502]	−0.0648 [0.0470]
Observations	126	126	126	126	126	126	126	126
Countries	6	6	6	6	6	6	6	6
Period	1985-2008	1985-2008	1985-2008	1985-2008	1985-2008	1985-2008	1985-2008	1985-2008
R-squared	0.15	0.16	0.18	0.19	0.16	0.17	0.19	0.21
dlopen	0.0147 [0.0148]				0.0017 [0.0159]			
dlexp		0.0016 [0.0198]				0.009 [0.0206]		
dlimp			−0.0423 [0.0131][a]				−0.0418 [0.0126][a]	
dlrer				0.0256 [0.0099][b]				0.0319 [0.0108][a]
dly	0.2149 [0.0376][a]	0.2172 [0.0384][a]	0.2481 [0.0377][a]	0.2193 [0.0376][a]	0.2506 [0.0378][a]	0.2504 [0.0381][a]	0.2795 [0.0364][a]	0.2581 [0.0372][a]
dlw					−0.0453 [0.0155][a]	−0.0462 [0.0136][a]	−0.0397 [0.0140][a]	−0.0531 [0.0127][a]
Observations	378	378	378	378	359	359	359	359
Countries	15	15	15	15	15	15	15	15
Period	1980-2007	1980-2007	1980-2007	1980-2007	1980-2007	1980-2007	1980-2007	1980-2007
R-squared	0.18	0.18	0.21	0.19	0.22	0.22	0.26	0.25

Source: prepared by the author.

N.B.: This table reports results for regressions of employment with the volume of trade, exports, imports and the real exchange rate in differences and for specification (5) for the G6 and G15 samples, respectively. Robust standard errors are reported in square brackets below each coefficient.

[a], [b] and [c] indicate statistical significance at 1%, 5% and 10%, respectively.

2. Cycles and employment

This subsection presents the results of the estimation of (6) for the eight countries included in Gutiérrez (2007), using wage and total employment series for 1994-2007 and total employment series for 1980-2007.[16] Unfortunately, there is no wage employment series going further back, and indeed some observations are unavailable for certain of the countries included in the sample.

Specification (6) considers the differential effect of recessions on the demand for employment, which is captured by the REC dummy. Using annual series for eight countries in the region, Gutiérrez (2007) identifies phases of accelerating and slowing output when the cycle obtained from a Hodrick-Prescott filter for per capita GDP presents three consecutive years of a rising and falling trend, respectively. Periods in which there is no marked tendency are defined as stable. The REC dummy thus takes the value 1 when the country is in a downturn phase for per capita output. Table A4 of the Appendix presents descriptive statistics for the change in total and wage employment and the REC dummy in the 1994-2007 period under analysis. One problem with this variable is that it does not exclusively capture periods of declining economic activity. This is because, according to the definition of a downturn used in Gutiérrez (2007), the economy could be growing below trend at both positive and negative growth rates. The particular problem for this series is that there are virtually no periods of economic contraction in the countries considered over the time period covered. In longer series it is possible to identify more extended periods of contraction. Accordingly, equation (6) was estimated with the total employment series for the G15 panel, defining a recession as a period in which GDP growth is negative. The results are reported in columns 6 and 7 of table 4.

Table 4 summarizes the results of the labour demand estimates.[17] The specifications of columns 2, 4 and 6 come from adding only the REC dummy to the original specification (4). In the first place, we observe substantially higher employment-output and employment-wage elasticities in the demand for wage employment than in that for total employment. In

the second place, the REC coefficient is negative in all cases, although not statistically significant.

Meanwhile, columns 3, 5 and 7 show the results of the estimation of (6) for wage and total employment, as applicable. The positive and in some cases statistically significant signs for $dlyREC$ and $dlwREC$ indicate an increase in absolute employment-output elasticity and a reduction in employment-wage elasticity during downturns.

The final rows of table 4 report the coefficients for the total effects of changes in output and real wages on employment during recessions, obtained by estimating specification (6). These coefficients represent short-term employment-output and employment-wage elasticities at times of recession and are equivalent in equation (6) to $a'(1 + f')$ and $b'(1 + f')$, respectively. In all cases, the coefficients of $dly + dlyREC$ are greater than those of dly and are statistically significant.

In the case of wage employment, employment-output elasticity rises from 0.3 at times of stability and rising growth to almost 0.75 during recessions. Total employment also becomes considerably more responsive to changes in GDP during recessions, albeit not to the same extent (columns 5 and 7).

Meanwhile, the wage coefficient in the equation with wage employment falls from –0.22 at times of stability and faster GDP growth to –0.03 in recessions. There also seems to be a tendency for wages to become detached from total employment during recessions. Thus, in the estimation in column 7 of table 4, where negative output growth is used as a measure of recession, the wage coefficient goes from –0.07 in periods of stability and strong growth to –0.04 in recessions.

A first explanation for these results is that companies' demand for labour is constrained by lower demand for their products in recessions and that falling wages are not enough to boost employment. In this context, expectations must also be an important factor. Thus, for example, even when recruitment subsidies exist at times of recession, firms will not necessarily increase employment if they do not expect demand for their products to recover.

The table 4 results can also be explained using two of the traditional Marshall rules for derived factor demand (Hamermesh, 1993): (i) first, if a negative demand shock involves redundancies, it is to be expected that labour costs will fall as a share of firms' total production costs and therefore that these will ultimately respond with few changes in wages. In this context, demand for labour would become more

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[16] The total employment data used in this subsection come from the G15 panel. The countries considered are Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru and Venezuela.
[17] The coefficients of the lagged dependent variable were not reported, being very similar to those of the hhk model in table 2.

TABLE 4

Employment and cycles

(Dependent variable: growth in wage employment (dllwage) and aggregate employment (dll))

	dllwage	dllwage	dll	dll	dll	dll
dly	0.411	0.305	0.225	0.194	0.201	0.175
	[0.0621][a]	[0.0596][a]	[0.0386][a]	[0.0366][a]	[0.0529][a]	[0.0427][a]
dlw	−0.178	−0.225	−0.079	−0.122	−0.047	−0.070
	[0.0937][c]	[0.0994][b]	[0.0459][c]	[0.0503][b]	[0.0135][a]	[0.0243][a]
REC	−0.007	−0.021	−0.002	−0.007	−0.008	−0.007
	[0.0070]	[0.0063][a]	[0.0039]	[0.0043]	[0.0047]	[0.0051]
dlyREC		0.442		0.133		0.064
		[0.1292][a]		[0.0730][c]		[0.1325]
dlwREC		0.193		0.134		0.031
		[0.1507]		[0.0748][c]		[0.0325]
Observations	91	91	96	96	359	359
Countries	8	8	8	8	15	15
Period	1994-2007	1994-2007	1994-2007	1994-2007	1980-2007	1980-2007
R-squared	0.33	0.4	0.25	0.28	0.23	0.23
Total effects						
dly + dlyREC		0.747		0.327		0.238
		[0.1175][a]		[0.0654][a]		[0.1250][c]
dlw + dlwREC		−0.032		0.012		−0.039
		[0.1135]		[0.05636]		[0.0194][b]

Source: prepared by the author.

N.B.: Columns 2 to 5 report the results for regressions of specification (4). The sample encompasses the eight countries included in Gutiérrez (2007), whence the REC variable is obtained. Results are presented for wage employment (columns 2-3) and total employment (columns 4-5). Columns 6 and 7 present the results for 15 countries, taking a decline in GDP as a measure of recession. Wage employment data are only available for the 1994-2007 period. The total effects *dlw* and *dly* deriving from the interaction with REC are also reported. Robust standard errors are reported in square brackets below each coefficient.

[a], [b] and [c] indicate statistical significance at 1%, 5% and 10%, respectively.

sensitive to demand for firms' products than to wages; (ii) furthermore, if the demand elasticity of output falls in recessions, firms will have fewer incentives to cut prices and this will feed through into lower employment-wage elasticity. In other words, during recessions the impact of falling wages on prices would not translate into higher demand for their products. This hypothesis could be supported by evidence from a large literature showing that the price elasticity of demand for output is procyclical.[18]

This would be consistent with lower employment-wage elasticity in recessions.[19]

Lastly, the observation in all cases of higher wage employment elasticities in relation to total employment suggests a change in the composition of employment during recessions. The fact that wage employment is destroyed to a far greater extent than total employment when economic growth diminishes appears to indicate that informal employment behaves countercyclically, helping to reduce the negative impact of recessions on total employment.[20]

[18] The procyclicality of output demand elasticity can be explained by an imperfect competition argument. With imperfect competition, firms produce below socially optimum levels. The volatility of output during cycles means that this inefficiency is countercyclical and the market power of firms can thus be expected to increase in recessions when production falls. Thinking along these lines can be found in Blanchard and Kiyotaki (1987).

[19] See, for example, Edmond and Veldkamp (2008). In this literature, the procyclicality of the price elasticity of demand for output derives from the countercyclicality of profit margins, defined as the ratio between marginal costs and prices.

[20] This result can be found online in Loayza and Rigolini (2006), who observe countercyclical behaviour in formal employment in

V

Conclusions

This study presents dynamic labour demand estimates based on data for 15 Latin American countries over the 1980-2008 period.

The results yield employment-output and employment-wage elasticities with signs that are consistent with theory and the international empirical evidence. The magnitudes of the elasticities are somewhat smaller than the average values reported by Hamermesh (1993) for a large number of studies. One of the reasons for this divergence is probably that estimates reflect net aggregate effects. There is thus a loss of information on adjustment differences between and within sectors.

In any event, and despite the limitations of using aggregate data, there are some results that may be of relevance to the region's current economic context. In

particular, an asymmetry is observed in the response of employment to its main determinants with respect to the economic cycle. Indeed, recessions not only bring downward shifts in the demand for labour, but also changes in the responsiveness of employment to economic growth and to changes in real wages.

The results predict an increased employment-output elasticity and a decreased employment-wage elasticity during the output slowdown and contraction phases. This suggests that policies to reduce labour costs would have a limited impact in reducing unemployment during recessions. Conversely, the results suggest that the positive employment impact of policies to stimulate aggregate demand would be enhanced at times of crisis.

Lastly, it is found that the effects described in the previous paragraph are concentrated in wage employment rather than total employment. This can be interpreted as a reallocation of surplus wage workers to the informal sector of the economy during recessions. These employment flows into the informal sector seem to reduce the negative impact of downturns on total employment.

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a sample of industrialized and developing countries. Using data from Brazil and Mexico, Maloney and Bosch (2008) find that the percentage of formal employment is countercyclical, although shifts from formal to informal employment are not countercyclical but procyclical.

APPENDIX

TABLE A1

Six countries: descriptive statistics, G6 panel (1985-2008)

Country	dll	dly	dlw	dlrer	dlopen
Argentina	0.020	0.033	0.013	0.018	0.050
	0.026	0.060	0.078	0.147	0.075
Brazil	0.021	0.027	−0.003	−0.009	0.037
	0.021	0.026	0.058	0.094	0.058
Chile	0.027	0.056	0.025	0.003	0.021
	0.017	0.027	0.012	0.056	0.028
Colombia	0.034	0.039	0.011	0.010	0.016
	0.039	0.025	0.014	0.091	0.019
Costa Rica	0.037	0.051	0.007	0.009	0.031
	0.030	0.024	0.029	0.044	0.030
Mexico	0.018	0.027	0.011	−0.006	0.038
	0.027	0.030	0.042	0.096	0.064
Average	*0.026*	*0.039*	*0.011*	*0.004*	*0.032*
	0.028	*0.036*	*0.045*	*0.093*	*0.050*

Source: prepared by the author.
N.B.: For each country, the first row shows the mean of each variable and the second its standard deviation.

TABLE A2

Fifteen countries: descriptive statistics, G15 panel (1980-2007)

Country	*dll*	*dly*	*dlw*	*dlrer*	*dlopen*
Argentina	0.022	0.02	−0.004	0.046	0.038
	0.021	0.062	0.055	0.162	0.083
Bolivia (Pl. St. of)	0.03	0.023	0.034	0.03	0.017
	0.022	0.028	0.052	0.088	0.054
Brazil	0.025	0.024	0	0.009	0.01
	0.019	0.032	0.043	0.1	0.075
Chile	0.023	0.045	0.019	0.02	0.016
	0.035	0.049	0.029	0.085	0.049
Colombia	0.036	0.035	0.019	0.017	0.007
	0.018	0.023	0.015	0.085	0.048
Costa Rica	0.036	0.041	0.003	0.02	0.018
	0.02	0.036	0.044	0.128	0.087
Ecuador	0.036	0.026	0.007	0.024	0.01
	0.025	0.035	0.069	0.089	0.061
Guatemala	0.02	0.028	0.011	0.002	0.013
	0.025	0.023	0.088	0.071	0.071
Mexico	0.029	0.026	−0.001	0.002	0.029
	0.014	0.034	0.051	0.084	0.067
Nicaragua	0.029	0.016	−0.046	−0.037	0.012
	0.023	0.041	0.214	0.232	0.133
Panama	0.033	0.038	0.004	0.02	0.018
	0.024	0.05	0.022	0.025	0.152
Paraguay	0.036	0.026	0.004	0.034	0.043
	0.025	0.029	0.031	0.097	0.102
Peru	0.034	0.024	−0.038	−0.03	0.003
	0.016	0.062	0.096	0.084	0.072
Uruguay	0.016	0.019	−0.005	0.022	0.019
	0.021	0.055	0.047	0.102	0.06
Venezuela (Bol. Rep. of)	0.037	0.021	−0.051	0.01	−0.001
	0.021	0.064	0.059	0.096	0.06
Average	*0.03*	*0.027*	*−0.003*	*0.013*	*0.017*
	0.023	*0.044*	*0.079*	*0.111*	*0.083*

Source: prepared by the author.

N.B.: For each country, the first row shows the mean of each variable and the second its standard deviation.

TABLE A3

Market opening, real exchange rate and real wages
(Dependent variable: growth in real wages (dlw))

	dlw	dlw	dlw	dlw	dlw	dlw	dlw	dlw
dlopen	–0.343				–0.225			
	[0.0603][a]				[0.0656][a]			
dlexp		–0.364				0.003		
		[0.1217][b]				[0.1728]		
dlimp			0.180				0.203	
			[0.0419][a]				[0.0452][a]	
dlrer				–0.154				0.058
				[0.0262][a]				[0.1569]
Observations	126	126	126	126	382	382	382	382
Countries	6	6	6	6	15	15	15	15
R-squared	0.17	0.14	0.1	0.1	0.06	0	0.05	0.01
Period	1985-2008	1985-2008	1985-2008	1985-2008	1980-2007	1980-2007	1980-2007	1980-2007

Source: prepared by the author.

N.B.: This table reports the results for regressions of real wages with the volume of trade, exports, imports and the real exchange rate (rer) in differences, for the G6 (columns 2-3) and G15 (columns 4-5) samples. Robust standard errors are reported in square brackets below each coefficient.

[a] and [b] indicate statistical significance at 1% and 5%, respectively.

TABLE A4

Eight countries: descriptive statistics, 1994-2007

Country	dll	dllwage	REC
Argentina	0.026	0.024	0.538
	0.027	0.044	0.519
Brazil	0.016	0.021	0.308
	0.02	0.016	0.48
Chile	0.014	0.024	0.462
	0.015	0.022	0.519
Colombia	0.027	0.014	0.385
	0.02	0.039	0.506
Costa Rica	0.036	0.032	0.462
	0.025	0.036	0.519
Mexico	0.02	0.026	0.385
	0.013	0.025	0.506
Peru	0.03	0.032	0.385
	0.008	0.046	0.506
Venezuela (Bol. Rep. of)	0.041	0.034	0.538
	0.024	0.042	0.519
Average	*0.026*	*0.025*	*0.433*
	0.021	*0.034*	*0.498*

Source: prepared by the author.

N.B.: For each country, the first row shows the mean of each variable and the second its standard deviation. rec is a dummy obtained from Gutiérrez (2007) which takes the value 1 when the country is in a phase of gdp slowdown.

(Original: Spanish)

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Child stunting and socio-economic inequality
in Latin America and the Caribbean

Guillermo Paraje

This paper investigates the factors determining the extent of the problem of child stunting and its socio-economic distribution in eight countries of Latin America and the Caribbean. It does so using a methodology that allows a socio-economic inequality index (the concentration index) to be decomposed by the factors affecting it. In the countries analysed, household "wealth" (measured by an indicator of material well-being) and maternal education are the most important determinants in the distribution of child stunting. The biomedical factors considered may be important in explaining the level of stunting, but their contribution to explaining inequality is relatively small. Geographical, cultural, ethnic and idiosyncratic factors also play a limited explanatory role, one that apparently depends on their relationship to the distribution of the socio-economic variables mentioned.

Guillermo Paraje

Professor at the School of Business

Universidad Adolfo Ibáñez,

Chile

➥ g.paraje@cantab.net

I

Introduction

Child stunting has enormous economic and social implications. For one thing, it is associated with negative health outcomes, particularly increased child mortality. Pelletier and others (1995), for example, showed that an average of 56% of deaths among under-5s in 53 developing countries were a direct or indirect consequence of inadequate nutrition. More recently, Black and others (2008) have reported that child stunting is responsible for some 2.2 million deaths a year and 21% of disability-adjusted life years (DALYs) lost in middle- and low-income countries.

Broadly speaking, child stunting carries both direct social costs (in the form of higher mortality, but also higher morbidity and the monetary cost this entails) and indirect ones. The latter include a permanent diminution in children's cognitive abilities, late entry into the education system and higher school drop-out rates, among other things (Victora and others, 2008). These factors are associated with a loss of labour productivity and economic growth (WHO, 2001). Given these characteristics, stunting entails a permanent loss of present and future resources and an alteration in their distribution.

At the same time, the disproportionate concentration of stunting in the lowest socio-economic strata would imply, among other things, that as the relative scale of the direct and indirect economic costs increases, stunting becomes not just a consequence of economic inequality but also a cause (owing to its impoverishing effect on sufferers), so that a vicious circle is created.

This relationship is very striking in Latin America and the Caribbean, as illustrated in figure 1, which shows the prevalence of child stunting at the national level (stunted children as a percentage of the total) and among households in the poorest quintile of a large group of middle- and low-income countries. The fact that stunting is more common among households

in the poorest quintile than in an average household in all these countries (all observations are above the 45° line marked on the chart) shows that this situation is invariably related to poverty. It can also be appreciated from the chart, however, that when the average prevalence is taken (low or high relative to other developing countries), the region's countries have prevalences in the bottom quintile that are among the highest in the world.

This has immediate implications for socio-economic policies: if the aim is to reduce average stunting levels, prevalence among the poorest households needs to be reduced, which means making the distribution less unequal. Thus, not only is it necessary to understand the causes of stunting in order to act upon them, but it is crucial to understand what variables affect its socio-economic distribution, since in principle there could be variables that are unimportant in explaining the average level of stunting but very important in explaining its distribution.

The main purpose of this paper is to identify and quantify the effect that major socio-economic and biomedical variables have had not only on the level of child stunting but also on its socio-economic distribution in eight countries of Latin America and the Caribbean during the early years of the twenty-first century. Although the methodology used is not new and has been applied in other cases (Wagstaff, Van Doorslaer and Watanabe, 2003; Hosseinpoor and others, 2006; Van de Poel and others, 2007; Chen, Eastwood and Yen, 2007), this study makes a number of contributions to the literature. First, it considers a large number of countries in the region with different development levels and from different subregions (Central America, Caribbean, Andean region). Although these countries are known to have high levels of economic inequality (De Ferranti and others, 2004), the effect of this on health —and child stunting in particular— has been less studied, particularly from a regional perspective.[1]

[1] We have only found three studies where socio-economic differences are compared for different groups of countries in Latin America and the Caribbean (Larrea, 2002; Larrea and Freire, 2002; Martínez, 2005). These authors use a different methodology from the present study, however.

FIGURE 1

**Developing countries (49 countries, 86 observations):
prevalence of child stunting in the poorest quintile, 1990-2005**
(Percentages)

◆ Developing countries ■ Latin America and the Caribbean
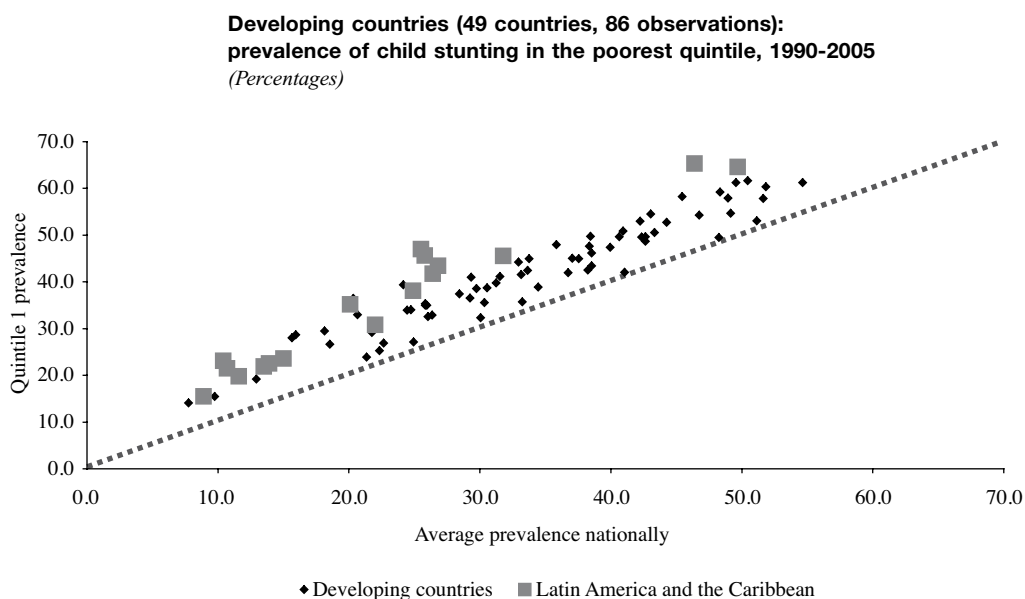
Source: prepared by the author on the basis of D. Gwatkin and others, *Socio-Economic Differences in Health, Nutrition, and Population within Developing Countries. An Overview*, Washington, D.C., World Bank, 2007 [online] http://go.worldbank.org/XJK7WKSE40.

Second, the new World Health Organization (WHO) reference standard is used to measure stunting (WHO, 2006). Instead of taking the United States population for comparison purposes, this new reference framework includes population groups from countries with differing degrees of development and different ethnic make-ups, such as Brazil, Ghana, India, Norway and Oman (as well as the United States). The reference population in those countries are people whose diet (chiefly in the case of newborns) and health care meets certain recommended standards. Consequently, this reference standard is broader (because it includes different populations) and at the same time more precise (because it takes specific groups within these populations) when it comes to measuring nutritional deficiencies. So far as the author is aware, this is the first study that has adopted this standard for the study of socio-economic inequality in child stunting in the region.[2]

Lastly, use is made of a simple explanatory model with variables that directly correlate to health, education and income policies. These variables are also simple to relate to models proposed for analysing the socio-economic determinants of health, like the one recommended by the recent Commission on Social Determinants of Health (WHO, 2008).

This paper is structured as follows. Section II presents the methodology used to decompose the determinants affecting stunting and its socio-economic distribution. The data sources used in this study are also described. Section III presents the results of the analyses conducted, while section IV sets forth the conclusions of the study and presents a number of policy recommendations for reducing the impact of stunting and its unequal socio-economic distribution.

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[2] Paraje (2008) and ECLAC (2008) use the same methodology as this study, but child stunting is measured using the old reference standard (based only on the United States population).

II

Methodology and data source

There are a number of factors that can be related in the aggregate to stunting, whose primary cause is an inadequate intake and assimilation of nutrients. These factors could be grouped into at least four categories (Martínez and Fernández, 2006). First, there are environmental factors, such as natural phenomena (floods, earthquakes, droughts, etc.) and "entropic" ones (i.e., those caused by human action on the environment), such as environmental pollution, that can temporarily or permanently affect the ability of the families affected by them to produce food or generate income.

But even if these factors are not present or their influence is moderate, food production or income generation can be plentiful in the aggregate but inadequate at the individual level owing to the unequal distribution of entitlements.[3] Second, what are known as socio-economic and cultural factors can determine the allocation of these entitlements via the distribution of productive assets (physical and human capital) and thence income.

Third, there are production factors, including the "characteristics of production processes", "the degree to which they utilize natural resources" and "the extent to which these processes mitigate or aggravate environmental risks" (Martínez and Fernández, 2006, p. 35).

Lastly, biomedical factors include elements that can affect an individual's propensity to become malnourished, such as the mother's nutritional status (particularly during gestation and the child's early months of life), the duration of breastfeeding (a shorter period of breastfeeding tends to increase the likelihood of child stunting), the child's sex and age, congenital factors, etc.

The methodology applied in this study to approach the problem of child stunting from a quantitative perspective considers this set of factors both directly and indirectly. This methodology consists in, first, estimating a multivariate regression between the child stunting variable and a set of relevant independent variables, and then using this estimation to decompose the socio-economic inequality of stunting into the factors causing it.

Much of the literature on the subject assumes that the statistical relationship to be considered in the first step of this process is a reduced form production function for child stunting within households (Grossman, 1972), which is estimated at the country level. This function is used to consider all the factors that directly influence the average level of child stunting, along with variables which are not included directly in the estimation but whose influence on stunting is intermediated by the variables included. For example, the ethnic group to which a child belongs might be considered a decisive factor in his or her degree of stunting. If this influence arises because, for example, the ethnic group possesses genetic characteristics or unobservable factors that differentiate it from other groups and are what cause stunting, then membership or otherwise of this ethnic group ought to be treated as a relevant variable within this "child stunting production function".[4] Conversely, if this ethnic group has high levels of stunting (above the average) and it is considered that these might be caused by low incomes (below the average) or inadequate parental education, then it is these variables (income, education, etc.) that ought to be considered in the explanation rather than ethnic variables as such.

In the present study, the function it is proposed to estimate has the following linear form:

$$z_{i,t} = \beta^0_t + \Sigma \beta^k_t x^k_{i,t} + \Sigma \beta^m_t x^m_{h,t} + \varepsilon_{i,t} \qquad (1)$$

where $z_{i,t}$ is the nutritional level of individual i in country t; $x^k_{i,t}$ is a set of explanatory variables at the level of each individual, i; and $x^m_{h,t}$ is a set of explanatory variables at the level of the individual household, h. The coefficients that accompany these variables are, then, a statistical estimation of the marginal importance of each of these factors in explaining the average level of stunting.

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[3] This argument is clearly set out by Drèze and Sen (1989) to explain how famines can occur even in situations where food is otherwise fairly abundant.

[4] The effect of ethnic variables on stunting was treated as irrelevant in the multicentre study by the World Health Organization (who) to determine reference standards for growth in childhood (who, 2006).

In a second stage, setting out from the estimation of this linear relationship, it is possible to use certain indicators of socio-economic inequality in the nutritional status of children and break this inequality down into its causes. The indicator chosen for this purpose is the concentration index, interpreted (and calculated) in much the same way as the well-known Gini coefficient (used to measure income inequality) and, like this, derived from a graphic tool that is easy to interpret: the concentration curve (homologous to the Lorenz curve).[5] In the case of stunting, this curve charts the cumulative nutritional status (nutritional deficiency) of children in accordance with the socio-economic position (as measured by income or wealth, for example) of their households. The concentration index is equal to twice the area between the concentration curve and the 45° line (which marks a neutral distribution of the variable under consideration).

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[5] See Kakwani, Wagstaff and Van Doorslaer for a description of this index and its asymptotic properties (1997).

If the concentration curve is below the diagonal, the concentration index takes values in the range [0; 1] (indicating that the variable analysed is concentrated among households of a higher socio-economic level). If the curve is above the diagonal, the index takes values in the range [–1; 0]. The more (less) concentrated the variable is, the more (less) this index will approach the value one (as an absolute value). In the case of child stunting, the index is highly likely to be in the [–1; 0] range, indicative of concentration in poor households. Figure 2 shows the concentration curve of child stunting for Honduras (2005), with a concentration index of –0.191.

According to Wagstaff, Van Doorslaer and Watanabe (2003), if stunting can be explained by equation (1), the socio-economic inequality of that stunting, summarized in their concentration index, can be decomposed as follows:

$$CI_t^z = \sum \left(\beta_t^k \bar{x}_t^k \big/ \bar{z}_t \right) CI_t^k + \\ \sum \left(\beta_t^m \bar{x}_t^m \big/ \bar{z}_t \right) CI_t^m + \left(G_\varepsilon \big/ \bar{z}_t \right) \tag{2}$$

FIGURE 2

Honduras: concentration curve for child stunting, 2005
(Percentages)

Source: prepared by the author on the basis of demographic and health surveys (DHS).

where CI^z_t is the stunting concentration index in country t; CI^k_t and CI^m_t are the concentration indices for the explanatory variables; the expressions $\left(\beta_t \, \bar{x}_t \, / \bar{z}_t \right)$ are the "elasticities" of stunting in relation to the explanatory variables; and $\left(G_\varepsilon / \bar{z}_t \right)$ is a residual term reflecting all the elements not explained by (1).[6]

Lastly, dividing both terms in (2) by CI^z_t yields the relative influence of each variable on the socio-economic inequality of the variable explained:

$$1 = \sum \left(\beta^k_t \bar{x}^k_t / \bar{z}_t \right) \left(CI^k_t / CI^z_t \right) + \sum \left(\beta^m_t \bar{x}^m_t / \bar{z}_t \right)$$

$$\left(CI^m_t / CI^z_t \right) + \lceil \left(G_\varepsilon / \bar{z}_t \right) / CI^z_t \rceil \qquad (3)$$

Equation (3) shows the contribution of each variable to total socio-economic inequality in child stunting (left-hand side of the equation), weighted by its importance as an explanatory factor in the average level of stunting.

Three elements affect this contribution. The first is the importance of this factor with respect to the average level of stunting, and it is given by the coefficient of each variable in the linear regressions reported (β coefficients). If this has a high value, the factor is going to have a greater explanatory "weight" in the inequality of stunting. The second element is the average level attained by this variable, in relation to the average level of stunting. The higher a variable's mean, the greater its relative contribution to the inequality of stunting will be. These two elements (regression coefficient and mean of the variable) serve to estimate the "elasticity" of each variable with respect to the level of stunting (and they are used to weight the influence of the socio-economic inequality of each explanatory variable on the inequality of child stunting). Lastly, the third element is the socio-economic concentration of each variable or, in other words, its index of concentration. The greater the impact of a variable on the result (i.e., the higher its elasticity in respect of stunting) and the greater its relative concentration in a specific group (such as "poor" households), the better it will explain the relative concentration of the result.

The data used to estimate equations (1), (2) and (3) are from the demographic and health surveys (DHS) compiled by Macro International Inc. and available at www.measuredhs.com, which are conducted in over 75 medium-low- and low-income countries in different regions of the world. They are nationally and subnationally representative household surveys with large sample sizes (usually between 5,000 and 30,000 households) whose main objective is to measure living conditions, health behaviour and health outcomes among women of childbearing age and children. The indicators thus compiled have the advantage of being fully comparable within countries over time and between countries. They are compiled at irregular intervals, usually every five years. The DHS used in this case are the most recent available (at the time this study was prepared) for the following countries (the survey year is given in parentheses):

1. Bolivia (2003)
2. Colombia (2005)
3. Dominican Republic (2007)
4. Haiti (2005)
5. Honduras (2005)
6. Guatemala (1999)
7. Nicaragua (2001)
8. Peru (2004)

The dependent variable to be estimated in equation (1) is a measurement often used as an indicator of children's chronic or long-term nutritional status: the standardized height-for-age coefficient or z-score. Usually, if this coefficient is more than two standard deviations below the median for the reference population, the child is considered to be stunted (i.e., to have nutritional deficiencies sustained over time with consequences for normal physical growth). Children under five (up to 59 months of age inclusive) are the population taken in all the countries except Bolivia, which has data only for children under 36 months.

This paper does not use a dichotomous variable to measure stunting or its absence, but employs the z-score itself (or more precisely its negative to facilitate interpretation of the results). Thus, it is possible to capture all information on a child's nutritional situation (nutritional status and, where stunting exists, its severity), which would not be the case if a dichotomous variable were used (all that would be measured would be the existence or otherwise of stunting in the child).

The explanatory variables of equation (1) have been selected on the basis of the theoretical and empirical evidence provided by the economic literature and the

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[6] The appendix to Wagstaff, Van Doorslaer and Watanabe (2003) details how equation (2) is obtained, but it is a well-known result in the income distribution literature. The residual term can be interpreted as the concentration index of the error in regression (1), ε. A small remainder or none would thus mean that the regression error had no specific distribution in relation to the socio-economic variable used to stratify households.

information available in the source selected. This being so, the relationships estimated between child stunting and the set of explanatory variables constitute "reduced form" estimates that implicitly incorporate a number of relationships between stunting and variables that are not directly used. Relevant variables not measured by the DHS, such as culture or idiosyncratic differences between groups, are considered tangentially via the region or country or the parents' education variables. As mentioned earlier, the fact that these variables do not explicitly appear in the ratios estimated does not mean their relative importance is overlooked; rather, there is a supposition that they act indirectly by influencing other, more direct channels.

The explanatory variables used can be grouped, following Martínez and Fernández (2006), into socio-economic factors, environmental factors and biomedical factors.[7] Among the former, measured at the household level, is the "wealth" or "material well-being" index. This index is constructed using principal components analysis (a methodology described in Filmer and Pritchett, 2001), which draws upon information about households' material conditions (availability of electricity, people per room, the materials used in floors, walls and roofs, etc.) and ownership of certain assets (car, motorcycle, bicycle, television set, refrigerator, etc.). The DHS do not report on any kind of monetary variable (such as income or spending), and the "wealth" indicator is the only one that can be used to measure households' material wealth.[8] The expectation must be that the greater the value of this index (the greater the household's "wealth"), the lower the level of child stunting will be, given households' greater opportunities to ensure a stable source of nourishment for their children.[9]

Also used is the mother's formal education measured in completed years of schooling; the formal education of the husband or partner, likewise measured in completed years of schooling (where women are single or without a partner, the educational level of the household head is taken); and the mother's occupational status (skilled versus unskilled employment, the reference group being non-participants in the labour market). Educational variables, especially in the case of maternal education, must also be expected to have a negative influence on stunting, and indeed on health outcomes in general, as is shown by Armar-Klemesu and others (2000) and Harttgen and Misselhorn (2006). The channels through which this variable acts are often manifold and complex and may include good hygiene practices, a greater ability to learn best practices in childcare, better use of public or private health services, etc. (Cleland and Van Ginneken, 1998). Again, better maternal education is often a source of higher income for the household, which reinforces its positive influence. Given the possible existence of non-linear effects, the maternal education variable is also squared (as in Larrea and Kawachi, 2005). A positive (negative) coefficient for this variable would show increasing (decreasing) marginal returns on maternal education for stunting.

Where labour variables are concerned, there are at least two opposing effects that could influence the nutritional situation of children. On the one hand, having the mother working outside the home means higher incomes and thus a better socio-economic situation (and less child stunting). On the other, it means that children will have to be left in the care of other people who will not necessarily be as well qualified as the mother, affecting (negatively) their health.[10] For low-skilled occupations, this negative effect will probably exceed the positive effect referred to, with maternal employment ultimately being a cause of child stunting (all other factors being constant). Larrea and Kawachi (2005) consider these channels for the case of Ecuador and find a (non-significant) negative relationship between stunting and children not being cared for by their parents. Unfortunately, this variable is not part of the DHS and thus cannot be included in this study.

The (household-level) environmental factors considered include the area where the house is situated (urban versus rural) and the politico-geographical region. In general, the literature documents better health indicators in urban areas than rural ones, particularly where child stunting is concerned (Smith,

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[7] There is no direct correspondence between the variables used in this study and those proposed by Martínez and Fernández (2006), mainly owing to the absence of data for some of them. For example, the environmental variables employed here (actually geographic variables) are meant to capture some of the causes proposed in that study.

[8] See Rutstein and Johnson (2004) and Paraje (2008) for a description of the advantages and drawbacks of this indicator.

[9] Many studies have found a close relationship between indicators of material well-being (whether the "wealth" indicator used here or household income/spending figures from other surveys) and child stunting, among them Wagstaff, Van Doorslaer and Watanabe (2003), Harttgen and Misselhorn (2006), Van de Poel and others (2007) and Chen, Eastwood and Yen (2007).

[10] It is very likely that the person left in charge of the child when the mother is out at work will have fewer occupational qualifications than her and, very probably, less education.

Ruel and Ndiaye, 2005). However, these differences usually conceal large disparities within these groups, caused among other things by the distribution of socio-economic characteristics such as income, education, household composition, etc. When these characteristics are taken into account the health disparities between urban and rural households disappear or greatly diminish (Van de Poel and others, 2007).

The politico-geographical region can also determine health outcomes. In countries where, for example, ethnic groups, particular economic activities or health services are geographically concentrated, the incidence of child stunting can display large regional differences (Martínez, 2005; Chen, Eastwood and Yen, 2007). For the purposes of this study, subnational regions and districts have been grouped as proposed by the DHS. A definition of these groups can be found in table A of the Annex.

Biomedical factors (for individual children) include sex (boys being the reference group), age in months at the time of the survey, age squared (to take account of non-linear relationships between this variable and child stunting), birth order (first children being the reference group) and birth weight in grams.[11] Sex is included to cover the possibility of gender bias. Generally speaking, there is little evidence of this and when such differences are encountered, they tend to show boys being more affected by stunting than girls (Marcoux, 2002; Chen, Eastwood and Yen, 2007).

Age tends to be positively related with stunting, but in a non-linear fashion: stunting increases sharply during the early months of life and later stabilizes (Valdivia, 2004; Larrea and Kawachi, 2005; Chen, Eastwood and Yen, 2007). Among children in Bolivia, Colombia, Ecuador and Peru, for example, this stabilization point occurs around the twentieth month of life (Martínez, 2005; Valdivia, 2004).

Birth order can also be related to stunting. The further down in this order children are, the more likely they are to be stunted, as they have to "compete" with their older siblings for maternal care and food, among other things (Martínez, 2005). Lastly, birth weight is closely related to morbidity in the early

months of life, the ability to absorb nutrients properly, and future development in general (Jewell, Triunfo and Aguirre, 2007; Victora and others, 2008). This indicator is more direct and has a greater impact on stunting than, for example, the mother's body mass index as used by Smith, Ruel and Ndiaye (2005) and Harttgen and Misselhorn (2006), and is preferred for that reason.

Lastly, a variable measuring households' access to the health-care system is considered. Assuming the other variables are constant and there is a properly functioning health-care system that provides high-quality services at a low price, it is to be expected that access to these services will reduce child stunting. Unfortunately, there is no variable in the DHS that measures that aspect and can be theoretically linked to the problem of stunting. One of the alternatives available is to use prenatal care (with appropriate care it would be possible to detect, for example, congenital factors that might cause low birth weight, or maternal nutrition could be improved). However, this type of care would require at least four visits to trained professionals, entailing an economic cost for the mother (in time, transport, etc.) even if these did not charge for their services. The decision as to whether or not to receive proper care would thus come to depend on the relative amount of this cost and, ultimately, on the socio-economic situation of the mother. Statistically, including a variable like this one would entail a problem of endogeneity (Schultz, 1984).

To avoid this, an alternative variable was chosen: skilled attendants at birth (professional care compared to non-professional care).[12] Although this variable is not strictly related to the child's immediate nutritional outcome, it can affect it since skilled attendants at birth can reduce infant and maternal morbidity after the birth and help the mother obtain information on how best to care for the child (Smith, Ruel and Ndiaye, 2005). This variable is thus included not only because it has this consequence for stunting but, crucially, to measure the availability of (access to) basic health services (health care, vaccinations, etc.). The implicit assumption is that if the mother has access to the health system at the time she gives birth, she also has such access in less critical circumstances.

For information purposes, table 1 gives percentages for the prevalence of child stunting (stunted children

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[11] A child's birth weight is a variable with many unreported values. So as not to lose this important variable, imputation was carried out using the "hot-deck" method with the child's birth size as reported by the mother (very large, larger than average, average, smaller than average, very small) and maternal education (no education, incomplete/complete primary, incomplete/complete secondary, tertiary). Because categories are used for maternal education, the resulting variable does not present problems of colinearity with maternal education in years.

[12] A birth is considered to have been attended by a professional when it has taken place in the presence of a qualified doctor, a qualified nurse or midwife, an auxiliary midwife or some other professional as defined by each country.

TABLE 1

**Latin America and the Caribbean (selected countries):
prevalence of stunting by determinant. 1999-2007**

(Percentages)

Variable	Bolivia 2003	Colombia 2005	Dominican Republic 2007	Guatemala 2002	Haiti 2005	Honduras 2005	Nicaragua 2001	Peru 2004
National average	*30.9*	*15.6*	*9.8*	*52.5*	*27.6*	*29.3*	*24.4*	*29.9*
Region								
Region 0	34.0	16.4	7.4	32.7	19.9	18.6	8.7	8.7
Region 1	40.1	18.1	8.2	63.9	31.5	23.4	20.1	22.9
Region 2	31.3	14.5	11.5	55.4	31.6	27.5	33.6	42.2
Region 3	41.9	13.3	9.0	52.2	-	35.4	32.6	32.4
Region 4	46.6	15.8	9.0	54.6	-	47.1	-	-
Region 5	22.2	-	15.5	61.7	-	17.9	-	-
Region 6	16.6	-	8.9	74.2	-	30.0	-	-
Region 7	36.5	-	17.4	-	-	32.6	-	-
Region 8	30.2	-	12.0	-	-	53.6	-	-
Region 9	-	-	11.6	-	-	50.8	-	-
Region 10	-	-	-	-	-	55.2	-	-
Region 11	-	-	-	-	-	48.6	-	-
Region 12	-	-	-	-	-	27.9	-	-
Region 13	-	-	-	-	-	32.9	-	-
Region 14	-	-	-	-	-	23.6	-	-
Region 15	-	-	-	-	-	24.9	-	-
Area								
Rural	40.3	22.1	12.7	61.5	32.3	38.0	34.7	47.4
Urban	24.0	12.5	8.4	37.2	18.5	17.2	14.2	13.2
Wealth								
Quintile 1	46.2	25.3	16.5	72.8	37.7	49.8	41.1	57.0
Quintile 2	38.6	16.4	9.8	67.4	35.8	38.5	31.3	40.8
Quintile 3	25.2	13.5	7.2	60.2	31.5	24.9	20.5	18.7
Quintile 4	19.5	9.8	7.7	33.6	19.9	14.3	10.3	7.3
Quintile 5	12.9	4.9	4.5	12.2	6.2	7.2	5.7	6.0
Mother's education								
No education	48.6	31.6	16.2	70.8	37.9	52.6	41.3	61.1
Incomplete/complete primary	37.7	19.9	12.6	49.1	26.8	31.4	25.7	47.6
Incomplete/complete secondary	18.8	11.6	9.2	19.3	14.2	13.8	10.6	17.5
Incomplete/complete tertiary	13.8	5.7	4.7	3.3	2.6	5.4	6.6	5.5
Occupational situation of mother								
Does not work outside the home	27.3	20.1	10.3	54.8	25.9	31.9	26.8	20.2
Skilled work	28.0	6.0	6.5	41.0	9.0	21.6	13.0	10.8
Unskilled work	34.0	15.7	10.6	49.4	30.4	26.7	23.3	37.8
Partner's education								
No education	43.1	21.5	16.9	66.3	37.2	47.7	36.5	57.3
Incomplete/complete primary	40.3	19.5	12.5	57.6	32.0	30.6	27.3	47.8
Incomplete/complete secondary	22.7	11.3	8.3	22.9	16.4	15.4	27.1	24.5
Incomplete/complete tertiary	14.0	6.1	7.1	15.5	8.8	8.8	7.2	9.7
Sex								
Male	34.0	16.9	11.2	54.0	30.2	31.3	25.7	34.4
Female	27.6	14.3	8.3	50.8	25.2	27.3	23.1	25.3
Birth order								
First child	22.2	11.1	7.9	42.4	22.1	20.6	18.5	20.8
Second child	28.1	15.8	8.2	41.8	20.9	24.7	20.3	22.1
Third child	30.1	16.0	10.9	49.7	24.6	28.0	20.9	27.4
Fourth or subsequent child	38.4	23.5	14.2	63.8	35.7	40.8	34.4	48.9
Age								
Under 12 months	14.6	9.3	8.2	30.5	14.7	13.2	9.6	12.9
Between 12 and 24 months	35.2	18.5	12.7	55.2	31.6	28.9	24.5	32.9
Over 24 months	41.5	16.8	9.4	58.6	30.9	33.8	29.1	35.1
Skilled birth attendance								
Unattended	45.3	26.0	25.2	66.4	35.1	49.3	40.5	52.6
Attended	23.0	14.5	9.7	50.0	21.8	28.3	22.7	20.4

Source: prepared by the author on the basis of demographic and health surveys (DHS).

TABLE 2

Latin America and the Caribbean (selected countries): mean and standard errors of the variables used, 1999-2007

Variable	Bolivia 2003 Mean	Std error[a]	Colombia 2005 Mean	Std error[a]	Dominican Republic 2007 Mean	Std error[a]	Guatemala 2002 Mean	Std error[a]	Haiti 2005 Mean	Std error[a]	Honduras 2005 Mean	Std error[a]	Nicaragua 2001 Mean	Std error[a]	Peru 2004 Mean	Std error[a]
Z-score for chronic malnutrition (height for age)	1.43	0.028	1.03	0.014	0.74	0.018	2.14	0.084	1.37	0.039	1.44	0.022	1.25	0.029	1.44	0.058
Region 1	0.08	0.010	0.25	0.010	0.26	0.026	0.08	0.020	0.47	0.038	0.04	0.007	0.27	0.021	0.24	0.036
Region 2	0.19	0.017	0.18	0.010	0.12	0.012	0.09	0.024	0.19	0.025	0.04	0.006	0.35	0.024	0.43	0.040
Region 3	0.04	0.006	0.24	0.011	0.17	0.017	0.10	0.028	–	–	0.06	0.009	0.17	0.019	0.14	0.027
Region 4	0.09	0.012	0.18	0.010	0.06	0.006	0.11	0.023	–	–	0.05	0.007	–	–	–	–
Region 5	0.04	0.006	–	–	0.05	0.005	0.22	0.033	–	–	0.19	0.018	–	–	–	–
Region 6	0.24	0.020	–	–	0.09	0.009	0.11	0.022	–	–	0.05	0.008	–	–	–	–
Region 7	0.04	0.007	–	–	0.03	0.005	–	–	–	–	0.05	0.008	–	–	–	–
Region 8	0.01	0.002	–	–	0.05	0.005	–	–	–	–	0.04	0.005	–	–	–	–
Region 9	–	–	–	–	0.08	0.010	–	–	–	–	0.03	0.004	–	–	–	–
Region 10	–	–	–	–	–	–	–	–	–	–	0.05	0.006	–	–	–	–
Region 11	–	–	–	–	–	–	–	–	–	–	0.02	0.003	–	–	–	–
Region 12	–	–	–	–	–	–	–	–	–	–	0.07	0.010	–	–	–	–
Region 13	–	–	–	–	–	–	–	–	–	–	0.05	0.008	–	–	–	–
Region 14	–	–	–	–	–	–	–	–	–	–	0.02	0.003	–	–	–	–
Region 15	–	–	–	–	–	–	–	–	–	–	0.07	0.010	–	–	–	–
Urban	0.58	0.023	0.67	0.012	0.67	0.019	0.38	0.051	0.34	0.033	0.42	0.019	0.50	0.026	0.51	0.040
Wealth	1.70	0.038	2.56	0.027	2.49	0.032	0.00	0.000	1.55	0.065	1.43	0.031	0.00	0.000	1.60	0.075
Mother's education (years)	6.70	0.136	7.77	0.079	9.00	0.120	3.34	0.254	3.86	0.216	5.61	0.102	5.34	0.151	8.11	0.268
Mother's education squared	65.16	2.060	76.76	1.297	98.81	2.275	25.07	2.761	32.08	2.764	49.85	1.654	46.71	1.850	84.79	4.383
Mother: skilled work (ref. not working)	0.12	0.008	0.08	0.005	0.14	0.007	0.08	0.013	0.06	0.009	0.09	0.005	0.10	0.007	0.10	0.012
Mother: unskilled work (ref. not working)	0.51	0.013	0.77	0.007	0.30	0.010	0.20	0.019	0.61	0.019	0.33	0.008	0.27	0.010	0.61	0.023
Partner's education (years)	7.89	0.125	7.09	0.082	8.50	0.116	4.42	0.284	5.26	0.234	5.43	0.107	5.29	0.153	9.24	0.238
Child's sex: female	0.49	0.008	0.50	0.006	0.48	0.008	0.49	0.014	0.51	0.011	0.49	0.006	0.49	0.008	0.49	0.013
Second child	0.21	0.007	0.28	0.005	0.27	0.007	0.19	0.011	0.19	0.009	0.23	0.005	0.21	0.007	0.25	0.010
Third child	0.16	0.006	0.17	0.005	0.21	0.006	0.16	0.009	0.13	0.009	0.16	0.005	0.15	0.006	0.17	0.011
Fourth or subsequent child	0.38	0.010	0.18	0.006	0.19	0.009	0.42	0.021	0.40	0.018	0.33	0.008	0.32	0.011	0.27	0.018
Child's age (months)	17.94	0.159	28.93	0.200	29.64	0.260	29.08	0.339	27.82	0.379	30.28	0.189	28.94	0.237	28.42	0.408
Child's age squared	427.60	5.650	1127.21	11.857	1168.73	15.745	1122.21	22.936	1055.76	22.798	1180.34	12.041	1113.18	14.474	1097.33	25.825
Birth weight (grams)	3371.22	11.930	–	–	3295.80	10.715	3260.60	22.475	3519.78	37.981	3273.83	8.739	3230.84	11.429	3190.52	18.379
Skilled birth attendance	0.65	0.017	0.91	0.005	0.99	0.002	0.85	0.019	0.57	0.022	0.95	0.004	0.91	0.007	0.70	0.030
Sample size	5 044		10 159		8 272		2 942		2 368		9 116		5 626		2 237	

Source: prepared by the author on the basis of demographic and health surveys (DHS).

[a] Robust standard errors, considering the sample design.

as a percentage of the total) when the population is divided into groups on the basis of the explanatory variables proposed.

In all cases, levels of stunting are higher in rural households than in urban ones and it is not uncommon to find that they are twice (in Colombia, Haiti and Nicaragua, for example) or even four times (Peru) as high in the former as in the latter. Furthermore, the lower the "wealth" quintile a household belongs to and the less education the mother or her partner has, the greater the prevalence of stunting. The relationship between stunting and the mother's occupational situation is less clear. In some countries (for example, Colombia, the Dominican Republic, Guatemala and Nicaragua), the highest rates of stunting are found among children whose mothers are not in paid employment. However, in others (Bolivia, Haiti, Peru) the greatest prevalence is among children whose mothers are in unskilled employment.

Where biomedical variables are concerned, there is always a greater prevalence among boys than among girls and this increases down the birth order (chiefly among boys who come third or later) and with age (it is much greater among boys over one than among those under one). In all the countries, lastly, the prevalence of stunting is considerably lower among children who were delivered by professionals than among those who were not.

It should be noted that the table 1 percentages do not consider the different interactions between the variables. These will be dealt with in the multivariate analysis below.

Table 2 presents descriptive statistics (mean and robust standard errors) for all the variables used. The first line, for example, gives the mean of the z-score for stunting. After the transformation mentioned earlier (which consists in multiplying the original z-score by –1), the countries with the highest means for this indicator are those where children's average nutritional status is most deficient. Thus, countries such as Guatemala, Peru, Honduras and Bolivia present a worse average nutritional status than Colombia and the Dominican Republic.

Of the explanatory variables chosen, maternal education (one of the main determinants of child stunting, as discussed in the next section) also displays large discrepancies between the countries analysed. In the Dominican Republic, for example, the mothers in the sample have an average of nine years' schooling, while in Guatemala the figure is only 3.3 years.

III

Inequality in stunting and its causes

1.   The determinants of child stunting

Table 3 summarizes the results of the linear regressions using ordinary least squares (OLS) for the eight countries considered, together with the value of their t-ratios (estimated using robust standard errors).

The model estimated has a good explanatory capacity for all the countries, with R^2 ranging from 0.10 for the Dominican Republic to 0.39 for Peru.[13] Even in cases where this indicator is comparatively low, high values were obtained for the F-statistic (which measures the statistical significance of all the ratios jointly).

The ratio that goes with the material well-being indicator, the "wealth" indicator in this case, is significant and negative for all the countries.[14] Nonetheless, given the nature of this index (of ownership of assets and services), the individual significance of the ratio cannot be analysed. It is highly likely that certain of the variables composing it, such as the existence of secure sources of water and waste disposal, may have a large individual impact on child stunting, something that is also recognized in the literature (Smith, Ruel and Ndiaye, 2005).

The maternal education variable has the expected sign in all cases (greater education has a negative effect on stunting levels), although it is significant

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[13] How good a model adjustment is depends on the type of model being estimated. The adjustments obtained are within the levels observed in studies similar to this one (Wagstaff, Van Doorslaer and Watanabe, 2003; Harttgen and Misselhorn, 2006; Larrea and Kawachi, 2005).

[14] This finding is consistent with what is reported, among others, by Wagstaff, Van Doorslaer and Watanabe (2003); Valdivia (2004); Smith, Ruel and Ndiaye (2005); Larrea and Kawachi (2005); Chen, Eastwood and Yen (2007).

TABLE 3

Latin America and the Caribbean (selected countries): determinants of child stunting, 1999-2007

Variable	Bolivia 2003 Coefficient	T-value[a]	Colombia 2005 Coefficient	T-value[a]	Dominican Republic 2007 Coefficient	T-value[a]	Guatemala 2002 Coefficient	T-value[a]	Haiti 2005 Coefficient	T-value[a]	Honduras 2005 Coefficient	T-value[a]	Nicaragua 2001 Coefficient	T-value[a]	Peru 2004 Coefficient	T-value[a]
Region 1	0.123	1.64	-0.274[b]	-5.93	-0.093	-1.27	-0.099	-0.44	0.007	0.10	0.027	0.34	0.104[b]	2.10	0.109	1.20
Region 2	-0.062	-0.97	-0.355[b]	-7.31	-0.037	-0.54	-0.155	-0.74	-0.035	-0.41	0.063	1.08	0.219[b]	3.96	0.186[c]	2.10
Region 3	0.233[b]	3.15	-0.375[b]	-7.94	0.024	0.35	-0.098	-0.44	—	—	0.137[c]	2.40	0.077	1.08	-0.034	-0.35
Region 4	0.308[b]	3.64	-0.358[b]	-7.13	0.003	0.04	0.134	0.74	—	—	0.267[b]	4.11	—	—	—	—
Region 5	-0.287[b]	-3.82	—	—	0.078	1.05	0.241	1.38	—	—	0.020	0.37	—	—	—	—
Region 6	-0.402[b]	-7.02	—	—	-0.094	-1.42	0.219	1.04	—	—	0.004	0.06	—	—	—	—
Region 7	0.059	0.65	—	—	0.056	0.64	—	—	—	—	-0.068	-0.92	—	—	—	—
Region 8	-0.092	-0.93	—	—	—	—	—	—	—	—	0.462[b]	5.46	—	—	—	—
Region 9	—	—	—	—	—	—	—	—	—	—	0.364[b]	4.78	—	—	—	—
Region 10	—	—	—	—	—	—	—	—	—	—	0.363[b]	4.66	—	—	—	—
Region 11	—	—	—	—	—	—	—	—	—	—	0.246[b]	3.11	—	—	—	—
Region 12	—	—	—	—	—	—	—	—	—	—	-0.204[b]	-2.83	—	—	—	—
Region 13	—	—	—	—	—	—	—	—	—	—	0.007	0.11	—	—	—	—
Region 14	—	—	—	—	—	—	—	—	—	—	-0.129	-1.85	—	—	—	—
Region 15	—	—	—	—	—	—	—	—	—	—	0.024	0.36	—	—	—	—
Urban	0.102	1.61	0.003	0.08	0.024	0.63	0.099	0.92	0.094	1.14	0.063	1.64	0.006	0.11	0.077	1.04
Wealth	-0.219[b]	-6.22	-0.154[b]	-8.30	-0.145[b]	-6.33	-5 0013.430[b]	-9.10	-0.238[b]	-4.85	-0.315[b]	-12.14	-22 785.180[b]	-7.71	-0.346[b]	-8.00
Mother's education	-0.055[b]	-3.74	-0.033[b]	-2.92	-0.014	-1.15	-0.074[b]	-3.62	-0.020	-1.00	-0.079[b]	-8.38	-0.050[b]	-3.94	-0.034	-1.28
Mother's education squared	0.002[c]	2.43	0.001	1.09	0.000	0.55	0.002	1.39	0.001	0.41	0.003[b]	5.40	0.001	1.65	-0.000	-0.04
Mother: skilled work (ref. not working)	-0.005	-0.08	-0.164[b]	-2.75	0.041	0.90	0.277	1.88	0.045	0.35	0.001	0.01	-0.032	-0.55	0.122	1.12
Mother: unskilled work (ref. not working)	0.042	1.06	-0.075[c]	-2.25	0.030	0.90	0.075	0.89	-0.011	-0.17	0.014	0.51	-0.013	-0.35	0.170[b]	2.81
Partner's education	-0.013[c]	-2.21	-0.009[c]	-2.62	-0.005	-1.09	-0.017	-1.55	-0.017	-1.42	-0.011[b]	-2.75	-0.007	-1.34	-0.007	-0.77
Child's sex: female	-0.170[b]	-4.46	-0.092[b]	-4.32	-0.114[b]	-4.52	-0.164[b]	-3.41	-0.198[b]	-3.21	-0.124[b]	-5.36	-0.103[b]	-3.25	-0.194[b]	-4.15
Second child	0.040	0.73	0.095[b]	3.60	0.101[b]	2.74	0.044	0.72	-0.071	-0.85	0.108[b]	3.90	0.046	1.31	-0.004	-0.08
Third child	0.038	0.72	0.087[b]	2.62	0.110[b]	2.64	0.139	1.72	-0.148	-1.81	0.135[b]	3.59	0.062	1.42	0.029	0.39
Fourth or subsequent child	0.030	0.60	0.178[b]	4.72	0.182[b]	3.83	0.175[c]	2.40	0.071	0.85	0.152[b]	4.68	0.152[b]	3.89	0.206[b]	2.98
Age in months	0.094[b]	14.42	0.035[b]	13.69	0.013[b]	4.13	0.088[b]	14.19	0.050[b]	6.76	0.056[b]	18.49	0.054[b]	14.80	0.054[b]	8.99
Age in months squared	-0.002[b]	-8.95	-0.000[b]	-11.94	-0.000[b]	-4.07	-0.001[b]	-13.60	-0.001[b]	-6.09	-0.001[b]	-15.38	-0.001[b]	-11.39	-0.001[b]	-7.87
Birth weight (grams)	-0.000[b]	-7.00	—	—	-0.000[b]	-11.17	-0.000[b]	-5.35	-0.000[c]	-3.29	-0.000[b]	-12.02	-0.000[b]	-9.47	-0.000[b]	-8.60
Skilled birth attendance	-0.150[b]	-3.38	-0.002	-0.05	-0.227	-1.76	0.106	1.28	-0.179[b]	-2.82	-0.106	-1.89	-0.051	-0.72	-0.125	-1.51
Constant	2.036[b]	13.81	1.565[b]	17.78	2.249[b]	12.72	2.585[b]	8.58	1.676[b]	10.63	2.106[b]	19.64	1.769[b]	12.79	2.601[b]	11.67
R-squared	*0.293*		*0.130*		*0.100*		*0.364*		*0.137*		*0.295*		*0.250*		*0.393*	
F-test	*67.39[b]*		*48.73[b]*		*16.74[b]*		*64.78[b]*		*18.04[b]*		*88.41[b]*		*67.39[b]*		*40.75[b]*	
Number of observations	*5 044*		*10 159*		*8 272*		*2 942*		*2 368*		*9 116*		*5 626*		*2 237*	

Source: prepared by the author on the basis of demographic and health surveys (DHS).

[a]   Calculated using robust standard errors.
[b]   Different from zero with a 99% significance level.
[c]   Different from zero with a 95% significance level.

[a], [b] and [c]: The dependent variable is the negative of the height-for-age ratio for children under 60 months (except in Bolivia, where it is for children under 36 months).

only in the cases of Bolivia, Colombia, Guatemala, Honduras and Nicaragua. This fact that this ratio is not significant in the Dominican Republic, for example, is unsurprising given the high average level and low variability of this variable (see table 2). In the case of Haiti, for example, average levels of schooling are very low, but so is variability: just over 35% of mothers have no formal education, while the next 40% are divided practically equally by year of schooling (i.e., just over 6% of the sample of mothers have attained each year of schooling). This means that much of the population (just over 75%) is very poorly educated and the distribution of this variable is compressed, which reduces its explanatory power.

The coefficient that goes with maternal education squared shows decreasing marginal returns on education for child stunting, which would appear to indicate that, at least where stunting is concerned, money would be better spent increasing primary enrolment than secondary enrolment.[15] In all cases, furthermore, the coefficient associated with maternal education is higher than the one associated with the partner's education (which is only significant in Bolivia, Colombia and Honduras).

The child's age and age squared are also highly significant and present the expected signs in all cases. The incidence of stunting increases with age, although with a slowing rate of increase.[16] Again, stunting tends to affect boys more than girls and this effect is significant in most cases (such as Marcoux, 2002). At the same time, birth order does not seem to be important (except in the cases of Colombia, Honduras and the Dominican Republic), unless we take high birth order numbers (fourth child onward), whereupon the coefficients become positive and significant (except in Bolivia and Haiti).

The level of stunting does not seem to differ between urban and rural areas when controlled for the remaining independent variables, as in Smith, Ruel and Ndiaye (2005) and Van de Poel and others (2007). This does not mean it may not be more frequent in a specific geographical area (table 1 shows that it is in fact more common in rural areas) but that its greater or lesser frequency is due to the concomitant

existence of other characteristics, such as the greater or lesser level of "wealth" and maternal education in these areas. In other words, the dispersal observed in stunting levels is not explained in most countries by differences between geographical areas, but by variables reflecting differences within them.

The limited influence of this variable probably owes something to regional fixed effects as well, although these are not significant in all cases and are only important in a few countries. In Bolivia, for example, stunting levels were significantly higher in Oruro and Potosí than in La Paz, when controlled for the other variables. In Colombia, all regions had lower average levels of stunting than the Bogotá area (controlling for the other variables). In Peru, stunting levels were higher in the Sierra than in the Lima region. It is likely that unconsidered variables such as "culture" or idiosyncratic factors more generally are acting through regional variables in some countries that present large cultural/ethnic differences between the Andean region and the other regions (such as Bolivia and Peru).

Lastly, the coefficient associated with the health system access variable (skilled attendants at birth) is only significant in two cases (Bolivia and Haiti).[17] It is no coincidence that these are the countries with the least access to this service in the sample considered. Whereas in Bolivia and Haiti just 65% and 57%, respectively, of births are attended by a professional, coverage is over 90% in countries such as Colombia, the Dominican Republic, Honduras and Nicaragua. With these levels of coverage, amounting practically to universal access to this service, this variable ceases to be relevant as an explanation for the average level of stunting in most cases.

2. Causes of inequality in stunting

As was mentioned in section I, a key aspect of the situation with stunting at the present time (and in future since, as explained earlier, the problem can persist strongly into the long term) is its socio-economic distribution and the causes of this. To design policies, then, it is essential to understand how certain determinants of stunting affect its distribution.

Table 4 shows the elasticities, as defined in equation (2), and the concentration indices (CIs) of

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[15] This finding is the opposite of the one reported by Larrea and Kawachi (2005) for Ecuador, although consistent with most of the literature consulted.

[16] This finding is consistent with the one found by Valdivia (2004), Larrea and Kawachi (2005) and Harttgen and Misselhorn (2006), although not with that of Wagstaff, Van Doorslaer and Watanabe (2003).

[17] Harttgen and Misselhorn (2006) find that health infrastructure access variables are of relatively low importance in explaining child stunting (although not child mortality).

TABLE 4

Latin America and the Caribbean (selected countries): relevant elasticities and concentration indices, 1999-2007

Variable	Elasticities								Concentration indices							
	Bolivia 2003	Colombia 2005	Dominican Republic 2007	Guatemala 2002	Haiti 2005	Honduras 2005	Nicaragua 2001	Peru 2004	Bolivia 2003	Colombia 2005	Dominican Republic 2007	Guatemala 2002	Haiti 2005	Honduras 2005	Nicaragua 2001	Peru 2004
Region 1	0.007	-0.065	-0.032	-0.004	0.002	0.001	0.022	0.018	-0.338	-0.195	0.117	-0.484	-0.160	0.238	0.132	0.141
Region 2	-0.008	-0.064	-0.006	-0.007	-0.005	0.002	0.061	0.056	0.052	-0.035	-0.139	-0.294	-0.265	0.050	-0.217	-0.198
Region 3	0.007	-0.087	0.005	-0.004	–	0.006	0.010	-0.003	-0.008	-0.031	0.114	-0.177	–	-0.154	-0.416	-0.304
Region 4	0.020	-0.063	0.000	0.007	–	0.009	–	–	-0.217	-0.010	-0.125	0.128	–	-0.285	–	–
Region 5	-0.008	–	0.005	0.025	–	0.003	–	–	0.251	–	-0.392	-0.087	–	0.454	–	–
Region 6	-0.068	–	-0.012	0.012	–	0.000	–	–	0.177	–	-0.075	-0.441	–	-0.215	–	–
Region 7	0.002	–	0.002	–	–	-0.002	–	–	-0.222	–	-0.541	–	–	-0.292	–	–
Region 8	-0.000	–	0.001	–	–	0.012	–	–	-0.207	–	-0.138	–	–	-0.477	–	–
Region 9	–	–	0.008	–	–	0.007	–	–	–	–	-0.034	–	–	-0.437	–	–
Region 10	–	–	–	–	–	0.012	–	–	–	–	–	–	–	-0.618	–	–
Region 11	–	–	–	–	–	0.003	–	–	–	–	–	–	–	-0.323	–	–
Region 12	–	–	–	–	–	-0.010	–	–	–	–	–	–	–	-0.340	–	–
Region 13	–	–	–	–	–	0.000	–	–	–	–	–	–	–	-0.171	–	–
Region 14	–	–	–	–	–	-0.002	–	–	–	–	–	–	–	-0.173	–	–
Region 15	–	–	–	–	–	0.001	–	–	–	–	–	–	–	0.113	–	–
Urban	0.041	0.002	0.022	0.017	0.023	0.018	0.002	0.027	0.367	0.279	0.174	0.424	0.520	0.469	0.420	0.428
Wealth	-0.261	-0.382	-0.490	-0.381	-0.269	-0.312	-0.319	-0.384	0.330	0.235	0.208	0.359	0.344	0.377	0.327	0.364
Mother's education	-0.258	-0.250	-0.169	-0.116	-0.057	-0.307	-0.214	-0.194	0.237	0.177	0.157	0.406	0.377	0.270	0.318	0.214
Mother's education squared	0.102	0.056	0.045	0.027	0.013	0.099	0.050	-0.004	0.378	0.287	0.250	0.572	0.519	0.456	0.448	0.346
Mother: skilled work (ref. not working)	-0.000	-0.013	0.008	0.011	0.002	0.000	-0.003	0.009	0.238	0.440	0.312	0.316	0.532	0.275	0.385	0.496
Mother: unskilled work (ref. not working)	0.015	-0.056	0.012	0.007	-0.005	0.003	-0.003	0.072	-0.047	0.006	0.014	0.246	-0.102	0.134	0.122	-0.132
Partner's education	-0.071	-0.061	-0.054	-0.035	-0.066	-0.040	-0.029	-0.043	0.184	0.186	0.154	0.340	0.290	0.274	0.329	0.155
Child's sex: female	-0.059	-0.044	-0.073	-0.038	-0.074	-0.042	-0.040	-0.066	-0.005	0.002	0.008	-0.029	-0.006	0.011	-0.004	0.011
Second child	0.006	0.026	0.038	0.004	-0.010	0.017	0.008	-0.001	0.127	0.076	0.090	0.158	0.150	0.139	0.115	0.086
Third child	0.004	0.014	0.031	0.010	-0.014	0.015	0.007	0.003	0.004	-0.007	-0.037	0.091	0.039	0.045	0.055	0.062
Fourth or subsequent child	0.008	0.032	0.047	0.035	0.021	0.035	0.039	0.039	-0.216	-0.353	-0.274	-0.202	-0.237	-0.244	-0.245	-0.322
Age in months	1.181	0.979	0.508	1.194	1.007	1.173	1.254	1.067	-0.003	0.006	0.011	0.006	0.009	0.002	-0.011	-0.010
Age in months squared	-0.469	-0.538	-0.328	-0.661	-0.547	-0.591	-0.608	-0.576	-0.006	0.007	0.015	0.009	0.011	0.004	-0.014	-0.020
Birth weight (grams)	-0.548	–	-1.312	-0.352	-0.171	-0.501	-0.615	-0.769	0.003	–	0.003	0.001	-0.023	0.012	0.011	0.015
Skilled birth attendance	-0.068	-0.002	-0.304	0.042	-0.074	-0.070	-0.037	-0.061	0.223	0.066	0.007	0.090	0.178	0.025	0.052	0.215
Total									-0.148	-0.126	-0.142	-0.168	-0.126	-0.191	-0.196	-0.231

Source: prepared by the author on the basis of demographic and health surveys (DHS).

child stunting and its explanatory variables, all with the expected sign. Those variables that are mainly found in households with a better socio-economic situation, such as "wealth", education, residence in urban areas and access to the health system, have positive CIs. Those that are mainly concentrated among households with a worse socio-economic situation, such as stunting itself or a position well down the birth order (fourth or subsequent), have a negative CI. Other variables that do not have an established pattern of socio-economic concentration, such as the child's sex or age, may have CIs that are positive or negative but in any event are close to zero, thereby showing that there is no clear pattern of socio-economic concentration.

In addition, the CIs of child stunting, which are broken down as per equations (2) and (3), show different situations in the group of countries analysed. Colombia and Haiti, for example, are the countries that have CIs closest to zero, and thus have the lowest level of socio-economic inequality where stunting is concerned. This does not imply that their situations are similar, however, since while the national prevalence of stunting in the former is 15.6% (i.e., 15.6% of children under 60 months present some degree of stunting), the figure in Haiti is 27.6%. Thus, the lower national prevalence combined with the relatively low degree of socio-economic inequality in the distribution of stunting make the situation of Colombia "preferable" to that of Haiti.

At the other extreme are Guatemala, Nicaragua and Peru, with CIs of –0.191, –0.196 and –0.231, respectively, for child stunting. In the particular case of Guatemala, the country's relatively high CI is also associated with greater national prevalence for the whole sample, indicating the existence of a pattern of "mass deprivation" with a high concentration in the households with the worst material living conditions.

Table 5 presents a decomposition of the CI for stunting by cause, as per equation (3).

In all cases, "wealth" is by far the most important variable in explaining socio-economic inequality in child stunting. The marginal contribution of this variable (all other factors being constant) ranges from 53% in Nicaragua to 81% in Guatemala. Even in countries with a relatively low prevalence of stunting, such as the Dominican Republic, the marginal contribution of "wealth" exceeds 71%. This means that, in the case of the Dominican Republic, if disparities in the distribution of "wealth" disappeared (all other factors being constant), inequality in child stunting would fall by 71%.

This large marginal contribution is explained by the high "wealth" elasticities of stunting (see table 4) and, above all, by the high concentration of "wealth" (as the respective CIs in table 4 show). There is an abundant literature showing that the region's countries have high levels of socio-economic inequality (De Ferranti and others, 2004), but the finding that this high inequality has such a large impact on a health problem like child stunting is a new one. Accordingly, reducing stunting (by reducing its socio-economic inequality) means not only adopting appropriate health policies (for example, to quickly detect cases of child stunting and put corrective mechanisms in place) but addressing basic material inequalities that are factors in stunting, in addition to such health policies. The range of policies that ought to be applicable to this problem thus extends well beyond health policies to encompass, for example, housing, employment, income and macroeconomic policies that set out to provide poorer households with a stable economic environment.

Educational variables (mother's and partner's education) are the next-greatest contributors to inequalities in child stunting, with the education of the mother being the variable with the greatest marginal impact. As was mentioned in the previous section, the more highly educated the mother is (in years of schooling), the lower the prevalence of child stunting tends to be. Because education is relatively concentrated among the "wealthiest" households (their CI is strongly positive in all cases), this contributes positively to explaining inequality in stunting. But this pro-inequality effect of education is offset by the existence of another, non-linear relationship between maternal education and stunting: the effect of this variable on stunting tends to disappear as years of schooling rise (and they do rise in more prosperous households), so that the final outcome of this variable is less than the effect that would be found if only years of maternal education were considered. The final result (considering both effects) ranges from 10% in the Dominican Republic to 23% in Colombia and Nicaragua.[18]

As might be expected, biomedical variables (sex, age, birth order, birth weight) are not very important when it comes to explaining inequality in child stunting,

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[18] This would mean that, in the case of Nicaragua for example, if all mothers had had the same level of education (the national average), inequality in stunting would have been 23% lower than the actual figure, other things being equal.

TABLE 5

Latin America and the Caribbean (selected countries): determinants of inequality in child stunting, 1999-2007
(Percentages)

Variable	Bolivia 2003	Colombia 2005	Dominican Republic 2007	Guatemala 2002	Haiti 2005	Honduras 2005	Nicaragua 2001	Peru 2004
Region 1	1.51	–10.13	2.67	–1.09	0.30	–0.10	–1.50	–1.11
Region 2	0.29	–1.75	–0.58	–1.16	–1.04	–0.04	6.73	4.74
Region 3	0.04	–2.13	–0.44	–0.47	–	0.48	2.20	–0.45
Region 4	2.96	–0.51	0.02	–0.51	–	1.36	–	–
Region 5	1.39	–	1.33	1.28	–	–0.61	–	–
Region 6	8.13	–	–0.62	3.04	–	0.02	–	–
Region 7	0.25	–	0.84	–	–	–0.37	–	–
Region 8	–0.06	–	0.09	–	–	3.04	–	–
Region 9		–	0.20	–	–	1.66	–	–
Region 10		–	–	–	–	3.82	–	–
Region 11		–	–	–	–	0.54	–	–
Region 12		–	–	–	–	–1.79	–	–
Region 13		–	–	–	–	0.02	–	–
Region 14		–	–	–	–	–0.18	–	–
Region 15		–	–	–	–	–0.07	–	–
Urban	–10.24	–0.40	–2.63	–4.39	–9.60	–4.51	–0.50	–5.07
Wealth	58.27	71.31	71.41	81.80	73.62	61.59	53.22	60.39
Mother's education	41.33	35.32	18.65	28.21	17.09	43.43	34.75	17.95
Mother's education squared	–25.91	–12.73	–7.95	–9.35	–5.33	–23.67	–11.36	0.53
Mother: skilled work (ref. not working)	0.07	4.53	–1.76	–2.03	–0.79	–0.01	0.52	–1.88
Mother: unskilled work (ref. not working)	0.48	0.29	–0.12	–1.01	–0.41	–0.23	0.17	4.13
Partner's education	8.86	8.99	5.85	7.14	15.20	5.70	4.83	2.88
Child's sex: female	–0.21	0.05	0.41	–0.66	–0.35	0.24	–0.08	0.30
Second child	–0.51	–1.58	–2.38	–0.38	1.21	–1.26	–0.46	0.03
Third child	–0.01	0.08	0.83	–0.55	0.45	–0.35	–0.21	–0.09
Fourth or subsequent child	1.18	8.88	9.06	4.18	3.89	4.43	4.92	5.45
Age in months	2.17	–4.86	–3.87	–4.30	–6.85	–0.97	6.81	4.72
Age in months squared	–1.98	2.86	3.45	3.42	4.74	1.27	–4.21	–4.86
Birth weight (grams)	1.15	–	2.68	0.29	–3.06	3.05	3.35	5.13
Skilled birth attendance	10.27	0.10	1.48	–2.25	10.49	0.92	0.97	5.68
Total explained decomposition	*99.41*	*98.30*	*98.63*	*101.23*	*99.55*	*97.42*	*100.16*	*98.45*
Residual	*0.59*	*1.70*	*1.37*	*–1.23*	*0.45*	*2.58*	*–0.16*	*1.55*
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Source: prepared by the author on the basis of demographic and health surveys (DHS).

although some of them are relevant to its level. Children's sex, for example, does not have a set pattern of socio-economic distribution (for example, girls are no more or less common in "poor" households than in "wealthy" ones), so that in this context they have no explanatory power. The remaining variables have a small effect taken separately (birth order variables are the ones with the greatest explanatory power, especially in the case of children who are well down it), but taken together they never account for more than 10% of inequality in stunting levels.

Regional and geographic variables do not have a set general pattern either, but depend on the country. Whereas in the Dominican Republic, Guatemala and Honduras neither regional variables nor area (urban/rural) make any significant contribution to explaining inequality in the distribution of stunting (stunted children are not found to be concentrated in any specific region or area, for example, if the other variables are left unchanged), in countries such as Colombia their contribution is considerable. For example, region 1 (Atlantic) has a substantially lower level of stunting than the reference region (Bogotá) and contains a large proportion of poor households. The combined effect of these two factors is that their contribution to inequality in stunting is negative (i.e., other things being equal, the lower level of stunting in the Atlantic region would translate into less inequality in stunting

nationally). In Bolivia, meanwhile, urban households have better material conditions than rural ones (the area CI for Bolivia is strongly positive and shows that urban households are concentrated in the "wealthier" households category), although children from those households have worse nutritional indicators than the average (when the other explanatory variables remain constant). This means that the effect of this variable on inequality in child stunting is also negative (10%).

Lastly, the behaviour of the health system access variable (skilled attendants at birth) differs between countries. In those where coverage is relatively low (Bolivia, Haiti and Peru, for example, where only 65%, 57% and 70% of births, respectively, are attended by health-care professionals), the contribution of this factor to explaining inequality in stunting levels ranges from 6% to 10%. Again, in those countries such as Colombia and the Dominican Republic where a large proportion of births are attended by professionals (and health system access is high generally), the effect is naturally small since socio-economic inequalities tend to disappear in the distribution, which also removes the explanatory effect on average stunting levels by eliminating the variance of the variable. Nonetheless, the fact that the great majority of the population in these countries does have access to skilled attention during childbirth, for example, does not mean there are not still socio-economic differences in the quality of the service they receive. Unfortunately, there are no instruments in the DHS to incorporate this aspect.

IV

Conclusions

There are many causes determining the level of child stunting in a country, and these causes are usually interrelated in complex ways. Geographic or area variables may seem important when it comes to explaining the level and inequality of stunting, but once they are considered as part of broad models with additional explanatory factors, their relative importance diminishes. This study shows what variables are the most important when it comes to explaining the average level of stunting and its socio-economic distribution. In the countries studied, where socio-economic inequalities are important, stunting can only be permanently reduced by attacking the socio-economic factors underlying it. Accordingly, the public policies needed to reduce the incidence of this problem have to be wide-ranging: while stunting is a health problem, with major economic consequences, policies to reduce it need to deal not only with health but also with income, education, housing and other things.

Of all these socio-economic factors, "wealth" (as measured in the DHS) makes the greatest contribution to explaining inequalities in child stunting. The "wealth" indicator used does not measure family income/expenditure but living conditions in the home, asset ownership and services available. Thus, improved distribution of "wealth" (which has been shown here to have a substantial effect on the distribution and level of stunting) does not necessarily mean taking resources away from one group to give to another but, for example, improving access to drinking water and adequate sanitation for households that lack it. Naturally, policies of this type can have a potentially redistributive effect depending on the progressiveness of the tax structure.

The educational level of the parents, and particularly the mother, is another variable that decisively influences the level and distribution of stunting. For improvements in education to have their full effect on stunting, however, they must mainly benefit the "poorest" households and focus on the basic education level. Countries such as Bolivia, Guatemala, Haiti, Honduras and Nicaragua are still far from achieving universal primary schooling (although some have made progress towards this) and have a long way to go; further advances will surely bring an improvement in indicators like child stunting. Similarly, policies to improve women's position in the labour market, involving for example the provision of childcare for mothers working outside the home, may also have a positive effect on child stunting, and the more that policies are focused on mothers in poor or low-income households, the greater this effect will be.

Geographical, cultural, ethnic and idiosyncratic factors play some explanatory role, but this apparently derives from their relationship with the distribution of socio-economic variables, mainly "wealth" and maternal

education. This does not mean they are unimportant when it comes to designing sectoral policies, or that public policies should overlook them. What this means is that public policies to reduce child stunting should be designed on the basis not of households' location but of their socio-economic characteristics (material well-being, education of the mother and her partner, etc.). Only by reducing these inequalities can the region's countries aspire to leave child stunting and its dreadful consequences behind them.

(Original: Spanish)

APPENDIX

TABLE A

Latin America and the Caribbean (selected countries): regional grouping of departments or provinces

Country	Region	Department/Province
Bolivia		
	La Paz (Region 0)	
	Chuquisaca (Region 1)	
	Cochabamba (Region 2)	
	Oruro (Region 3)	
	Potosí (Region 4)	
	Tarija (Region 5)	
	Santa Cruz (Region 6)	
	Beni (Region 7)	
	Pando (Region 8)	
Colombia		
	Bogotá (Region 0)	
	Atlantic (Region 1)	
	Eastern (Region 2)	
	Central (Region 3)	
	Pacific (Region 4)	
Dominican Republic		
	National District (Region 0)	
	0 (Region 1)	
		Santo Domingo
		Monte Plata
	I (Region 2)	
		Azua
		Peravia
		San Cristóbal
		San José de Ocoa
	II (Region 3)	
		Espaillat
		Puerto Plata
		Santiago
	III (Region 4)	
		Duarte
		Hermanas Mirabal
		María Trinidad Sánchez
		Samaná
	IV (Region 5)	
		Bahoruco
		Barahona
		Independencia
		Pedernales
	V (Region 6)	
		El Seibo
		La Altagracia
		La Romana
		Hato Mayor
		San Pedro de Macorís

(continues overleaf)

(continued)

Country	Region	Department/Province
	VI (Region 7)	
		Elías Piña
		San Juan
	VII (Region 8)	
		Dajabón
		Monte Cristi
		Santiago Rodríguez
		Valverde
	VIII (Region 9)	
		La Vega
		Monseñor Nouel
		Sánchez Ramírez
Guatemala		
	Metropolitan (Region 0)	
	North (Region 1)	
	North-East (Region 2)	
	South-East (Region 3)	
	Central (Region 4)	
	South-West (Region 5)	
	North-West (Region 6)	
Haiti		
	Metropolitan Area (Region 0)	
	North (Region 1)	
		North
		North-East
		Antibonite
		Centre
		North-West
	South (Region 2)	
		South
		South-East
		Grande-Anse
Honduras		
	Francisco Morazán (Region 0)	
	Atlantic (Region 1)	
	Colón (Region 2)	
	Comayagua (Region 3)	
	Copán (Region 4)	
	Cortés (Region 5)	
	Choluteca (Region 6)	
	El Paraíso (Region 7)	
	Intibucá (Region 8)	
	La Paz (Region 9)	
	Lempira (Region 10)	
	Ocotepeque (Region 11)	
	Olancho (Region 12)	
	Santa Bárbara (Region 13)	
	Valle (Region 14)	
	Yoro (Region 15)	
Nicaragua		
	Managua (Region 0)	
	Pacific (Region 1)	
		Chinandega
		León
		Masaya
		Granada
		Carazo
		Rivas

(continues overleaf)

(continued)

Country	Region	Department/Province
	North Central (Region 2)	
		Boaco
		Chontales
		Jinotega
		Matagalpa
		Estelí
		Madriz
		Nueva Segovia
	Atlantic (Region 3)	
		Río San Juan
		Northern Atlantic Region (RAAN)
		Southern Atlantic Region (RAAS)
Peru		
	Lima (Region 0)	
	Costa (Region 1)	
		Callao
		Ica
		La Libertad
		Lambayeque
		Moquegua
		Piura
		Tacna
		Tumbes
	Sierra (Region 2)	
		Ancash
		Apurimac
		Arequipa
		Ayacucho
		Cajamarca
		Cusco
		Huncavelica
		Huanuco
		Junín
		Pasco
		Puno
	Selva (Region 3)	
		Amazonas
		Loreto
		Madre de Dios
		San Martín
		Ucayali

Source: prepared by the author on the basis of demographic and health surveys (DHS).

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Argentina: how to study and act
upon local innovation systems

Gabriel Yoguel, José A. Borello and Analía Erbes

Gabriel Yoguel

Teacher-researcher at the Institute

of Industry (IDEI),

General Sarmiento National

University,

Buenos Aires Province, Argentina

➥ gyoguel@ungs.edu.ar

José A. Borello

Teacher-researcher at the

Conurbation Institute (ICO),

General Sarmiento National

University,

Buenos Aires Province, Argentina

➥ jborello@ungs.edu.ar

Analía Erbes

Teacher-researcher at the Institute

of Industry (IDEI),

General Sarmiento National

University,

Buenos Aires Province, Argentina

➥ aerbes@ungs.edu.ar

This article examines a number of ideas about local innovation systems, how best they can be studied and what needs to be done to develop them further. It is based on experiences in Latin America generally and Argentina in particular. The first part briefly reviews the literature on local production and innovation systems. Following this, 10 hypotheses about the workings of innovation systems are presented, together with the same number of approaches to studying the characteristics and potential of any specific existing system. The third part sets out a number of measures that could be applied to improve local innovation systems in a given country or region. This paper argues that it is both possible and necessary to build bridges between analysis and action, theory and practice.

I

Introduction

The purpose of this article is to systematize a number of ideas about the workings of local innovation systems and the measures that could be taken to develop them further. We address a range of issues that are of central importance in any evaluation of the way these operate and in the design of policy actions to increase the capabilities and connectivity of systems of this type. Although most of the issues discussed derive from an analysis of the Argentinean experience, it is possible that they may also illustrate the situation of other Latin American countries.

Although studies of the subject have yielded an increasingly precise description and understanding of the 'local innovation system' concept, they have made less progress in identifying certain general characteristics. Again, while policies centred on what we might generically call local development have become increasingly important

in Latin America, there has not been any major effort to stylize the different approaches and delineate possible areas of action.[1] Nonetheless, some recent critical contributions do coincide, on certain points, with our approach (Fernández, Amín and Vigil, 2008).

This article is divided into six sections. Following this introduction, the second section gives a stylized description of the main contributions of the literature to the topic under discussion. The third part presents a conceptualization of local innovation systems and discusses a number of theories about how they operate, arising from research carried out in Argentina. The fourth section proposes a methodology for studying them. The fifth section lays out a number of policy measures that, in our view, ought to be implemented to improve the functioning of systems of this type. Lastly, we present our conclusions.

II

The nature and importance of local innovation systems

The importance of the issues discussed in this article can be appreciated from a number of facts reported in recent studies. These studies have argued that economic agents are operating within a framework of growing competition, that the nature of this competition has changed and that a higher level of cognitive capabilities

is required (Ernst and Lundvall, 1997; Lall, 1992; Yoguel and Boscherini, 1996). It is also argued that these capabilities do not derive only from particular static factors, but that the institutional environment firms operate in has become more important. Part of this environment is constructed and replicated

[1] The main exceptions are the studies by Albuquerque (2004), Boisier (2004) and Vásquez Barquero (2000).

in geographical areas that are local and regional in nature (Albadalejo and Romijn, 2000; Camagni, 1991; Morgan, 1995; Nomisma, 1993; Poma, 2000).

Although the whole issue of local development is only now coming to prominence on the public agenda and in the policies applied by the governments of Latin America in recent years (Albuquerque, 2004), this is a subject that goes back a long way in disciplinary fields such as urban sociology, urban planning, geography and economics, so much so that Marshall (1890) himself discusses two central aspects of any local innovation system: the relationships between economic agents and their territorial expression.

Marshall's emphasis on the division of labour connects him with classical authors such as Smith, Marx and Durkheim (Groenewegen, 1987), as well as with contemporary ones. Thus, while Sayer and Walker (1992) consider the division of labour to be an important aspect in the analysis of different economic systems, Fröbel, Heinrichs and Kreye (1980) and Massey (1995) believe that, in its geographical variant particularly, it can yield an understanding of the production structure and the logic thereof. However, it was Scott (1988 and 1993) who made a more direct connection between the division of labour and the evolving characteristics and nature of local production and innovation systems.

Hirschman (1958), for his part, emphasized not the division of labour but the nature and meaning of relationships between firms.[2] As he sees it, development requires the mobilization of hidden resources and the construction of a public space that is crucial for the formation of a democratic society where private interests do not dominate. Hirschmanian thinking gave rise to a number of later elaborations addressing, among other issues, the qualitative attributes of production systems (Fredriksson and Lindmark, 1979), unequal power relationships within these (Coraggio, 1987; Rofman, 1984; Taylor and Thrift, 1983) and their role in reducing uncertainties (Storper and Walker, 1989). Interest in these production clusters gave rise to a whole terminology around the issue: subcontracting networks (Holmes, 1986; Scott, 1983 and 1986), distribution networks (*filières*) (Truel,

1983), sectoral blocks (Lifschitz, 1986) and commodity chains (Hopkins and Wallerstein, 1986; Gereffi and Korzeniewicz, 1990).

When production systems came to be analysed from the territorial point of view, new concepts emerged such as territorial production complexes (Gorenstein, 1993; Smith, 1981; Storper and Walker, 1989), clusters (Humphrey and Schmitz, 2000) and territorial circuits of production, circulation and accumulation (Coraggio, 1987; Rofman, 1984). The term "industrial district", originally used by Marshall, was dusted off by Italian and then English-speaking authors to refer to the geographical concentration of closely interrelated firms for the purpose of producing certain goods (Piore and Sable, 1984). The industrial district idea was later applied to a variety of production systems (Markusen, 1995).

While much of the literature we have touched upon assumes that knowledge- and capacity-building and incorporation processes underlie the interaction of local systems, most of these studies do not articulate an explicit interest in these subjects. To some extent, this is because these processes have begun to receive a more precise characterization only in the past two decades.

Against this background, Marshall's industrial district idea was taken up by authors who emphasized that learning and innovation took place within spatially concentrated production systems. Thus, for example, it was noted that clusters generate spillovers and collective learning. Some authors understood the industrial district as a cognitive laboratory producing spillovers of knowledge related to the public good concept (Bellandi, 1989; Becattini, 1990). Other approaches highlighted the importance of the informal sharing of knowledge among economic agents as a source of competences[3] (Camagni, 1991; Capello, 1999; Maskell and Malmberg, 1999), while studies carried out in Silicon Valley and Denmark, Sweden and Norway (Saxenian, 1996; Dahl, 2002; Power and Lundmark, 2004; Stambol, 2003) have shown that the spread of knowledge resulting from worker mobility within a local system increases collective competences and generates economies that are internal to the industry and external to firms. In turn, workers benefit from

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[2] Hirschman's approach also explains the reasons for unbalanced development in Latin America, the emergence of economic groups, the tensions between exit and voice, the formation of progressive and regressive alliances and the weaknesses present in production chains.

[3] By competences are meant all those capabilities of economic agents that enable them, among other things: (i) to solve problems, (ii) to interact and work in teams and (iii) to switch between abstract and concrete thinking.

upward occupational mobility as they are enabled to pursue their careers in other local businesses. Some of these authors see the movement of staff between different firms as being what distinguishes a production cluster from a mere concentration of businesses.

The interest in systems is partly due to concern among a number of social scientists with the role played by innovations and the creation of knowledge and capabilities in economic development. This school of thought has mainly focused on the study of national innovation systems, before turning to the relevant local, regional and sectoral aspects (Lundvall and Maskell, 2000). The starting point for these studies are the interactions between economic agents, which means that they do not confine themselves to analysing the internal behaviour of firms. Accordingly, emphasis is laid on the importance of systems in the innovation process, and not just firms and technology centres (Cooke, Gómez Uranga and Etxebarria, 1997; Freeman, 1995). As a result of the emphasis on interactions, consideration has been given to the existence of different types of production systems and of the specificity of knowledge creation processes within each of them.

Thus, some studies examine the scope for creating competitive advantages by producing and sharing knowledge within a production system (Bisang and others, 2004; Albornoz, Milesi and Yoguel, 2004; Yoguel, Novick and Milesi, 2003; Casalet,

Cimoli and Yoguel, 2005). One of the most virtuous network configurations is where there is geographical concentration with generation of externalities that promote collective efficiency and cooperation (Schmitz, 1995; Meyer-Stamer, 1998). Thus, while some systems tend to be less effective (Humphrey and Schmitz, 2000; Poma, 2000), others develop cooperative processes for learning and spreading tacit knowledge (Freeman, 1988; Camagni, 1991; Nonaka and Takeuchi, 1995).

Studies of the processes leading to the development of innovations within local production systems have also turned their attention to how knowledge creation and utilization capacities might be expanded. Progress has been made in differentiating the different modes of knowledge, with a distinction drawn between the codified and tacit kinds (Nonaka and Takeuchi, 1995; Johnson, Lorenz and Lundvall, 2002; Rullani, 2000). Studies have also evaluated the importance of the different forms of knowledge for the creation of competitive advantages by economic agents.

Lastly, various authors have developed templates that can be used not only to analyse groups of interrelated firms that are relatively concentrated in a single place, but also to tailor policies to them (Altenburg and Meyer-Stamer, 1999; Albuquerque, 2004; Wolfe and Gertler, 2004). Thus, for example, what are known as "production arrangements" are of particular interest in Brazil (Lastres, Cassiolato and Maciel, 2003; SEBRAE, 2002).

III

Local innovation systems: conceptualization and some preliminary hypotheses derived from the Argentinean experience

Considering the information given in the previous section, what we mean by a local innovation system is the space of interaction among firms and between firms and institutions in a common geographical location that includes relationships of both competition and cooperation. These systems are heterogeneous and have very different levels of complexity, depending on the number and characteristics of the actors and agents composing them and on the formal and informal links between them. Thus, a given system may be placed anywhere along a scale of situations ranging

from the utmost virtuosity, with significant learning and creation of dynamic competitive advantages, to the other extreme in which both are practically non-existent.

What we mean to describe is not an ideal model whose variables already have established values. As we will show, our description will identify the key elements characterizing a system, but without setting a value upon them, as they vary from one system to another.

Local innovation systems encompass both production systems and education and training

institutions, unions and professional associations and technological research and development bodies. All production systems have a local facet, leaving aside the fact that some include a variety of local organizations from a region, different regions in the same country or even different countries. Although there is no generally accepted definition of what constitutes the local sphere of a production system and no one procedure for identifying the geographical limits concerned, different authors and some national institutes of statistics have equated it with the local labour market.

Thus, a local production system can be delimited empirically by looking at people's daily movements from home to workplace. In Argentina, a unit has been proposed, the 'local economic area', to define them on the basis of these commuter journeys (Mazorra, Filippo and Schlesser, 2005; Borello and others, 2002 and 2004).

Analysis of local systems in Latin America generally, and Argentina in particular, reveals how little information is available on the most basic aspects of their morphology and functioning. This state of affairs may be due to the lack of researchers with a background in the subject, the low level of importance attached to the local sphere by much of the scientific and technical community, the lack of awareness of the importance of developing local systems, and a dearth of appropriate statistics, since the geographical units used by the bodies collecting information do not usually coincide with the areas concerned. There are also some deeper issues arising from the idea prevalent in many disciplines that the local sphere is unimportant in the workings of national or global systems. Thus, for example, while it is true that the economic sciences and sociology have concerned themselves with these problems, there are fields such as the economics of local systems and urban sociology that are still peripheral interests in these disciplines.

Besides these issues, the literature allows certain generalizations to be made about the workings of local innovation systems in Argentina (Borello, 2008; Borello and others, 2002 and 2004; Lugones and Sierra, 1999; Boscherini, Malet Quintar and Yoguel, 1997; Boscherini and Quintar, 1997; Boscherini, López and Yoguel, 1998; Yoguel and Boscherini, 1996 and 2001; Quintar and others, 1993; Rearte, Lanari and Alegre, 1997; Sepúlveda, 1999; Carmona, 2006; Sierra 2002; Yoguel and López, 2000; Yoguel, 2000). However, it is not possible to identify their common features without

acknowledging the marked heterogeneity between them. This diversity is a central characteristic of systems of this type, both in their external facets and in their particular ways of working and nurturing knowledge.

The heterogeneity of local systems can be appreciated by analysing the following aspects: (i) the size and physical form of the system (measured in square kilometres, population, gross output); (ii) its characteristics in terms of the number of urban centres, composition of output, employment, etc.; (iii) the characteristics of public and private actors; (iv) the existence of translators;[4] (v) the development of the public space; (vi) the type of institutional architecture (top-down, bottom-up or mixed); (vii) the degree of competition between economic agents; (viii) the scale of knowledge dissemination; (ix) understanding of the morphology, problems and potential of each system; (x) the level of knowledge appropriation by local actors; (xi) the rate of company creation and demise; (xii) circulation of workers and technical staff, among other things.

The existence of major differences in the aspects referred to complicates the task of establishing general rules for the functioning and characteristics of systems. Considering the information available in Argentina, however, it is possible to put forward a number of hypotheses reflecting their key features in the country.

(i) First, the way a local system operates can become either a constraint on the development of firms or a factor that enhances their growth and that of the society around them. Economic dynamism increasingly depends on the level of accumulated knowledge and experience, the skills and capabilities of human resources and the quality of institutions, the interaction between the different agents, research and development (R&D) activities and the existence of economies of scale. Given that all these are interrelated, the characteristics of this relationship will determine the complexity of the system. Despite this, it is possible to affirm that the existence of linkages between agents who drive the development of learning and knowledge-sharing processes is limited by the level of endogenous competences attained, both in firms and in institutions (Yoguel, Robert and Erbes, 2009).

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[4] Translators are people who are capable of establishing a fruitful dialogue between different actors in a local system, such as business leaders and technology experts.

(ii) Despite the above, the mere existence of well-functioning local systems does not do away with evolutionary differences between firms, as not all are capable of taking advantage of the virtuous institutional environment and positive externalities deriving from the proper functioning of a system with these characteristics. Generally speaking, firms with a lower level of competences tend to profit more from tangible externalities (such as trained labour and physical infrastructure) than from intangible externalities in the form of technological and market information and knowledge.

(iii) It is observed that agents (firms and institutions) require minimum competences without which it is hard for them to make good shortfalls in their knowledge, reduce strategic uncertainty, strengthen learning processes, counteract weaknesses in their organizational culture and, crucially, appropriate externalities generated in the local system. This minimum threshold of necessary competences rises as systems lose virtuosity. In a local system that produces positive externalities, less individual effort will be required by firms to achieve competitive advantages and quasi-rents in the market (Yoguel and Boscherini, 2001). In environments of this type, size is not an obstacle to firms gaining access, for example, to the benefits deriving from corporate cooperation agreements or public programmes of technological support.

(iv) Thus, when the local system generates positive externalities that economic agents can appropriate, the development of firms' capacity for innovation, and thence their competitiveness, does not depend (or depends less) on their size (Yoguel and Boscherini, 2001). In this case, the local system can act as a quasi-market that increases technical and organizational competences, favouring smaller agents. Thus, positive externalities counteract the competitive disadvantages arising from company size.

(v) The virtuous characteristics of a local system also depend on its institutional features. Thus, institutional development is a determining factor and also a reflection of the capacity of economic agents for innovation. The institutional environment is thus a basic factor in the generation of a public space that can facilitate the progress of the local system concerned. The creation of this public sphere is in itself a symptom of the degree of development attained, while at the same time it is the place where agents can improve their competences, whatever the initial differences in capacity between them. As a result of the collective

character of the actions undertaken and the flow of formal and informal interactions between the different types of agents, large quantities of codified and tacit knowledge begin to be generated and circulated, contributing to the formation of individual and group competences and the creation of public goods and 'club' goods. Unlike public goods, the latter include knowledge that can be used to exclude those who are not members of the subsystem. More specifically, the knowledge, agreements and activities concerned are developed within a production complex and can benefit those agents belonging to it, but not outsiders. Consequently, these club goods constitute what Michael Storper calls "untraded interdependencies".

(vi) As in the case of firms, the existence of a lower degree of institutional development raises the minimum threshold of competences needed to take advantage of existing technological services, while technological cooperation never rises above a very low level. Again, local systems have great difficulty making codified knowledge tacit (i.e., territorializing it) and then recodifying it and making it global. Thus, it is essentially within individual firms that knowledge is spread and generated, without any institutional support or presence.

(vii) What the above shows is that the process of developing a local innovation system is neither simple nor automatic and requires the creation of translation mechanisms, as the agents involved speak different languages and operate by dissimilar logics and cultures. This variety of languages is a key institution in local systems, as important for their operation as banks, firms and universities (Poma, 2000). The great weakness of translation mechanisms partly explains the dearth of established interactions between the different types of agents.

(viii) The peculiarities developed by the agents and actors forming part of a system determine its idiosyncratic features. All actors in a local system have know-how that can be used as the basis for constructing new knowledge, although this stock varies greatly between and within different systems. This know-how is expressed through innovations and competences. The differences between economic agents in this respect and their understanding of what is new and important can give rise to problems of translation and interaction.

Added to the original differences between systems is their capacity to develop learning and knowledge construction and transformation processes, these latter being crucial for interpreting ever-greater economic

uncertainty and complexity. In turn, these processes constitute the basis of a common stock of knowledge that underpins the homogenization and differentiation processes needed in the new competitive environment (Rullani, 2000). In this context, knowledge becomes valuable because of its potential to generate higher productivity, but also because it makes possible the interpretation of structural uncertainty. The scope for using it for one or the other purpose determines the characteristics of individual economies and the differences between them in terms of specialization to produce physical goods, goods that are fundamentally intangible or tangible goods with a high knowledge content (Poma, 2000). This last category is a core policy goal and a particularly great challenge for less developed countries, regions and systems.

(ix) In this context, a useful indicator of the functioning of a local system is its ability to identify and get the best out of hidden resources. Given that businesses need to make an effort to perceive and imagine changes before others do (Poma, 2000), their task consists in mobilizing what Hirschman (1967) calls the invisible component of the economy —defined as the ability to stimulate and organize hidden and overlooked resources and capabilities. Thus, territorial systems differ both in the latent resources available to them and in their ability to identify and benefit from these. In consequence, the way these latent or hidden resources are extracted or brought out comes to play a much more important role than the production of physical goods. Thus, the challenges of territorial development are greater still in cases where resources are not hidden but simply absent, whereas in virtuous local systems, which are composed of numerous agents and interactions, the invisible component of the economy is more easily made visible.

(x) Lastly, it needs to be stressed that the workings of local innovation systems partly depend on their production specialization profile, which determines certain basic characteristics of their virtuosity in the social and production spheres. The decision as to what to produce, quite apart from how, establishes the core activities that mark out the range of possibilities of a local system. Naturally, these activities are dynamic and changing. The specialization profile establishes parameters that are important for local development, such as the intangible component of the goods and services produced, the technology and division of labour in their production, the opportunities for opening up new technological frontiers on the basis of this interaction, and the composition of the workforce producing the goods concerned. The debate about the specialization profile, then, is also a discussion about the kind of society that is desired. In other words, what to produce and what to specialize in are economic decisions but also distributive ones that affect the scope for the local economy to generate learning processes and technological and industrial spillovers among the different agents composing it (Reinert, 2006). Viewed in this way, economic policy is also social policy.

The 10 positions put forward in the preceding paragraphs can be seen as working hypotheses relating to the functioning of local innovation and production systems in Argentina. Although they concern a particular country, a number of studies conducted in the region suggest that they could be extended to (and tested on) a variety of situations in Latin America.

Taken together, these hypotheses provide a framework for at least two more general considerations. First, the local development paradigm and toolbox assumes certain existing conditions that are found in some regions of European countries but do not necessarily obtain in Argentina. Second, while local institutions and production structures are fairly rigid and tend to be perpetuated over time, the present is not always a hypothesis of the future. The transformation of the urban structure in Argentina has opened a window of opportunity for qualitative improvement in local production systems. This can be inferred from certain studies showing the substantial absolute and relative growth of medium-sized cities since the 1950s (Vapñarsky and Gorojovsky, 1990; Vapñarsky, 1995). Many of them are now large enough to justify the introduction of certain public- and private-sector services and activities for which there would not previously have been a sufficient mass of users or consumers.

IV

Some general guidelines for analysing local innovation systems

Considering the hypotheses presented in the previous section and the considerations they give rise to, the present section offers a set of general guidelines for analysing local innovation systems. This is a guide that identifies key aspects to be studied but does not specify the particular characteristics they acquire in each of the systems analysed.

This guide sets out to study local economic systems from a perspective that prioritizes aspects related to the construction of certain intangible elements such as the competences of economic agents, creativity and innovation capabilities and the creation and incorporation of knowledge. Thus, it represents one of the various possible ways of approaching and analysing local systems.

As mentioned, the list of factors to be considered derives from the characterization of local systems in the preceding pages, whose themes were organized into three major groups: core characteristics of local systems, institutional and interactional aspects, and statements and hypotheses relating to their functioning. The first two are concerned with more descriptive and general elements, while the third is essentially speculative and encompasses more specific issues. Lastly, we present some additional aspects that do not fall under any of the three points above, relating to the purpose, scope and existing resources of local systems and the availability of earlier information and studies to provide a basis for researching and analysing them.

1. The characteristics of a local system[5]

This section considers the characteristics of local systems defined as local economic areas (LEAs). When studying such systems, it is important to bear in mind their physical and organizational features and the peculiarities of their economic and employment structure, and to identify any constraints on their development. Analysing these aspects reveals the virtuosity of each system in terms of spillovers generated, and the potential for economic agents to increase their capabilities.

As regards the physical and organizational features of systems, consideration must be given to general characteristics and physical properties. The former are derived mainly from indicators revealing the structure of the system —urban nodes, approximate area of the LEA, number of municipal districts or departments and number of provinces involved— and the demographic dynamic (total population, intercensal growth rate). The latter concern internal and external connectivity, the existence of internal subsystems and the rural-urban mix, among other things.

When identifying the economic and employment structure of local systems, meanwhile, it is important to include the characteristics of the production dynamic in relation to output, the branches of activity that exist, the size of companies and the jobs generated, among other things. At the same time, it is necessary to consider the specialization profile, the level of linkage between firms of different sizes and their integration into the overall system, the leading economic and institutional agents and the degree to which the local system concerned is open or closed, i.e., its relations with the various external agents. It is also necessary to ascertain the dynamic of technological and organizational competence formation among the firms acting in this system, particularly in relation to size and the ability to capture externalities in the environment, so that their economic and employment performance can be explained. In relation both to these matters and to those described in the previous paragraph, economists and geographers have developed a variety of indicators that can be used to compare structures and systems (Goodall, 1987).

The constraints on the development of local systems are the other facet of the potential described above. Although they can be identified in various ways, the following are important when the development of learning and knowledge generation processes is at issue: (i) centralization of production activities and decision-making, (ii) financial constraints that prevent development processes from being implemented and

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[5] Some ideas in this section were taken from Borello and others (2004).

(iii) a lack of structures for creating awareness about the importance of local systems in the creation of competitive advantages and the implementation of programmes that can help to improve the competences of individuals, firms and institutions.

2. Institutions and interrelationships within a local system

As was mentioned in the hypotheses presented in the third section, the capacity-building efforts of systems and private agents need to be complemented by the generation of institutional capabilities. Accordingly, two central issues need to be considered.

First, to characterize any local system it is necessary to identify and describe local institutions involved with production activities. In particular, there needs to be knowledge of their structure and functionality and of the presence of programmes and projects that allow the knowledge possessed by institutions to connect with that of firms and other organizations. This reveals the degree of public-private engagement. Again, it is indispensable to formulate local policies from a perspective broader than that of local agents, centring rather on networks of firms, human resource development and local needs. Furthermore, it is necessary to understand the characteristics of evaluations of the way these programmes and institutions work.

Secondly, in describing the system it is necessary to provide an appreciation of the importance acquired by a range of tangible and intangible elements that define its virtuosity. These include the variety of languages; the public and private actors who operate within this variety, allowing information and knowledge to be shared; the circulation of human resources, and thus knowledge; endogenous competences, their "systemicity" and thence the homogeneity or heterogeneity of economic agents; and the public space.

3. The dynamic and workings of local systems

The way systems work and their importance for local development can be assessed from a number of aspects associated with the dynamic of their institutional and production characteristics. For one thing, it is important to be aware of the importance of the role assumed by the local system in promoting the competitiveness of firms, reducing uncertainty for economic agents and increasing their technical and organizational skills, while generating externalities that compensate for the differences between them. Here, it is necessary to know what the minimum threshold of competences is if knowledge creation and dissemination processes are to exist.

Again, the importance of the local system as a space that promotes interaction and integration of knowledge can also be evaluated on the basis of the existence and characteristics of institutional and production networks. In this context, it is crucial to analyse the innovation functions developed by the most dynamic institutions and agents. The active presence of both and the ability to spread knowledge to the rest of the system are important elements in the latter's learning and production processes. It is also necessary to evaluate the system's potential to mobilize the invisible component of the economy, i.e., to locate and organize hidden resources.

From an institutional perspective, consideration must be given to the importance the different subject areas are acquiring in the local development agenda. Here, differences can be observed in the dynamics of systems depending on the priority given in public-sector policies to efforts to promote institutional development and relations between the public and private sectors and between private-sector actors, to create knowledge-based competitive advantages, to train translators and to influence the complexity and internationalization of networks, among other things.

The issues raised in the three parts of this section are meant to provide a summary of the main elements to be considered when analysing the importance of local systems as spaces for generating knowledge and competitive advantages. The rest of this paper will present some suggestions for policies that it is believed would improve the aspects discussed and enhance innovation systems.

V

Some suggestions for policies to promote local systems

In the previous sections, we carried out a stylized analysis of the idea of a local innovation system, treating it as a gradient of the situation in which specific systems are placed in respect of the degree of development of all the elements used to characterize them. This section, unlike the previous ones, is essentially propositional. It identifies the premises and assumptions on which policy recommendations are based, describes jurisdictional and real aspects affecting policy deployment and reviews core problems and proposals for action.

1. Premises and suppositions relating to local systems and policies

The premises and assumptions on which local system policymaking is based include some metapolicy aspects, clearly revealing the experimental character that intervention should assume and identifying a number of key elements for implementation.

Where metapolicy issues are concerned, the application of a public policy designed to improve the workings of local innovation systems presupposes the existence of three conditions for intervention (Yoguel, 2003). First and foremost, proper financing is needed. Although this is not the only requirement, it is a necessary condition that is often overlooked in policy design in Argentina. Second, awareness-raising measures need to be implemented in advance, as do actions to ensure the participation of all local agents and actors in policy design and implementation. Lastly, it is necessary to create or strengthen a system of coordinated decentralization and intelligence in which local agents and actors can make known their interests and ideas, thus providing opportunities for policy transmission and generating a specifically local set of institutions (voice, in Hirschman's sense). It is important to create a public space in which interaction between different agents is encouraged, and this means identifying both the areas that favour this and those that hinder the sharing of information and knowledge.

Another key element of metapolicy is to identify regressive local coalitions that constrain both the dynamic of structural change in the region and the generation and spread of learning processes. Here, a central policy objective should be to activate autonomous locally-based agents who can help to form progressive coalitions. According to the logic of Bianchi and Miller (2000), progressive coalitions depend on the existence and creation of complementarities, manifested in production chains and the different linkages between private and public agents.

In an evolving, globalized economy, policy needs to be experimental and to undergo regular review and modification, which means that the metapolicy elements referred to above are crucial. In particular, they should make it possible to clear the blockages identified and support the development of progressive alliances, so that agents and actors come to inhabit the territory rather than merely being lodgers in it. A degree of institutional stability is necessarily required for alliances of this type to exist and develop (Bianchi and Miller, 2000).

The position set out in the preceding paragraphs assumes the presence of certain minimum conditions in terms of income, access to decent housing and public services and infrastructure, so that policy actions can be oriented towards the creation of capabilities and the satisfaction of needs over and above the primary ones of food, health care and access to certain basic public goods. This need for a certain minimum basis holds not just for tangible matters like those mentioned, but also includes justice in a broad sense (social, environmental and territorial).

Setting out from these minimum conditions, key policy elements should be aimed at developing the institutional system, the production environment for economic agents, production networks and the different types of production chains, human resources and an organization of labour that facilitates the generation of learning and knowledge-sharing processes. Differences between systems translate into particular configurations that are reproducible only in part and that consequently require policies tailored to the specific characteristics of the context. These considerations show how important it is to follow an approach aimed at ascertaining needs and generating

responses on the basis of the guidelines proposed in the fourth section of this paper.

The idea is to turn the local sphere into a space where dynamic rather than static competitive advantages can be created, with priority given to the efficiency of physical and cognitive infrastructure; where good use can be made of information and knowledge that is external in origin but can be internalized (homeostatic processes); where endogenous innovation dynamics can be developed in local systems (autopoietic processes); and where specific competences can be generated. In sum, policies should generate self-regulation mechanisms and levels of systemic autonomy that lead to evolutionary learning. This would permit the creation of the internal conditions needed to improve the system, together with strategies aimed, firstly, at establishing new institutions or functionally reforming existing ones and, secondly, at generating models favouring the development of an environment that facilitates the incorporation of local firms into the global space.

To complement this, there is a need to consider other aspects that are vital for an understanding of the dynamic of local systems and to formulate policies that can strengthen them. First and foremost, policies need to set out from the cultural elements that identify the local system, which means recognizing the diversity of idiosyncratic behaviours, evolutionary paths and production arrangements that limit the scope for mechanically reproducing measures applied in other local systems.

Second, it is necessary to build upon the existing basis, i.e., of institutions, programmes and policies that are already in progress. Furthermore, there are often projects, laws, activities and private-sector actions oriented towards resolving the difficulties that can arise in a system. Failure to acknowledge this background and act accordingly practically guarantees that the same obstacles will arise. The atomization of actions and policies bearing upon a single issue is a characteristic of much policymaking and policy implementation in Argentina and other countries. Existing activities are a good laboratory for evaluating measures that work and for making progress in this area.

Third, it is necessary to develop a sequence of stages and to plan actions out, although these must be preceded by a minimum diagnosis of the starting situation. Not all the data need necessarily be available, so that while a good policy will always advance into unknown areas, a minimum of prior knowledge is required.

Fourth, and following on from the previous point, the measures implemented need to include research and action mechanisms that, reflecting the experimental character of policies, make it possible to collect information about their implementation and the level of participation among the agents involved.

Lastly, the technical rationality entailed in the two previous aspects should not be divorced from the political need to achieve immediate results in the short term (two years). In other words, the first condition for a policy to be at all effective is that it continue to exist over time. This requires a technical effort to prioritize measures and be selective about the actions undertaken.

2. Jurisdictional and real aspects of problems and policy implementation on the ground

In designing actions, it is essential to be aware of the irregularities that define and establish the way problems and policies develop on the ground. In the first place, it is necessary to consider the geographical extent of the local system and the administrative jurisdictions operating in the territory concerned. To operate in local systems, coordinated action may be required by different municipal and provincial governments.[6] In the second place, it is important to understand the sphere in which these processes actually operate.

From the standpoint of jurisdiction, it is necessary to understand the juxtaposition of municipal, provincial and national powers within each local system. In Argentina, the heterogeneity of the legal powers belonging to the provinces is compounded by the existence of over 2,000 municipal governments (communes, communal councils and others) that differ greatly from one another. However, while the administrative authorities guide and orient innovation processes, these need to be analysed in their actual sphere of application.

Another system that should be identified is that of local production clusters and networks, as this provides an overview of all the activities and institutions that interconnect vertically or horizontally to produce goods, services or both, and to generate the processes of innovation and knowledge creation

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[6] In almost all the local systems of Santa Fe Province, for example, coordination is required between at least one municipal government and the provincial government, since the rural areas around the municipalities come under provincial jurisdiction.

and use that go with production. The elements and interactions composing a network often extend beyond the jurisdictional limits previously identified, although it may often be found that most of the activities of a particular network are centred on a local system. It needs to be recalled, however, that in Argentina as in other countries, the geographical concentration of firms that carry out similar activities does not necessarily imply a close relationship between them.

Local areas, lastly, are part of regional spaces. It is difficult to define exactly what the limits of regional innovation systems are, as these need to be established on the basis of information that is not always fully and systematically available. In countries like Argentina, the regional innovation level, which often encompasses a number of provinces and local systems and may extend for hundreds of kilometres, may be the most interesting to understand and manage.

3. Identifying and characterizing core problems and policy proposals

Some of the core problems that can be considered in relation to the development of local innovation systems are the level of endogenous competences among local economic agents; interaction among firms, and between these and institutions; and the integrated functioning of local and regional systems.

a) *The competences of agents*

A number of problems with local innovation systems are due to the limited competences of both firms and institutions. In business organizations (chambers of commerce and business associations), but also in the 'third sector' (social, neighbourhood and non-governmental organizations), there is a lack of professionalization and the technical and professional staff available are few and undertrained. Difficulties are also encountered in generating new individual and collective routines in firms and institutions, and the number of public and private actors is small.

Proposals for solving problems of this type require the construction of a taxonomy of situations that are differentiated by the importance of the constraints described. A vital starting point in local innovation systems that are at the lowest levels of the gradient is to carry out activities to raise awareness of the importance of increasing the competences of agents and institutions. Given that the value of such measures is often not appreciated in many of these local systems, progress will only be made with these

activities if the subject is first placed on the discussion and working agendas of firms and institutions. In local systems where awareness-raising has already taken place, action should begin with a self-diagnosis of the specific problems of agents and actors so that they have systematized information available to reflect on their own practices. In this case, awareness-raising measures can only be implemented after identifying people and institutions capable of helping economic agents to prepare diagnoses and self-assessments, bearing in mind the diversity of existing situations. Actions oriented towards private-sector agents would have to be accompanied by institutional self-diagnoses that yielded information about their shortcomings when it came to formulating and implementing development programmes. It is also necessary to create appropriate incentives to encourage the incorporation of technical and professional staff into the institutions comprising the local system.

In many local innovation systems, efforts to find new ways of financing the expenditure involved in operating chambers of commerce are vital if institutions of this type are to play a proactive role in developing economic agents' competences. Given that the lack of resources and the limited representativeness of these organizations are a major obstacle to the generation of services for firms (Borello, 2008), there seems to be a need for new systems of public-private financing. In cases where a longer process of diagnosis and reflection on the workings of the local innovation system has taken place, the need to establish new institutions or modify existing ones may already have been identified. For example, intermediate or 'bridging' institutions with public and private representation may be crucial for generating effective processes of knowledge production, circulation and appropriation.

Constraints on the development of endogenous competences also arise from the characteristics of public policies oriented towards this objective. In particular, it is difficult for economic agents to identify and take advantage of the policy instruments that exist. In this context, policy actions ought to turn upon at least three core issues. First, there is a need to ensure policy instruments are accessible to local agents by simplifying procedures and creating a one-stop shop for provision. The availability and scope of these instruments are critical. Second, it is necessary to rethink existing policies and mechanisms in the light of the needs and development of local competences. This need stems directly from the difficulties involved in applying universal policies and from the marked

heterogeneity of systems. Third, there is a need to develop tools and spaces for evaluating existing policies, with the participation of both policymakers and users. It will be vitally important not only for evaluation to be carried out after policies have been applied, but for there to be ongoing monitoring of these during the implementation process.

b) *Interaction between agents*
    With respect to interaction among economic agents, and between these and institutions, it is once again possible to identify a series of needs that apply to all local systems, although without overlooking the differences in terms of the importance they assume in each.

    One issue here is the inadequate presence and coordination of institutions and economic agents in the public space, as a result of which knowledge is shared between them only sporadically or not at all. This is partly due to the lack of emphasis on outreach, applied research and dissemination activities in the programmes of universities, technology centres and secondary and tertiary vocational training institutions.

    A variety of policies ought to be applied here, all with the goal of enhancing the interaction between the different types of agents making up the local system. For this, awareness-raising measures notwithstanding, what is primarily required is to change outlooks and cultures in which there is no settled tradition of collaborative behaviour. Secondly, measures are needed to foment the creation of networks involving agents of different types and sizes (firms, institutions, chambers of commerce, etc.), and this will require the presence of linking agents and incentives to integrate systems of collaboration that help to enhance competences. This entails a twofold plan of action encompassing both the creation of new ties and the formalization of existing ones and designed specifically to strengthen the public goods and club goods of local chains. Thirdly, it is also indispensable from the public policy standpoint to formulate strategic plans that operate in the main production networks, involving all public and private actors. Among other issues, strategic planning serves to reduce the uncertainty surrounding the orientation of public policies on the basis of the information that exists about priority issues and their promotion.

    Important though it is, increasing interactions between economic agents is not an automatic process. On the contrary, the diversity of goals and languages with which different types of agents operate, even within a homogeneous local system, requires the presence of linking agents. This being so, a major weakness that can hinder the development of a local system is the lack of translators in technical and competence-building areas, and of network integrators and organizers.

    In this situation, the needful lines of action centre on the training of human resources with an aptitude for translation and organization. Their main characteristic should be the ability to converse both in the languages of the business world and in those of science and technology, and their main task would be to bring these different worlds together to facilitate the creation of knowledge networks. How human resources of this type are to be developed also differs significantly depending on the local system concerned. In the first place, the need for translators must be based on the characteristics of each system. This means determining the areas in which there are specific gaps and applying measures to create the relevant capabilities in order to make better use of internal system synergies and improve the capacity for absorbing knowledge generated externally. After this, training programmes need to be created to train local translators, organizers and integrators on the model of those found naturally within the system. It is important to systematize what these people know and combine it with other knowledge derived from regional or national experience in this area.

c) *Integrating local and regional systems*
    In addition to those described above, it is also possible to identify core problems associated with the integrated functioning of local and regional systems.

    Here, one of the problems detected in most of the studies reviewed has been a failure to make awareness of the importance of knowledge and the local sphere part of the relevant discussion agenda. This affects local systems very unequally. For less developed ones, awareness-raising among local agents and actors is critical. One initiative might be to include these subjects in the syllabuses of schools, universities and tertiary vocational training institutions. In more developed systems, awareness-raising measures could centre on the promotion of academic, corporate and artistic events that contribute to a greater understanding of the importance of these issues, and on financial support for forums, conferences and other such events to bring together people from different institutions.

    Another of the problems detected is the lack of the kind of specialization in production activities that would bring increasing returns to scale, generate spillovers and increase the scope for appropriating

quasi-rents from innovation efforts that are mainly carried out independently by economic agents. The scope of the measures that might be applied also depends on the development level of local systems.

A crucial starting point in less developed systems is to establish the possibility of creating a new economic specialization, based on existing activities and the characteristics of goods and services demand that is unmet locally. One thing that is required here is to recognize creative and commercial capabilities and promote them in training activities already under way, so that they can then be deliberately introduced into local firms and institutions. The idea is to capture and exploit not only the organized capabilities of the latter, but the potential of people trained in the area. Actions of this type may serve to reverse the exodus and outflow of skilled people. In more developed systems, consideration could be given to orienting major national and international negotiations towards the promotion of their new investment projects. In those that have the requisite starting capabilities, a long-term approach should be taken to fostering the development of activities that are faster-growing nationally and globally, examples being business and environmental services, tourism, new materials and design.

The workings of local systems are also affected by the difficulty of detecting and prioritizing physical investment needs. As with other aspects dealt with in earlier paragraphs, it is not easy to carry out a diagnosis. The various decades of crisis in Argentina and other countries of Latin America seem to have reduced their ability to contemplate and devise new projects involving substantial investment. To improve the workings of local innovation systems, it may be necessary to reconstruct planning arrangements for identifying and characterizing the physical investments that are essential at every level —national, provincial and municipal— of the State machinery.

It is possible that the measures set out in earlier paragraphs may be difficult to apply because of the pronounced internal heterogeneity that usually characterizes local innovation systems. This is due to the presence of inequalities that prevent transformative actions from being formulated. Accordingly, the first step is to identify and define these inequalities. The next is to take advantage of imbalances in the local system itself and promote the spread of knowledge by means of contacts between people and institutions with different capabilities. Lastly, there needs to be positive discrimination between individuals, groups, institutions, neighbourhoods and localities when

public resources are allocated, so that capabilities and new institutions can be generated in the most disadvantaged areas.

For all the importance of the matters brought up here so far, it should be made clear that the workings of local innovation systems do not depend solely on their internal dynamic, but also on their relationship with other systems. Being either too open or too closed to the contributions of neighbouring systems or regions, and indeed of other regions and systems around the world, is an obstacle to the development of local systems. In other words, a degree of balance is required.

To achieve this, it is necessary to pursue versatile integration into the global system, working with whatever degree of openness or reserve is needed for knowledge feedback within the system to boost its development. This means building up the capacity to read and interpret the regional, national and international scenes in different areas: trade and technology; the field of more general scientific knowledge, which can only be decoded, however, by a body of agents with specific cognitive capabilities; and the more general field of codifying business competences.

For local innovation systems to work better, lastly, a solution needs to be found to problems associated with a lack of knowledge and statistics describing them. Although this is quite an ambitious objective in the context of Latin American statistical systems, which are still hard put to it to generate proper economic and sociodemographic information, it is essential to have some aggregates that provide a picture of the dynamic of the system as a unit of analysis. The implementation of policies whose development effects are positive requires prior diagnostic processes, which are very hard to carry out without certain basic information. For this reason, there is a need for sustained progress in the following areas: (i) conducting research to delimit, identify and characterize local and regional economic systems and their innovation dynamic; (ii) undertaking research to identify knowledge gaps in systems; (iii) establishing mechanisms to promote research involving different technical, educational and business institutions in different places; (iv) fostering the creation of national statistical databases that allow a comparative study to be made of local systems, such as the Database for the Study of Employment Dynamics (BADE) of the Ministry of Labour, Employment and Social Security and the SME Map of the Secretariat of Industry, both in Argentina; and (v) promoting the construction of local information systems (Borello, Gajardo and Bettatis, 2003).

VI

Final considerations

The present article has presented a brief systematization of a number of ideas about the workings of local innovation systems in Argentina. Setting out from this, it has sought to define a range of aspects that are critical to the analysis of such systems and the measures that would have to be applied to improve them. It must be emphasized, however, that the general description of fields of analysis and policies does not detract from the importance of specific measures, given the heterogeneity of existing situations. Accordingly, the proposals put forward are simply guidelines for identifying the needs and the spheres of action that ought to be specified in the light of the dynamic and characteristics of the different systems.

Much of what has been proposed in this paper represents a major challenge for the different people and institutions involved in the science and technology system and for the public- and private-sector bodies involved with production activities. This is because our conception and comprehension of how local systems operate and what their problems are is not confined to technical and operational issues: the importance of political and cultural aspects is recognized, even if they are not at the centre of the analysis. From a technical standpoint, it is essential to strive to produce

more and better statistics for local and regional analysis. However, this task cannot be contemplated in isolation from the need to train people to use (and demand) this information in more sophisticated ways. The difficulty of generating appropriate data and more advanced research is partly due to the political aspects that permeate a number of the issues raised in this study, among them the need to create public spaces and spheres of discussion. Local research will only improve if we strengthen the capacity to conduct it. Once again, an issue that might seem to be purely technical cannot be resolved without confronting regressive local coalitions that often have regional or national support.

The limits of the possible, even in difficult situations, can be extended or expanded still further when support is forthcoming from national or provincial institutions whose general goals in terms of promoting and improving local innovation and production systems are similar. Neither the State, nor employers' organizations, nor institutions are monolithic, fossilized entities. There are institutions from which initiatives like the ones proposed in this study can come, even in a context of fragile and sometimes incomplete democracies.

(Original: Spanish)

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Brazil: how macroeconomic variables affect
consumer confidence

Helder Ferreira de Mendonça

Identifying which macroeconomic variables underlie consumer confidence is an essential step towards implementing sound economic policies. This article contributes to the subject by way of an empirical analysis based on ordinary least squares (OLS), generalized method of moments (GMM) and vector autoregression (VAR) techniques for the case of Brazil. The findings indicate that following a loose fiscal policy which increases public debt and taking measures to increase the volume of lending to the private sector does not represent a good strategy for improving consumer confidence. Moreover, the credibility of inflation targeting is a very important driver of consumer expectations. Working to enhance credibility is thus a key step for economies seeking to attain a high level of consumer confidence.

Helder Ferreira de Mendonça

Professor, Department of Economics,

Fluminense Federal University (UFF),

Brazil

Researcher at the National Council

for Scientific and Technological

Development (CNPq)

↝ helderfm@hotmail.com

I

Introduction

In late 2008, the world experienced the greatest economic crisis since the Great Depression of 1929. The origin of the crisis was financial but its effects on the real economy have spread around the world. The threat of a deep recession in economies such as the United States, Europe and Japan has created a wave of global pessimism. Falling equity market values have forced the postponement of investment decisions by firms, thus further contributing to the decline in economic growth. Another important reason for this negative sentiment has been the decline in aggregate consumption, which broadly speaking has mainly been the result of two factors: the fall in world stock markets, led by the slide on Wall Street, and a reduction in the credit available to consumers.

The first of these factors underlying the decrease in consumption has operated through the wealth effect, the point being that a fall in share prices reduces consumers' current income. The second factor came about because of a crisis of confidence. Owing to a lack of confidence in the solvency of the financial system, banks have adopted a conservative stance and the result has been a reduction in liquidity in credit markets. Consumption (especially of durable goods) has also been postponed, amplifying the precautionary character of the current economic environment.

In an attempt to obviate the problems of a deep recession, the central banks of industrialized economies (for example, the United States, the United Kingdom, Canada, Sweden and Switzerland) have cut interest rates in the hope of spurring economic activity. The expectation is that this mechanism will serve to create not only a stimulus to consumption but also an incentive to investment by reducing the cost of credit. Moreover, countercyclical fiscal policies, known as "rescue packages", have been used by the world's leading economies (Europe, Japan and the United States) to put the economy back on track. In short, there is now a consensus that it is not possible to wait for market forces to fix the crisis.

An important question that has to be asked in this environment is whether macroeconomic policies are capable of stabilizing the economy. Nowadays, macroeconomic policies are conducted with a view to guiding public expectations. In other words, the efficient conduct of economic policy depends on policymakers

taking account of public expectations about the future without pursuing time-inconsistent policies. At a time of imminent recession, therefore, identifying the key macroeconomic variables that affect household consumption and corporate investment decisions is crucial to the planning of economic policy.

The problems of the recession unleashed by the United States financial crisis have affected even economies that have no direct links to the financial institutions which have been declaring bankruptcy. In some emerging economies whose financial sectors have little foreign participation, in fact, the credit channel is not the main monetary transmission mechanism, and the number of stockholders is not great. However, this has not been enough to isolate these economies from the crisis. A good example is Brazil, one of the main emerging economies. The fear of recession comes through in President Luiz Inácio Lula da Silva's words of December 2008: "If you have debts, try to balance your budget first. But if you have some money put by or have just received your Christmas bonus, and you want to buy a fridge or oven, or change your car, do not forego your dreams out of fear of the future."

When economies plunge into recession, the main objective of policymakers is to minimize social losses by adopting economic policies that restore public confidence. In practice, since the spread of inflation targeting in the 1990s, expectations of behaviour have been a key variable in the system. Hence, identifying the macroeconomic variables that underlie consumer confidence is an essential prerequisite for implementing sound economic policies. This article contributes to our understanding of the subject by providing an empirical analysis of the Brazilian case.

It is important to note that the literature on consumer confidence normally evaluates the effect that a change in consumer confidence has on macroeconomic variables and focuses on the United States or European countries (see, for example, Fuhrer, 1993; Nahuis and Jansen, 2004; Ludvigson, 2004). There is thus a gap in the literature where emerging economies with inflation targeting regimes are concerned. Accordingly, there is a strong case for analysing the situation in Brazil, which is one of the most important emerging economies and also a potential test bed.

Since 1999, Brazil has applied accountable monetary and fiscal policies. The adoption of inflation targeting represents a clear use of monetary policy to guide public expectations. The last few years have been a time of stable economic growth, low inflation and improving social welfare. In short, it can be argued that the Brazilian economy is based on solid macroeconomic foundations. This paper is organized as follows. The next section shows the relationship between consumer confidence and macroeconomic variables and presents the data for Brazil. Section III presents the analysis based on empirical evidence yielded by the ordinary least squares (OLS), generalized method of moments (GMM) and vector autoregression (VAR) techniques, and section IV concludes the paper.

II

Consumer confidence and

macroeconomic variables

The standard analysis of aggregate consumption in textbook macroeconomics highlights two main macroeconomic variables, namely income and the real interest rate. In accordance with the Keynesian perspective, disposable income is seen as the main variable determining consumption. In other words, there is a positive relationship between disposable income and consumption. When consumers' intertemporal choices are considered, the real interest rate also plays an important role. An increase in the interest rate entails two competing effects on overall saving, a positive one through the substitution effect and a negative one through the income effect (Romer, 2006).

Household consumption decisions are not affected by income and real interest rates alone. It is true that an increase in output or a cut in the interest rate may affect aggregate consumption. Over and above this, however, it is necessary to ascertain whether variables associated with the conduct of economic policy are capable of affecting consumer expectations.

A variable that is important for consumer confidence is the volume of lending to the private sector. At times of crisis there is a tendency for credit to dry up abruptly, which in turn intensifies the recession. It is important to realize that this variable is directly related to the conduct of monetary policy. A central bank decision to cut the interest rate is an attempt to reduce borrowing costs. Thus, a decrease in the volume of credit leads to a fall in household consumer confidence.

Taking into account the argument of the Ricardian equivalence proposition, it is possible to make a connection between the conduct of fiscal policy and household consumption decisions. This very well-known proposition states that when a government adopts an expansionary stance, consumption does not increase as a result. In the traditional Keynesian argument, on the other hand, the outcome is completely different. In this case, consumption is closely related to fiscal policy decisions. In other words, fiscal policy has the power to increase consumption.

Nowadays, a non-negligible variable considered by households in their consumption decisions is the credibility of monetary policy. This point has become increasingly important with the adoption of inflation targeting as a monetary regime by several countries since the 1990s. An important task of this monetary regime is to act as a nominal anchor guiding public expectations. In this context, central bank transparency is fundamental. "Central bank transparency could be defined as symmetry of information between monetary policymakers and other economic agents. High degrees of transparency reduce uncertainty, improve private-sector inferences about central bank goals and increase the effectiveness of monetary policy" (de Mendonça and Simão Filho, 2008, p. 117). Therefore, as pointed out by de Mendonça and Simão Filho (2007, p. 498), "transparency could increase the accountability of the central bank in its pursuit of targets, and thus increase its credibility too".

Hence, when the public expectation is that the inflation rate will match the inflation target, the central bank can reduce the interest rate without losing its control over inflation. In consequence, credit becomes cheaper and there is thus an incentive for investment and consumption in the economy to increase. It is therefore reasonable to assume a relationship between household consumer confidence and the credibility of monetary policy.

1.   Data

Considering the arguments above and with a view to estimating the impact of macroeconomic variables on consumer confidence in Brazil, an empirical analysis was conducted using ordinary least squares (OLS), generalized method of moments (GMM) and vector autoregression analysis (VAR) techniques. The period of analysis runs from January 2000 to October 2008. The justification for using this period is that Brazil adopted a flexible exchange-rate regime in January 1999 and inflation targeting in June of the same year. Moreover, in late 1999 the Brazilian Treasury announced a strategy for managing public debt more credibly.[1] Therefore, 1999 represents a turning point for the macroeconomic analysis of the Brazilian economy. In addition, the market expectations series available from the Central Bank of Brazil (BCB) started in January 2000. The (monthly) series used in this study are:

(i) The index of consumer confidence (ICC). This index is calculated by the São Paulo Federation of Commerce (Fecomercio) and it evaluates the degree of confidence felt by the population in the general condition of the country and in current and future household living standards. This variable accordingly represents household consumer confidence in the empirical models. As can be observed in figure 1, the ICC rose until the beginning of 2005 and performed well from then on. The exception is the second semester of 2005. The fall in the ICC that year was due to weak economic growth (only 2.3%), representing a performance below the Latin American average.

(ii) Gross domestic product (GDP) at constant prices. This series is available from the BCB and corresponds to cumulative 12-month GDP as measured by the general price index-domestic availability (IGP-DI) for the month in millions of Brazilian reais. The GDP graph in figure 1 shows the path over the period.

In general terms, a trend of economic expansion is observed. Notwithstanding, 2003 was a year in which economic activity declined and 2005 saw a slowdown in economic growth. This variable is important to the analysis because much of the literature considers output to be a very important determinant of consumption. In short, an increase (decrease) in this variable is expected to entail an increase (decrease) in the ICC.

(iii) Real interest rate (IR). This series is calculated from the difference between the cumulative base rate (Over/SELIC) for the month in annual terms and annual inflation expectations, both of these series being provided by the BCB. Over/SELIC is the main inflation targeting instrument used by the BCB. Given that the real interest rate in Brazil is the highest in the world, any change in it alters public expectations about the present and future performance of the economy. Over a short-term horizon, any increase in the interest rate tends to lead to a decrease in output owing to the substitution effect from current to future consumption. Figure 1 reveals that only after 2005 did the real interest rate decrease. A possible reason for this behaviour over the last few years may be the success of the BCB in meeting the inflation target. Focusing on the effect of the real interest rate on the ICC, one would expect to find a negative relationship between these variables.

(iv) Credibility (CREDIB). The credibility index represents the credibility of the inflation target and is measured using the methodology developed by de Mendonça (2007). On the basis of the argument presented by Agénor and Taylor (1992) regarding the use of expected inflation series to derive a credibility index, the Cukierman and Meltzer (1986) definition of credibility and the suggestion made by Svensson (1999), we created a monetary policy credibility index that considers deviations in expected inflation ($E(\pi)$) from the core inflation target (π_t^c).[2] Incorporating the information made available by the BCB and the annual inflation targets set by the National Monetary Council, the credibility index is a result of:

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[1] See de Mendonça (2007) for an analysis of the initial impact of the adoption of inflation targeting in Brazil. Regarding the strategy adopted by the Brazilian Treasury, see de Mendonça and Vivian (2008).

[2] The official price index used in Brazilian inflation targeting is the national consumer price index (extended) (IPCA).

FIGURE 1

Brazil: selected macroeconomic variables

ICC

GDP
(*Millions of reais*)

IR
(*Percentages*)

CREDIB

PD
(*Percentages of GDP*)

CRED
(*Percentages of GDP*)
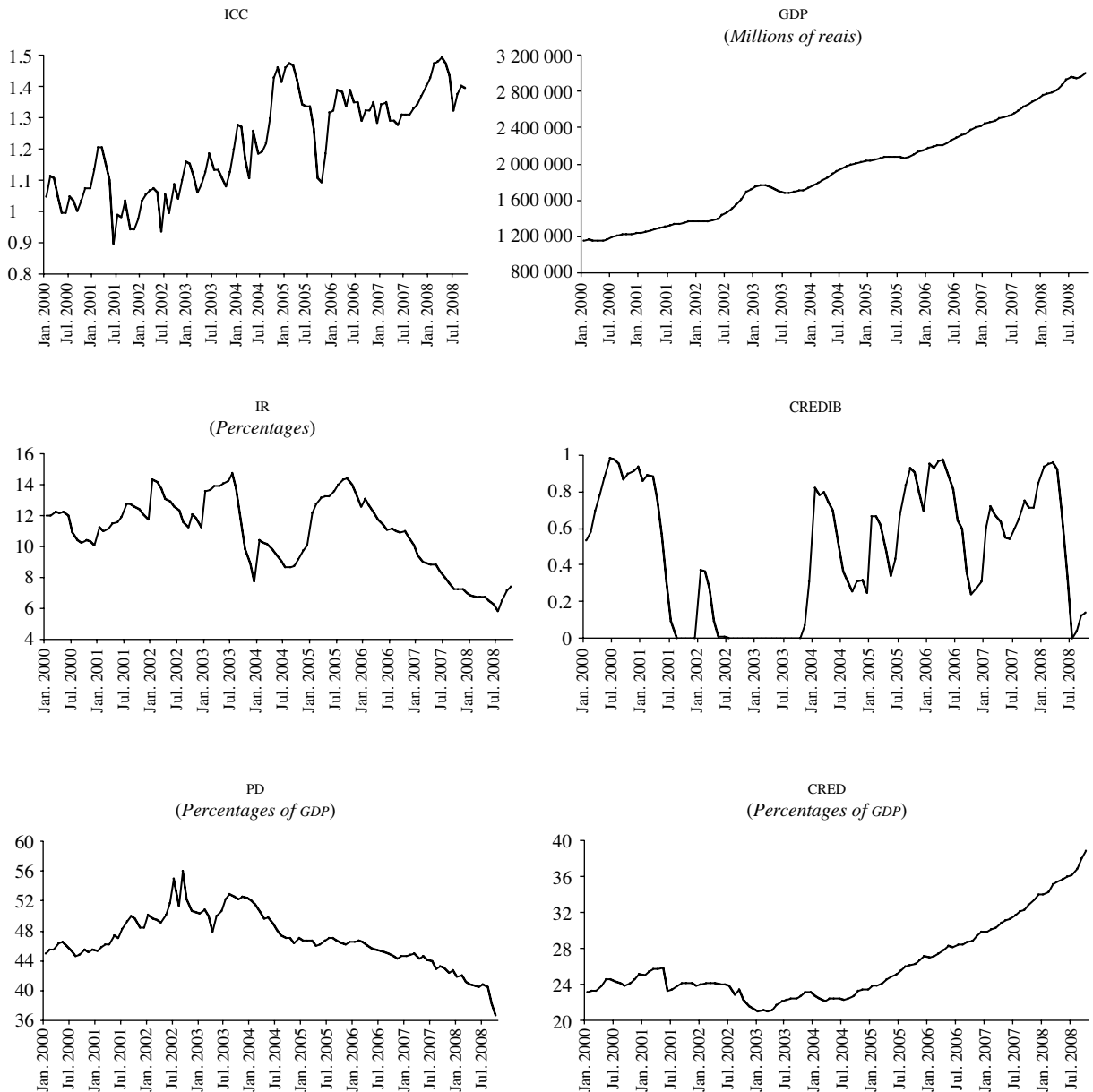
Source: Central Bank of Brazil and São Paulo Federation of Commerce (Fecomercio).

ICC: Index of consumer confidence.
GDP: Gross domestic product.
CREDIB: Credibility.
CRED: Credit.
IR: Real interest rate.
PD: Public debt.

$$CREDIB = \begin{cases} 1 & if & E(\pi) = \pi_t^c \\ 1 - \dfrac{1}{\pi_t^* - \pi_t^c}\Big[E(\pi) - \pi_t^c \Big] & if & \pi_{tMIN}^* < E(\pi) < \pi_{tMAX}^* \\ 0 & if & E(\pi) \geq \pi_{tMAX}^* \quad or \quad E(\pi) \leq \pi_{tMIN}^* \end{cases} \qquad (1)$$

The credibility index therefore presents a value of between 0 and 1 strictly if expected inflation is situated between the maximum and minimum limits (π_t^*) set for each year and takes a value equal to 0 when expected inflation exceeds one of these limits.

The performance of the credibility index is not stable over time (see figure 1). The worst performance was between the second semester of 2001 and the end of 2003. The reason for the practically null credibility of this period was a combination of several factors that held back the Brazilian economy. The main ones were the instability of the United States stock market, the losses incurred by United States companies and the crisis in Argentina, which drove away investment in emerging countries' bonds and thus produced a sharp rise in country risk. The exchange rate of the Brazilian currency also overshot owing to the political upheaval caused by the presidential election in late 2002. In short, 2002 and 2003 were marked by a failure to meet inflation targets. The inflation target in 2002 was 3.5% with a tolerance interval of ± 2%, and the actual inflation rate was 12.53%. After this appalling performance, the BCB adjusted the 2003 inflation target from 3.25% with a tolerance interval of ± 2% to 4% with a tolerance interval of ± 2.5%. This change was not sufficient, however, and in January 2003, in an open letter, the BCB set a target of 8.5% with no tolerance interval. In spite of this, 2003 inflation was 9.3%. The credibility index performed poorly right up to the end of the period under analysis. The rationale for this result was that the Brazilian economy grew substantially over the period, giving rise to an imbalance between aggregate demand and supply. Moreover, the price of commodities, especially oil, put upward pressure on inflation.

The specific relationship between the credibility index and the ICC is that when credibility performs well, inflation is easier to control and thus there is less need to raise interest rates. When the credibility index is low, on the other hand, the effort that has to be made by the central bank (increases in the interest rate) to meet the inflation target is greater. A positive relationship between these variables is therefore expected.

(v) Public debt/GDP ratio (PD). This series is available from the BCB and is for total consolidated net public-sector debt as a percentage of GDP. Since January 1999, Brazil has been implementing a strategy to improve the public debt profile. One of its objectives is to lower the public debt/GDP ratio by gradually reducing the proportion of exchange rate- and interest rate-indexed bonds, while increasing the share of public debt made up of fixed-rate and price-indexed bonds. The path of the public debt reveals a deterioration in this ratio in 2002, when it passed the 50% mark, a level that continued to be exceeded until early 2004 (see figure 1). The acceleration in the growth of public debt was due to "market fears" about a possible victory for Luis Inácio Lula da Silva in the presidential elections. A speech in which the candidate expressed unorthodox ideas increased the risk perceived by investors and triggered a process of rising interest rates and currency devaluation. However, the victory of this candidate and the establishment of the new government in 2003 did not change the course of economic policy. As a result, fiscal efforts to reduce the public debt/GDP ratio were stepped up, and it has been falling ever since.

The connection of the public debt/GDP ratio with the ICC is that it acts as a proxy for government fiscal performance. An increase in this ratio means that the government is engaging in loose fiscal behaviour. Consumers may interpret this behaviour as necessitating a tight fiscal policy in the future, so that it may induce a fall in aggregate consumption. A negative relationship is therefore expected between the public debt/GDP ratio and the ICC.

(vi) Credit (CRED) represents total lending to the private sector as a proportion of GDP, and the series is available from the BCB.[3] The volume of credit is important for decisions to bring forward future consumption. At times of credit rationing, the volume

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[3] It is important to note that although total lending to the private sector is used rather than lending to households, the difference is immaterial in this case because the correlation of the series for the period under analysis is 0.93.

of resources available is reduced and thus aggregate consumption (as well as the ICC) tends to fall. As can be observed from figure 1, lending to the private

sector increased considerably after 2004. A possible explanation for this path is the systematic reduction in the base rate by the BCB in the same period.

III

Empirical evidence

On the basis of the macroeconomic variables listed in the previous section, the equation for household consumer confidence is given by:

$$ICC = f(GDP, IR, CREDIB, PD, CRED), \qquad (2)$$

with the expected signs for the relationships expressed through partial derivatives below:

$\partial f/\partial GDP>0; \ \partial f/\partial IR<0; \ \partial f/\partial CREDIB>0; \ \partial f/\partial PD<0; \ \partial f/\partial CRED>0.$

  Using the above-mentioned variables to estimate the ICC, the OLS and GMM methods were applied. The reason these methods were used is that they allow us to observe whether the propositions presented are applicable to the Brazilian economy. One reason for using GMM is that while OLS estimations have problems of serial autocorrelation, heteroskedasticity or non-linearity, which is typical in macroeconomic time series, this method provides consistent estimators for the regressions (Hansen, 1982).

  As pointed out by Wooldridge (2001, p. 95), "to obtain a more efficient estimator than two-stage least squares (or ordinary least squares), one must have overriding restrictions". The weighting matrix in the equation was chosen to enable the GMM estimates to be robust, considering the possible presence of heteroskedasticity and autocorrelation of unknown form. In addition, the use of instruments needed to be dated to the period $t - 1$ or earlier as a condition for predicting the contemporaneous variables which were unavailable at time t.

  The variables in the regressions (except the ICC) are lagged on the hypothesis of strict exogeneity of the variables. This hypothesis would clearly be neglected if lags were not used, owing to the possible contemporaneous effect of the ICC on the other variables. The first equation (basic model), which estimates the effects caused by output and indirectly by the management of monetary policy (setting of the

base rate) on the ICC, treats GDP and IR as independent variables. Other variables were included to produce robust estimates. Five equations were estimated for the ICC on the basis of equation (2), taking the OLS and GMM methods into consideration:

(3) $ICC = f(GDP_{-1}, IR_{-3})$
(4) $ICC = f(GDP_{-1}, IR_{-3}, CREDIB_{-1}),$
(5) $ICC = f(GDP_{-1}, IR_{-3}, PD_{-1}),$
(6) $ICC = f(GDP_{-1}, IR_{-3}, CRED_{-3}),$
(7) $ICC = f(GDP_{-1}, IR_{-3}, CREDIB_{-1}, PD_{-1}, CRED_{-3}),$

1. Analysis with OLS and GMM

The reported t-statistics in the OLS estimates are based on the estimator of Newey and West (1987), which is consistent in the presence of both heteroskedasticity and autocorrelation of unknown form (see table 1). Furthermore, as pointed out by Cragg (1983), overidentification analysis has an important role in the selection of instrumental variables to improve the efficiency of the estimators. With this objective, the GMM estimates apply the following instrumental variables in the regressions: constant, ICC_{-1}, ICC_{-2}, ICC_{-3}, GDP_{-2}, GDP_{-3}, GDP_{-4}, GDP_{-5}, IR_{-4}, IR_{-5}, IR_{-6}, $CREDIB_{-2}$, $CREDIB_{-3}$, $CREDIB_{-4}$, PD_{-2}, PD_{-3}, PD_{-4}, $CRED_{-4}$, $CRED_{-5}$, $CRED_{-6}$. An important property of the instrumental variables is their ICC-related exogeneity. A standard J-test was performed with the objective of testing this property for the validity of the overidentifying restrictions (Hansen, 1982). According to the results, all models are correctly specified (see table 1).

  The estimates in table 1 reveal, for both methods (OLS and GMM), that the constant is positive and has a high statistical significance in all specifications. Regarding the effect from GDP to ICC, it is observed that although the coefficient is very low, it is positive and is statistically significant at the 1% level for all specifications. Therefore, as theoretically expected, periods of rising output tend to lead to an increase in the ICC. The effect caused by the real interest rate in

TABLE 1

Index of consumer confidence (icc)
(OLS and GMM estimates)

Explanatory variable	OLS estimates					GMM estimates				
	Specification Eq(1)	Specification Eq(2)	Specification Eq(3)	Specification Eq(4)	Specification Eq(5)	Specification Eq(1)	Specification Eq(2)	Specification Eq(3)	Specification Eq(4)	Specification Eq(5)
Constant	0.8422[a] [6.2400] (0.1350)	0.776324[a] [5.5184] (0.1407)	0.9396[a] [4.5185] (0.2079)	1.2011[a] [5.2221] (0.2300)	1.8697[a] [4.1736] (0.4480)	0.8576[a] [11.8616] (0.0723)	0.5330[a] [7.8539] (0.0679)	0.9865[a] [6.1034] (0.1616)	0.9971[a] [9.3936] (0.1061)	1.5679[a] [4.9783] (0.3149)
GDP(-1)	$2.38\text{E}{-}07$[a] [7.5082] ($3.17\text{E}{-}08$)	$2.36\text{E}{-}07$[a] [8.8030] ($2.68\text{E}{-}08$)	$2.32\text{E}{-}07$[a] [7.4215] ($3.13\text{E}{-}08$)	$3.12\text{E}{-}07$[a] [6.4426] ($4.84\text{E}{-}08$)	$3.29\text{E}{-}07$[a] [8.6958] ($3.78\text{E}{-}08$)	$2.28\text{E}{-}07$[a] [11.3073] ($2.02\text{E}{-}08$)	$2.55\text{E}{-}07$[a] [15.1321] ($1.69\text{E}{-}08$)	$2.17\text{E}{-}07$[a] [9.1646] ($2.36\text{E}{-}08$)	$3.87\text{E}{-}07$[a] [10.0386] ($3.85\text{E}{-}08$)	$3.96\text{E}{-}07$[a] [17.6575] ($2.24\text{E}{-}08$)
IR(-3)	-0.0082 [-1.0552] (0.0078)	-0.005429 [-0.6827] (0.0080)	-0.0070 [-0.8250] (0.0085)	-0.0166[c] [-1.8738] (0.0088)	-0.0129[c] [-1.7288] (0.0074)	-0.0103[a] [-2.6610] (0.0039)	0.0111[a] [2.9935] (0.0037)	-0.0091[b] [-2.2152] (0.0041)	-0.0090[c] [-1.8879] (0.0048)	-0.0073[c] [-1.7129] (0.0043)
CREDIB(-1)		0.079776[b] [2.3589] (0.0338)			0.0801[b] [2.1452] (0.0373)		0.1456[a] [9.0682] (0.0161)			0.1370[a] [6.6309] (0.0207)
PD(-1)			-0.0021 [-0.5183] (0.0041)		-0.0110[c] [-1.9349] (0.0057)			-0.0026 [-0.9754] (0.0027)		-0.0065 [-1.5548] (0.0042)
CRED(-3)				-0.0158[b] [-2.0854] (0.0076)	-0.0260[a] [-3.2370] (0.0080)				-0.0182[a] [-4.5406] (0.0040)	-0.0301[a] [-5.7497] (0.0052)
F-statistic	118.5965	90.2214	78.6467	98.7898	84.5847					
Prob. (F-stat.)	0.0000	0.0000	0.0000	0.0000	0.0000					
J-statistic						0.1375 p>0.68	0.1266 p>0.69	0.1331 p>0.65	0.1147 p>0.77	0.1091 p>0.69
RMSE	0.0882	0.0839	0.0881	0.0811	0.0700	0.0925	0.0913	0.0929	0.0942	0.0777
Adjusted R^2	0.6975	0.7241	0.6955	0.7420	0.8038	0.6504	0.6635	0.6433	0.6430	0.7484

Source: author's estimates.

Marginal significance levels: [a] denotes 0.01, [b] denotes 0.05 and [c] denotes 0.1. Standard errors in parentheses and t-statistics in square brackets.
GDP: Gross domestic product.
IR: Real interest rate.
CREDIB: Credibility.
PD: Public debt.
CRED: Credit.
RMSE: Root mean square deviation.

most of the specifications is not robust when OLS models are considered. On the other hand, the analysis with GMM models indicates that this variable is important in explaining the ICC. The predominantly negative sign bears out the idea that increases in the real interest rate inhibit household consumption decisions.

By contrast with the negative effect of the real interest rate on the ICC, credibility is a variable that plays an important role in improving consumer confidence. Both OLS and GMM estimations indicate that the coefficient of credibility is positive and has a strong statistical significance. This outcome is in agreement with the theory and indicates that the success of inflation targeting is crucial to household consumption decisions.

The inclusion of public debt in the model reveals that this variable is not relevant as an explanation for the ICC. Although the sign of the variable is negative and thus indicates that a fall in the public debt/GDP ratio contributes to an increase in the ICC, most of the models did not show statistical significance. As regards the effect of credit volumes on the ICC, an apparent puzzle is identified: the sign of this variable is contrary to what would be expected in theory and all specifications indicate that the coefficients are statistically significant. A possible explanation for this result is that an increase in the volume of credit also represents an increase in the number of households in debt and this, combined with the high interest rates prevailing in Brazil, erodes consumer confidence.

2. VAR analysis

Since there is a connection over time between the variables applied in the foregoing analysis, it is useful to extend the study by carrying out a VAR estimation. This method makes it possible to analyse the dynamic impact of random disturbances on the system of variables. Impulse response analysis in particular is attractive because it allows us to evaluate the response of the ICC to shocks (or innovations) generated by residual variables over time (Sims, 1980). Because the best specification for forecasting the ICC is given by equation (5) for both the OLS and the GMM methods, the set of variables used in the VAR analysis is represented by GDP, IR, CREDIB, PD and CRED.

Before the VAR estimation, the unit root tests, namely the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP), were carried out. The results of both tests confirmed the null hypothesis (non-stationary series) for the original values of the series

under analysis. In the case of first difference, on the other hand, the null hypothesis is rejected at the 1% significance level, and thus the series are stationary (see Appendix, table A.1). Therefore, all series in this analysis are I(1).

The choice of the VAR lag order was determined using the Akaike (AIC) and Hannan-Quinn (HQ) information criteria. It is observed that both models (with and without constant) indicate that the lag order for VARs is 2 and that the best-fit model is with constant (see Appendix, table A.2). Furthermore, the residuals were normally distributed. The outcomes of the unit root tests indicate that the use of the first difference of series in the VAR is correct; however, this manner of proceeding can result in the long-run relationships between series being lost. Hence, it is necessary to ascertain whether a linear combination between series is stationary even if individually series are non-stationary. In other words, we need to see whether series are cointegrated, because in this situation it is advisable to use vector error correction (VEC) in the estimations.

The intercept and trend were included on the basis of the Pantula principle (Harris, 1995). The results presented in table A.3 show that a correct specification is the use of an intercept within the cointegrating vector. The cointegration tests proposed by Johansen (1991) with regard to the significance of the estimated eigenvalues indicate that both trace and maximum eigenvalue statistics reject the non-cointegration hypothesis (see appendix, table A.4). In consequence, there is a long-term equilibrium relationship between the variables under consideration and thus a VEC is estimated.

Vector autoregressive (VAR) estimates are commonly interpreted using impulse-response functions and the standard method uses an "orthogonality assumption", so that the result may depend on the ordering of variables in the VAR (see Lutkenpohl, 1991). Notwithstanding, in this analysis the variables were ordered in different ways for the impulse-response function analysis, but the results did not change significantly.

On the basis of the above-mentioned methodology, figure 2 shows the results of the generalized impulse-response functions for a time horizon of 36 months. An unexpected positive change in the public debt ratio has a negative and significant effect over time. This result is in agreement with the previous results (constant was statistically significant for all specifications in both methods, OLS and GMM). Furthermore, this outcome

FIGURE 2

Impulse response
(Response to Cholesky One S.D. Innovations)
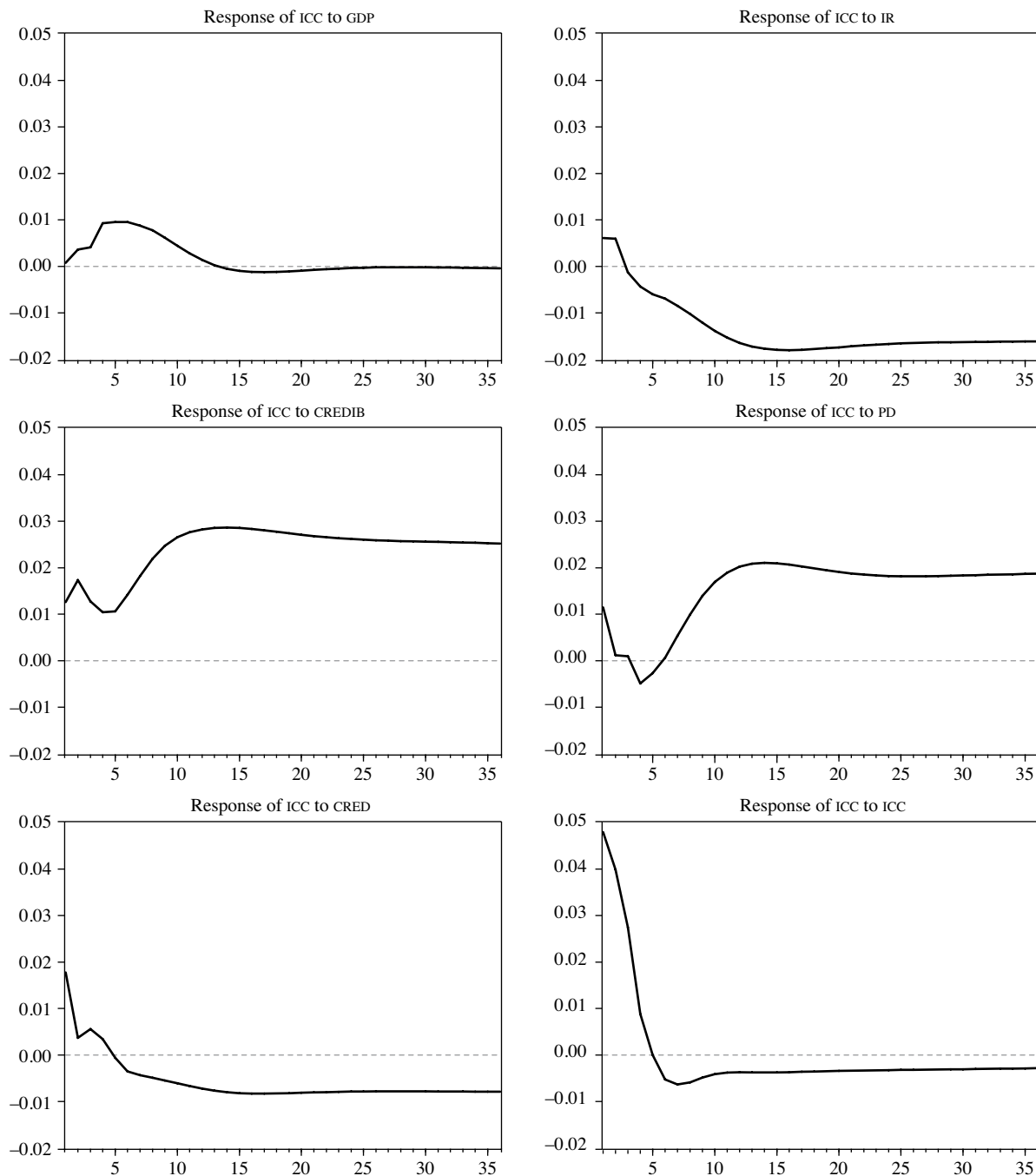
Source: prepared by the author.

ICC: Index of consumer confidence.
GDP: Gross domestic product.
IR: Real interest rate.
CREDIB: Credibility.
PD: Public debt.
CRED: Credit.

suggests that there is a need to adopt a fiscal policy strategy that reduces the stock of public debt.

Broadly speaking, the results of the VEC estimates are in accordance with those of the OLS and GMM analyses. The impulse-function graph reveals that a positive credibility shock promotes an increase in the ICC that persists over time (see figure 2). This finding strengthens the idea that the use of inflation targeting is an important strategy for driving public expectations. On the other hand, a positive real interest rate and credit volume shock leads to a reduction in the ICC that is not avoided.

The analysis of the impact of a rise in public debt reveals upward pressure on the ICC six months after the shock. This observation is apparently contrary to that found in the OLS and GMM estimations, but the first effect (a fall in the ICC) is in consonance with the results reported in table 1. One explanation for the reversal of the tendency is the existence of a considerable lag between the changes in public debt and their effect on consumer expectations. With regard to GDP, it is observed that a positive shock on this variable leads to an increase in the ICC in the first 12 months.

IV

Conclusion

The empirical analysis suggests that macroeconomic variables play a substantial role in determining household consumer confidence in the Brazilian economy. The findings reveal that an increase in output or credibility contributes to an improvement in consumer confidence. On the other hand, increases in lending to the private sector and in the real interest rate damage confidence. Public debt, meanwhile, is not an effective instrument for moulding consumer expectations.

An important implication of this study is that, in economies such as that of Brazil, following a loose fiscal policy that increases public debt and taking measures to increase the volume of lending to the private sector does not represent a good strategy for improving consumer confidence. What the findings do indicate, though, is that the credibility of the inflation target is a very important driver of consumer expectations. Therefore, developing credibility is crucial for economies that are trying to attain a high level of consumer confidence.

(Original: English)

APPENDIX

TABLE A.1

Unit root tests

(ADF and PP)

Series	ADF			PP		
	Lag	Test	1% critical values	Lag	Test	1% critical values
GDP	2	3.8483	–2.5876	6	6.5517	–2.5872
D(GDP)	0	–4.0171	–3.4944	2	–4.1566	–3.4944
IR	0	–0.8799	–2.5872	0	–0.8799	–2.5872
D(IR)	12	–3.1838	–2.5903	3	–8.2529	–2.5874
CREDIB	0	3.6570	–3.4937	3	–1.5798	–2.5872
D(CREDIB)	0	–7.8249	–3.4944	12	–6.0131	–2.5874
PD	1	–0.9757	–2.5874	5	–0.8732	–2.5872
D(PD)	0	–12.8304	–2.5874	0	–12.8304	–2.5874
CRED	1	–3.0121	–3.4944	2	3.3218	–3.4937
D(CRED)	0	–6.5634	–2.5874	6	–8.8207	–4.0487
ICC	0	–3.5934	–4.0478	2	–3.8044	–4.0478
D(ICC)	0	–10.1815	–2.5874	8	–10.5826	–2.5874

Source: prepared by the author.

N.B.: Augmented Dickey-Fuller test (ADF): the final choice of lag was made on the basis of the Schwarz criterion (SC). No-constant specification or time trend was used for the GDP, IR, D(IR), PD, D(PD), D(CRED) and D(CONF) series. Constant was used for the D(GDP), CREDIB and D(CREDIB) series. Constant and linear trend was used for conf. Phillips-Perron test (PP): lag is the lag truncation chosen for the Bartlett kernel. GDP, IR, D(IR), CREDIB, D(CREDIB), PD, D(PD) and D(CONF). Constant was used for CRED. Constant and linear trend was used for CONF and D(CRED).

TABLE A.2

AIC and HQ criteria for VAR

VAR Order	With constant		No constant	
	AIC	HQ	AIC	HQ
0	39.99192	40.05594		
1	23.13847	23.58657	23.52156	23.90564
2	22.54732[a]	23.37951a	22.92496[a]	23.69313[a]
3	22.83064	24.04691	23.02309	24.17535
4	22.97928	24.57964	23.19122	24.72756
5	22.99014	24.97458	23.16333	25.08375
6	23.17986	25.54838	23.39972	25.70424
7	23.27416	26.02677	23.54158	26.23018
8	23.44275	26.57945	23.65272	26.72540

Source: author's estimates based on the Akaike (AIC) and Hannan-Quinn (HQ) criteria.

[a] Denotes lag order selected by the criterion.
VAR: vector autoregression.

TABLE A.3

Number of cointegrating relations

Data trend:	None	None	Linear	Linear	Quadratic
Test type	No intercept No trend	Intercept No trend	Intercept No trend	Intercept Trend	Intercept Trend
Trace	1	3	2	2	1
Max.–eigenvalue	1	1	1	1	0

N.B.: Number of cointegrating relations, by model, selected at 5% level.*

Rank or no. of CEs	No intercept No trend	Intercept No trend	Intercept No trend	Intercept Trend	Intercept Trend
0	25.09646	25.09646	25.14402	25.14402	25.17400
1	25.11454	25.13210	25.23447	25.27739	25.35115
2	25.37612	25.42983	25.49587	25.57408	25.60401
3	25.78937	25.73732	25.78879	25.90949	25.96547
4	26.23064	26.19615	26.20376	26.34155	26.37721
5	26.69913	26.68261	26.68347	26.81486	26.80554
6	27.23809	27.21517	27.21517	27.33957	27.33957

Source: prepared by the author.

N.B.: Schwarz information criterion by rank (rows) and model (columns).
CE: Cointegrating equation.

* Critical values based on MacKinnon, Haug and Michelis (1999).

TABLE A.4

Johansen's cointegration tests

Hypothetical number of CEs	Eigenv.	Trace			Maximum eigenvalue		
		Trace statistic	5% critical values	Prob.[a]	Max.-eigenvalue statistic	5% critical values	Prob.[a]
R = 0	0.4227	143.2814	103.8473	0.0000	56.5803	40.9568	0.0004
R ≤ 1	0.2497	86.7011	76.9728	0.0075	29.5860	34.8059	0.1841
R ≤ 2	0.2423	57.1151	54.0790	0.0261	28.5801	28.5881	0.0501
R ≤ 3	0.1185	28.5350	35.1928	0.2182	12.9910	22.2996	0.5576
R ≤ 5	0.0938	15.5440	20.2618	0.1968	10.1462	15.8921	0.3212
R ≤ 6	0.0511	5.39783	9.1645	0.2426	5.3978	9.1645	0.2426

Source: prepared by the author.

[a] Denotes MacKinnon-Haug-Michelis (1999) p-values.
CE: Cointegrating equation.

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Exchange-rate management in Brazil

Daniela M. Prates, André M. Cunha and Marcos T.C. Lélis

Daniela M. Prates

Professor at the Economics Institute

of the State University at Campinas

(UNICAMP)

Researcher at the National Council

for Scientific and Technological

Development (CNPq), Brazil

➥ daniprates@eco.unicamp.br

André M. Cunha

Professor at the Federal University

of Rio Grande do Sul (UFRGS)

Researcher at the National Council

for Scientific and Technological

Development (CNPq), Brazil

➥ amcunha@hotmail.com

Marcos T.C. Lélis

Professor at the University of Vale

do Rio dos Sinos (UNISINOS)

Economist with the Brazilian Trade

and Investment Promotion Agency

(APEX), Brazil

➥ mcaputi@uol.com.br

This paper examines four hypotheses: (i) in Brazil, as in other peripheral countries in the post-crisis context, a policy choice appears to have been made for a flexible exchange rate within a currency band ("dirty float"); (ii) the underlying reasons for this policy appear to have more to do with pass-through of exchange-rate variations and precautionary demand for reserves than with the maintenance of a competitive real exchange rate; (iii) in the country's peculiar situation, considerable capital mobility is conjoined with large and liquid financial derivatives markets and a reserves build-up policy that carries a high fiscal cost; (iv) until April 2006, reserves accumulated in much the same way under the floating exchange-rate system as they had under the currency band regime; there have been changes since then owing to the rapid growth of reserves.

I

Introduction

In 1999, in line with the dominant trend among leading emerging economies, the Brazilian authorities adopted a floating exchange-rate system. The managed exchange-rate policies (fixed rate or bands) that were the rule in these economies in the 1990s had the virtue of ensuring the stability of the nominal exchange rate (one of the key prices in capitalist economies), but proved extremely vulnerable to real currency appreciation and speculative attacks, culminating in a series of currency crises in the second half of the decade. After these crises, the policies mentioned gave way to floating exchange-rate systems. Although this system was adopted officially in most emerging countries, in practice the respective monetary authorities sought to check exchange-rate movements by intervening actively in the currency markets. In other words, the predominant exchange-rate regime in the period since the crisis has actually been a dirty float with different degrees of intervention, in which a central bank presence has been the rule and not the exception. Systematic currency market intervention —"fear of floating", as Calvo and Reinhart (2000) put it— appears to be the result of "defensive strategies" in an international financial environment characterized by alternately rising and falling capital flows. They include: (i) reducing external vulnerability by building up excess official reserves, or "precautionary demand" (Flood and Marion, 2002; Jeanne and Rancière, 2006), and (ii) adopting export-based growth policies (Dooley, Folkerts-Landau and Garber, 2005; Aizenman and Lee, 2005; Soto and García, 2006).

The dirty float system relieved the acute external vulnerability of the Brazilian economy, which had resulted in a current-account deficit of about 4% of gross domestic product (GDP) during the fixed or managed exchange-rate period (1995-1998), with a consequent US$ 180 billion expansion of external liabilities. Between 2003 and mid-2007, when the international financial crisis originating in the United States subprime mortgage market broke out, this regime was implemented in an exceptionally favourable international context. Rising commodity prices and a high level of international financial liquidity ensured a continuing balance-of-payments adjustment despite the tendency for the real to appreciate.

What will be examined here is the way the floating exchange-rate system was managed in Brazil between 1999 and 2007, with emphasis on the period of abundant capital flows into peripheral countries (from 2003 until mid-2007). Four hypotheses will be examined: (i) as in other peripheral countries in the post-crisis context, Brazil appears to have opted for a dirty float policy; (ii) the underlying reasons for this policy appear to have more to do with pass-through of exchange-rate variations to domestic prices and precautionary demand for reserves than with the other factors that would justify "fear of floating", such as the desire to maintain a competitive real exchange rate; (iii) the Brazilian experience is characterized not only by a combination of considerable capital mobility and large and liquid financial derivatives markets, but also by a lack of transparency regarding the goals and targets of exchange-rate policy and the high fiscal cost of the reserves build-up policy; (iv) until April 2006, reserves continued to accumulate under the floating exchange-rate system much as they had under the currency band regime; there have been changes since then owing to the rapid growth of reserves.

This study is divided into four sections. Following this Introduction, section II presents the institutional format and determinants of the Brazilian floating exchange-rate system and calculates the indicators of the country's "fear of floating". Section III analyses the way this regime was managed in the 2003-2007 period and section IV conducts an econometric exercise designed to bring out the factors determining changes in currency reserves and their accumulation pattern under the managed and flexible exchange-rate systems. Lastly, some final considerations are presented in section V.

II

The floating exchange-rate system in Brazil

The floating exchange-rate system was introduced by the Central Bank of Brazil in January 1999 after speculative attacks had greatly depleted reserves during the preceding months, leading the authorities to seek financial assistance from the International Monetary Fund (IMF). Under the Brazilian institutional model, it is the Central Bank that determines the exchange-rate regime, its targets and its management (i.e., exchange-rate policy).[1] However, international reserves belong to the Union.[2] They are administered by the Central Bank, and the accounting results associated with management of the currency are converted every six months into Union revenue or expenditure items.

The new exchange-rate system preceded the inflation targeting regime established in June 1999. Despite its precedence in time, it seems that in the institutional context of the economic policy framework in place since 1999 (whose pillars also include primary surplus targets), the floating exchange-rate system ranks well below the inflation targeting regime, which was established by presidential decree and whose goals and indicators are the responsibility of the National Monetary Council (CMN). This hypothesis is supported by the scarcity of official documents referring to the floating exchange-rate system and its management and the fact that none of them (including Notification no. 6,565, which instituted the floating exchange-rate system) lay down the general macroeconomic objectives of this regime.[3] Although the notification does establish the aim of exchange-rate policy (mitigating short-term exchange-rate volatility), it does not spell out the underlying macroeconomic objective. As Moreno (2005) points out, this aim may be subordinated to different objectives that are not mutually exclusive, such as controlling inflation,

supporting external competitiveness and maintaining financial stability.

By reviewing the proceedings of the Central Bank of Brazil Monetary Policy Committee (COPOM) and the inflation reports, it is possible to form some hypotheses about these objectives.[4] References to the effects of the exchange rate on domestic price indices in some of these documents (which form part of the inflation targeting system) reveal that, besides the preservation of financial stability, management of the floating exchange-rate system in Brazil also has the (sometimes unacknowledged) aim of controlling inflation. The lack of disclosure about the objectives of this system appears to be due not to any explicit strategy to enhance its effectiveness (given that Central Bank interventions in the currency market are fully disclosed) or to accountability standards being lower than for monetary policy, but rather to its subordination to that policy.[5] This being so, one theory might be that the macroeconomic goals of the floating exchange-rate system are implicit and largely coincide with those of the inflation targeting regime, namely price stability and financial system stability. These goals have not been constant over time, however, but have varied with a more general factor influencing the management of this regime, namely the phase in the international liquidity cycle, as detailed below.

The obvious hierarchical relationship between the monetary system (dominant) and the exchange-rate system (subordinate) in the institutional framework of economic policy is not peculiar to Brazil. On the contrary, whether because exchange-rate movements are particularly liable to feed through to inflation in emerging economies, or because of their greater vulnerability to the recent instability of capital flows, a number of countries that have paired a floating exchange rate with inflation targeting have included inflation control and financial system stability among the macroeconomic objectives of the exchange-rate system. This hierarchy reflects the vital role of

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[1] Emerging countries have different models for regulating currency markets. Central banks are not necessarily responsible for running exchange-rate policy and managing reserves (Moser-Boehm, 2005).

[2] In accordance with Article 21 of the 1988 Constitution of the Federal Republic of Brazil.

[3] The Central Bank of Brazil website (www.bcb.gov.br) has no section dealing with the exchange-rate system or exchange-rate policy, whereas there is a huge section on the inflation targeting system. The only explicit reference to exchange-rate policy is in the annual reports of the Bank.

[4] COPOM sets the base interest rate in Brazil.

[5] In general, as Moser-Boehm (2005) points out, governance aspects seem to be less explicit for foreign-exchange intervention than for monetary policy decisions.

exchange-rate movements in the virtuous functioning of inflation targeting regimes in these countries, and not their irrelevance (Grenville, 2000; Mohanty and Scatigna, 2005).

The main peculiarity of this pairing in Brazil is the fact that these goals are not made explicit, even though the Central Bank is the institution responsible for managing both systems, a factor that minimizes the likelihood of the kind of policy coordination problems seen in certain countries where exchange-rate policy is conducted by the government. In economies that thus combine a floating exchange rate with inflation targeting, for example, it is explicitly recognized that stabilizing inflation requires exchange-rate management to take account of a high level of trade exposure and pass-through (Ho and McCauley, 2003).

Where the legal situation is concerned, Notification 6,565 stipulates that official interventions in the currency market should be occasional, suggesting that the exchange rate will be allowed to fluctuate in a way that approximates to a "clean float". In the situation that followed the crisis of the 1990s, however, what seems to have predominated in Brazil, as in other peripheral countries, was a "dirty float" exchange-rate policy. Furthermore, the goals and targets of this policy did not remain constant following its adoption and it was not confined to interventions in the spot currency market, but involved a broader array of instruments. Before analysing the different dimensions of the dirty float policy, it is important to answer two related questions: (i) is there "fear of floating" in Brazil? (ii) what were the factors that shaped this policy?

A preliminary response to the first question can be sought in the indicators of relative volatility developed by Hausmann, Panizza and Stein (2000) to detect the existence (or otherwise) of "fear of floating" in emerging countries that have adopted floating exchange-rate systems. These indicators are an attempt to solve, at least in part, the problems raised by the indicators of absolute volatility (in international reserves, interest rates and exchange rates) presented in Calvo and Reinhart (2000)—measured by the frequency with which monthly fluctuations in the variables remain within predetermined ranges throughout the period considered.[6]

Hausmann, Panizza and Stein (2000) use indicators to assess relative volatility between exchange and interest rates and between exchange rates and reserves, using the standard deviation as a measure of volatility for these rates and, in the case of reserves (measured in monetary units), taking the standard deviation divided by the mean of the M2 aggregate (to avoid distortions due to different units). These indicators have the merit of taking account of the level differentials of the variables (in accordance with the use of these volatility measures) and of showing how the monetary authorities have reacted (through higher interest rates or currency market intervention) relative to the scale of the shock experienced.

Souza (2005) and Souza and Hoff (2006) calculated similar indicators for Brazil from January 1999 to December 2005 and concluded that, taking the mean of those seven years, there was no fear of floating in Brazil. The results obtained by those authors indicate very similar values in the indicators of Brazil and the United States (0.26 and 0.23 in the case of the exchange-rate/reserves indicator and 1.39 and 1.33 in the case of the exchange-rate/interest-rate indicator) and suggest that the exchange-rate system in operation is close to a genuine float (the indicators for Asian countries are much lower and indicate that interest rates and reserves are being used to stabilize the exchange rate). Updating this calculation to June 2007 (see table 1) yields a practically identical result for the exchange-rate/reserves indicator (0.25), which bears out the true float hypothesis, and a lower result in the case of the exchange-rate/interest-rate indicator (1.13), which would indicate a greater willingness to

TABLE 1

Brazil: "fear of floating" indicators, 1999-2007

	Relative volatility	
	Exchange/ interest	Exchange/ reserves
January 1999-December 2005	1.39	0.26
January 1999-June 2007	1.13	0.25
January 1999-December 2002	1.34	0.42
January 2003-June 2007	0.73	0.17

Source: prepared by the authors on the basis of data from the Central Bank of Brazil.

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[6] There are three main problems with these indicators: (i) the interest-rate volatility indicator tends to overestimate variations in countries with higher average interest rates, a description that fits most emerging countries; (ii) not all interest-rate changes

reflect attempts to stabilize the exchange rate; (iii) exchange-rate volatility may be the result of powerful external shocks affecting the country.

use interest rates to stabilize the exchange rate over this longer period (January 1999-June 2007).

Analysing the behaviour of relative volatility indicators over the whole period (January 1999-December 2005 or January 1999-June 2007) does not seem the best approach, as it masks importance differences in their trajectory following the adoption of the floating exchange-rate system. These differences are largely associated with the behaviour of capital flows to emerging countries, and thus to Brazil. As figure 1 shows, it is possible to identify two distinct phases in this cycle from 1999 onward, each with its own challenges and room for manoeuvre in exchange-rate policy.

The first period, which began in January 1999 and ended in December 2002, was the "down" phase in the liquidity cycle of the 1990s. During those four years, the rise in risk aversion among global investors after the Asian and Russian crises led to a sharp retrenchment in flows of external financial capital to emerging countries (portfolio investment and other capital flows, including bank lending in its various forms). Total flows did not turn negative thanks to the relatively favourable performance of foreign direct investment.

The second phase lasted from 2003 to mid-2007, with an upturn in the liquidity cycle beginning in the former year. The level of liquidity in the latter year was

unprecedented. As in other cyclical booms preceding busts, the first half of 2007 was characterized by excessive euphoria that resulted in an extraordinary level of absorption of external resources by emerging economies, easily offsetting the lacklustre performance of the second half of the year after the outbreak of the United States subprime mortgage crisis. Net flows, which include direct and portfolio investment and bank lending, totalled US$ 617.7 billion.[7]

Calculating relative volatility indicators for these two periods reveals the differences of behaviour in the "pessimistic" and "optimistic" phases of the international liquidity cycle. In the period from January 1999 to December 2002, both indicators (exchange rate/interest rate and exchange rate/reserves) reached high values (1.34 and 0.42, respectively) relative to the whole period, and particularly the second period (January 2003-June 2007). Conversely, the results for this period (0.73 and 0.17, respectively) are lower than the period total and than those of the first period.

Although the indicators calculated by Hausmann, Panizza and Stein (2000) for the two subperiods (January 1999-December 2002 and January 2003-June 2007) captured major differences in relative

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[7] See Biancareli (2009), World Bank (2009), Lane (2008) and Reinhart and Reinhart (2008) on the subject of international liquidity cycles in emerging countries.

FIGURE 1

Net capital flows into emerging countries
(Billions of dollars)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009[a]
Total flows	226.57	207.49	61.59	67.64	63.68	73.50	53.93	154.19	221.92	226.86	202.89	617.73	109.49	−190.21
Direct investment	116.53	151.06	156.63	171.91	164.00	180.47	144.44	161.35	183.94	243.69	241.37	359.03	459.28	312.77
Portfolio investment	96.69	50.30	39.81	67.03	17.24	−76.90	−86.43	−3.83	10.00	−5.57	−100.71	39.47	−155.20	−234.51
Other capital flows	13.39	6.14	−134.85	−171.30	−117.56	−30.08	−4.08	−3.33	27.97	−11.26	−62.23	219.23	−194.59	−268.47

Source: International Monetary Fund, World Economic Outlook Database, April 2009.

[a] Forecast.

volatility between the external financing bust and boom phases, they are clearly insufficient to characterize the floating exchange-rate system in Brazil and explain the specificities of its operation in these two phases. According to these indicators, Brazil had less "fear of floating" in the pessimistic phase than in the optimistic one, which does not seem to make sense, given not only the strong pass-through effect but also the increased external vulnerability of the economy and the greater currency mismatch for the private sector in the first phase.[8] The lower relative volatility in the second phase does not reflect a greater "fear of floating" but rather the positive effects of the favourable external context on the volatility of the exchange rate and the other financial variables (interest and reserves). The resumption of currency purchasing by the Central Bank of Brazil in the spot currency market from late 2004, made possible precisely by this context, also seems to have helped reduce this volatility (see section III). While these indicators were higher than those used by Calvo and Reinhart (2000), they also have some limitations: reserve purchases may have been a precautionary demand strategy and thus not aimed at influencing the level or volatility of the exchange rate, besides which the monetary authorities have other exchange-rate and even economic policy instruments (including capital controls) available to them to meet their exchange-rate targets.

This means that, if analysed in isolation without considering the external and internal (structural and macroeconomic) factors influencing the management of the floating exchange-rate system, these indicators can lead to faulty conclusions. The phase of the international liquidity cycle influences the management of the floating exchange-rate system in emerging economies generally and Brazil in particular, owing to its high degree of financial openness. While this cycle is the main external factor influencing management of the system, the degree of financial openness can be regarded as the main structural internal factor.

The financial opening of the Brazilian economy began in the late 1980s and was extended over the course of the 1990s. The institutional changes made in that period led to significant liberalization of foreign portfolio investment in the domestic financial market and the international capital market. Thus,

when the floating exchange-rate system came into effect, on 16 January 1999, financial opening in the Brazilian economy was already quite well advanced. A decisive measure that opened it up considerably more was adopted a year later, on 26 January 2000. Resolution 2,689 deregulated applications by foreign investors in share and fixed-income security markets and gave them unrestricted access to the local financial derivatives market, where they had hitherto been limited to operations to cover their positions in spot markets. Although the Brazilian financial derivatives market was already more highly developed than most emerging countries' by the late 1990s, foreign investors' freedom of action in the Mercantile & Futures Exchange (BM&F) would greatly increase its liquidity and depth and have considerable repercussions on the management of exchange-rate policy that would only be felt in the phase of optimism, particularly after 2004 (see section III).

This high degree of financial openness, and global investors' access to the organized financial derivatives market in particular, intensified the effects of booms and busts in capital flows on the country's key prices, particularly the exchange rate (which became the main mechanism for transmitting capital flow volatility to financial markets and the real economy), but also reinforced the interaction between exchange-rate, monetary and fiscal policies (inevitable in economies that embraced financial globalization) and reduced their respective room for manoeuvre. In this context, management of the floating exchange-rate system (and also of the inflation targeting policy) was largely subordinated to the wealth allocation decisions of global investors. However, the interaction between external factors (international liquidity cycle) and structural internal ones (degree of financial openness) had different repercussions for system management in the "pessimistic" and "optimistic" phases of the cycle. There were different challenges and degrees of freedom for exchange-rate policy depending, to a large extent, on the balance-of-payments situation and external vulnerability of the Brazilian economy —these being arguably the most decisive domestic macroeconomic variables affecting it.

The further opening of the Brazilian economy in 2000, when Arminio Fraga Neto was President of the Central Bank of Brazil, did not have concrete effects during the early stages of the floating exchange-rate system (January 1999 to December 2002), when the country was affected by external currency constraints and the consequent structural scarcity of sellers and

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[8] Studies such as those of Hakura and Choudhri (2001) and Mohanty and Scatigna (2005) have suggested that Brazil and Turkey are among the countries with the highest levels of currency pass-through.

excess of buyers in the Brazilian currency market. In this context, foreign investors scaled back their positions in Brazilian assets, and the BM&F was no exception. The volumes traded on that exchange increased in 1999, once the upheaval caused by the alteration in the exchange-rate regime had passed, and in 2000, only to fall back again following the speculative attack in 2001 (see table 2). A decisive contribution to the "evaporation" of liquidity in this market in a context of excess dollar demand (whether for risk cover or for speculation) was the ban on the Central Bank operating with currency derivatives that was

imposed under the agreement with the International Monetary Fund (IMF) in March 1999 (and retained in the 2001 agreement). In consequence, the effects of the mismatch between foreign currency supply (weak flows) and demand (flows and stocks) have fallen mainly on the spot foreign-exchange market and on public securities indexed to the exchange rate.

During this period, the monetary authority's room for manoeuvre in pursuing its main goals was severely limited by three factors: (i) its inability to operate in the currency derivatives market, (ii) the limited volume of international reserves available for interventions in the spot currency market (less than the assets available to the Central Bank of Brazil because of the limits imposed by the agreement with the IMF) and (iii) the now very large build-up of public securities indexed to the exchange rate.

In their efforts to meet the goals of the floating exchange-rate system in the pessimistic phase, the Central Bank authorities did not confine themselves to intervening in the spot currency market but used other exchange-rate policy instruments, such as issuing securities indexed to the exchange rate and currency swaps, which are equivalent to selling dollars forward and buying contracts for Interfinancial Deposits (DI), securities that yield the Brazilian short-term interest rate. In 1999 particularly, the monetary authority also adopted regulatory measures to stimulate the supply of currency in the foreign-exchange market and, most importantly, to restrain demand.

TABLE 2

Volumes traded on the Mercantile & Futures Exchange, by asset type
(Dollars)

Year	Currency	Interest-rate
1999	12 166 257	25 292 621
2000	12 164 002	25 290 221
2001	21 612 354	43 835 697
2002	17 349 055	71 186 758
2003	19 320 993	83 553 886
2004	27 421 447	139 066 000
2005	41 810 287	146 655 688
2006	59 824 092	174 569 023
2007	115 883 665	263 434 704

Source: summary of Mercantile & Futures Exchange (BM&F) data.

III

The floating exchange-rate system in the optimistic phase

The combination of financial openness and deep derivatives markets proved a "double-edged sword" when it came to managing the floating exchange-rate system in Brazil, with each "edge" manifesting itself at different phases in the international liquidity cycle. As summarized earlier, during the phase of pessimism and scarce external resources, this combination intensified the effectiveness of speculative attacks against the Brazilian currency and reduced the scope for exchange-rate management to restrain pressure for devaluation. In the optimistic phase, which began in

2003 and lasted until mid-2007 (when the subprime mortgage crisis broke out in the United States), with capital flows returning and external trade and flows showing positive results (owing to the depreciation in the earlier period, but also to the international trade cycle), the adoption of an over-tight monetary policy resulted in an uninterrupted trend towards appreciation, which was mainly responsible for the effectiveness of the inflation targeting policy.

Although kept subordinate to inflation targeting, exchange-rate management was given greater latitude by

the benign external environment, and this contributed decisively to the favourable evolution of the balance of payments (with the current account in surplus from 2003 and the financial account after 2005). It is possible to identify two distinct periods of exchange-rate management in this phase of optimism, the first running from January 2003 to November 2004 and the second from December 2004 to mid-2007. The Central Bank barely intervened in the spot currency market in the first period. This was as might have been expected from January 2003 to July 2004, when the exchange rate remained stable following the early months spent correcting the excessive interventionism of exchange-rate policy in 2002. Even after July 2004, when the currency began its long appreciation, the authority was only intermittently active in the market, given the implicit objective of using this process to achieve its inflation targets. In that period, the main strategy of exchange-rate policy was the aggressive redemption of currency bonds, which continued into the following period.

The second period (December 2004 to June 2007) was characterized by the return of the Central Bank as a buyer in the two segments of the currency market, spot and forward. Intervention in the spot market was temporarily suspended between March and September 2005, even though the real continued to appreciate. From October 2005, the Central Bank maintained a constant presence in this market with the explicit goal of accumulating international reserves without imposing a trend or floor on currency fluctuations or heightening volatility in the market (BCB, 2007). Given the restrictive monetary policy of the period, the authority consistently adopted a strategy of sterilized intervention, i.e., it set out to neutralize the monetary impact of its currency purchases by selling public securities on the open market.

The policy of accumulating international reserves, adopted in late 2004 to strengthen the country's external position directly (by creating a "cushion" of foreign-currency liquidity) and indirectly (by positively influencing external ratings) came up against two major limitations: the large build-up of mainly short-term securitized public debt indexed to the policy rate (the Special System of Clearance and Custody or SELIC rate) and the large differential between domestic and external interest rates, which made these reserves extremely costly to maintain (in absolute terms and by comparison with other emerging countries). A rough calculation of this cost in June 2007, when reserves reached US\$ 147 billion and there was a 7.08%

differential between the SELIC rate and the yield on 10-year Treasury notes (the favoured destination for these reserves), puts it at US\$ 10.5 billion a year.[9] If account is taken of exchange-rate movements from late 2004, when the reserves build-up policy was renewed, this cost was even higher, as the dollar depreciated against the real over the period.

This same interest-rate differential, in the context of a sharp reduction in country risk, stimulated short-term capital inflows in pursuit of profits from arbitrage or speculation and played a decisive role in the appreciation of the currency after September 2004. In other words, a high policy rate in the Brazilian economy has two simultaneous and contradictory effects: on the one hand, it stimulates the build-up of the country's short-term external liabilities (in the form of fixed-income portfolio investments and short-term debt), while on the other, it increases the cost of maintaining the foreign-currency reserves that are the "cushion" needed to cope with the potential for this liability to go into reverse. It is no coincidence that the financial account recorded a surplus of US\$ 87 billion in 2007.

Certain factors contributed decisively to the boom in capital flows in 2007, even as the policy of policy rate cuts continued. First, the expectation of achieving an "investment grade" rating (which was only awarded in late April 2008) stimulated foreign portfolio investment. Second, in January 2007 the Central Bank slowed down the pace of cuts in the policy rate (from 0.5% to 0.25%) and country risk continued to diminish in the international market, ensuring a continuing large gap between the SELIC rate and the so-called "arbitrage-neutral SELIC" rate (see figure 2), which is the sum of country risk and the lowest-risk interest rate (the federal funds rate, which is the United States Federal Reserve policy rate) and represents the cost of Brazilian borrowing abroad. This encouraged investors to arrange short-term credit lines to carry out arbitrage operations in the local financial market.

These same factors led foreign investors to maintain or even extend their positions in the Brazilian financial derivatives market. Derivatives linked to the exchange rate of the real, traded locally (BM&F) and in the over-the-counter market, played a decisive role in

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[9] Working independently, McCulley and Toloui (2007) used a similar methodology and reached a result equivalent to the one presented in this paper.

FIGURE 2

SELIC and arbitrage-neutral SELIC rates
(Percentages)

—✳— Special System of Clearance and Custody (SELIC) rate
—■— Arbitrage-neutral SELIC rate (federal funds rate + Brazil risk)
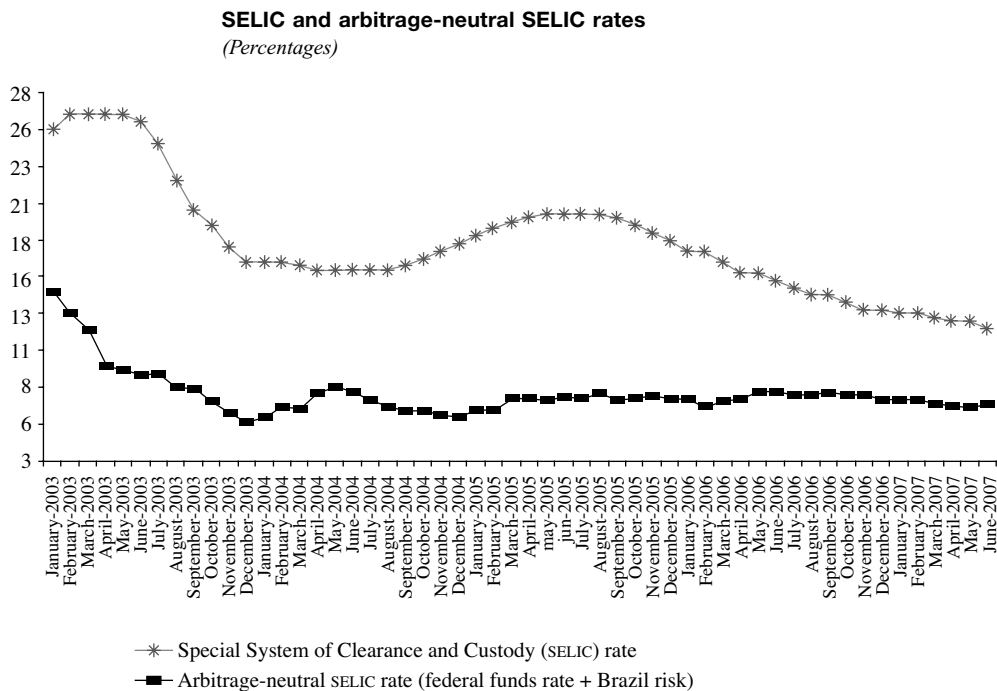
Source: Central Bank of Brazil and Federal Reserve System.

currency appreciation from 2004.[10] The positions of these investors were largely in short selling contracts that turned a profit when the real appreciated. Thus, in the optimistic phase of the international liquidity cycle alone, the combination of a floating exchange rate and foreign investors' unrestricted access to the BM&F led to an increase in the liquidity and depth of this market and, consequently, in opportunities for arbitrage and speculation with the exchange rate of the real. Against a background of declining country and exchange-rate risk, foreign investors' operations in the spot and forward currency markets heightened the appreciation of the real over 2007. This tendency, in turn, further increased the profitability of these operations and encouraged more of them, creating self-fulfilling prophesies. With the currency supply thus expanding, the Central Bank of Brazil stepped up its interventions in the spot currency market, lifting Brazilian international reserves to unprecedented levels. Despite this large-scale official intervention, however, the real continued to appreciate steadily (in nominal and real terms).

The continued appreciation of the real notwithstanding the currency purchases by the Brazilian monetary authority was due, in part, to the strategy of intervening in the spot currency market.[11] In the up phase of the international liquidity cycle, the goal of Central Bank buying in the currency market was to reconstitute a foreign-currency liquidity "cushion" and reduce exchange-rate volatility, while trying not to influence the appreciating trend of the real (which proved essential to the effectiveness of the targeting policy). In this context, the level of the exchange rate was not a target of exchange-rate management. The Brazilian authority only intervened in certain circumstances to reduce the pace of appreciation of the real, adopting a strategy of "leaning against the wind" since sudden changes in the level of the currency can increase uncertainty, stimulate speculative movements and exacerbate exchange-rate volatility.[12] In accordance with its general macroeconomic goals and their respective targets, the Central Bank pursued

[10] The financial derivative mechanism employed in this over-the-counter market is the non-deliverable forward (NDF).

[11] As in most of these countries (Archer, 2005), the bulk of trading is done by electronic auction (Mercantile & Futures Exchange clearing system, introduced in 2006) or by telephone via Central Bank of Brazil dealers in the interbank market.
12 Regarding this strategy, see Mihalijek (2005).

a strategy, announced in advance to its dealers, of acting at day's end before the market closed to "mop up" dollars at prevailing prices, without seeking to influence market quotations. As Archer (2005) points out, this is precisely the strategy recommended when the monetary authority is not setting out to influence the exchange rate.

However, while the real might have appreciated much less dramatically if the Central Bank of Brazil had adopted another intervention strategy in the spot currency market, it would have appreciated nonetheless. It can plausibly be argued that a change in this strategy would only have slowed the pace of exchange-rate appreciation, but would not have been sufficient to halt it given the extent of the economy's financial openness. In this context, contrary to what the conventional theoretical approach assumes, emerging countries, vulnerable as they are to sudden surges or stops in capital movements, are actually faced with an "impossible duality" (Flassbeck, 2001): adoption of a floating exchange-rate regime does not guarantee automatic adjustment of the balance of payments and monetary policy independence; on the contrary, it strengthens the relationship between the policy rate and the nominal exchange rate and the influence of global investors' portfolio decisions on these key prices. This relationship manifested itself in different ways depending on the phase in the international liquidity cycle.[13] In the period of abundant liquidity (see figure 2), it was interest-rate movements that came to shape the trajectory of the exchange rate. Furthermore, the inability of the Central Bank to control the policy rate and nominal exchange rate simultaneously in a context of freely mobile capital was taken to an extreme by two specific factors: the high fiscal cost of sterilization operations and the existence of large and liquid financial derivatives markets.

A brief international comparison will illustrate the relative size of this market and the amount of (mainly foreign investors') money riding on the appreciation of the real. Not only is the BM&F one of the world's leading derivatives exchanges – specifically, it ranked eighth in the two-month period January-February 2007 – and the second-largest emerging-market exchange (only the South Korean exchange, where share index options predominate, is larger), but the number of

contracts traded there experienced the fastest growth of any of them between the first two months of 2006 and the first two months of 2007.[14]

Thus, the most singular feature of the Brazilian currency market is the size, liquidity and depth of its forward segment, characteristics that are inseparable from the unrestricted access of foreign investors to this segment, which strengthened the channels of transmission between the latter's investment decisions, the interest rate and the nominal exchange rate and made arbitrage between offshore and onshore currency derivatives trades a viable proposition. This characteristic of the Brazilian currency market also shaped the management of exchange-rate policy. From February 2005, the Central Bank decided to offer currency derivatives, known as reverse swaps (which are exactly the opposite of the swaps made available during periods of depreciation in the real). With its reverse swap operations, the monetary authority positioned itself at the opposite extreme from foreign investors in BM&F currency trades, taking dollar purchase positions with a view to easing downward pressure on the dollar (i.e., appreciation of the real) in the future. As with interventions in the spot currency market, the provision of reverse swaps only slowed the pace of appreciation in the real, preventing the forward dollar price (and thence the spot price) from plummeting.

Given the context of extensive capital mobility and the existence of large and liquid financial derivatives markets, the Brazilian monetary authority would be unable to determine both the interest rate and the exchange rate of the real simultaneously. By opting for a tight monetary policy to ensure the effectiveness of the inflation targeting policy, the authority abandoned any kind of target for the nominal exchange rate, which became the determined variable in the system and, at the same time, the key to this effectiveness. In this period of plentiful external liquidity and an appreciating real, the high level of pass-through

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[13] Conversely, as Mohanty and Scatigna (2005) point out, economies that maintain some degree of control over capital flows are able to insulate their monetary and exchange-rate policies from the effects of these cycles, at least in part.

[14] See Johnson (2007). In the first two months of 2007, real-related currency derivatives negotiated on the Mercantile & Futures Exchange occupied an unprecedented position in terms of the number of contracts traded in organized currency derivatives markets: "BM&F's U.S. Dollar contract led the sector for the second year in a row with a 51.4% increase to 10.97 million contracts. It was follow by CME's Euro FX contract which rose 22% to 6.73 million contracts." Another explanation for this unprecedented figure is that some global investors used these contracts as a proxy for derivatives of emerging currencies that correlate closely with the real (such as the Turkish lira and the South African rand) but are not traded in deep and liquid organized derivatives markets.

in the Brazilian economy became an "ally" of this policy, given the positive effects of appreciation on domestic inflation.

Thus, exchange-rate policy cannot be said to have been ineffective in the period. The Central Bank was not only fully aware of the role played by appreciation of the real when it came to meeting strict inflation targets, but actually induced it by running a tight monetary policy (alleging demand pressures). The goals of intervention were to contain volatility in the currency market and, most importantly, to build up reserves, and both were achieved fairly successfully.

Nonetheless, this policy choice had two adverse side-effects. First, there was the real-term appreciation of the Brazilian currency. As figure 3 shows, following correction of the excessively interventionist stance of exchange-rate policy from 2002 to early 2003 and the brief spell of stability between May 2003 and May 2004, the real strengthened virtually without interruption, both bilaterally (against the dollar) and effectively (against a basket of 13 currencies). In the up phase of the international liquidity cycle (January 2003 to June 2007), the real experienced a bilateral appreciation (against the dollar) of 55.9% and an effective appreciation of 46.9% (this lower percentage was due to the dollar's loss of value against the other currencies over the period).

The second effect was a consequence of the first and consisted in a loss of competitiveness for manufactured goods exports, as the main commodities exported by Brazil benefited in the appreciation period from rising international prices.[15] According to the export profitability index calculated by the Foreign Trade Studies Centre Foundation (FUNCEX), the main

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[15] This rise was associated both with demand from China and with speculation in futures markets, stimulated by a context of dollar devaluation and low interest rates in the central countries. See Gottschalk and Prates (2006) and UNCTAD (2009).

FIGURE 3
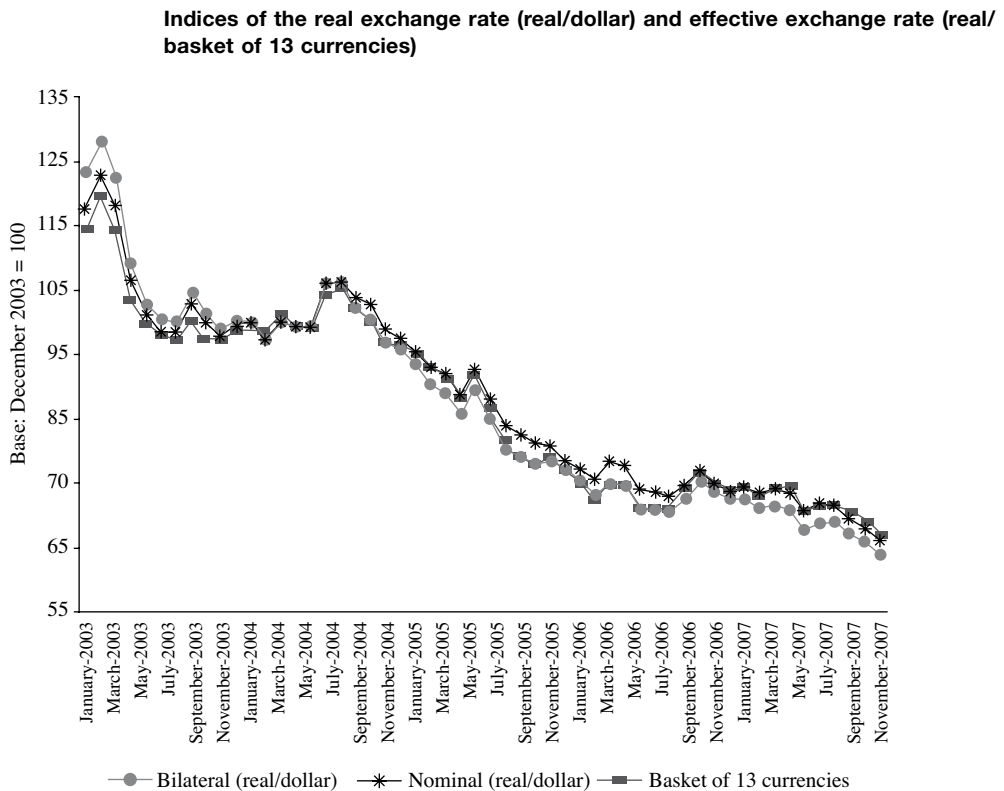
Indices of the real exchange rate (real/dollar) and effective exchange rate (real/basket of 13 currencies)

Source: prepared by the authors on the basis of data from the Foreign Trade Studies Centre Foundation (FUNCEX).
N.B.: Deflated by the consumer price index.

manufacturing export sectors recorded a sharp decline in profitability between 2003 and 2007 (see figure 4), and this was most acute precisely in those with the greatest technology content and value added (such as electronic equipment, spare parts and other vehicles, machinery and tractors and automotive vehicles). Conversely, in commodity processing industries, which also benefited from this rise, profits either fell by less (iron and steel and non-ferrous metallurgy) or actually increased (oil refining and petrochemicals).

FIGURE 4
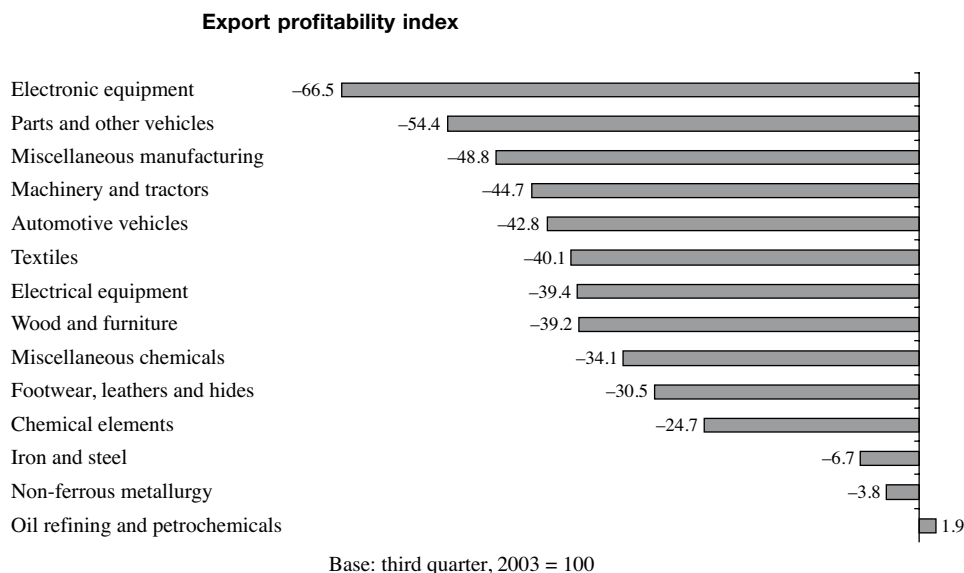
Export profitability index

Electronic equipment	–66.5
Parts and other vehicles	–54.4
Miscellaneous manufacturing	–48.8
Machinery and tractors	–44.7
Automotive vehicles	–42.8
Textiles	–40.1
Electrical equipment	–39.4
Wood and furniture	–39.2
Miscellaneous chemicals	–34.1
Footwear, leathers and hides	–30.5
Chemical elements	–24.7
Iron and steel	–6.7
Non-ferrous metallurgy	–3.8
Oil refining and petrochemicals	1.9

Base: third quarter, 2003 = 100

Source: prepared by the authors on the basis of data from the Foreign Trade Studies Centre Foundation (FUNCEX).
N.B.: The sectoral export profitability indices are calculated from the average nominal exchange rate for the month (real/dollar), corrected for the ratio between the respective sectoral export price indices and the corresponding sectoral cost indices.

IV

The evolution and determinants of international reserves: an econometric exercise

This section will seek to explain the behaviour of international reserves in Brazil between 1995 and 2007, considering that two exchange-rate regimes applied in that time (managed exchange rate in 1995-1998 and floating rate in 1999-2007), with a view to establishing whether there were changes in the determinants and pattern of reserves accumulation under the dirty float system by comparison with the system of exchange-rate bands.

The econometric model used is a univariate structural time series model.[16] The following series

were used: international reserves (RS), current-account balance (CA), net inward foreign direct investment (FDI) and net inward portfolio investment (FPI). Table 3 gives the estimated hyperparameters for the unobserved components of the RS series.[17]

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a univariate time series econometric model was constructed. The structural models, meanwhile, follow the approach of decomposing the series analysed into its unobservable components. The best fit for the unobservable components in the structural model of international reserves followed the approach suggested by Harvey and Koopman (2005). See Harvey (1989) on the advantages of univariate structural time series models and on the use of the Kalman filter.

[16] The methodology proposed by Harvey and Shephard (1993) was used. Starting from a set of observations of a single variable,

[17] The source for all the series used are raw data from the Central Bank of Brazil (www.bcb.gov.br). These were processed as follows:

TABLE 3

**Hyperparameters estimated for the reserves
logarithmic model, 1995-2007**

Components	Estimates	Q ratio
σ_ε^2	0.000	0.0000
σ_η^2	571.11 x 10^{-5}	1.0000
σ_ς^2	1.1705 x 10^{-5}	0.0020
AR(1)	3.3239 x 10^{-5}	0.0058

Source: Central Bank of Brazil.
Ljung-Box Q (11.7): 13.994 (0.0513). N-BS: 323.15 (0.0000).

The inclusion of an autoregressive term in the model presented in table 3 was determined by the way the international reserves series for Brazil varies. This term also mitigates alterations in the irregularity component. Consequently, σ_ε^2 is observed to behave non-randomly, and this means that alterations in the RS dynamic mainly take the form of changes in the linear parameter (level) and the angular parameter (slope) of its trend, σ_η^2 and σ_ς^2, respectively. Two statistics were established following observation of the behaviour of the innovations estimated: (A) Ljung-Box Q (p,q), which defines a serial autocorrelation test in the residuals estimated, and (B) Bowman-Shenton, which establishes the normality of the distribution of these residuals. The first statistic indicates a lack of serial autocorrelation in the disturbances estimated, taking a 5% significance level. Where the Bowman-Shenton statistic (N-BS) is concerned, however, the hypothesis that the distribution of the estimated residuals behaves normally is rejected. This finding establishes the presence of high values for these innovations, so that observation of their dynamic becomes crucial. Figure 5 presents: (A) the behaviour

of RS, (B) the estimated model innovations, (C) the estimated residuals of the irregularity component, (D) the estimated residuals of the level of the trend and (E) the estimated residuals of the slope of the trend, and the periods of greatest volatility in the innovations estimated are made explicit (panel B). It is no coincidence that there should have been great volatility between October 1997 and April 1999, a time of financial crises in emerging markets (Asia in October 1997, Russia in August 1998 and Brazil in January 1999). However, the months of greatest strain were those from September 1998 to April 1999, a period of crisis during which the Brazilian exchange-rate regime altered. Besides these periods, isolated movements can be observed in the volatility of these innovations in March and July 1995, associated with the uncertainty produced by the Mexican crisis, followed by the recovery of reserves. Other periods of great volatility came in April 2000 with the Argentinean crisis, June 2002 (pre-election period or "Lula effect") and December 2005.

Comparison of panels B and D shows that innovations are heavily influenced by the dynamic of the estimated residuals of the level of the trend in the RS series. Both the dynamic and the size of the two disturbances are similar. Regarding the size of the estimated residuals of the unobserved components in the RS series, one thing that stands out is that the largest of them is in the angular parameter of the trend. This indicates that changes in the RS trend occur abruptly, i.e., following a break in the trend level of this series, not in its slope, which suggests a sudden stop dynamic (Izquierdo, Talvi and Calvo, 2006). Nonetheless, in April 2006 there was a peak in the estimated residuals of the trend slope, so that periods of great volatility in the estimated innovations of the irregularity component are practically the same as those indicated in relation to the estimated residuals of the trend level. Owing to the greater amplitude of the latter, a level break can be identified as the predominant element.

Table 4 details the months in which substantial alterations in RS behaviour are most feasible. It turns out that including the binary variables in the months indicated with extreme values, taking two standard deviations, produces a correct fit for the estimated residuals. In other words, there is a normal distribution in relation to these innovations. Furthermore, taking a 5% statistical significance level, the hypothesis that the estimated parameters for all the binary variables proposed are equal to zero is rejected. The unobserved

(i) Brazilian international reserves, international liquidity concept (RS): this series is obtained in current dollars, seasonally adjusted, on the basis that its dynamic might be affected by the trade balance. A logarithmic transformation was also implemented when the series was decomposed into its unobserved components; (ii) current-account balance of the Brazilian economy (CA): this aggregate is calculated in current dollars, subject to a seasonal adjustment for the reason already given in relation to the RS series; (iii) net inward foreign direct investment in Brazil (FDI): as with the previous series, this aggregate is obtained in current dollars, but no seasonal adjustment is required; and (iv) net inward portfolio investment in Brazil (FPI): this series too is expressed in current dollars and requires no seasonal adjustment.

FIGURE 5

(A) Behaviour of international reserves (logarithm)
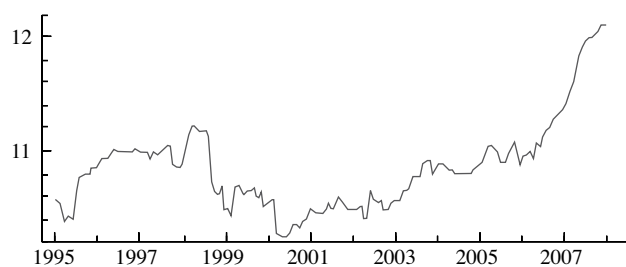
(B) Innovations
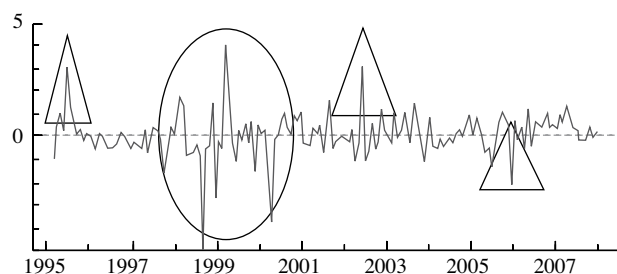
(C) Estimated residuals for irregularity
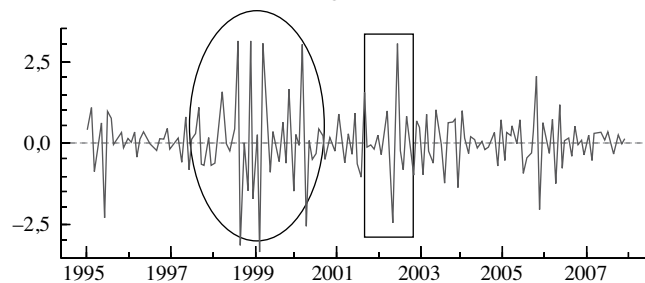
(D) Estimated residuals for level
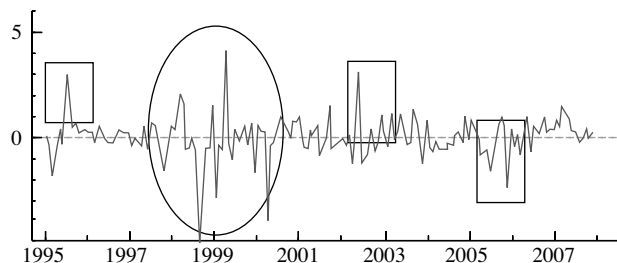
(E) Estimated residuals for slope
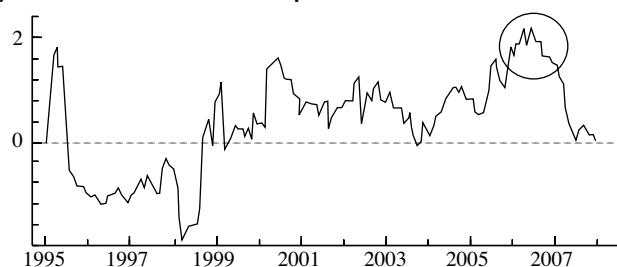
Source: Central Bank of Brazil.

component strongly influencing movements in RS is confirmed to be their trend level, irrespective of the exchange-rate regime.

Another important finding is that statistically the rate of reserves growth remained unchanged until April 2006, when it began to accelerate, even though a floating exchange-rate regime was operating in the

Brazilian economy. In other words, the pattern of reserves accumulation was similar up until April 2006 under both the managed exchange-rate regimes and the floating system. From that time on, reserves growth accelerated even though the formal exchange-rate regime was one of free flotation. Figure 6 shows the alterations that took place in the RS series.

TABLE 4

Estimates of binary components for the reserves logarithmic model, 1995-2007

Components	Coefficient	t-statistic	p value
Irregularity dummy (April 1998)	0.07980	2.8378	0.0052
Level dummies (March 1995)	–0.13216	–3.324	0.0011
Level dummies (July 1995)	0.23176	5.8462	0.0000
Level dummies (August 1995)	0.12577	3.1725	0.0018
Level dummies (October 1997)	–0.12438	–3.1376	0.0020
Level dummies (March 1998)	0.14100	3.5462	0.0005
Level dummies (September 1998)	–0.40070	–10.108	0.0000
Level dummies (January 1999)	–0.23975	–6.0299	0.0000
Level dummies (April 1999)	0.29051	7.2915	0.0000
Level dummies (December 1999)	–0.16135	–4.0377	0.0001
Level dummies (April 2000)	–0.28999	–7.2785	0.0000
Level dummies (June 2002)	0.25808	6.4867	0.0000
Level dummies (June 2003)	0.11402	2.8659	0.0047
Level dummies (December 2003)	–0.11151	–2.7905	0.0059
Level dummies (December 2005)	–0.19044	–4.7658	0.0000
Slope dummies (April 2006)	0.052275	5.6526	0.0000

Source: Central Bank of Brazil.
Ljung-Box Q (11.7): 10.974 (0.1398). N-BS: 1.5549 (0.4596)

FIGURE 6

International reserves in Brazil, logarithmic scale, 1995-2007
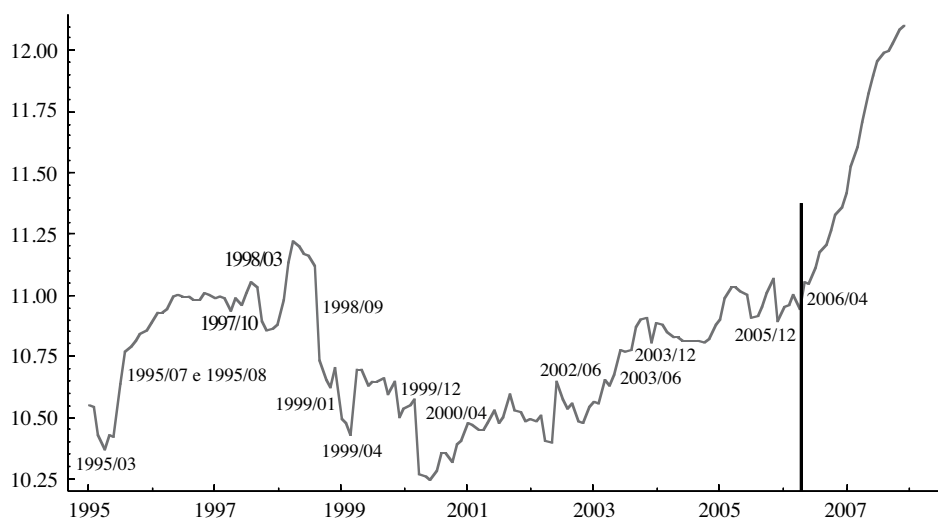
Source: Central Bank of Brazil.

It is necessary to particularize the dynamic of the RS series shown in figure 4 together with the sign of the parameters attained by the binary components presented in table 4. The first period delimited was one in which the level of RS fell (in March 1995) because of the Mexican crisis, followed by two months of strong recovery (July and August 1995). The Asian crisis is clearly reflected in the change of level of the series analysed in October 1997. In March 1998, the volume of RS increased strongly once again. Following that month, there was a series of sharp contractions in the level of the decomposed series and in April 1999 there was a positive change. These deteriorations in RS were associated with the financial crises in the Russian and Brazilian markets. The Argentinean crisis, for its part, shows up in the reserve losses recorded in December 1999 and, most particularly, in April 2000. Positive changes are observed in RS levels until December 2003, and there were some small changes in that month and in December 2005. This insignificant drop in level did not obviously affect the dynamic of RS, because in April 2006 a large change in the growth rate of this aggregate is indicated, with RS accumulation accelerating considerably.

Hitherto, statistical analysis of the international reserves time series has reinforced the hypothesis of the preceding analysis that exogenously determined liquidity cycles influence the behaviour of official interventions in the Brazilian currency markets, captured in this paper by variations in official reserves. According to textbook models, the introduction of a free float in 1999 should have been followed by a slowdown in the build-up of reserves. Not only did this not happen but from 2006 there was a structural break in the series suggesting an accelerating build-up. This coincides with the Central Bank strategy of improving the country's external solvency profile during an upturn in the international liquidity cycle.

With the RS series characterized in its unobserved components, the aim of the next exercise will be to pin down the determinants of this variable in Brazil during the period from January 1995 to December 2007.[18] As already mentioned, two significant alterations in the movement of the RS series were observed: considerable volatility between September 1998 and April 1999 and an alteration in the rate of RS accumulation growth, but only from April 2006. When these movements are examined, the focus narrows to three periods in the

dynamic of the economic aggregate analysed, covering the months from January 1995 to August 1998, May 1999 to March 2006 and April 2006 to December 2007, respectively. The number of months in the last period is rather small for the purposes of the econometric exercise proposed in this section. The econometric method is applied in a way that uses the association between the second and third periods, controlling for the change of slope in the RS series by the addition of binary variables. The statistical model that will be used in the attempt to identify the structural determinants of RS in Brazil will be applied to two periods, then: from January 1995 to July 1998 and from May 1999 to December 2007. Equation (1) identifies the basic model, considering an equation in level form, which is to be estimated:

$$RS_t = \beta_0 + \beta_1 + \beta_1 CA_t + \beta_2.FDI_t + \beta_3.FPI_t + \varepsilon_t \quad (1)$$

where CA represents the current-account balance, FDI is net inward foreign direct investment, FPI denotes net foreign portfolio investment and ε symbolizes the effects of the variables not included in the proposed model.[19]

When the unit root tests are carried out on the series indicated in equation (1) for the first period established, it transpires that the RS series is the only one to be first-order cointegrated, i.e., it concludes with the presence of a unit root (Enders, 2004). The presence of a unit root is not observed for the other series, which correspond to I(0).[20] The characterization of series I(1) and I(0) determines the need to use equation (1) in difference form:

$$\Delta\left(RS_t\right) = \beta_0 + \beta_1.\Delta\left(CA_t\right) + \\ \beta_2.\Delta\left(FDI_t\right) + \beta_3.\Delta\left(FPI_t\right) + \varepsilon_t \quad (2)$$

Equation (2) was initially estimated without considering the breaks referred to in the exercise whereby the RS series was decomposed into its unobserved components. The binary variables referred to were then included and the resulting alterations

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[18] The exercise in this section is based on Aizenman and Lee (2005).

[19] It should be recalled that the exercise in this section consists of determination models, which means that we are not attempting to predict reserve movements, so that it is clearer to characterize ε as omitted variables.

[20] The statistical responses obtained are independent of the test specified, whether augmented Dickey-Fuller (ADF) or Phillips-Perron (PP).

observed. Table 5 presents the statistical results of the model defined earlier for the January 1995 to August 1998 period, without dummies.

TABLE 5

Reserves model without inclusion of binary variables

(January 1995-August 1998)

Variable	β_i	t-statistic	p value
Constant	713.27	0.9976	0.3240
Δ (CA)	0.6573	2.8313	0.0075
Δ (FDI)	0.0934	0.2699	0.7887
Δ (FPI)	0.8916	4.5143	0.0001
AR(1)	0.4941	3.2579	0.0024

Source: Central Bank of Brazil.
R^2: 0.52347
Akaike information criterion: 18.46272
Schwartz information criterion: 18.66958
Durbin-Watson: 1.8507
White heteroskedasticity: 3.2523 (0.7766)

TABLE 6

Reserves model with inclusion of binary variables

(January 1995-August 1998)

Variable	β_i	t-statistic	p value
Constant	475.54	1.5187	0.1381
Δ (CA)	0.4722	1.8125	0.0787
Δ (FDI)	0.3749	0.9424	0.3526
Δ (FPI)	0.4111	1.9463	0.0599
DU 1995/03	–3529.20	–1.7478	0.0895
DU 1995/07	6724.50	3.3719	0.0019
DU 1995/08	5205.10	2.6666	0.0116
DU 1997/10	–7815.51	–3.7110	0.0007
DU 1998/03	7066.89	2.9840	0.0052

Source: Central Bank of Brazil.
R^2: 0.70484
Akaike information criterion: 18.14289
Schwartz information criterion: 18.51151
Durbin-Watson: 1.8284
White heteroskedasticity: 6.9518 (0.80297)

An AR(1) term is included in an attempt to correct the serial autocorrelation in the residuals estimated. Nonetheless, the Durbin-Watson (D-W) statistic is in an unclear area.[21] In this first model estimated, the components influencing the variations in RS are FPI and CA, so that the estimated value of the parameter linked to the first variable is higher than that of the second. This result assigns a greater influence to capital movements intended for foreign portfolio investment in determining RS variations (see section III).

Table 6 details the statistics of the model estimated for the first period, considering the alterations in level of the trend for the RS series identified earlier. Dummies were introduced for changes in level from March 1995, July 1995, August 1995, October 1997 and March 1998. It should be stressed, however, that we are working with series in differences, and the test for structural change in the linear parameter of the trend was applied to the series in level. Thus, considering the characterization of expression (2), what are obtained are specific binary variables, i.e., the unit value for just

the month where the behaviour of the series changes. In this way, an alteration in the linear parameter of the series in level (level dummies) becomes just a disturbance in the series in difference.

The D-W statistic is once again in an intermediate area, but implementing the B-G test establishes a statistic of 0.1692 with a p value of 0.6808, determining the rejection of serial correlation for the innovations estimated. The W-H test determines rejection of heteroskedastic behaviour for the residuals. The Akaike and Schwartz information criteria and R^2 indicate that this model is a better fit for the data than the model presented in table 5. Nonetheless, the variables considered statistically significant in explaining the movements of RS at a 5% level now require a 10% statistical significance level. In other words, when a level of significance with a lower tolerance is taken, the shocks caused by international crises provide a better explanation for RS behaviour than the Brazilian balance-of-payments accounts. Consequently, when a 10% statistical significance level is taken, the same variables as proved decisive in explaining RS variations in the model set out in table 5 continue to present the same property. It is striking, however, that the value of the parameter related to FPI was lower than that for CA. In other words, when abrupt changes in the level of the aggregate analysed are controlled for, the current-account balance is more important than movements in net inward portfolio investment in

[21] We then implemented the Breusch-Godfrey (B-G) serial correlation test, prescribing a statistic of 0.7090 with a p value of 0.3998 and rejecting the presence of autocorrelation in the residuals estimated. Furthermore, the White test for heteroskedasticity (W-H) does not reject homoskedasticity in the innovations estimated. Consequently the behaviour specified for the residuals agrees with traditional statistics theory.

explaining RS variations. Consequently, reserves loss or accumulation shocks, expressed in the dummies, relate more to movements originating in FPI than in CA in the period between January 1995 and August 1998. Lastly, it is observed that the signs encountered in the binary variables listed in this model are identical to those established in the exercise of decomposing RS into their unobserved components, confirming the good fit of the statistics presented in table 6.

The same exercise was then applied to the second period, May 1995 to December 2007. Regarding the degree of cointegration of the series selected, it transpires that the RS series is I(1), irrespective of the unit root test applied. The tests applied to the CA and FPI aggregates presented divergences. When the ADF statistic was used, both series were I(1), whereas with the Phillips-Perron (PP) method they came out as I(0). In the FDI series both tests indicate an absence of unit root. Consequently, the econometric exercise structured as per expression (2) is delimited in this second period. The results in table 7 do not incorporate the binary variables and there is an observable need to impose an AR(1) term on the structure proposed in order to correct the serial autocorrelation established in the residuals estimated. Furthermore, this specification does not manifest the problem of heteroskedasticity in the innovations. As for the variables that are important in determining the RS variations, the only one that showed statistical relevance was FPI, taking a 10% significance level.

In the next model estimated, account is taken of alterations in the RS series, which are demonstrated in the decomposition exercise for that aggregate. There was an alteration in the RS volume growth rate from

April, giving rise to the introduction of a dummy alteration variable in the slope of the statistical model to be characterized.[22] Table 8 sets out the statistical results arrived at with this new specification.

Notwithstanding the lack of serial autocorrelation in the residuals estimated after this component is adjusted using an AR(1) term, this characterization presents the non-homoskedastic residuals. When the results of this model are compared with the one detailed in table 7, this difficulty does not prevent us from discovering a better data fit. Furthermore, as in the previous result, the only variable that presented statistical significance in the determination of the RS variations was FPI. However, it is necessary to look for the weighting of the heteroskedasticity problem in the distribution of the residuals estimated by including a White matrix. This new specification is presented in table 9.

The heteroskedasticity test employing the White matrix indicates that RS are explained solely by shocks. In the Brazilian economy, in other words, the balance-of-payments current account does not determine the

TABLE 7

Reserves model without inclusion of binary variables

(May 1999-December 2007)

Variable	β_i	t-statistic	p value
Constant	1 348.19	2.2418	0.0272
Δ (CA)	0.5014	1.5744	0.1186
Δ (FDI)	0.0232	0.2202	0.8262
Δ (FPI)	0.2136	1.8940	0.0612
AR(1)	0.4142	4.4768	0.0000

Source: Central Bank of Brazil.
R^2: 0.2034
Akaike information criterion: 19.23801
Schwartz information criterion: 19.36668
Durbin-Watson: 2.1977
White heteroskedasticity: 7.07613 (0.3138)

TABLE 8

Reserves model with inclusion of binary variables

(May 1999-December 2007)

Variable	β_i	t-statistic	p value
Constant	591.87	1.417	0.1599
Δ (CA)	0.2466	1.0440	0.2993
Δ (FDI)	0.0415	0.5444	0.5875
Δ (FPI)	0.1923	2.3504	0.0208
DU 1999/12	–6 912.95	–2.9300	0.0043
DU 2000/04	10 306.72	–4.3867	0.0000
DU 2002/06	9 636.61	4.1338	0.0001
DU 2003/06	3 880.25	1.6515	0.1021
DU 2003/12	–6 710.77	–2.8756	0.0050
DU 2005/12	12 398.99	–5.2673	0.0000
DU 2006/04	4 691.50	5.2545	0.0000
AR(1)	0.3359	3.2719	0.0015

Source: Central Bank of Brazil.
R^2: 0.6486
Akaike information criterion: 18.55682
Schwartz information criterion: 18.86564
Durbin-Watson: 2.0656
White heteroskedasticity: 41.2922 (0.0000)

[22] A binary slope variable in an econometric architecture in difference becomes a level dummy, which assumes the introduction of the element "1" after the period delimited, so that a succession of zeroes appears first.

TABLE 9

**Reserves model with inclusion of binary
variables and White matrix**
(May 1999-December 2007)

Variable	β_i	t-statistic	p value
Constant	591.87	1.7680	0.0804
Δ (*CA*)	0.2466	1.1089	0.2704
Δ (*FDI*)	0.0415	0.6153	0.5399
Δ (*FPI*)	0.1923	1.4505	0.1504
DU 1999/12	–6 912.95	–12.4519	0.0000
DU 2000/04	–10 306.72	–17.2839	0.0000
DU 2002/06	9 636.61	6.4099	0.0000
DU 2003/06	3 880.25	8.1172	0.0000
DU 2003/12	–6 710.77	–5.5780	0.0000
DU 2005/12	–12 398.99	–10.2520	0.0000
DU 2006/04	4 691.50	3.3512	0.0012
AR(1)	0.3359	2.6354	0.0099

Source: Central Bank of Brazil.
R^2: 0.6486
Akaike information criterion: 18.55682
Schwartz information criterion: 18.86564
Durbin-Watson: 2.0656
White heteroskedasticity: 41.2922 (0.0000)

volume of international reserves absorbed. Although it is a better fit, the model presented in table 9 does not permit a statistical specification of the macroeconomic aggregates conditioning RS variations in Brazil. Indeed, observation of the variance in the residuals estimated shows this rising after April 2006 to a value of 1.51 x 10^7. For the purposes of comparison, between May 1999 and March 2006 this value was 2.97 x 10^6. This alteration was established in the month that marked the turning point in the downward trend of the RS series. The choice was thus made to exclude the months following this turning point and, consequently, the binary variable representing the change in the rate of growth in the series analysed, with the model being restructured using a period from May 1999 to March 2006.

The statistics estimated, adjusted to the new suggested period, can be observed in table 10. In addition, an AR(1) term was introduced into the new model to correct the autocorrelation of the residuals

estimated. The evidence provided by these new estimates suggests that the hypothesis of heteroskedasticity in the innovations is to be rejected, establishing a behaviour pattern for these components that fits traditional statistics theory. The main determinant of variations in Brazilian RS is net inward portfolio investment. This finding agrees with the previous exercise, which did not include the binary variables of the econometric model (the period including the turning point in the decline of the series analysed was excluded).

Indeed, it can be stated in general that the FPI variable is the main determinant of international reserves accumulation in the Brazilian economy throughout the period considered. Nonetheless, a longer series is badly needed so that the behaviour of reserves in the period subsequent to April 2006 can be analysed and this finding confirmed. Something else that has emerged is the importance of external shocks associated with financial boom and bust cycles, something already ascertained in the analysis of section III.

TABLE 10

RS model with inclusion of binary variables
(May 1999-March 2006)

Variable	β_i	t-statistic	p value
Constant	488.35	1.7912	0.0776
Δ (*CA*)	0.3482	1.6369	0.1061
Δ (*FDI*)	0.1617	1.0161	0.3131
Δ (*FPI*)	0.2253	2.1729	0.0332
DU 1999/12	–6 709.98	–3.7100	0.0004
DU 2000/04	–9966.65	–5.5026	0.0000
DU 2002/06	9 283.40	5.2165	0.0000
DU 2003/06	4 047.44	2.2551	0.0273
DU 2003/12	–6 382.83	–3.5765	0.0006
DU 2005/12	–11 894.95	–6.5661	0.0000
AR(1)	0.2393	2.0330	0.0458

Source: Central Bank of Brazil.
R^2: 0.6514
Akaike information criterion: 17.97613
Schwartz information criterion: 18.30130
Durbin-Watson: 2.0070
White heteroskedasticity: 17.4059 (0.1349)

V

Final considerations

This article set out to reveal the extent to which management of the floating exchange-rate system in Brazil did or did not partake of the tendency observed among the main emerging economies to adopt a "dirty float" strategy in practice. The existence of an international financial environment marked by cycles of exogenously determined optimism and pessimism would appear to provoke reactions such as "fear of floating" or the precautionary build-up of international reserves. The econometric exercises conducted suggest that: (i) the reserves accumulation pattern was statistically similar in the periods during which a managed (1995-1998) and floating (1999-2006) exchange-rate regime was applied; (ii) from April 2006 a major structural shift is seen, with the reserves build-up accelerating; (iii) exogenously determined financial cycles seem to influence reserves movements; and (iv) capital flows appear to affect reserves more than flows of goods, services and income (current account).

Similarly, this article has sought to examine some institutional peculiarities of the Brazilian situation, including the substantial depth of the country's derivatives markets, which greatly increases the vulnerability of the exchange rate in these cycles. It was also shown that the management of the floating exchange-rate system in Brazil has been subordinated to the more general goal of price stabilization (i.e., to the inflation targeting regime), something that is not exclusive to Brazil. In this context, with the level of the exchange rate neglected as a policy goal after 2003, the authorities ceased to use exchange-rate management to defend the external competitiveness of exports, a strategy that seems to have been applied time and again in Asian economies. According to analyses like that of Rodrik (2007), this option can pose a risk, even in the medium term, to the maintenance of trade and current-account surpluses that are robust enough to permanently and sustainably offset the country's external vulnerability.

Emphasis must be laid on the high fiscal cost of the strategy of official currency market intervention by the Central Bank of Brazil (and thus of reserves accumulation) and we need to ask whether, within the same economic policy framework, the Brazilian monetary authority might not be able to employ a combination of different instruments in the spot and derivatives markets. Unlike currency purchases in the spot market, reverse swaps do not increase foreign currency liquidity, but they do entail equally high fiscal costs for the Treasury. The Central Bank could have opted for a strategy of intervention in the spot currency market and had a greater influence on the appreciation trend of the real. This would have allowed it to make less use of these derivatives or replace them with operations in the BM&F forward market which, while less transparent than swaps (carried out via auctions), would be more effective at moderating the currency's future appreciation against the dollar.

(Original: Portuguese)

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Chile: academic performance and educational management
under a rigid employment regime

Ricardo D. Paredes and Valentina Paredes

W orking with census information on standardized academic performance tests and using different estimation techniques, this article analyses sociodemographic and management factors affecting the performance of Chile's municipal schools. The evidence suggests that the system's lack of flexibility, particularly where teacher dismissal is concerned, is an important factor but not the main cause of poor academic performance. Conversely, the differences in academic performance between municipal schools that can be attributed to management are almost twice the standard deviation of the System for Measuring the Quality of Education (SIMCE) performance test and 20 times the increment ascribed to the "complete school day" initiative, which costs the equivalent of half a point of gross domestic product (GDP).

Ricardo D. Paredes

School of Engineering,

Catholic University of Chile

and Centre for Research on

Educational Policy and Practice

(CEPPE)

➥ rparedes@ing.puc.cl

Valentina Paredes

Department of Economics,

University of California, Berkeley

➥ vparedes@econ.berkeley.edu

I

Introduction

Primary education performs poorly in Chile. This is particularly striking because the country has not only been channelling significant resources into education, but has also implemented major reforms in the sector. Despite all these efforts, performance indicators have remained virtually unchanged.

A question that is becoming increasingly vital all over the world, but particularly in Latin America, is whether differences in educational performance are due to the different institutional mechanisms governing schools and whether decentralization and certain forms of privatization may account for them. In Chile, the first country to implement major reforms, municipal schools take in more than 50% of primary students but obtain substantially lower scores than other types of school. A recurrent explanation for the

underperformance of these schools is that, as well as taking in more vulnerable students, they are subject to a very rigid regulatory framework regarding teacher dismissal and salaries.

In this study we analyse the importance of the Teaching Statute (*Estatuto Docente*) and other factors in addition to that legislation, which lays down the principles regulating the operations of the education sector in municipal districts. The effects of management on performance are a particular interest of this paper, which is divided into four sections. Section II briefly reviews the literature and describes the institutional characteristics of municipal schools. Section III estimates measures of municipal school performance and introduces a set of management variables. Section IV concludes with recommendations.

II

The Chilean education system

1. The institutional framework

Until the late 1970s, the Ministry of Education was responsible for financing public education in Chile, regulating curricular content and investing in infrastructure. Negotiations with teachers were centralized, something that was deemed to be a source of conflict and regional inequity. The reform of 1980 sought to change this situation, reflected as it was in the low quality of education, high repetition and drop-out rates, low investment and a lack of incentives (Hanushek, 1998).

One of the main tools of the reform was the introduction of incentives, which involved market

elements, targeted expenditure and, in particular, certain forms of privatization and decentralization. Three categories of schools were created as a result: (i) municipal schools, administered by the municipalities and financed by a government subsidy based on attendance per student and municipal contributions; (ii) subsidized private schools, also financed by the State with the same attendance subsidy per student and, since 1992, by additional contributions made within certain limits by parents; and (iii) fee-paying private schools, financed exclusively from parents' contributions. A detailed description can be found in Mizala and Romaguera (1998).[1]

In 1988, the System for Measuring the Quality of Education (SIMCE) test was created. It consists of four parts that measure knowledge of content from

[1] A minority of municipal schools operate under municipal corporations (*corporaciones municipales*), which have some degree of financial autonomy and greater latitude to determine salaries and the employment regime of workers in educational management support roles.

the present and the past: language and communication (language), mathematical studies (mathematics), study and understanding of nature (science) and study and understanding of society (social studies). The test is taken at the end of the school year. While widely accepted, the SIMCE, like most other standardized tests, has come in for considerable criticism (see, for example, Eyzaguirre and Fontaine, 1999).

The results of this standardized test have been made public since 1995 to give parents a tool with which to judge the performance of their children and to foster competition between schools. This test has been the main instrument for measuring the quality of education in the country and the authors have used it as their primary information source. In 1998, it was modified and standardized so that it could be used to follow up school performance. The new test has an open-ended scale that measures student abilities (cognitive skills). It uses item response theory (IRT), a procedure linking students' scores to aptitudes that is applied in most international tests of academic attainment, such as the Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA). Thus, even if two students answer the same number of questions correctly, their scores could differ as different levels of aptitude are being measured. The SIMCE 2000 scores, with a mean of 250 points and a standard deviation of 50 points, serve as a benchmark against which eighth grade results (including the 2004 results used in this study) are compared.

In 1991, Chile enacted the Teaching Statute, which provided for centralized pay bargaining and protected teachers at municipal schools from dismissal, and thus made the system even more inflexible (Tokman, 2004; Beyer, 2001). In 1996, the National System for the Evaluation of School Performance (SNED) was introduced. This programme requires schools to provide information on educational processes and results, and establishes incentives for teachers (Mizala and Romaguera, 1999 and 2000a). In 2007, the government finished implementing the complete school day initiative, increasing the primary school week from 30 to 38 hours and the secondary school week from 36 to 42 hours. This initiative was based on a curricular reform which changed study plans and programmes and laid down minimum compulsory syllabuses.

Regarding the consequences of the reforms, they are generally agreed to have increased coverage and reduced repetition rates. However, most analysts also find that education quality is low, that educational results are highly stratified and that the level of instruction is unsatisfactory by international standards (Heyneman, 1991 and 2004; Bellei and González, 2002; Brunner, 2005; Valenzuela, 2008; Paredes and Ruiz, 2009). The Third International Mathematics and Science Study-Repeat (TIMSS-R), for instance, shows that in 1999 Chilean eighth grade students ranked 35 among 38 countries in mathematics and science, while in 2003 they ranked 40 out of 45 in mathematics and 37 out of 45 in science. Chile even ranks below countries with lower per capita gross domestic product (GDP) and investment in education, such as Jordan and Malaysia. Furthermore, the 2003 TIMSS-R showed that the gap in quality between the low- and high-income sectors had increased between 1990 and 2003 from 120 to 142 points on a scale having a mean of 500 and a standard deviation of 100. Tokman (2004) arrives at similar conclusions on the basis of other international tests, namely PISA, the International Adult Literacy Survey (IALS) (Hanushek and Kimko, 2000) and TIMSS.

Besides the relative underperformance of low-income groups, Chilean students also perform badly on average. Figure 1 shows these two situations. On the standardized SIMCE scale, a score below 226 means that the student has not even assimilated the content of the courses preceding the year in which he or she sat the examination. A score of between 227 and 267 shows that the student has partial mastery of the preceding courses but has not assimilated the content of the course currently being taken. This is especially important considering that the SIMCE is taken at the end of the year.

There is a large literature on the consequences of these reforms. The broad consensus is that coverage has increased substantially over the last 15 years but that the reforms have done little to reduce the educational gap between households by income level or to improve the absolute quality of education. There has been less analysis of the role of school municipalities and of the effects of the Teaching Statute on academic performance (Paredes and Lizama, 2006).

2. Assessing municipal education

Most studies on Chile have treated socio-economic factors as determinants of educational outcomes (Mizala and Romaguera, 2000a and 2002; Gallego, 2002; Sapelli and Vial, 2002; García and Paredes, 2009; Chumacero and Paredes, 2008). In line with the

FIGURE 1

SIMCE[a] scores by income group, 2003
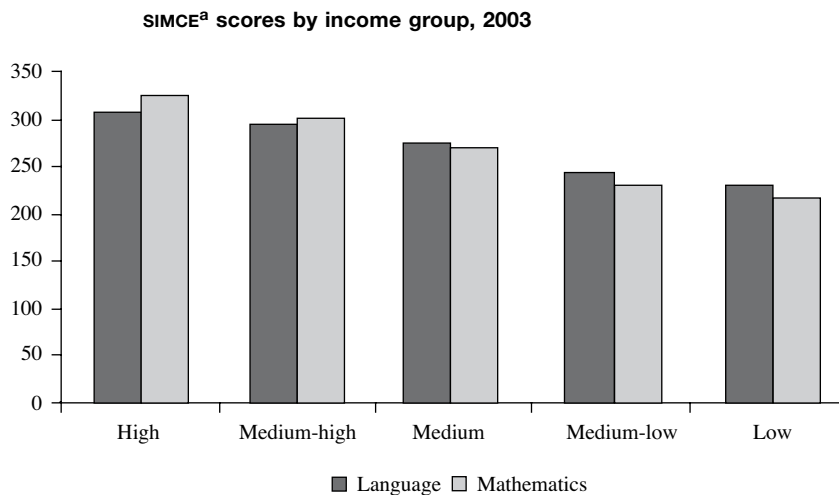
Source: J.J. Brunner, "Experiencia internacional y desafíos nacionales de gestión escolar", Santiago, Chile, Fundación Chile, 2005.

[a] System for Measuring the Quality of Education.

international literature, they find that socio-economic variables significantly affect academic results. Thus, any analysis of education quality must consider the characteristics of students.[2]

Table 1 shows the results of two regressions employing two different estimation techniques, ordinary least squares (OLS) and hierarchical linear modelling (HLM). The use of a multilevel model that takes account of influences common to students at the same school reflects the possibility that observations may not be independent (Steenbergen and Bradford, 2002). In this model, academic attainment is represented by Y_{ij} and depends on a group of socio-demographic factors X (see equation 1) that specify level 1 (student) of the mixed effects model:

$$Y_{ij} = \beta_{0j} + \beta_1 X_{ij} + \varepsilon_{ij} \qquad (1)$$

The vector X_{ij} contains a series of student characteristics (sex, educational level of mother and family income). The error ε_{ij} is assumed to be independent and have an identical distribution $N(0,\sigma_e^2)$. Level 2 (school) is represented by equation (2):

$$\beta_{0j} = \gamma_{00} + \gamma_{01} C_j + \eta_{0j} \qquad (2)$$

where j indicates municipalities. The vector C_j contains school characteristics (e.g., rural location, school vulnerability index, average family incomes and average educational level of students' mothers). The error η_{0j}, which follows a distribution $N(0,\sigma_0^2)$, represents the portion of intercept that is not explained by the predictors at the school level and is supposedly independent of the predictors at the student level.

Both consider family income, parents' schooling, gender, location (urban) and institutional dummies associated with the two types of municipal schools ("department" and "corporation"), taking subsidized private schools and direct school expenditure (question put to parents in the SIMCE questionnaire) as the base.[3] Reflecting the findings of most studies, table 1 shows that all these variables have a significant impact on performance as measured by the SIMCE test using both OLS and HLM. Likewise, as in a number of other studies, both estimations show municipal schools performing more poorly than subsidized private schools, a difference that is particularly large in the case of municipal corporations.

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[2] For other studies, see Sapelli and Vial, 2002; Sapelli, 2003; Pavez, 2004; García and Paredes, 2009.

[3] At the beginning of the reform, a small number of municipalities chose to have a municipal corporation (*corporación municipal*) to manage schools. These corporations have a board and enjoy greater autonomy than a municipal department (*dirección municipal*). After a few years, the government decided not to give municipalities a choice of administration method. Most analysts suggest that the "random" way this option was introduced and withdrawn did not bias any student performance results.

TABLE 1

Fourth grade students: academic performance

(Average of three tests)

	OLS	HLM
Constant	201.50	208.92
	(414.43)[a]	(277.91)[a]
Income (00.000)	0.35	0.21
	(32.94)[a]	(19.69)[a]
Income 2 (00.000)	–0.0000013	–0.0000008
	(21.92)[a]	(13.05)[a]
Gender	0.30	1.01
	(1.55)	(5.38)[a]
Urban	–1.08	–2.54
	(3.40)[a]	(4.16)[a]
Private fee-paying	7.70	19.5
	(13.30)[a]	(16.83)[a]
Municipal	–7.30	5.14
	(30.21)[a]	(8.41)[a]
Municipal corporation	–11.67	–9.45
	(41.56)[a]	(11.80)[a]
Father's schooling	1.51	1.18
	(44.46)[a]	(36.29)[a]
Mother's schooling	3.07	2.37
	(85.39)[a]	(67.65)[a]
Expenditure (00.000)	0.20	–0.55
	(4.38)[a]	(10.24)[a]
Observations	220 212	220 212
R^2	0.20	0.19
Number of groups		7 313

Source: estimates based on simce results, Ministry of Education.
N.B.: The robust t-statistic is given in parentheses.

[a] Significant at 1%.

There is a great deal of debate over this difference, however. The gap between private and municipal schools as estimated in table 1 requires more thorough analysis since, for example, the choice of school type is endogenous, biasing the estimates.[4] Increasing the number of controls reduces the bias against municipal schools. In fact, controls such as "fixed school effects" and "selection variables", for instance, could make this difference negligible (see, for example, Bellei, 2005; Contreras, Bustos and Sepúlveda, 2007).

Fortunately, one clear advantage of this study is that it is only concerned with municipal schools and therefore does not have to deal with the private/municipal controversy. To answer the main question of this paper, we can work exclusively with municipal schools. This does not mean we cannot form some estimate of how restrictive the Teaching Statute is and what its effects on academic performance are, since the same employment regime affects each municipality differently depending on its exposure to the more restrictive aspects of the law. Thus, for instance, we can expect the effects to be more serious for municipalities with older teachers, since the Teaching Statute imposes greater conditions with age, and the restrictions will particularly affect those requiring greater flexibility.

[4] See Hsieh and Urquiola (2006); Anand, Mizala and Repetto (2006); McEwan (2001); Contreras (2002); Sapelli and Vial (2002).

III

Evaluating municipalities

1. Socio-economic and environmental variables

As already stated, a clear advantage of our procedure is that it does not require us to confront the private/public controversy. We can focus our work by estimating educational performance equations for municipal schools only, and because the conclusions do not differ we shall report only the results for the OLS estimations.

We first estimated a model incorporating the same type of sociodemographic variables as are used in table 1, but for municipal schools only. In view of what is done in most studies, we included the school vulnerability index estimated by the Ministry of Education, average schooling and average income in the municipal district as a sort of control for social capital. We then considered a set of variables associated with budgetary constraints affecting education in each municipal district. This was done because differences in municipal resources are very significant in Chile, with budgets depending heavily on the taxes levied by each municipality (chiefly property and motor vehicle taxes). The variable we used for this purpose was the expenditure per student notified by municipalities, which does not differentiate by funding source.

We also considered variables reflecting the basis of the education function that have been justified by different studies, such as the teacher-student ratio, the number of municipal schools within the municipal district, the number of registered students and coverage, as measures of scale.[5] Furthermore, we considered the length of tenure of teaching staff as measured by the payment of *bienios*, a teaching salary component based on experience (measured in two-year units) which is included in the salaries and wages account. This latter variable, which is essentially exogenous to each municipal district, reflects the extent to which the Teaching Statute affects salaries, since tenure is associated with different capabilities but also entails

greater constraints and creates an obstacle to dismissal. Lastly, we included variables reflecting the distribution of expenditure between personnel, operating costs and investment.

Since the results of the regressions for each test are quite consistent, in table 2 we only report the results for average performance. From this table we can infer that, taken as a whole, the model is appropriate but has considerably less explanatory power than one covering all students. The relatively low R^2 shows the huge dispersion between municipalities. For the whole sample, in any event, the sociodemographic variables have a significant impact on the scores obtained by students, a result that is consistent with the different studies carried out in Chile and internationally.[6]

Regarding municipal organization, the findings are quite striking. The results in the first column show that municipal schools run by municipal corporations do worse than those run by municipal departments, even though they have fewer institutional constraints. Evidently this absence of constraints may mean that resources are better channelled, but the data suggest that autonomy has also meant a greater diversion of efforts from education to other interests that could well be directly related to the evaluation of the mayor. However, interestingly enough, the introduction of municipal controls makes this difference disappear.[7]

The results also show that academic performance is affected by institutional constraints. Whilst the coefficients associated with sociodemographic variables remain statistically and economically important with the introduction of institutional controls, the coefficient associated with *bienios*, reflecting the ageing of teaching staff, is negative and significant. This means that we cannot rule out the existence of

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[5] Coverage, which is notified by the municipalities, does not reflect the percentage of young people in the municipal district who are studying, since some districts are net exporters and others net importers. Thus, the variable is more of a scale proxy than a coverage variable as such. We are grateful to the CEPAL Review referee for bringing this point to our attention.

[6] In addition to statistical importance, there needs to be a clear analysis of pedagogical relevance. We do not make the distinction in this paper; instead, we shall later analyse orders of magnitude compared with the estimated effects of other educational programmes on performance.
[7] Of course, the introduction of more and more controls may capture the difference between municipal corporations and departments. An analysis of the specific elements behind the different ways municipalities manage education is beyond the scope of this paper, but is clearly a natural step. See García and Paredes (2009) for a study that attempts to open up this "black box".

TABLE 2

Municipal schools: determinants of SIMCE averages
(Ordinary least squares)

	Coefficient	Beta	Coefficient	Beta
Constant	203.08		208.10	
	(123.17)[a]		(62.65)[a]	
Income (00.000)	0.43	0.14	0.48	0.15
	(22.02)a		(18.31)[a]	
Income 2 (00.000)	−0.00000021	−0.10	−0.0000013	−0.10
	(16.43)[a]		(14.57)[a]	
Gender	0.98	0.01	−0.04	0.00
	(3.69)[a]		(0.10)	
Urban	−10.45	−0.09	−8.71	−0.08
	(24.06)[a]		(15.83)[a]	
Father's education (mean)	−0.05	0.05	0.29	0.02
	(.36)		(1.56)	
Mother's education (mean)	1.28	0.00	0.67	0.01
	(8.94)[a]		(3.79)[a]	
Income (mean)	0.16	0.03	0.18	0.03
	(6.13)[a]		(4.97)[a]	
Municipal corporation	−4.47	−0.04	−0.95	−0.01
	(15.30)[a]		(1.63)	
Coverage			13.15	0.05
			(8.44)[a]	
Number of municipal schools			0.15	0.06
			(10.57)[a]	
Bienios payments (00.000)			−19.58	−0.03
			(9.38)[a]	
Expenditure per student			0.01	0.02
			(4.63)[a]	
Operating expenses (00.000)			0.00	0.00
			(0.33)	
Investment (00.000)			0.00	0.00
			(0.65)	
Students registered			0.86	0.00
			(0.53)	
Students per teacher			−0.43	−0.03
			(6.32)[a]	
Staff expenses (00.000)			0.00	0.00
			(9.98)[a]	(0.35)
Observations	121 693		72 629	
R[2]	0.10			0.11

Source: estimates based on SIMCE results, Ministry of Education, and municipal data, Department of Regional and Administrative Development (SUBDERE).

[a] Significant at 1%.

two effects, but the data show the predominance of a negative effect. Thus, the competing hypotheses are: (i) there is a positive effect on students' performance since teachers' tenure is associated with greater experience and capabilities, and (ii) tenure can be associated with obsolescence, and is reflected in a larger proportion of teachers covered by the Teaching Statute. Municipalities have a variable proportion of teachers working on a contract basis and not subject to the statute, allowing replacements to be made with potentially positive incentivizing effects since effort is thereby encouraged and there is the prospect of a place on the permanent teaching staff.

2. Academic performance by municipality

Using the coefficients obtained from regressions like those in table 2, we can predict the performance of students and hence of municipal schools and municipalities. Consequently, the residual of the equations should show the relative performance of each municipality. One problem with this approach, however, is that this residual may be associated not only with the true performance of each municipality, but also with the influence exerted by "other factors" which have not been considered and are not orthogonal to the variables taken.

We might argue that a ranking that could truly be associated with performance would have to be constructed from an equation that only considered sociodemographic factors and budgetary constraints as expressed in the variables included in table 2. Table 3 shows three rankings, the first unconditional, the second conditional only upon sociodemographic factors and the third, in our opinion the correct one, also conditional upon budgetary factors. Table 3 presents results for only the 20 municipalities with the best and worst performance out of the whole sample of more than 300 municipalities. The "Unadjusted" columns show the simple difference between the effective average score by municipality and the national average. The "Adjusted for sociodemographic factors" column shows the residual from a regression that controls for sociodemographic factors and educational vulnerability elements and the "Adjusted for sociodemographic and municipal factors" column shows the residual of a regression that also controls for specific elements associated with the municipality, including municipal expenditure and *bienios* payments.

From this table it is clear that the adjusted and unadjusted rankings undergo very large changes once different types of variables are controlled for. Some municipal districts move from near the top of the ranking to near the bottom, which suggests that vulnerability explains a large part of the differences. However, more important than the precise ranking, which depends on the type of variables included, is the fact that the variance in scores between municipalities is huge whichever ranking is taken. Thus, even after adjusting for sociodemographic differences and municipal constraints, there is a difference of more than 100 points between the scores of schools in the municipalities with the best and worst results and of 45 points between the top and bottom deciles of municipalities.

3. Management

The estimated regression residuals shown in table 3 are attributable to a set of "other factors", and our hypothesis is that there are management elements among them. Management may affect performance in two ways. First, by making processes more efficient, it frees up a greater volume of resources to support teaching activities. Second, a significant part of management must consist in managing human resources and motivating student achievement.

If management elements are in fact explanatory factors that are not considered in the equations used to construct the rankings in table 3, and if they are not orthogonal to the variables included, the estimations giving rise to the ranking are not consistent. In fact, it is possible that higher-income families are over-represented in municipalities with better management, for instance. To capture the management effect, we used a number of indicators for administrative and teaching management collected by the SNED system, which is geared towards rewarding better-run schools. Among the battery of variables considered, the literature on the issue has stressed the importance of a particular subset, namely: (i) the existence of a management team, (ii) the frequency with which the management team meets, (iii) teacher follow-up and evaluation, (iv) the existence of programmes that involve training and development of staff capabilities, (v) annual planning, (vi) active involvement of the parents' association and the school community in management teams, (vii) acceptance of specific commitments by the school and (viii) disclosure to parents of information on performance test results (see, for example, Rivkin, Hanushek and Kain, 2001; Tokman, 2004; Bellei and González, 2002; Willms 2002; Pavez, 2004).

TABLE 3

Municipalities ranking best and worst for academic performance

Unadjusted		Adjusted for sociodemographic factors		Adjusted for sociodemographic and municipal factors	
Top 20 municipalities					
Providencia	49.42	Alto Hospicio	63.12	O'Higgins	66.62
Primavera	46.53	Mejillones	55.02	Corral	38.65
Viña del Mar	42.99	O'Higgins	50.56	Laguna Blanca	37.81
Las Condes	36.95	Isla de Pascua	42.68	Freirina	34.66
Ollagüe	36.82	Freirina	30.54	Andacollo	34.31
Licantén	34.12	Quilaco	28.9	La Higuera	30.92
Los Muermos	30.98	Corral	28.68	Sierra Gorda	30.66
Rinconada	30.83	Tocopilla	28.11	Huasco	29.57
Cabo de Hornos	30.19	Andacollo	27.81	Tocopilla	29.32
San Gregorio	28.13	Colchane	26.8	Chile Chico	29.15
Vichuquén	28.1	Lo Barnechea	26.19	Tucapel	28.33
Curaco de Vélez	27.35	La Higuera	25.01	Ollagüe	27.17
Ñuñoa	26.6	Caldera	24.97	San Gregorio	26.72
Purranque	26.45	Huasco	23.72	Caldera	23.51
Zapallar	26.26	Tucapel	22.82	Quilaco	22.87
Combarbalá	25.94	Calera	22.76	Natales	22.73
Alto Bío Bío	25.36	Calle Larga	22.71	Palena	22.49
San Fabián	24.23	Chillán Viejo	21.52	Lago Verde	22.43
Santo Domingo	23.03	Laguna Blanca	20.33	Pica	20.95
Juan Fernández	22.97	Los Vilos	20.01	Maullín	20.41
Bottom 20 municipalities					
Santa Juana	−22.89	Pumanque	−22.73	Puqueldón	−15.49
Laguna Blanca	−22.9	Combarbalá	−22.98	Algarrobo	−16.33
San Antonio	−23.61	Curanilahue	−23.71	La Cisterna	−16.57
Nogales	−24.24	Castro	−24.19	Hijuelas	−17.32
Marfil	−24.47	Pelluhue	−24.47	Palmilla	−17.79
Chillán Viejo	−24.88	Puqueldón	−24.77	Llanquihue	−19.02
Calera	−26.63	Treguaco	−24.98	Placilla	−20.43
La Higuera	−28.15	Primavera	−26	Paillaco	−20.54
Lo Barnechea	−28.54	General Lagos	−26.43	Quemchi	−21.4
Tucapel	−29.25	Quillón	−26.44	Melipeuco	−21.95
Corral	−30.29	Fresia	−26.88	Teno	−23.92
Freirina	−32.14	Vichuquén	−28.96	Hualañé	−24.63
Camarones	−36.16	Traiguén	−29.41	Fresia	−26.39
Colchane	−39.65	Hualañe	−29.63	Vichuquén	−26.84
Mejillones	−40.11	Curaco Velez	−30.58	Traiguén	−28.52
Andacollo	−40.78	Licantén	−34.79	Trehuaco	−29.2
Quilaco	−45.27	Rinconada	−40.15	Licantén	−38.98
Cholchol	−46.71	Purranque	−44.28	Rinconada	−45.38
O'Higgins	−53.99	Alto Bío Bío	−46.57	Alto Bío Bío	−46.11
Alto Hospicio	−66.18	Los Muermos	−51.28	Los Muermos	−51.67

Source: rankings using estimates based on SIMCE results, Ministry of Education, and municipal data, Department of Regional and Administrative Development (SUBDERE).

We measured the effect of these variables by re-estimating the equations but bringing in management variables at this stage. One of the main problems with these variables is that they have very low variance between municipalities. This is largely because municipalities may be entitled to monetary incentives that depend on the results of these variables. Consequently, variables like "having a management team" that are basically self-reported are positive in over 90% of municipalities. A second problem is the possibly endogenous nature of the variables. To deal with this, we experimented with the use of instrumental variables. We did not find significantly different results so, once again, only OLS results are reported. The findings presented in table 4 show that having a management team, having this team meet occasionally or with high frequency, developing teachers' capabilities and disclosing SIMCE results to parents are variables which are not only statistically significant but have an economically important impact on school performance.

Table 5 shows the rankings of the 20 best and worst municipalities in this aspect of performance and the last column shows the contribution of management factors on the assumption that management variables are orthogonal to socio-economic and budgetary variables. If this assumption is correct, management elements as measured by the SNED are indeed very important, which suggests that other management variables besides those included in the SNED may be critical.

Table 5 also shows that the order of magnitude of the difference between the municipalities with the best and worst average performance associated with factors that are neither sociodemographic nor associated with budgets or "measured management" is about 50 points, i.e., one standard deviation in the SIMCE (second column). This in turn is about nine times the effect that has been attributed to the complete school day initiative, which is costing half a point of GDP.

TABLE 4

Municipal schools: SIMCE determinants with management variables
(Ordinary least squares)

	Ministry of Education	Beta
Constant	195,35 (46,04)[a]	
Income (00.000)	0,46 (16,34)[a]	0,14
Income 2 (00.000)	0,00 (12,53)[a]	–0,10
Gender	0,43 (1,18)	0,00
Urban	–10,16 (16,63)[a]	–0,08
Father's education (mean)	0,41 (2,07)[b]	0,01
Mother's education (mean)	0,04 (0,19)	0,00
Income (mean)	0,18 (4,30)[a]	0,03
Municipal corporation	–1,00 (1,59)	–0,01
Coverage	15,75 (9,33)[a]	0,06
Students per teacher	–0,55 (7,32)[a]	–0,03
Bienios payments (00.000)	–20,09 (8,96)[a]	–0,04
Number of municipal schools	0,14 (8,65)[a]	0,05
Registered students	4,83 (2,76)[a]	–0,02
Staff expenses (00.000)	0,00 (8,31)[b]	–0,07
Operating expenses (00.000)	0,00 (0,75)	–0,01
Investment (00.000)	0,00 (3,43)	0,02
Management team	3,84 (4,26)[a]	0,02
Teacher evaluation	3,80 (9,87)	0,04
Parental involvement	1,68 (2,28)[a]	0,01
Annual planning	7,06 (4,05)[a]	0,01
Community involvement	7,13 (6,39)[a]	0,02
Disclosure of results	3,10 (3,33)[a]	0,01
Observations R^2	63 902 0,11	

Source: SIMCE and SNED, Ministry of Education and Department of Regional and Administrative Development (SUBDERE).

[a]   Significant at 1%.
[b]   Significant at 5%.

TABLE 5

Top- and bottom-ranking municipalities and management effects

Sociodemographic and municipal effects		Sociodemographic, municipal and managerial effects		Pure management effect	
Top 20 municipalities					
O'Higgins	66.62	Corral	47.15	Río Hurtado	27.63
Corral	38.65	Lago Verde	44.38	Graneros	17.29
Laguna Blanca	37.81	Sierra Gorda	37.99	Los Sauces	15.95
Freirina	34.66	La Higuera	35.07	Perquenco	14.93
Andacollo	34.31	Andacollo	34.47	Santo Domingo	13.44
La Higuera	30.92	Freirina	30.86	Antuco	10.17
Sierra Gorda	30.66	Huasco	29.24	Padre las Casas	9.37
Huasco	29.57	Maullín	28.68	La Cruz	8.80
Tocopilla	29.32	Tocopilla	27.30	Ercilla	8.64
Chile Chico	29.15	Tucapel	26.64	Puqueldón	8.37
Tucapel	28.33	Natales	25.34	Alto Bío Bío	7.67
Ollagüe	27.17	Santa Juana	24.79	Pelarco	7.52
San Gregorio	26.72	Palena	24.36	Pemuco	7.40
Caldera	23.51	Chillán Viejo	23.09	Monte Patria	7.16
Quilaco	22.87	Chile Chico	22.7	Quirihue	7.16
Natales	22.73	Cholchol	22.27	San José de la Mariquina	7.08
Palena	22.49	Caldera	21.39	Coinco	7.00
Lago Verde	22.43	Río Ibáñez	21.23	Lautaro	6.62
Pica	20.95	Cabildo	20.94	Chile Chico	6.44
Maullín	20.41	Calera	19.69	Marchigüe	5.96
Bottom 20 municipalities					
Puqueldón	−15.49	Vichuquén	−18.13	San Nicolás	−5.60
Algarrobo	−16.33	Palmilla	−18.56	Parral	−5.82
La Cisterna	−16.57	Llanquihue	−19.32	Yerbas Buenas	−6.08
Hijuelas	−17.32	Hualañé	−20.86	Pirque	−6.13
Palmilla	−17.79	Placilla	−21.11	Retiro	−6.27
Llanquihue	−19.02	Teno	−21.56	Cabildo	−6.28
Placilla	−20.43	Perquenco	−21.57	Doñihue	−6.45
Paillaco	−20.54	Quemchi	−21.94	Malipeuco	−6.67
Quemchi	−21.40	Santo Domingo	−22.00	Sierra Gorda	−7.33
Melipeuco	−21.95	Padre las Casas	−22.83	Empedrado	−7.48
Teno	−23.92	Puqueldón	−23.86	El Carmen	−7.70
Hualañé	−24.63	Los Sauces	−25.08	Maullín	−8.27
Fresia	−26.39	Paillaco	−25.75	Corral	−8.50
Vichuquén	−26.84	Río Hurtado	−25.79	Vichuquén	−8.71
Traiguén	−28.52	Fresia	−27.56	Santa Juana	−11.09
Treguaco	−29.20	Traiguén	−29.27	San Pablo	−11.44
Licantén	−38.98	Rinconada	−29.97	Chonchi	−12.64
Rinconada	−45.38	Treguaco	−31.23	Hualaihué	−13.46
Alto Bío Bío	−46.11	Alto Bío Bío	−53.79	Rinconada	−15.42
Los Muermos	−51.67	Los Muermos	−57.23	Lago Verde	−21.96

Source: authors' calculations based on OLS estimates.

IV

Conclusions

Educational outcomes in Chile are extremely poor by international standards, especially considering the economic effort made over the last 20 years and the important role of education quality in the inequity of income distribution. One of the reasons for this lies in the poor performance of municipal schools, where teachers are subject to a very rigid employment regime.

We analysed the effects of this rigid employment regime on academic performance within the context of municipal schools and concluded that sociodemographic factors explained most of the variance in municipal schools' performance. We also showed, however, that the employment regime adversely affected those schools. Security of tenure for teaching staff is the most important variable associated with the system's

operability and has a very adverse effect on school performance. Nonetheless, this factor is not the main reason for municipal schools' poor performance. In fact, the results suggest that differences ascribable exclusively to management, measured using simple indicators monitored by the SNED programme, have the most significant effect in accounting for the variation in school performance between municipalities.

The fact that the differences in the average scores of the 20 best- and worst-performing municipalities, respectively, are some three times as great as those attributable to the complete school day initiative, a programme requiring the investment of half a point of GDP, suggests that poor academic performance in Chile may have a great deal to do with management.

(Original: English)

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A new approach to gender wage gaps in Chile

Marcela Perticará and Ivonne Bueno

The purpose of this study is to examine gender wage gaps in Chile using a new database, the Social Protection Survey (EPS) 2002-2006, which makes it possible to control for actual work experience and its timing. Potential work experience variables do not reflect the intermittent and discontinuous participation of women in the Chilean labour market. Corrections are also introduced for occupational selection, and two key variables are instrumented: education and work experience. Although there are still wage differences between men and women, the introduction of controls for actual work experience and the instrumentation of this work experience and education bring the hourly wage gap down to some 11% to 18%, figures much lower than those reported in earlier studies for Chile. Contrary to expectations, this gap has widened in recent years.

Marcela Perticará

Assistant professor, Faculty of

Economics and Business, ILADES-

Alberto Hurtado University, Chile

➥ **mperticara@uahurtado.cl**

Ivonne Bueno

Analyst at the Department of

Labour Studies, National Institute of

Statistics, Chile

➥ **ivonne.bueno@gmail.com**

I

Introduction

In Chile, as in other Latin American countries, studies have been done on wage discrimination against women in the labour market. Numerous reports place the female labour force participation rate in Chile among the lowest in the region and indicate a large gender wage gap, with the female monthly wage averaging just 67% of its male equivalent.[1]

Many studies, including some very recent ones, have set out to quantify the wage gap between men and women in Chile (Bravo, Sanhueza and Urzúa, 2008a and 2008c; Gill, 1992; Gill and Montenegro, 2002; Montenegro, 2001; Paredes, 1982; Paredes and Riveros, 1994). These studies have produced different estimates for the extent of wage discrimination against women in Chile. Most of them conclude that women receive much lower wages than men. However, it is difficult to establish whether wage gaps are actually due to productivity differences (men and women differ in observable and unobservable characteristics) or to "discrimination".

The purpose of the present study is to examine these wage gaps using a new database, the panel of the Social Protection Survey (EPS) 2002-2006, which makes it possible to control for men's and women's actual work experience and its timing (how recently work experience was acquired). Earlier studies did not have this information and the only control was a potential work experience measure whose variables did not reflect women's intermittent and discontinuous participation in the Chilean labour force. Corrections are also introduced for non-participation and occupational selection and two key variables are instrumented: education and work experience. With the exception of Bravo, Sanhueza and Urzúa (2008a), the earlier literature did not deal with this problem of endogeneity.

This paper is structured as follows. Section II presents empirical evidence on the wage gap affecting women in Chile. Section III describes the methodology applied. Section IV specifies the data and models to be estimated. Section V gives the results and interprets the estimates. Lastly, section VI offers conclusions.

II

The literature on gender wage gaps in Chile

There is a huge literature on wage gaps between men and women in Chile. The results differ depending on the model specification and databases used. Most studies employ standard measures of cumulative actual experience and potential experience. On the whole, larger gender wage gaps are reported in the higher deciles or among people with a higher level of education. Pioneering studies carried out by Paredes (1982) and Paredes and Riveros (1994) estimate the average wage gap at between 20% and 30%, depending on the controls and specification used.

More recently, there have been five new studies on gender wage gaps in Chile: Bravo, Sanhueza and Urzúa (2008a, 2008b and 2008c), Ñopo (2007), Perticará (2007) and Perticará and Astudillo (2008).

Bravo, Sanhueza and Urzúa (2008a) simultaneously model occupational, educational and wage segregation. Using cross-sectional data from the 2002 EPS, the authors find that there are large hourly wage gaps between men and women in Chile, but that these depend critically on the level of experience accumulated and on education. Wage gaps are not statistically significant for individuals with a low education level (incomplete secondary education), but where they do become very substantial is for those with a high level. Bravo, Sanhueza and Urzúa (2008c) examine wage gaps between men and women in three occupational categories, namely business school graduates, doctors

[1] See SERNAM (2007) and Acosta, Perticará and Ramos (2007).

and lawyers, using a University of Chile student database that contains detailed family histories and even a measure of self-esteem. The authors find significant wage differentials only among lawyers.

Perticará and Astudillo (2008) employ quantile regression techniques and the decomposition technique suggested by Machado and Mata (2005) to evaluate the unexplained wage gap right across the conditional wage distribution. Importantly, they introduce controls for actual work experience. The authors estimate a "characteristics" effect (wage gap attributable to differences in the characteristics of men and women) that is small and statistically non-significant until around percentile 50 (median), where it turns positive (favourable to women) and rises monotonically to reach 7% in percentile 90. The "parameter" effect is invariably negative throughout the distribution, but tends to be magnified in higher percentiles. In the upper tail of the wage distribution, women compensate for "discrimination" with better attributes. These results are consistent with the findings of Bravo, Sanhueza and Urzúa (2008a), Gill and Montenegro (2002) and Montenegro (2001).

Perticará (2007) carried out a sensitivity analysis to evaluate the wage gap in Chile using the 2004 EPS and controlling for actual work experience for the first time. The author found that including actual work experience variables reduced the wage gap by about 50%, but the unexplained wage gap tended to widen when selection bias was controlled for.

The study by Ñopo (2007) is perhaps one of the most innovative, as it uses matching techniques to evaluate the gender wage gap in the 1992-2003 period. This author matches up men and women by their demographic and occupational characteristics and finds clear evidence of a wage "ceiling" for women in Chile.[2] He also observes that the unexplained component of the wage gap is proportionally greater for individuals with high wage, university education and managerial jobs, a finding that is qualitatively similar to the one reported by Gill and Montenegro (2002) and Montenegro (2001).

Lastly, there are the studies by Montenegro (2001) and Gill and Montenegro (2002), who use the National Socio-economic Survey (CASEN) and quantile regression techniques to decompose the gender wage gap into an explained component (differences in attributes between men and women) and an unexplained component (the usual measure of discrimination) or coefficients effect. These authors find systematic differences in returns to education and experience by gender throughout the conditional wage distribution. The unexplained gap (discrimination) rises from 10% to 40% as we approach the highest percentiles of the conditional income distribution.

[2] There is said to be a "ceiling" or "glass ceiling" when the unexplained component of the pay gap is proportionally greater in the upper income deciles.

III

Methodological considerations

Many methodological approaches have been used in different studies to evaluate gender wage gaps. Recent reviews of the literature include Gunderson (2006), Altonji and Blank (1999), Blau (1998) and Blau and Kahn (2000).

One of the most popular procedures in the literature on gender wage gaps is to estimate a linear model that uses some measure of earnings (monthly or hourly wage) as a dependent variable and an array of controls plus a dummy capturing the individual's gender as regressors. The coefficient of this dummy is then interpreted as the wage gap between men and women. Another approach sets out to evaluate the

wage gap using the classic decomposition of Oaxaca (1973) and Blinder (1973), subsequently generalized by Oaxaca and Ransom (1994) and Neumark (1988).

The present study opts to use the traditional approach and estimate the model[3]

$$\ln W_{it} = \alpha + X_{it}\beta + \gamma G_i + \mu_i + u_{it} \qquad (1)$$

where $\ln W_{it}$ is the logarithm of the wage for individual i in period t; the explanatory variables used are a set

[3] Perticará and Bueno (2008) use both approaches and compare the results obtained.

of regressors that include regional controls, such as whether the individual is working with or without an employment contract, education, work experience, marital status and company size. The G_i variable is a dichotomous or dummy variable indicating gender and takes the value 1 if the individual is a woman. Lastly, the error term is composed of an individual effect μ_i and an idiosyncratic error term μ_{it}.

The G_i coefficient is interpreted as the wage gap between men and women; if this coefficient is negative and statistically different from zero, the interpretation is that women are paid less on average than men.

Note that the random effects and fixed effects approach could be used for this model. The random effects model can be estimated only under the assumption that there is no correlation between the individual effect μ_i and the explanatory variables of the model. If, however, the individual effect is correlated with some variable in X (such as education or work experience, for example), the random effects estimator will be inconsistent. Conversely, the fixed effects method does not allow the gender wage gap coefficient to be estimated, since the G_i variable —which is invariant in time— is absorbed if this method is applied.

It is important to stress that the database used in this study allows the problems of endogeneity and modelling of individual effects to be addressed simultaneously, while also providing us with good measures of actual work experience, which are so hard to come by in Chilean databases.

1. Potential experience versus actual work experience

With the exception of those by Bravo, Sanhueza and Urzúa (2008a and 2008b), studies of gender wage gaps in Chile have used measures of potential work experience. Potential experience is estimated by subtracting years of education and the age of entry into the school system (six in Chile) from the person's current age. Comparing men and women by "potential experience" is not accurate because women tend to have intermittent working careers, usually as a result of having and caring for children. In other words, it may be the case that there are wage differences in favour of men because men and women with the same potential experience differ in actual experience (specifically, women average less actual experience than men). Consequently, the wage gap could be explained by differentials in actual experience rather than by discrimination.

In view of the above and for the purposes of the analysis of wage gaps in this study, employment history variables and labour intermittency variables were constructed in accordance with the idea developed by Light and Ureta (1995), who developed variables reflecting not just the number of years worked over an individual's career, but also the timing of that work experience. Those authors set out to generate variables for quantity and months worked during each of the years comprising an individual's employment history. The purpose of this type of specification is to highlight the fact that women's employment histories are far more chequered than men's and that accordingly it is not enough to model wages as a function of continuous work experience variables; other dimensions such as the timing of spells of employment need to be measured too. As Stanley and Jarrell (1998), Weichselbaumer and Winter-Ebmer (2005) and Gunderson (2006) point out, studies reporting large wage gaps between men and women do not usually control properly for work experience or do not include a control for selection. Given the availability of information in the database that will be used, and to establish a comparison between this methodology and earlier studies in which potential work experience is included as a measure, two sets of models will be estimated, one using the measures of actual work experience, permitting the construction of variables that reflect the continuity of men's and women's work experience, and one using the potential work experience measure.

2. Endogeneity and sample selection

In the wage model described earlier, there is a problem of endogeneity with two of the regressors, education and work experience. In particular, education may be correlated with an (unobservable) skills component; if this skills effect is positively correlated with education and with wages as well, the effect of the education variable will be overestimated. Furthermore, the work experience variable may be correlated with the individual effect, as individuals who are more "skilled" or better equipped to prosper in the labour market will tend in turn to have higher wages and more work experience.

If a correlation is suspected between the individual effect and explanatory variables, the random effects estimator will not be consistent. The fixed effects estimator cannot be obtained, since the gender effect will be diluted along with the fixed

effect and we will not be able to evaluate the gender wage differential.

To solve this problem of endogeneity, the model used is that of Hausman and Taylor (1981), which seeks to estimate the model coefficients using an instrumental variables estimator. In particular, model (1) can be described as follows:

$$Y_{it} = X_{it}\beta + Z_i\gamma + \mu_i + u_{it} \qquad (2)$$

where the X variables vary over time, whereas the Z variables (including the individual's gender) are invariant over time. The individual effect may be correlated with some of the variables in X or in Z. In each set of variables there are exogenous variables (X_1, Z_1) and endogenous variables (X_2, Z_2). In particular, Hausman and Taylor propose using the following set of variables as instruments: $A = [QX_1 \; QX_2 \; PX_1Z_1]$. The QX variables are the X variables expressed as deviations from their mean, while the PX_1 variables are the X_1 variables expressed as averages. Thus, variables that are exogenous and variant over time can be used twice over as instruments. Variables that are exogenous and invariant over time (Z_1 in our particular case of the individual's gender) are used as instruments of themselves. The order condition for identification is that the number of variables in X_1 must be as large as the number of variables in Z_2. For the Hausman and Taylor estimator to be more efficient than the fixed effects estimator, the number of exogenous variables that are variant over time must be larger than the number of endogenous variables that are invariant over time.

Once the problem with the endogeneity of the education and work experience variables has been solved, we find that there are two further problems when it comes to estimating a wage equation and comparing wages by gender. The first problem is the well-known one of selection bias, since only the wages of individuals in work are observed. The second concerns men and women who do not exogenously choose the occupations they work in, so that even when the average wage differential between men and women remains positive, this may be related to self-selection decisions by women.

Akin to the correction for selection bias used by Heckman (1979) is the idea developed by Lee (1998), who suggests a multinomial logit model estimated to predict the likelihood of occupational allocation. The occupational model is given by:

$$I_{ij}^* = Z_{ij}Y_{ij} + V_{ij} \quad (j = 1,2,3,4,5) \qquad (3)$$

where I is the (unobserved) latent variable and Z is a vector of variables (personal characteristics of individuals and their families) which determines the likelihood of an individual working in each of the occupations, while subscript i is the individual and j the six occupational categories used in this model (professional and managerial workers, professional technical workers, clerks, sales assistants, skilled workers in agriculture and industry and unskilled workers). The I variable can take the values 1 to 6. The individual picks the alternative that maximizes his or her utility $P(y_i = j) = P_{ij} = prob(I_{ij}^* > I_{ik}^*)$ whenever $i \neq k$.

A selectivity term for each observation (λ_{ij}) is constructed on the basis of this model and then introduced as an independent variable for the regression. For the purposes of this study, the regressions have been estimated separately for each occupation (j) and the coefficient of the gender variable in each occupation will thus reflect the wage gap between men and women after controlling for the existence of occupational self-selection.

The specific occupation equation (for $j = 1, 2,\ldots,J$) will be given by:

$$\ln W_{it} = \alpha + X_{it}\beta + \gamma G_i + \lambda_{ij}\theta_j + \mu_i + u_{it} \qquad (4)$$

where once again $\ln W_{it}$ is the wage logarithm for individual i in period t; the X_{it} matrix includes regional controls, employment characteristics, education variables, work experience and marital status, among other things. The G_i variable refers to the individual's gender and the λ_{ij} variable is the selection coefficient or Mills ratio constructed from the model estimate given in (3).

IV

Data and models to be estimated

The data used in this study come from the Social Protection Survey (EPS), whose purpose is to gather information on the labour market and the Chilean social protection system. It is a longitudinal survey that has so far been applied in three rounds, 2002, 2004 and 2006. The fourth round will not be held until December 2009.

The EPS includes information on about 17,000 individuals, of whom 50% are women. It records general information about respondents and information on their work history, family income, assets, social protection, health, training and personal history, among other aspects.

The self-reported work histories in the EPS contain fairly detailed (self-reported) information about respondents' periods of activity (employment and unemployment) and inactivity. This report can be used to reconstruct the work histories of men and women whose reported employment between January 2002 and the latest survey registers information about wages. Self-reported employment histories go back only to the beginning of 1980. For this reason, all the estimates are presented for men and women who were under 50 in 2006. This decision is justified by the consideration that respondents over 50 (in 2006) were aged over 24 in 1980, the assumption accordingly being that their work histories are underreported.[4]

The final sample contains information on 26,655 employment events for 10,068 individuals, 27% of observations being from 2002, 37% from 2004 and 35% from 2006.

The data in tables 1 and 2 give a better idea of how far the accumulation of actual experience differs between men and women. These tables present empirical distributions of the portion of time worked during the last five and 10 years, for men and women respectively, by education level and age band. If we

observe women aged 40 to 49 with less than 12 years of formal schooling, only 16.3% have worked more than 90% of the time in the past five years, while just 13.3% have worked more than 90% of the time in the past 10 years. Some 72.7% have worked less than 10% of the time in the past five or 10 years.

It would seem that continuous employment is far from being the norm among women with a low education level. More educated women present more continuous patterns of employment: 66.1% (58.7%) of women with 16 years of education or more have worked over 90% of the time in the past five or 10 years. The employment patterns of educated women still fall well short of the norm for men, however. In the group aged 40-49 with 16 years of education or more, some 85% of men have worked for more than 90% of the time in the past five or 10 years.

There is clear evidence for the need to introduce proper controls into the wage equation if men's and women's wages are to be compared. Specifically, the models presented in the following section will control not only for actual work experience, but also for the timing of that experience.

Table 3 shows the averages and standard deviations of the main variables used in this study, for men and women. As can be seen, men and women differ substantially in their levels of actual work experience. We find that men earn a significantly higher average hourly wage: $6,019, as compared to $5,277 for women, with a standard deviation of $17,781 for men and $9,487 for women. Regarding the average education of parents, we do not find any significant difference for men or women.

Three sets of results are presented. First, model (1) is estimated as a random effects model, ignoring the fact that the education and work experience variables could be correlated with the error term. Three versions of this estimation are presented, with potential experience, with actual experience, and with variables reflecting the timing of work experience. Three continuous variables are constructed: months worked in the past five years, months worked in the past 10 years and months worked in the past 15 years. Thus, the coefficient of the months worked in the past five years variable and the coefficient of the months worked in the past 10 years variable indicate the additional returns from months worked

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[4] Given that work histories are self-reported, it is reasonable to think that events from further back will be reported less reliably, and this reporting error could be greater among older individuals (40-49). Nonetheless, there are two reasons for ignoring this problem in the present study. The first is that we are instrumenting both the education and the work experience variables (which potentially present measurement errors), and the second is that we tried out specifications with even younger samples of women, taking under-40s only, for example. Sample sizes are substantially reduced when this is done and some standard errors are magnified, but the results are qualitatively similar.

TABLE 1

**Continuity in the employment histories of men and women,
by age band and education level, as of 2006**

Gender and years of education	Time worked over the last five years *(Percentages)*				
	Over 10%	Over 30%	Over 50%	Over 70%	Over 90%
Male					
0-11 years educ.					
20-29	91.7	69.5	56.6	41.7	16.5
30-39	95.1	90.9	84.3	72.7	48.1
40-49	96.7	91.6	84.2	70.3	47.5
12 years educ.					
20-29	93.1	62.9	48.9	33.1	13.1
30-39	97.7	94.7	90.2	82.3	59.5
40-49	99.0	98.5	94.4	88.1	66.7
12-15 years educ.					
20-29	70.3	40.7	28.4	21.3	9.4
30-39	98.9	96.3	89.8	81.7	61.6
40-49	99.3	98.5	93.5	87.7	72.8
16 years educ.					
20-29	66.2	24.9	13.7	9.2	5.7
30-39	92.3	83.4	78.6	69.8	52.8
40-49	99.0	97.3	95.2	92.4	84.0
Female					
0-11 years educ.					
20-29	61.9	39.1	19.6	10.8	3.3
30-39	75.4	50.0	35.0	24.6	12.9
40-49	72.7	52.6	40.6	28.3	16.3
12 years educ.					
20-29	81.5	44.0	28.6	15.8	6.9
30-39	78.4	58.2	45.2	33.5	22.5
40-49	81.1	62.7	49.9	38.4	26.1
12-15 years educ.					
20-29	79.5	41.3	31.9	16.2	5.0
30-39	86.4	76.4	65.5	53.8	36.1
40-49	85.9	73.6	63.5	55.4	43.0
16 years educ.					
20-29	54.1	20.6	10.5	5.5	2.0
30-39	89.5	71.0	64.5	57.4	44.6
40-49	95.0	88.3	83.7	74.7	66.1

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

in more recent years. In the second set of estimates, the Hausman and Taylor method is used to correct for endogeneity in education and work experience. Once again, three versions are estimated with different measures of work experience. None of these models includes correction for occupational selection.

In the third place, the observations are grouped into six occupations (professional and managerial workers, professional technical workers, clerks, sales assistants, skilled manual workers and unskilled workers) and we estimate occupation-specific wage models that correct for sample selection.

TABLE 2

**Continuity in the employment histories of men and women,
by age band and education level, as of 2006**

Gender and years of education	Time worked over the last 10 years *(Percentages)*				
	Over 10%	Over 30%	Over 50%	Over 70%	Over 90%
Male					
0-11 years educ.					
20-29	90.1	62.3	44.2	21.6	3.8
30-39	95.5	92.8	88.3	76.9	44.6
40-49	96.6	91.9	87.7	80.4	48.5
12 years educ.					
20-29	89.9	70.2	51.5	38.1	31.5
30-39	97.9	94.4	90.5	83.6	53.9
40-49	99.1	98.8	96.6	91.8	67.8
12-15 years educ.					
20-29	66.2	27.2	11.7	4.4	0.7
30-39	99.2	95.6	88.2	74.9	47.7
40-49	99.3	95.3	94.4	89.1	71.3
16 years educ.					
20-29	56.5	10.9	6.2	3.0	0.3
30-39	94.0	79.3	68.9	51.0	29.0
40-49	99.6	98.4	96.8	95.2	85.2
Female					
0-11 years educ.					
20-29	64.4	28.4	12.4	3.5	0.7
30-39	79.2	49.4	36.4	22.6	9.2
40-49	73.3	51.7	39.2	26.1	13.3
12 years educ.					
20-29	73.1	54.5	42.0	34.8	31.1
30-39	83.8	59.3	48.7	31.2	15.9
40-49	83.7	58.6	47.5	33.5	20.9
12-15 years educ.					
20-29	67.	27.0	7.9	3.6	0.8
30-39	93.1	79.6	62.6	49.1	29.8
40-49	88.6	74.3	68.2	58.6	38.1
16 years educ.					
20-29	49.4	7.2	4.0	1.8	0.6
30-39	90.9	70.2	59.6	45.7	26.4
40-49	96.0	87.6	82.0	72.4	58.7

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

TABLE 3

Averages and standard deviations of the main variables for men and women

	Men		Women	
	Average	Standard deviation	Average	Standard deviation
North	0.13	0.33	0.11	0.31
South	0.49	0.50	0.45	0.50
Small firm	0.53	0.50	0.56	0.50
Medium-sized firm	0.15	0.36	0.12	0.32
Large firm	0.25	0.44	0.27	0.44
Married	0.73	0.44	0.50	0.50
Separated	0.07	0.25	0.17	0.37
Years of education	10.3	3.5	11.7	3.5
Employment contract	0.65	0.48	0.68	0.47
Actual experience	18.8	6.2	15.1	6.7
Potential experience	23.5	9.3	21.4	9.1
Mother can read	0.84	0.36	0.90	0.30
Father can read	0.87	0.33	0.92	0.28
Mother without education	0.20	0.40	0.14	0.35
Mother with basic education	0.49	0.50	0.52	0.50
Mother with secondary education	0.28	0.45	0.31	0.46
Mother with higher education	0.03	0.18	0.03	0.18
Father without education	0.20	0.40	0.18	0.38
Father with basic education	0.43	0.50	0.43	0.50
Father with secondary education	0.31	0.46	0.33	0.47
Father with higher education	0.06	0.23	0.06	0.24
Monthly wage (pesos)	294 847	747 040	215 895	368 050
Hourly wage (pesos)	6 021	17 819	5 293	9 527
2002	0.25	0.43	0.25	0.43
2003	0.04	0.20	0.04	0.20
2004	0.19	0.39	0.19	0.39
2005	0.18	0.38	0.18	0.39
2006	0.20	0.40	0.21	0.41
2007	0.13	0.34	0.13	0.33
Months worked over last 5 years	56.0	8.5	51.6	14.1
Months worked over last 10 years	110.2	18.8	97.6	29.8
Months worked over last 15 years	158.7	34.6	135.2	47.5

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

V

Results

The estimates are arrived at using the sample of individuals aged 18 to 49. Monthly wages and hourly wages in the main occupation are taken in all cases. Hourly wages are estimated by dividing the monthly wage by the number of hours worked a month, as self-reported by the individual. Wages are deflated by the consumer price index (IPC) for the month the

wage is reported.[5] Annual dummies are added in all the regressions to control for real wage growth, and these same dummies interacted by gender are

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[5] If the job was ongoing at the time of interview, the month and year of the interview are taken. If the job had ended, the month and year it ended are taken.

added so that the behaviour of the wage gap can be observed over time.

To begin with, we shall see the results obtained from the estimates with each of the work experience measures (potential experience, actual experience and alternative experience), without correcting for selection bias.

For the measure of alternative experience in particular, three continuous variables are constructed: months worked in the past five years, months worked in the past 10 years and months worked in the past 15 years. Thus, a positive coefficient for the months worked in the past five years variable is an indication that months of more recent work experience are better rewarded in the labour market.

In all the specifications attempted, the wage gap between men and women is clearly negative. In other words, women are paid less then men. The largest gaps are obtained with the model where only potential experience is controlled for, which gives a

monthly wage gap of about 32%,[6] while the hourly wage gap is distinctly smaller at about 21% (see tables 4, 5 and 6).

In the second set of estimates presented, the Hausman and Taylor method is used to correct for endogeneity in education and work experience. Once again, three versions are given with different measures of work experience.

The smallest wage gap is obtained in the Hausman and Taylor models (see tables 7 and 8), when the wage gap found is in the order of 12% for hourly wages and 19% for monthly wages.

Three results deserve particular attention. First, there is a strong upward trend in real wages, which saw

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[6] It should be noted that the coefficient of the dummy is $\hat{\beta}_1 = -0.381$. The pay differential between men and women is calculated using the expression $100\left[\exp\left(\hat{\beta}_1\right) - 1\right]$. Replacement with the value of $\hat{\beta}_1$ gives a gap of about 32% to the detriment of women.

TABLE 4

Model I, potential experience, monthly and hourly wage model
(Natural logarithms)

Gender	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Female	-0.381	***	0.0134	-0.238	***	0.013
North	-0.063	***	0.0165	-0.073	***	0.016
South	-0.183	***	0.0108	-0.166	***	0.010
Married	0.074	***	0.0100	0.077	***	0.010
Separated	0.069	***	0.0156	0.058	***	0.016
Years of education	0.038	***	0.0050	0.011	***	0.005
Years of education2	0.002	***	0.0002	0.004	***	0.000
Potential experience	0.026	***	0.0016	0.020	***	0.002
Potential experience2	0.000	***	0.0000	0.000	***	0.000
Employment contract	0.218	***	0.0076	0.116	***	0.008
2003 dummy	0.066	***	0.0095	0.061	***	0.010
2004 dummy	0.099	***	0.0098	0.121	***	0.010
2005 dummy	0.110	***	0.0100	0.164	***	0.011
2006 dummy	0.178	***	0.0118	0.223	***	0.013
2003*female dummy	0.012		0.0151	0.007		0.016
2004*female dummy	0.006		0.0156	0.007		0.017
2005*female dummy	-0.003		0.0154	-0.005		0.016
2006*female dummy	0.009		0.0189	-0.004		0.020
Constant	10.895	***	0.0516	7.312	***	0.061
Number of observations	26 655			26 655		
R2	0.3614			0.3516		
χ2 test	7 481.65			7 335.09		
P value χ2 test	0.000			0.000		

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

* Statistically significant at 10%.

*** Statistically significant at 1%.

TABLE 5

Model I, actual experience, monthly and hourly wage model
(Natural logarithms)

Gender	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Female	-0.307	***	0.014	-0.187	***	0.013
North	-0.055	***	0.016	-0.067	***	0.016
South	-0.170	***	0.011	-0.155	***	0.010
Married	0.067	***	0.010	0.078	***	0.010
Separated	0.066	***	0.015	0.062	***	0.016
Years of education	0.028	***	0.005	0.000		0.005
Years of education²	0.002	***	0.000	0.004	***	0.000
Actual experience	0.046	***	0.002	0.033	***	0.002
Actual experience²	-0.001	***	0.000	-0.001	***	0.000
Employment contract	0.208	***	0.008	0.107	***	0.008
2003 dummy	0.064	***	0.009	0.064	***	0.010
2004 dummy	0.092	***	0.010	0.121	***	0.010
2005 dummy	0.101	***	0.010	0.166	***	0.011
2006 dummy	0.169	***	0.012	0.224	***	0.013
2003*female dummy	0.003		0.015	-0.001		0.016
2004*female dummy	-0.003		0.016	-0.001		0.017
2005*female dummy	-0.014		0.016	-0.014		0.017
2006*female dummy	-0.013		0.019	-0.022		0.020
Constant	10.933	***	0.048	7.384	***	0.058
Number of observations		26 655			26 655	
R²		0.3713			0.3545	
χ² test		7 907.06			7 459.46	
P value χ² test		0.000			0.000	

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.
* Statistically significant at 10%.
*** Statistically significant at 1%.

TABLE 6

Model I, alternative experience, monthly and hourly wage model
(Natural logarithms)

Gender	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Female	-0.283	***	0.014	-0.170	***	0.013
North	-0.056	***	0.016	-0.067	***	0.016
South	-0.168	***	0.011	-0.154	***	0.010
Married	0.070	***	0.010	0.080	***	0.010
Separated	0.070	***	0.015	0.065	***	0.015
Years of education	0.023	***	0.005	-0.003		0.005
Years of education²	0.002	***	0.000	0.004	***	0.000
Actual experience	-0.011	***	0.005	-0.007		0.005
Actual experience2	0.000	***	0.000	0.000		0.000
Months worked last 5 years	0.003	***	0.000	0.002	***	0.000
Months worked last 10 years	0.002	***	0.000	0.001	***	0.000
Months worked last 15 years	0.001	***	0.000	0.001	***	0.000
Employment contract	0.202	***	0.008	0.101	***	0.008
2003 dummy	0.068	***	0.009	0.068	***	0.010
2004 dummy	0.097	***	0.010	0.124	***	0.010
2005 dummy	0.107	***	0.010	0.170	***	0.011
2006 dummy	0.169	***	0.012	0.225	***	0.013
2003*female dummy	0.007		0.015	0.002		0.016
2004*female dummy	-0.004		0.016	-0.002		0.016
2005*female dummy	-0.011		0.015	-0.011		0.017
2006*female dummy	-0.007		0.019	-0.017		0.020
Constant	10.934	***	0.048	7.376	***	0.058
Number of observations		26 655			26 655	
R²		0.3813			0.3596	
χ² test		8 323.10			7 665.08	
P value χ² test		0.000			0.000	

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.
* Statistically significant at 10%.
*** Statistically significant at 1%.

TABLE 7

Hausman and Taylor model, correcting for endogeneity in actual experience and years of education, monthly and hourly wage model
(Natural logarithms)

Gender	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Female	-0.273	***	0.019	-0.187	***	0.018
South	-0.164	***	0.013	-0.155	***	0.013
Married	0.024	***	0.012	0.059	***	0.013
Separated	0.038	***	0.017	0.060	***	0.018
Years of education	0.032	***	0.005	0.013	***	0.005
Years of education^2	0.001	***	0.000	0.003	***	0.000
Employment contract	0.187	***	0.007	0.095	***	0.008
2003 dummy	0.066	***	0.010	0.082	***	0.010
2004 dummy	0.093	***	0.010	0.138	***	0.011
2005 dummy	0.107	***	0.013	0.199	***	0.013
2006 dummy	0.163	***	0.015	0.254	***	0.016
2003*female dummy	-0.005		0.014	-0.012		0.015
2004*female dummy	-0.016		0.015	-0.017		0.016
2005*female dummy	-0.028	*	0.015	-0.033	***	0.016
2006*female dummy	-0.029		0.018	-0.047	***	0.019
Actual experience	0.057	***	0.004	0.038	***	0.004
Actual experience^2	-0.001	***	0.000	-0.001	***	0.000
Constant	10.988	***	0.062	7.383	***	0.072
Number of observations	26 535			26 092		
χ^2 test	4 822.83			4 716.23		
P value χ^2 test	0.00			0.00		

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.
* Statistically significant at 10%.
*** Statistically significant at 1%.

TABLE 8

Model III, Hausman and Taylor model, correcting for endogeneity in actual experience, alternative experience and years of education, monthly and hourly wage model
(Natural logarithms)

Gender	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Female	-0.207	***	0.019	-0.127	***	0.019
South	-0.191	***	0.013	-0.187	***	0.013
Married	-0.008		0.012	0.024	*	0.013
Separated	0.002		0.017	0.020		0.018
Employment contract	0.198	***	0.008	0.108	***	0.008
2003 dummy	0.049	***	0.010	0.067	***	0.010
2004 dummy	0.074	***	0.011	0.122	***	0.011
2005 dummy	0.078	***	0.013	0.178	***	0.014
2006 dummy	0.137	***	0.015	0.239	***	0.016
2003*female dummy	-0.007		0.014	-0.015		0.015
2004*female dummy	-0.019		0.015	-0.022		0.016
2005*female dummy	-0.028	*	0.015	-0.035	***	0.016
2006*female dummy	-0.031	*	0.018	-0.050	***	0.020
Actual experience	0.064	***	0.004	0.044	***	0.004
Actual experience^2	-0.001	***	0.000	-0.001	***	0.000
Years of education	0.019	***	0.006	0.014	***	0.007
Years of education^2	0.000		0.000	0.001	***	0.000
Constant	11.223	***	0.066	7.625	***	0.077
Number of observations	26 535			26 092		
χ^2 test	3 361.25			2 583.83		
P value χ^2 test	0.00			0.00		

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.
* Statistically significant at 10%.
*** Statistically significant at 1%.

TABLE 9

Model III, estimation by instrumental variables (Hausman and Taylor method); endogenous variables: actual experience, alternative experience and years of education, monthly and hourly wage model

(Natural logarithms)

Gender	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Female	-0.208	***	0.019	-0.126	***	0.019
South	-0.190	***	0.013	-0.185	***	0.013
Married	-0.001		0.012	0.031	***	0.013
Separated	0.010		0.018	0.028		0.018
Employment contract	0.196	***	0.008	0.105	***	0.008
2003 dummy	0.056	***	0.010	0.072	***	0.010
2004 dummy	0.082	***	0.011	0.128	***	0.011
2005 dummy	0.090	***	0.013	0.185	***	0.014
2006 dummy	0.149	***	0.015	0.247	***	0.016
2003*female dummy	-0.006		0.014	-0.014		0.015
2004*female dummy	-0.019		0.015	-0.022		0.016
2005*female dummy	-0.028	*	0.015	-0.035	***	0.016
2006*female dummy	-0.029		0.018	-0.049	***	0.020
Actual experience	0.032	***	0.010	0.018	*	0.011
Actual experience^2	-0.001	***	0.000	-0.001	***	0.000
Months worked last 5 years	0.002	***	0.000	0.001	***	0.001
Months worked last 10 years	0.001	***	0.000	0.001	***	0.001
Months worked last 15 years	0.000		0.000	0.000		0.001
Years of education	0.018	***	0.006	0.013	*	0.007
Years of education^2	0.000		0.000	0.001	***	0.000
Constant	11.238	***	0.066	7.631	***	0.078
Number of observations	26 535			26 092		
χ^2 test	3 446.14			2 622.75		
P value χ^2 test	0.00			0.00		

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

* Statistically significant at 10%.

*** Statistically significant at 1%.

considerable growth in the 2002-2006 period. The wage gap between men and women, however, has tended to widen; on the whole, this gap is found to be greatest in 2005 and 2006, rising from about 12% to 16% (hourly wage, see table 9). This reveals that real wage growth was not uniform for men and women.

Second, the introduction of variables to control not only for the number of years of work experience but also for the timing of that experience reveals that the returns on years of recent work experience are higher. Analysis of the table 9 results in particular shows that the returns on recent years of work experience are twice as great as the normal rate of return.

Third, the results of the different estimation methods reveal the importance of taking account of the potential endogeneity of the education and work experience variables, which are evaluated using a Hausman test. The null hypothesis of these exogenous variables is rejected in all cases. If the work experience and education variables are instrumented,

there is a tendency to underestimate the effect of work experience and overestimate the effect of education on wages (see figure 1).

Fourth, specific models which also correct for sample selection are presented for each occupational group. Table 8 summarizes the coefficients found for the female variable in these estimates.[7] Once again, the wage gap remains unfavourable to women in all the specifications. Intra-occupation analysis reveals important differences, however.

— The smallest hourly wage gaps are found among professional technical workers and clerks (10% and 6%, respectively). The largest gaps are found

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[7] In the estimates prepared with the Hausman and Taylor methodology, only the coefficient of the female variable is presented. As with previous models, controlling for actual experience considerably reduces the component potentially attributable to "discrimination". These estimates can be consulted in Perticará and Bueno, 2008.

FIGURE 1

The effects of education and work experience in alternative models: random effects model versus Hausman-Taylor estimation

A. Work experience

◆ Random effects   ■ Hausman-Taylor method

B. Education

◆ Random effects   ■ Hausman-Taylor method
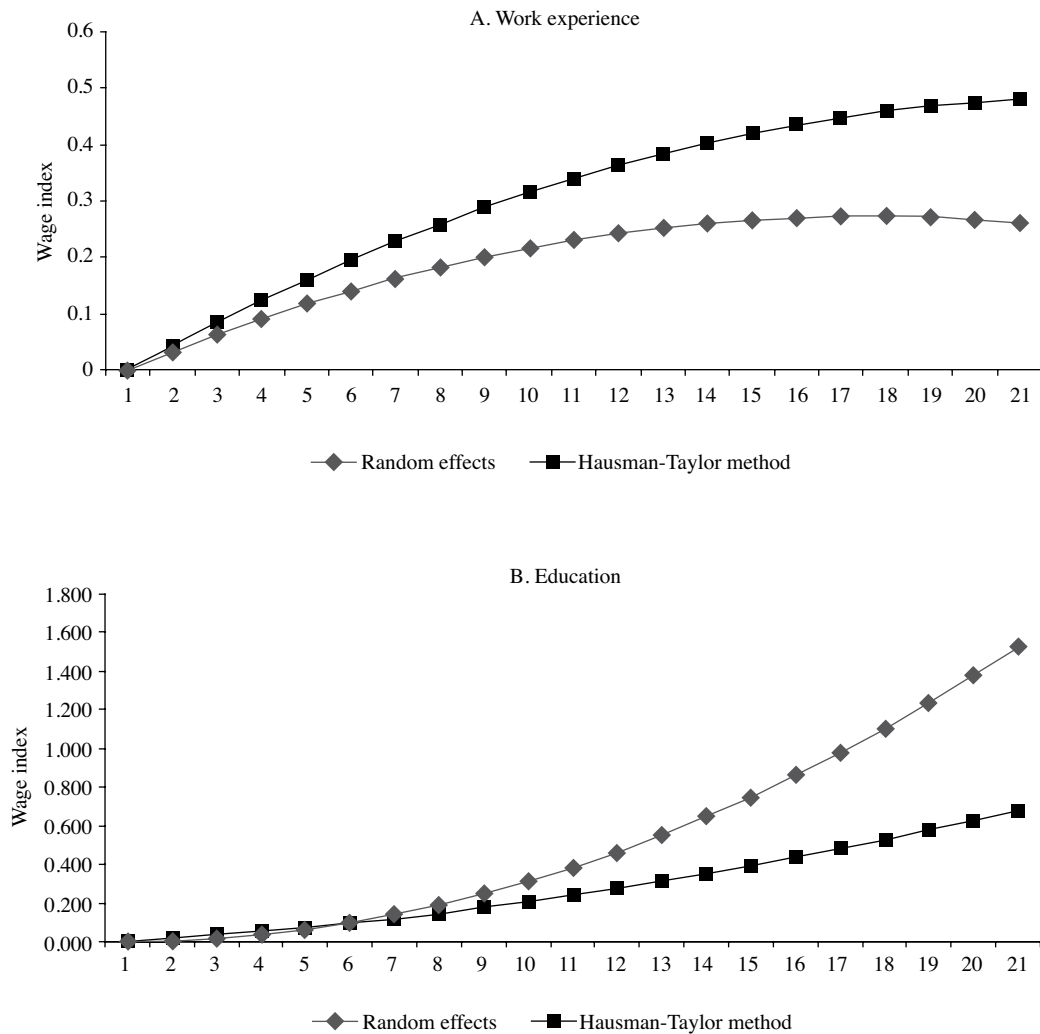
Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

among sales assistants (23%) and agricultural workers and skilled workers (17%). The wage gap between male and female professionals, while negative and large (33%), is not statistically significant, as the sample sizes in this group are smaller. The wage gap for unskilled workers is approximately 13%.

— In some specifications, the coefficient of the Mills ratio is not statistically different from zero, except in the following specifications: professionals,

hourly wage, sales assistants and unskilled workers. There is no evidence of occupational bias in these groups (see table 10).

— The gap for sales assistants and skilled manual workers is not only large but tends to widen over the period considered. While this gap stands at around 26% and 16% in the base year, in 2006 it is around 30% for both groups. The wage gap for unskilled workers almost doubles to about 22% in 2006 (see table 11).

TABLE 10

Hausman and Taylor model. Coefficients of the female variable in occupation-specific wage regressions, controlling for occupational bias, monthly and hourly wage model
(Natural logarithms)

	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Professional and managerial workers	-0.140		0.186	-0.333		0.212
Intermediate-level professional technical workers	-0.223	***	0.041	-0.105	***	0.042
Clerks	-0.146	***	0.039	-0.067	*	0.039
Sales assistants	-0.303	***	0.042	-0.261	***	0.042
Skilled manual and agricultural workers	-0.271	***	0.041	-0.188	***	0.042
Unskilled workers	-0.264	***	0.038	-0.146	***	0.038

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

N.B.: The coefficients of the Mills ratios are all statistically significant at 1%, except in the following specifications: professionals, hourly wage; sales assistants, hourly and monthly wage; unskilled workers (see explanation in text on page _____). In all cases, the χ^2 tests present high values, leading to rejection of the null hypothesis that all the coefficients are zero.
* Statistically significant at 10%.
*** Statistically significant at 1%.

TABLE 11

Evolution of occupation-specific wage gaps, selected occupations, 2002 and 2006
(Percentages)

	Monthly		Hourly	
	2002 gap	2006 gap	2002 gap	2006 gap
Sales assistants	-26.1	-32.6	-23.0	-30.0
Skilled manual workers	-23.7	-31.9	-17.2	-27.6
Unskilled manual workers	-23.2	-28.5	-13.6	-22.3

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

N.B.: The gap is estimated as $100 \left[\exp\left(\hat{\beta}_1\right) - 1 \right]$, where β is the coefficient of the female variable in the occupation-specific regression.

VI

Conclusions

The purpose of this paper has been to study wage gaps using a new database in Chile: the data panel of the Social Protection Survey (EPS) 2002-2006, which makes it possible to control for men's and women's actual work experience and its timing. Earlier studies did not have this information and only controlled with a measure of potential work experience; however, such a measure does not reflect women's pattern of intermittent and discontinuous participation in the Chilean labour market. Corrections have also been introduced for non-participation and occupational selection, and two key variables have been instrumented: education and work experience.

This study provides a detailed sensitivity analysis. It observes that the wage gap between men and women is clearly negative in all the specifications tried out

(base model, instrumental variables, controlling for selection). In other words, women are paid less than men. The largest gaps are obtained in the model where only potential experience is controlled for.

Among the main conclusions are the following. First, the data show a large rise in real wages in the 2002-2006 period. Second, it is the most recent years of work experience that present the highest rate of return. Third, the different specifications tried out force us to recognize the enormous importance of controlling for the potential endogeneity of the work experience and education variables. When instrumenting education and experience, we observe that if ordinary least squares (OLS) estimates or a panel data estimate fail to take this endogeneity into account, they tend to overestimate the effect of education (assign too much value to it) and underestimate the effect of work experience.

This study evaluates occupation-specific gaps and even introduces corrections for occupational self-selection, using the methodology proposed by Lee (1998). Even after cleaning up the endogeneity estimates and introducing the control for selection, the occupation-specific gaps are greatest for specialized workers and sales assistants (26% and 16%, respectively) and lowest among professional technical workers and clerks (10% and 6%, respectively). The wage gap for unskilled workers is 13%. Furthermore, the gap is not only large for sales assistants and skilled manual workers, but tended to widen over the period considered, from 26% and 16% in the base year to 30% in 2006 for both groups. The wage gap in the unskilled group almost doubled to some 22% in 2006.

(Original: Spanish)

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Colombia:

social capital, social movements and sustainable development in Cauca

Raúl Cortés Landázury and Mónica María Sinisterra Rodríguez

Modern development theorists have repeatedly argued that the associative networks constructed by civil society influence countries' economic growth processes by correcting aspects such as failures of the market and of democratic governance resulting from the operation of public policies. In the case of a region such as the Department of Cauca, situated in the south-west of Colombia, a profusion of social movements and collective action has not been matched by good economic results, by comparison with what has been achieved elsewhere in the country with similar or lower levels of social organization. The present paper sets out to specify the categories involved in this phenomenon in the light of the region's cultural peculiarities, which make it a crucial case study for understanding the effects of mass movements on Latin American development.

Raúl Cortés Landázury

Assistant Professor at the

Department of Economics, Faculty

of Accounting, Economics and

Management, University of Cauca

➥ **rcortés@unicauca.edu.co**

Mónica María Sinisterra Rodríguez

Associate Professor at the

Department of Economics, Faculty

of Accounting, Economics and

Management, University of Cauca

➥ **msinisterra@unicauca.edu.co**

I

Introduction

Over the past 15 years, the developing world and Latin America in particular have experimented with a wide range of policy and reform styles in the effort to speed up economic growth, reduce poverty and maintain democratic governance. To achieve these objectives, most countries acted almost as one in adopting the policies comprising the so-called "Washington Consensus", whose recommendations included matters like the defence of property rights, macroeconomic stability, support for the free market and trade integration (Hausmann, Rodrik and Velasco, 2006). The results were not entirely encouraging, but nor were those of the former statist model of inward-looking growth, at least when set against the goal of catching up with the societies of Europe and North America.

Although packages of measures were often driven by the same approaches, the scope and quality of public policies were not uniform. Consequently, there is a question that repeatedly comes up in research in this field: why have some countries or regions managed to adapt their policies quickly to changing external circumstances, or innovate when policies are unsuccessful, while others have reacted slowly and with great difficulty, or kept unworkable measures in place for long periods?

In any event, the experience of the 1990s made it clear that the complexity of development required a new attitude towards crucial elements such as economic growth that took account of links to political stability and institutional solidity, which are given much of their significance by the existence of a civil society that actively concerns itself with the defence of the public sphere. Indeed, multilateral organizations have expressed the view that the performance of institutions has major implications for the countries of the South. Because of this, since the mid-1990s organizations such as the United Nations Development Programme (UNDP)

(Alonso, 2007) have adopted the "good governance" approach as a strategy emphasizing the importance of political participation, a leading role for civil society organizations that are able to make their voices heard and the role of the State in promoting human and not just economic development (DNP, 1995).

However, research into the determinants of good governance, i.e., the phenomenon whereby symbiotic relationships are generated between the State, society and the market, has been giving increasing prominence to the concept of "social capital" as a catalyst for public and private efforts to promote well-being, which for many people has meant displaying attitudes of collective collaboration that provide the basis for the trust needed to invigorate economic transactions and ensure the viability of the institutional order (Fukuyama, 2004). Fertile though the concept is, however, with its virtually limitless variety of applications, there is still no consensus as to its theoretical meaning or methodological importance. Nonetheless, a minimum of agreement on this point is essential to give meaning to economic research and examine some of the elements that explain the sources of endemic distortion in markets and prevent resources from being used optimally to achieve well-being, the result being the kind of major regional differences we see in the development of the Department of Cauca.

This department in the south-west of Colombia is one of the country's poorest. In 2000, Cauca was economically worse off than any of the country's other 24 departments other than Chocó, with 77.2% of its population below the poverty line and 39.7% below the indigence line. The situation was much the same in 2005 when, according to the National Administrative Department of Statistics (DANE), 33.6% of the department's population was below the indigence line and 46.4% of households had unmet basic needs, compared with a national average of 27.6%. The provision of public services in Cauca (drinking water and sewage) is well below the national average (56.3% compared to 65.3% nationally). There is also an ongoing armed conflict and violence right up and down the region, this being mainly the work of outlawed armed groups exploiting the inaccessibility and intricate geography of the department.

About 21% of the inhabitants of Cauca are indigenous, with 84.5% of them living in reservations; there are 84 reservations covering a surface area of 519,850 hectares, equivalent to 17.7% of the departmental total (DNP, 2007). These reservations were originally created by the Spanish to protect the indigenous people, who governed themselves under an independent political authority called the *cabildo*. The land on these reservations is owned in common by the group inhabiting it, which holds formal title. This structure of land ownership, together with the maintenance of native languages and cultural traditions and the protection of communal territory, limits the scope for carrying out impersonal transactions, trading property rights or increasing market size and perpetuates the old institutional structure of government and ways of doing politics, generating a closed group effect or "embeddedness" in the sense used by Granovetter (1985) which stifles the dynamic of production.[1]

In the historical development of the Department of Cauca, the dominance of extractive industries has proved an obstacle to progress towards a republican way of life and the benefits of new political institutions. This was to become the main formal cause of the disadvantaged economic situation of Cauca, whose origins go back to the colonial era. The administrative and political structure of Cauca was clearly shaped by the colonial relationship that linked the newly conquered territories to the Spanish Crown. This relationship of dependency meant that the colonized peoples were deprived of the ability to take decisions about their own lives, territory, beliefs and culture. The Spanish Crown created hierarchical structures of government that sought to protect their own interests and formed networks of patronage which were confined to the geographical areas where their writ ran and whose purpose was to control and dominate the workforce (slaves) and land.

"Cauca introduced a particular variant of the exercise of State power that was aristocratic, religious and racist in character and that, within historical memory, has produced particular characteristics in the exercise of dominion. Until the late nineteenth century the capital, Popayán, was home to a number of the leading families in the Colombian slave trade,

most of whose victims were black. It was there too that the most concentrated racism against black and indigenous people was found, and the consequences can be seen to this day" (Jaramillo, 2007, p. 4). But the colonial inheritance did leave room for the institutions of the indigenous inhabitants, the group that has been perhaps most vehement in resisting exclusion and the concentration of power in the hands of those who have taken on the mantle of the old *encomenderos*. Paradoxically, the current indigenous institutional structure is based on the reservation and the *cabildo*, concepts introduced by the Spanish during the colonial period, but resignified and appropriated by the indigenous peoples (Caviedes, 2001) when they saw the opportunity to generate in them a political authority that would provide recognition and validation for their special ethnic characteristics.

Episodes of rent-seeking behaviour during the colonial period not only show the ineffectiveness of the government machinery and legal framework when it came to creating a system posited on the clear specification of property rights (over resources such as labour and land), but reveal a tradition under which the law was used whenever convenient to exercise exclusionary power, and not as a set of rules facilitating interaction. This issue has obviously been a constant in the evolution of Latin America, as shown by Naritomi, Soares and Assunção (2007) for the case of Brazil and De Soto (2001) for that of Peru. Thus, a description of the Colombian situation that focuses on the dynamics generated in the Department of Cauca not only reaffirms the need to strengthen economic and political institutions but calls into question the effectiveness of social movements when it comes to creating social capital capable of providing public goods and generating development.

A strong civil society, which has been a feature of some episodes of Cauca regional history, with social movements led by indigenous groups, would allow efficiency, growth and legitimacy to be combined, while at the same time banishing the conflict of values in the modern State (late capitalism), torn as it is between promoting efficiency, encouraging private activity and achieving legitimacy with strategies for welfare that constrain the "invisible hand".

The problem so far has been that despite the kind of social cohesion evinced by its indigenous movements, the links enjoyed by its political elites at the centre of national decision-making (Bogotá) and the existence of certain comparative advantages associated with the availability of natural resources,

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[1] These approaches to politics are clearly reflected in the actions of the Indigenous Social Alliance political party that entered the Colombian Congress after the new national constitution came into effect.

Cauca does not have a privileged position in regional and national development, and nor has it improved the living conditions of its inhabitants. There seems to be something going on with the cooperation networks of civil society that suggests the existence of a collective infrastructure torn between forces capable of generating synergies in development policy formulation and implementation and others that are more hidebound and suspicious of progress.

In view of all this, we shall first embark upon a theoretical and methodological discussion about the functionality of social capital as a factor in our understanding of the dynamic of regional development. We shall then proceed to a case analysis of the history of popular movements in the Department of Cauca, pointing out the strengths or weaknesses of associative action. Thirdly, we shall relate the social structure derived from the colonial period to the current development conditions of the municipalities in the department, before lastly giving a general overview of the work of civil society organizations in the mid-2000s.

II

Social capital in the development fabric:

a theoretical introspection

Social capital really does have the capacity to give a productive application to the associative resources embodied in the different social networks to which the members of a group have access, but it entails the complexity of linking individual interests to that of the collectivity. The early analyses of social capital that have now become the classics of the subject referred to the importance of personal relationships when examining economic systems. This is true of the treatment given to the subject by Coleman (1990) from a structuralist perspective, Bourdieu (1980) from a culturalist perspective and Granovetter (1985) from an institutionalist perspective. However, it is in Putnam, Leonardi and Nanetti (1993) that we find the acknowledgement of a valid relationship between social capital and economic development, and its ability to bring about change in conditions of welfare, in *Making Democracy Work*; it would later be recognized by multilateral agencies such as the World Bank as a vital instrument in development policy.

Social capital can be understood as the characteristics of life in society —social networks, rules and trust— that enable participants to act more effectively in association to achieve shared goals (Putnam, Leonardi and Nanetti, 1993, p. 167). This set of characteristics expands the range of opportunities available to people in a community, thus increasing the benefits of associative participation. Furthermore, a study carried out in Italy showed that social capital was capable of changing and developing over time, evidently meaning that a region's development level could change if its social capital were altered from outside.

Nonetheless, the proliferation of studies on the subject and the complexity consequently involved in engaging conceptually and methodologically with this intangible resource as contexts change have led to a growth of interest in the different forms social capital assumes, ranging from individual capital, embodied in dyadic contracts (i.e., contracts between two people, with egocentred networks), to group social capital in the form of stable teamwork with a leader who organizes and is recognized by his or her peers. What we are interested in is external social capital, characterized by the construction of community working relationships in the form of a "partnership" between State and non-State actors in a region, and between regions, as a result of which different resources are linked together to improve the adaptive efficiency of the economic structure and forge agreement on social coordination mechanisms.

In this way, the role of networks becomes an essential precursor of governance and economic stability.[2] But how can we calculate an asset that is evidently intangible, when public information is limited, there are geographical barriers to connectivity

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[2] Gabriel Almond and Sydney Verba (1992) developed a very detailed classification of the steps involved in the ascent to political development and its correlation with economic development, arguing that the final step in modernization was the existence of a participatory and proactive citizen body attuned to civic culture.

and political agitation has been systematic? Does it even make sense to discuss this topic in microlocal contexts that are preponderantly rural and have little human capital —this being largely confined to the urban societies of the country's north? And again, what is the point of doing so if we start by assuming a society like that of Cauca, all but fractured by the confrontation between powerful landowning local political elites and the leadership of emerging groups such as communities of indigenous people, campesinos and Afrodescendants?

Undoubtedly, the best way to answer these questions is to draw some distinctions regarding the role of recent collective actions in Cauca in determining social capital in the face of the changing development model of the late twentieth century.

III

Some background on the history of popular movements

Given the explanatory potential of social capital as a factor needed to invigorate economic transactions and underpin the institutional order, there has been a tendency to argue that it exists in those places where collective agitation has led to a proliferation of social movements (Ruiz, 2004; Villar, 2003). Indeed, if we are to believe some of the political and economic development literature (Ray, 1998; Valles, 2000; Blomstrom and Hettne, 1990), Cauca society today is in a stage of economic and political modernization insofar as the characteristics of these kinds of collective action, generally associated with advanced nations, evince developments such as an upsurge of post-materialist demands, i.e., of those requirements in society, based on symbolic values and the need for esteem, recognition and self-realization, associated with access to a range of (formerly imperceptible) goods such as ethnic, racial or sexual identity (see table 1).

Indeed, it could be said that the dynamic of social movements in the Department of Cauca since the second half of the last century confirms the existence of this social asset. However, theories about these characteristics do not accord with the classic definitions of social capital (Coleman, 2001; Putnam, Leonardi and Nanetti, 1993; Bourdieu, 2001; Dasgupta, 2004), which associate it at first sight with the strengthening of collective networks leading to economic progress, institutional respect and human capital formation.

But then, what are the characteristics of the collective action of civil society organizations in the Department of Cauca that are capable of generating social capital? Is there any relationship between the social mobilization of the 1990s and the generation of social capital?

One promising way into the subject is to create a theoretical matrix to explain the relationships between social movements and social capital in Latin America and thereby reach an understanding of the department's dynamic.[3]

It is thus worth beginning by defining "collective action". It is the phenomenon (Galvis, 2005) that aims to preserve or modify the position and interests of each group in society. Indeed, such action is often coordinated among a number of individuals in the same group who share the same position and the same plans and organize themselves on a fairly centralized basis. The matter does not end there, however, as the nature of their motives differs.

Some authors (Valles, 2000; Mariñez, 2001) have tried to reduce theories about the subject to a basic classification by dividing them into "rational" and "non-rational" approaches. Thus, the former are linked to the development of the main current of economics (neoclassical), in which human behaviour is interpreted as being guided by an instrumental rationality that weighs the benefits of undertaking common action against the costs. Examples of this tendency include the theory of public choice set forth

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[3] Social capital has been present in sociology for decades: Bourdieu (1980) and Coleman (1990) were already using the term in the 1980s, while Granovetter (1985) spoke of strong ties and weak ties and North (1990) developed his theory of institutions with contents very similar to what is now known as social capital. However, it was Putnam who placed it at the centre of the academic debate in the 1990s when exploring the role of civil society in determining disequilibria in regional development. In Latin America, the term is used in connection with ideas about forms of community development or partnership (Ruiz, 2004; Villar, 2003; ECLAC, 2007).

TABLE 1

Evolution of collective demands

Type of social demand	General goals	Specific goals
Materialist values (physical needs)	Security	- Strong armed forces - Anti-crime efforts - Maintenance of order
	Subsistence	- Economic growth - Employment - Inflation
Post-materialist values (social needs and self-realization)	- Aesthetic satisfaction - Intellectual knowledge	- Urban quality and landscape - Ecological balance - Freedom of expression
	- Identity - Self-esteem	- Recognition - Community cooperation

Source: prepared by the authors on the basis of J. Valles, *Ciencia política: una introducción*, Barcelona, Ariel, 2000, and R. Inglehart, *The Silent Revolution: Changing Values and Political Styles Among Western Publics*, Princeton, Princeton University Press, 1977.

by James Buchanan and Gordon Tulluck (1993) and the resource mobilization theory of Mancur Olson (1982). The second group, meanwhile, includes theories whose motives of action are based on logics much closer to the political sphere, as they encompass aspects such as socialization in early life (influence of culture, the family, etc.) as determinants of human actions rather than the cold decision-making of *homo economicus*. This group encompasses some neoinstitutionalist and culturalist theories.[4]

Taking Olson's analysis, collective action is the outcome of the roles of groups and organizations that act as structures developed to protect the interests of their members.[5] However, Olson does not relinquish the idea that there are selfish individual interests involved in the building of organizations, since this appears in principle to be an innate and ahistorical characteristic that does not clash with collective action, with rational, calculating actors seeking to improve their position by acting as part of a whole. In other words, the group is a common means to a particular end, and is not formed with a view to what others want. Although there may be some degree of common ground in the nature of human groupings, however, the author distinguishes between large and small groups. He thus emphasizes that the pursuit of collective goods is a characteristic of large groups or organizations only and that the behaviour of individuals within these groups is analogous to behaviour under conditions of perfect competition, in the sense that the decision as to whether or not to participate in the group will have only a nugatory effect on its outcome.[6]

In this analysis, furthermore, the creation of large groups is determined by the transition from primitive societies with a low level of occupational specialization (and little consensus) to modern ones where work becomes more complex and the survival of the collectivity depends on the ability to join forces and coordinate movements.

This type of approach is open to a number of criticisms, however. Perhaps the most important one, where its application to the context is concerned, is that it treats social and political relationships as deriving from a teleological, evolutionist dynamic

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[4] Functionalist sociology (Ritzer, 1993) recognizes collective action as an immediate response to State action constituting a kind of non-rational reaction.

[5] It follows that if this is not their goal, individual interests will be safeguarded by individual actions.

[6] In keeping with economic tradition, Olson notes that the incentives to organize are not just economic; there are also social incentives that have to do with social acceptance and position, but that are individual and not collective goods. He adds that rational individuals do not participate in large groups unless they are coerced or encouraged by the prospect of some benefit. He recognizes, however, that the effectiveness of collective action may be jeopardized by "free-riding", i.e., the presence of people who are in a position to benefit from the action of the group's other members and do so without incurring the costs of participation.

In small groups, the situation is different. The share of the collective good enjoyed by each member of the group is significant and the actions of one can affect others' level of provision.

that presupposes burgeoning organizational vigour stimulated by high economic growth. Needless to say, a conclusion like this is reminiscent of the famous Kuznetz curve, as the early stages of economic growth entail high and rising levels of inequality and deficient organization, mitigated as improving living conditions give rise to a new style of leadership in which civil society organizes in the interests of renewed growth, improving income distribution in a context of diminishing State interventionism and some shift away from primary activities as a source of employment.

We should add that, according to this Westernizing vision, the atavistic ties of the extended family are an impediment to the "coming of age" discussed by Kant, preventing the consolidation of individuals who are independent and free to enter into contracts involving other individuals and organizations in situations that are symbolically different to those of their personal background. In poor countries with discontinuous growth, however, it would seem that a different analytical perspective is to be adopted.

Potentially, "non-rational" approaches (political logics) banish instrumentalist calculation, so that collective actions are guided by different considerations, including the quest for identity. Thus, what could be seen under an Olsonian perspective as a means becomes, in the approach of Touraine (1978), an end in itself. The point would rather seem to be to observe whom individuals come up against once mobilized and how they can then differentiate themselves, rather than the material ends they might attain.

Touraine (1978) expands his viewpoint by using three models to recreate the nature of social movements in Latin America: internal social conflicts, nationalism and Marxist-Leninist revolutionary action. With this approach, social movements are seen as the outcome, firstly, of protests at deficiencies in quality of life (housing, jobs, food security, public services, etc.) involving non-separation of the private and public spaces;[7] secondly, of far more general demands involving aspects such as the defence of public education and wages; and thirdly, of identity struggles for economic and political autonomy and of class confrontation, all of which come very close to the goals of guerrilla groups.

In Touraine (1978), social movements have the potential to transform the life of society by transcending the defence of individual interests and affirming their specific ability to intervene in the formation of general policies and those aimed at defending the social body.

From this perspective, however, the prototypical organization supporting collection action does not seem to be one with strong and abiding organizational structures. Furthermore, it would seem that there is not much likelihood of an active civil society that promotes social capital being created in Latin America, not least because collective action is subordinated to institutions whose traditional political socialization norms ultimately mean that the course of collective action depends on the activities of the State, with this dependency thwarting their capacity for autonomy. Consequently, the very idea of the Kantian "coming of age" prevailing in liberal discourse, which assumes the existence of positive social capital, comes up against the cultural relativism that explains the individual as being subordinated to traditional institutions confined to the private realm; so that the vital spaces of social interaction cannot grow beyond what the family sphere permits.[8]

Consequently, the scope for extending social interaction, with acceptance of the risk inherent in new contracts, is limited, something that is explained on the symbolic level by the influence of the filial relationships of the *hacienda* in the public sphere. Thus, derived political subcultures like patronage and *caciquismo* (the dominance of local party bosses) have moulded the administration of the State, and in one way or another social movements end up under its wing, while the political elites (oligarchies) formed during the wars of independence developed mechanisms of social control which they perfected by exercising government until they could expertly control the pace of events. A characterization that accords with this type of approach, setting out from attributes such as the stability of their organizational structure, their pattern of discourse and their field of action, allows us to say that what Cauca has seen in recent times (the last two decades of the twentieth

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[7] In the Greek tradition, basic needs of an economic character are met in the private sphere. The public sphere, meanwhile, is where politics is carried on, collective interests are discussed and individuals are recognized as equals in debate.

[8] In Putnam (2000), it is possible to distinguish between positive and negative social capital. The former generates civic virtues consistent with the expansion of the public space and the strengthening of social networks that give rise to formal institutions and economic progress, while the latter is conducive to the formation of closed circles that breed conspiracies and crime networks.

century) has been the consolidation of types of organization associated with the social movement category (Valles, 2000), where the conjunctions of interests and their permanence over time are far weaker than in other types of organization such as interest groups and traditional political parties (see table 2).[9]

These are organizations (clubs, associations, etc.) of varying sizes that may eventually form networks and mobilize when the occasion arises. They do not constitute a single organization and nor do they have an explicit programme of action, but they originate in a rejection of institutional channels and conventional ways of expressing preferences. Accordingly, they engage in actions that range from mass sit-ins to direct action with some degree of violence, to civil resistance that involves breaking the law.[10] It is also worth emphasizing that social movements combine a twofold logic in their goals and strategies (Valles, 2000, p. 341). First, they set themselves up as instruments of participation within the political process and, second, they aim to achieve practical results from this activity by forcing themselves to make contact with the established power or confronting it for the purpose of negotiating and reaching agreements.

[9] An important characteristic of pressure groups is that they are recognized as voluntary associations whose main objective is to influence the political process by defending positions which affect the interests of a particular section of the community (wage workers, businesses, etc.). They pursue particular political objectives, but without aspiring to a general project of government (Galvis, 2005). Needless to say, the longer tradition of political parties and the academic attention paid to them does not necessarily mean that greater clarity can be assumed.

[10] In all cases, very close attention tends to be paid to the media repercussions and the effects on public opinion.

TABLE 2

Ideal typology of collective actors

Criterion	Type		
	Social movements	Interest groups	Political parties
Degree of structuring	Variable	Strong, stable	Strong, stable
Discourse	Cross-cutting	Sectoral	Universal
Preferred field of action	Social, non-conventional	Institutional, social	Institutional

Source: J. Valles, *Ciencia política: una introducción*, Barcelona, Ariel, 2000.

IV

The history of mass action in Cauca from 1990 to 2004

In Colombia, the creation of the Cauca Indigenous Regional Council (CRIC) and the National Association of Rural Users (ANUC), in 1970 and the late 1960s respectively, exemplifies the importance of mass action in the concert of regional development.[11] But does the fact that events of this type have taken place in the Department of Cauca imply the existence of

[11] It is important to stress that the new forms of action, which replaced the old class struggle, made use of media representations like those seen in the case of the Zapatista Army for National Liberation (EZLN) in Mexico and those that accompanied the Social Forum in Brazil. Furthermore, changes of this type favoured the growth of antiglobalization movements, which are advocates for global justice and equity as well as making ethnic and cultural demands. Examples include the Movement of Landless Rural Workers (MST) in Brazil, the *piqueteros* (members of the unemployed workers' movement) in Argentina and coca growers in Bolivia. The groups leading action of this type have been formed of indigenous people, workers, landless campesinos and small producers who have fallen victim to the international competition that arose with the new market development model.

social capital, as set forth by theory and evidence in Colombia and internationally?

Throughout its history, the Department of Cauca has seen a series of collective actions, most of them associated with the guerrilla insurgency, which then took a remarkable turn in the 1990s.[12] In view of these and other demonstrations, Cauca has been identified (Cuéllar, 2000) as the greatest repository of this resource in Colombia.

This process became manifest with the first mobilization in 1987, although some municipalities had already experienced activity between 1980 and 1985, examples being Santa Rosa, Bolívar and small towns such as El Rosal (San Sebastián), which decided to produce a "diagnosis" or list of urgent needs (Jaramillo, 2003), giving rise to the stoppage in Bolívar in December 1985 and the one in Sucre in May 1986. But it was the 1987 march that set the area irreversibly on the road to a social movement of extraordinary proportions. Its demands centred on the need to complete the highway to Santa Rosa and improve the section already built, although the list also included other needs requiring resolution.

It was then that the Pan-American Highway began to be identified as an effective symbol of struggle (Jaramillo, 2003; Tocancipá, 2004), once institutional channels had been exhausted and it had been shown that the ground rules imposed by the regime left no room for negotiations in government offices or bureaus but only in the spaces where forces came into conflict. The bulk of the marchers were from Santa Rosa and San Sebastián; the outcome was that they attained some of their objectives but also, among other things, that they created new associative resources not necessarily derived from guerrilla action.[13]

The penultimate decade of the twentieth century saw a kind of inflation where popular mobilization was concerned (see figure 1), coinciding with the introduction of the first generation of economic reforms following the shock unleashed by the external debt crisis of the 1980s. Halfway through the period, efforts were made to calm this as one presidential mandate gave way to another.

The culmination of the Government of César Gaviria, who had increased the pace of economic reform, contrasted with that of Ernesto Samper, who tried to check the impetus of his predecessor's measures, giving the State a somewhat more forceful role in social investment.

However, the increasing difficulties of governance resulting from corruption scandals and the penetration of the political arena by drug traffickers seems to have corroded the legitimacy of institutions yet further, so much so that collective protest actions were able to continue and even increase, as could clearly be seen by the end of the decade's second four-year term of office. However, expectations of a ceasefire and the failed effort to reach a peace agreement with FARC, which subsequently escalated its guerrilla and paramilitary activities, seem to have facilitated further implementation of the development model prevailing since the beginning of the decade. This meant a consolidation of the conservative ideological hegemony that was carried over from the Government of Andrés Pastrana (1998-2002) to that of Álvaro Uribe (2002-2006) and has been extended with the re-election of the latter.

Institutional weakness seems to be borne out by the mathematical progression in the frequency of mobilizations from 1993 until 1999. Following the First Regional Civic Stoppage of the Colombian Massif between 20 and 26 August 1991 (see table 3), nine municipalities joined the struggle and a far wider array of demands was established.

[12] Perhaps one of the first visible manifestations of the belligerency of the department arose in the 1910s with the indigenous uprising headed by someone who would become a leader of mythical proportions, Manuel Quintín Lame (Jaramillo, 2003). Lame set his ethnic group against the hegemonically dominant values, turning it into a force to be reckoned with in power relationships. Later, his name would be used by a guerrilla faction that was most active in the 1980s.

It also became a focal point of armed confrontation as a result of the consolidation of the guerrilla insurgency experienced by the country from the late 1940s onward, which was given a further impetus by the Cuban revolution —so much so that the Revolutionary Armed Forces of Colombia (FARC), the National Liberation Army (ELN), the People's Liberation Army (EPL), the Comando Pedro León Arboleda, the Workers' Revolutionary Party (PRT), the 19 of April Movement (M-19), the Jaime Bateman Cayón guerrilla group and the Quintín Lame, to name some of the major ones, had or still have a presence in the territory.

[13] The action only got as far as Guachicono and was named after it, as the negotiators preferred to restrain its advance towards the central highway.

FIGURE 1

Number of collective actions in the Department of Cauca, 1990-2002
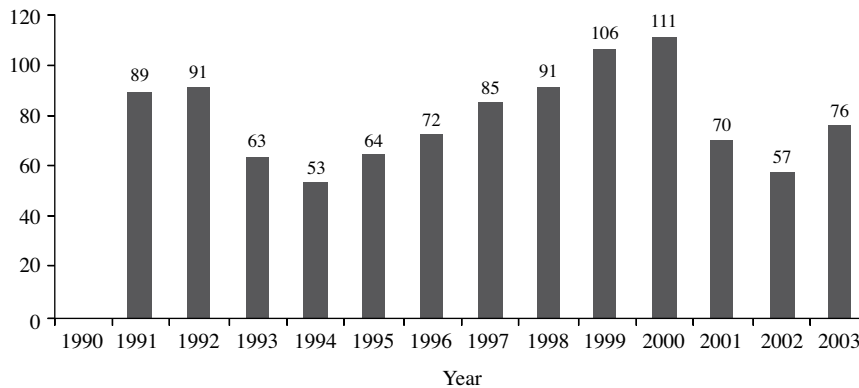
Source: J. Agredo and L. Flórez, "Hacia una caracterización de las acciones colectivas en el Departamento del Cauca (1990-2002)", degree thesis, Popayán, University of Cauca, 2005.

TABLE 3

Record of collective actions in the Department of Cauca

Year	Number of actions	Mobilization index Base: 1990 = 100.0
1990	89	100.0
1991	91	102.2
1992	63	70.8
1993	53	59.6
1994	64	71.9
1995	72	80.9
1996	85	95.5
1997	91	102.2
1998	106	119.1
1999	111	124.7
2000	70	78.7
2001	57	64.0
2002	76	85.4
Total	*1 028*	

Source: authors' calculations based on information from J. Agredo and L. Flórez, "Hacia una caracterización de las acciones colectivas en el Departamento del Cauca (1990-2002)", degree thesis, Popayán, University of Cauca, 2005.

In fact, 30,000 campesinos reached the Pan-American Highway, at the Rosas site, but the clamour of collective action began to die down, for after six months of preparation and after succeeding in negotiating with most central government officials, the resources of the initiative collapsed. However, mobilizations were to continue on a lesser scale before picking up again in 1994. This period must have served to strengthen the arguments and instruments of the struggle against formal channels for conveying social demands. Four main elements linking the theoretical discussion to the statistical evidence should thus be emphasized:

i) The consolidation of secure identity moorings within the organization, reinforced by the construction of an external enemy beyond the wider (national and regional) society and its homogenizing development project.

ii) The strengthening of the movement as a space of social recognition and the opportunity to construct and give vitality to the idea of territory and region.

iii) The validation of confrontation strategies to deal with public policy-making and implementation processes.

iv) The variable structuring of the movement (campesinos, indigenous people and Afrodescendants), but with a refinement of the discourse that is evident in the defence of regional coverage and symbolism, even with a minimal prioritization of the solutions being sought.

And indeed, the very scale of the movement suggests a fairly advanced internal process. Jaramillo (2003, p. 23) has the following to say about this:

"The 1991 mobilization was quite remarkable. It showed a capacity for organization and mobilization that already pointed the way to its future actions. It was an action, indeed, that must be regarded not merely as such but as the outcome of an earlier effort to organize civil sectors in the countryside, teachers

and political activities from the municipalities directly integrated into the geographical area of the Colombian Massif. The pressure it applied led to an inevitable acceptance of it as an interlocutor by the State, allowing it to negotiate satisfactorily. An important lesson here, however, was that its ignorance of the internal management and work of State institutions meant that most of what it negotiated had already been budgeted for by the government of the day."

Thus it was that, on 31 March 1991, the Committee for the Integration of the Colombian Massif (CIMA) was brought into being with the intention of progressing with four basic tasks: (i) fostering local and regional integration, (ii) holding the first cultural congress of the Massif, (iii) bringing out the regional newspaper and (iv) holding the first regional civic stoppage in the municipalities of the Colombian Massif.

In 1996, protest struggles briefly took a different path (Agredo and Flórez, 2005); the method used was not mass mobilization, but rather negotiations that included the Departments of Cauca, Huila and Nariño.

The idea of the region as a recognized entity gathered force thanks to efforts such as the Environmental and Agricultural Development Plan for the Colombian Massif and Southern Cauca, the comprehensive and sustainable production plan, the social harmony plan and the science and technology plan. This led to agreements on projects that were supposed to be implemented during 1996, 1997 and 1998. At the same time, geographical coverage was widened with the inclusion of other municipalities that had not participated in the first mobilization, but that were close to the area of influence of those municipalities that had.

However, the effervescence of the mobilization seemed to die down into a period of lethargy. Three things might explain what happened. First, the members of the organizations considered that the response of the State had met their expectations, and a phase of cooptation or collaboration with the latter began, something that is astonishing considering the far from distinguished position of the department as the country's second-poorest. Another possibility is that the vigour of the anti-guerrilla struggle waged by Uribe's Government and the proliferation of paramilitary groups discouraged mass mobilization and made organizations decide not to participate in events such as the seizure of the Pan-American Highway, for fear of being treated like insurgent factions by the police. This kind of thing cannot be ruled out, as paramilitary activity surged amidst talk of institutional order and restoring the State's monopoly of force, with the consequent repression of many expressions of social protest. Third, it may have happened that ties of integration within the overall organization weakened to such an extent that only organizations like CIMA and the Movement of Indigenous Authorities of Colombia (AICO) came out adequately strengthened, whereupon they sought to keep out organizations seen as free riders.

Thus, having rid themselves of bodies that benefited from the struggle with a minimum of effort, the more committed organizations moved on to new forms and methods of action, with the consolidation of national and international networks allowing them to create far stronger underpinnings of social capital embodying a more proactive, independent attitude towards the administration of power. However, a hypothesis like this would mean accepting with Olson (1982) that it is more centralized and less deliberative (horizontal) organizational structures that subsequently create the bonds of trust which are the hallmarks of social capital.[14] It also appears to have been accepted that their members should adopt a more instrumental stance to achieve their objectives. Perhaps as a result, collective actions became less and less spontaneous, with 84% of them resulting from more elaborate forms of organization during the period (see table 4).

All this would mean rejecting the Putnamian interpretation that identifies success in creating positive social capital with the existence of decentralized horizontal organizations, which indigenous organizers appear to be drawn to, if the call for greater participation and the rejection of the institutional channels for processing demands required by the verticality of public policymaking are anything to go by.[15]

Indigenous mobilization as such averaged just under four actions a year. The main motives of these actions were land recovery and the dishonouring of agreements.

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[14] In this analysis, the organizations traditionally considered to be vertical are basically unions, political parties and religious organizations.

[15] According to Cuéllar (2000a), Olson sees horizontal organizations as a potential obstacle to economic growth if they turn into interest groups in pursuit of preferential treatment that imposes disproportionate costs on society, i.e., when they are created on a basis of solidarity to conspire against the public good or restrict individual freedom or enterprise. Coleman (1990), finds that group "closure", social norms that produce an effect of "externality" and the prospect of obtaining individual benefits in both vertical and horizontal organizations act as drivers of progress.

TABLE 4

The indigenous movement

Year	Actions	Issue	Forms of action	Duration (days)	Principal outcomes	Presence of violence
1990						
1991	3	Land	Marches	One day	No agreement	No
1992	4	Government policies	Marches	One day	No agreement	No
1993	1	Government policies	Marches	One day	No agreement	No
1994	2	Housing	Sit-ins	One day	No agreement	No
1995	3	Government policies	Marches	One day	No agreement	No
1996	5	Land	Sit-ins	1 to 8 days	Written agreements	No
1997	2	Government policies	Marches	One day	No agreement	No
1998	5	Government policies	Sit-ins	One day	Written agreements	No
1999	6	Dishonouring of agreement	Blockades and roadblocks	2 to 8 days	Written agreements	No
2000	3	Dishonouring of agreement	Marches	One day	No agreement	No
2001	4	Dishonouring of agreement	Blockades and roadblocks	One day	No agreement	No
2002	6	Dishonouring of agreement	Blockades and roadblocks	One day	No agreement	No
Total	*44*	*Dishonouring of agreement*				

Source: J. Agredo and L. Flórez, "Hacia una caracterización de las acciones colectivas en el Departamento del Cauca (1990-2002)", degree thesis, Popayán, University of Cauca, 2005.

However, from 1997 to 2001, as increasing stress was laid on macroeconomic adjustment measures and the recovery of the coercive powers of the State (supported by illegal armies), the trend rose above the average, peaking at six a year. Thus, if collective actions were refined going into the negotiating phase, the forms and methods employed throughout the 1990s were not abandoned. This confirms that while joint struggles declined, indigenous people were able to maintain the form if not the pace of action (marches and roadblocks). Thus it seems they remained as the immediate objectives of ethnic recognition, contact and dialogue, taking advantage of the fact that the symbol of the external enemy had already been created and needed to be kept in view: the homogenizing economic model (Montoya, 2006) and the wider society separating them from the land. Meanwhile, their demands were practically reduced to two (land and compliance with agreements) and progress was made in consolidating cooperative associations to this end (see figure 2).

Campesinos meanwhile, having formerly allied themselves with the aboriginal inhabitants, now tended to distance themselves, partly because the greater media access of the regional elites, attuned to the philosophy of the political model propounded by the Government of President Uribe, gave currency to the idea that an agrarian counter-reform engineered by indigenous groups was gaining ground dangerously, the argument being that in their eagerness to recover land the latter would seize it not just from the old estate owners but from small proprietors too, and that the threat from the new "landlords" would have to be met by legitimate State violence in defence of private property. Again, the ethnic syncretism of the campesinos, most of whom are of mixed race, displays cultural differences from indigenous people, involving different ways of understanding the market and economy and of placing the interests of the community above those of the individual. They differ even in their symbolic relationship with the land itself.

The whole of the foregoing analysis contrasts with the theory supported by international evidence and with Colombian studies like those of María Mercedes Cuéllar (2000). That author, who measures social capital by the frequency of participation in horizontal organizations, argues that in Colombia:[16]

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[16] In a similar study, Sudarsky (1999) questions methodologies of this type, as he regards civic participation as just one dimension of social capital. He argues that factors such as institutional trust, political cohesiveness and control of the State and of hierarchies by society are elements that Putnam disregards and Cuéllar also overlooks. He adds that vertical linkage produces greater social capital and that activities associated with the communications media are related to social capital, but trust in them is dependent on a second factor he calls "faith in unvalidated information sources".

FIGURE 2

Collective actions of the indigenous movement in Cauca, 1990s
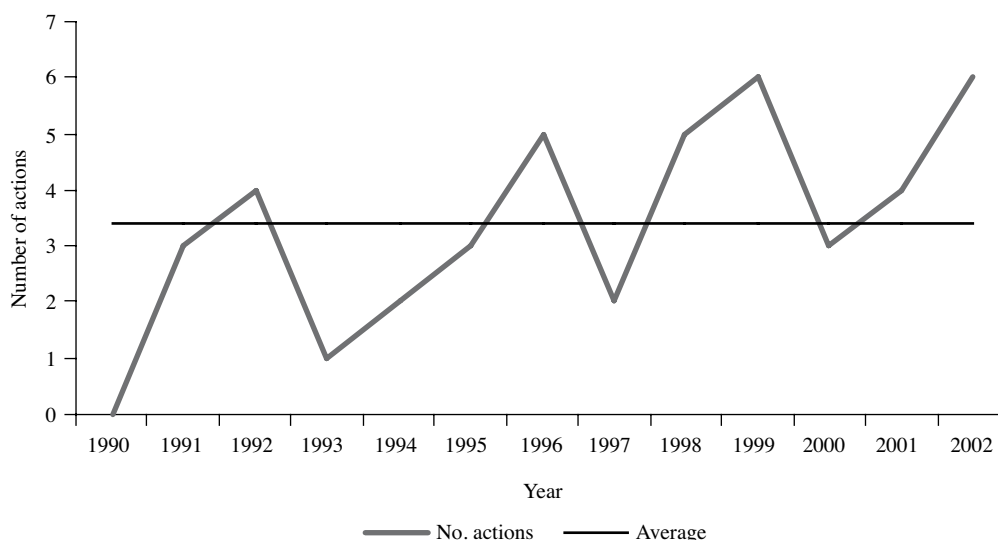
*"…The highest indices of associative activity are
found, in this order, in the Departments of Cauca,
Risaralda, Cundinamarca, the Capital District,
Santander and Boyacá. Conversely, they are lowest
in Guajira, Sucre, Quindío, Meta, Bolívar, Tolima,
Caldas and Atlántico" (2000b, p. 28).*

Nonetheless, the socio-economic conditions of
the department and the dynamic of social mobilization
evince major distortions. First, this type of analysis does
not tie the idea of collective action to the generation of
networks of cooperation between organizations, which
we shall address later on. Second, the social capital
concept transcends the social movement category,
since while social mobilization efforts generated high
levels of organizational concentration and linkage
in the early years of the decade, they fell off at the
end of the decade without any confirmation as yet
that greater participation in associative bodies was
instrumental in reducing poverty. It should be added
that all social capital embodies a social movement, but
not every social movement turns into social capital.
What seems to have been achieved is the strengthening
of indigenous organizations, but without any evidence
that the process of identity agglutination served to
consolidate cooperation networks within the civil
society of the region.

Third, the strength of collective action has not
served to bring civil society closer to the State either;
the effect has rather been to consolidate indigenous and
campesino identities around the rejection of institutional
channels, with the effect that public policy outcomes
have been generated through strategies of confrontation
rather than cooperation. Nor has it been permitted by
the conservative (integrationist) project, immersed as
it has been in the planning of national and regional
development, despite the formal spread of participation.
Fourth, there is no symbiotic relationship between the
action of social movements, social capital and income
levels (Cuéllar, 2000). The most depressed sectors and
places are those with the most collective actions. Fifth,
the relationship between social movements, social
capital and human capital does not prove significant,
given that indigenous movements, which do not have
the highest levels of schooling, have been the most
consistent and persistent in their collective actions.
This shows that formal education does not revitalize
this relationship and that other types of knowledge
may give a better idea of what is meant by a strong
organization. Sixth, economic growth is neither a cause
nor a consequence of social capital in the department,
but it can be related to mobilization, while rejection
of the impact of market orthodoxy has succeeded in
generating regionally recognized actions.

Although it is not possible to positively affirm the symbiotic relationship between social capital and social mobilization (action of movements), it is safe to say that they are the seeds of what this resource could represent for the region. Ultimately, the indigenous movement and the resulting mobilizations were the great beneficiaries of this whole period. They have thus turned into an "organized social movement", but it does not follow from this that social capital exists, at least as understood by classic authors such as Putnam, Leonardi and Nanetti (1993) or Coleman (1990).

V

The reliance on history in determining social capital

It has not been possible to demonstrate the relationship between cultural factors and long-term economic performance clearly, owing to the endogeneity of the first variable (Durlauf and Fafchamps, 2005). However, many authors see culture as affecting the development of political and economic institutions, which are the fundamental cause of comparative differences in development levels.

The use of microanalysis to identify the underlying dynamic in a region is a simple tool, but one that has great explanatory potential when the municipality is taken as the unit of analysis and the basis of local development. We shall show the extent to which development levels in the different municipalities of Cauca converged in the period from 1951 to 2005, bearing in mind characteristics such as the presence of indigenous culture or institutions of colonial origin.

Beta (or absolute) convergence takes place when poorer countries/regions or localities grow faster than wealthier ones. Sigma (or conditional) convergence takes place when the variance of per capita income among a group of countries/regions or localities tends to fall over time, until the poorest catch up with the wealthiest in per capita terms (Rey and Montouri, 1998). Because there is no system of regional accounts, however, population growth was used as a proxy for economic growth, following the Tiboutina hypothesis that people emigrate from areas with lower levels of efficiency and social welfare to those that are better placed in terms of progress and the provision of public goods to take advantage of the greater availability of well-being and growth there, with the result that populations in the latter rise.

Six ordinary least squares (OLS) regressions were run to estimate the following models:

(1) $g = \beta_0 + \beta_1 * LnPop_0 + \varepsilon$

(2) $g = \beta_0 + \beta_1 * LnPop_0 + \beta_2 * Indigen + \varepsilon$

(3) $g = \beta_0 + \beta_1 * LnPop_0 + \beta_2 * Dummcol + \varepsilon$

(4) $g = \beta_0 + \beta_1 * LnPop_0 + \beta_2 * Indigen + \beta_3 * Dummcol + \varepsilon$

(5) $g = \beta_0 + \beta_1 * LnPop_0 + \beta_2 * Indigen + \beta_3 * Dummcol + \beta_4 * Estates + \varepsilon$

(6) $g = \beta_0 + \beta_1 * LnPop_0 + \beta_2 * Indigen + \beta_3 * Dummcol + \beta_4 * Estates + \beta_5 * DisPop + \varepsilon$

where:
g is the population growth rate in the 1951-2005 period.
$LnPop_0$ is the natural logarithm of the population in the starting year (1951).
$Indigen$ is the indigenous population per municipality in 1998.
$Dummcol$ is a dummy variable used as a proxy for colonial origins, taking the value 1 if the municipality was founded in the sixteenth or seventeenth century and 0 if the municipality was founded in the eighteenth, nineteenth or twentieth century.
$Estates$ is the number of landed estates per capita in the municipality in 2002.
$DisPop$ is the geographical distance in kilometres from each municipality to Popayán.

Model (1) shows the traditional beta convergence hypothesis, while the rest seek to capture the impact

of colonial history on the development of the municipalities of Cauca. In particular, *Indigen*, *Dummcol* and *Estates* are intended to reflect the colonial heritage on the theory that municipalities that were founded during the colonial period, with greater land concentration or a larger indigenous population or both, possess a greater colonial legacy that is capable of affecting their development. *DisPop* aims to measures the impact of geography on municipal development, since Popayán is not just the capital of the Department of Cauca but is also on the Pan-American Highway, the main trunk road linking Cauca to the north and south of the country; it is possible that the further from Popayán a place is, the lower its level of economic activity.

The results of the analysis in figure 3 show that, for the period being studied, the correlation between the rate of population growth in the Department of Cauca between 1951 and 2005 and the natural logarithm of population size in 1951 (start of the period) tended to decline, indicating the presence of beta convergence, as is also shown by the estimated coefficient of correlation (–0.66). This process can be explained by migration between municipalities and accords with the results of Bonet and Meisel (1999), where Cauca is described as converging.

The results of the OLS estimations for the models formulated are presented in table 5. On the whole, the models do not have large specification biases.

Of the models regressed, the one with the best fit was model 6. The estates, distance from Popayán and population growth rate in 1951 variables had negative signs, meaning that the smaller the number of landed estates per capita in the municipality, the shorter the distance from Popayán and the lower the growth rate in 1951, the more the municipality will develop. The colonial period variable proved to be of low significance in regressions 3, 4 and 5, showing that the fact of a municipality having been founded during the colonial period has no bearing on its level of development. This relationship changes when distance from Popayán is introduced in model 6, where it becomes significant at 10%. Lastly, for a municipality to have a larger indigenous population proved to be a significant variable that positively affected development.

The average population growth rate of the municipalities in the Department of Cauca during the different intercensal periods reveals a clear reduction in dynamism, as it declined from 84.64% in the 1951-1964 period to 4.55% in 1993-2005 (see table 6). It would seem that until the 1960s the Department of Cauca presented a convergent inter-regional dynamic, understood as the need for faster growth to attain the growth levels of more developed municipalities.[17] Since then, disparities seem to have increased.

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[17] This result agrees with that of Bonet and Meisel (1999), showing convergence for Colombia between 1960 and 1990 but total divergence from 1990 onward.

FIGURE 3

Department of Cauca: beta convergence in population dynamics, 1951-2005
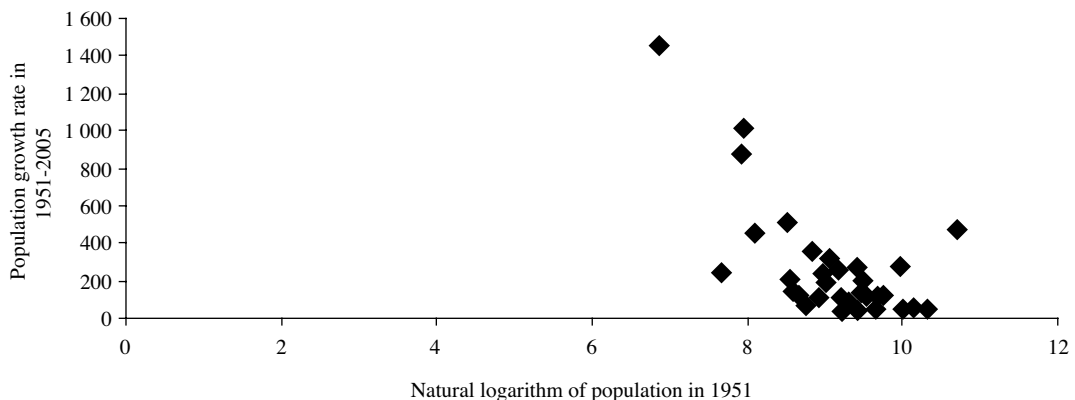
Source: authors' calculations based on information from the National Administrative Department of Statistics (DANE), population censuses.

TABLE 5

Development and institutions in Cauca
(Beta population convergence)

Variable[a]	Ln PGR$_{1951\text{-}2005}$ (1)	Ln PGR$_{1951\text{-}2005}$ (2)	Ln PGR$_{1951\text{-}2005}$ (3)	Ln PGR$_{1951\text{-}2005}$ (4)	Ln PGR$_{1951\text{-}2005}$ (5)	Ln PGR$_{1951\text{-}2005}$ (6)
Ln PGR$_{1951}$	-256.0391 (51.44315)[b]	-185.1979 (52.35486)[b]	-270.5674 (54.14719)[b]	-201.2122 (52.29970)[b]	-200.9329 (51.82363)[b]	-208.6150 (51.51182)[b]
Indigenous population		0.017280 (0.005982)		0.017058 (0.005856)[b]	0.015642 (0.005914)[b]/	0.014117 (0.005956)
Colonial period			-0.283179 (0.318740)	120.9314 (84.59463)	134.4677 (76.56500)	140.8214 (75.76432)
Estates					-0.303728 (0.245084)	-0.382603 (0.249414)
Distance from Popayán						-0.367358 (0.280693)
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	33	33	33	33	33	33
F statistic[c]	24.77180 (0.000023)	19.49182 (0.000004)	12.69638 (0.000101)	14.34427 (0.000006)	11.34093 (0.000013)	9.646287 (0.000023)
R^2	0.444164	0.565114	0.458413	0.597406	0.618340	0.641107

Source: authors' calculations based on information from the Agustín Codazzi Geographical Institute (IGAC) and the National Administrative Department of Statistics (DANE), population censuses.
N.B.: Ln PGR1951-2005: Natural logarithm of the population growth rate between 1951 and 2005.
Ln PGR1951: Natural logarithm of the population growth rate in 1951.

[a] The figures in parentheses below the regression coefficients are standard deviations.
[b] The variable is significant at 5%.
[c] P value in parentheses.

TABLE 6

Municipalities in Cauca: intercensal change in population growth rates

Municipality	PGR 1951-1964	PGR 1964-1973	PGR 1973-1985	PGR 1985-1993	PGR 1993-2005
Deviation: standard	105.9756685	25.33207284	28.35564532	39.50692188	23.3905385
mean	84.64455714	16.94496384	12.44300049	38.04881357	8.363971579
median	46.96828358	18.10022928	9.213949929	30.86376812	6.375710574
Variation coefficient	1.252008069	1.494961752	2.27884306	1.038322044	2.796582733

Source: authors' calculations based on information from the National Administrative Department of Statistics (DANE), population censuses.

The dispersion in population growth rates by municipality in the department bears out this hypothesis, as an increase in the dispersion of growth is observed for the 1964-2005 period compared to the same analysis for 1954-2005, whose coefficient of variation is greater.

The results also show (see table 6) that the decade from 1954 to 1964 was historically decisive for the compression of the population dynamic in Cauca and its development. During this period, the department experienced one of the most convergent episodes in its history, which coincided precisely with the agrarian reform process.

In summary, the statistics from the Department of Cauca show that the municipalities with the largest indigenous populations have experienced a higher rate of population growth. Furthermore, municipalities founded during the colonial period have better development prospects than those founded since independence if they are closer to the departmental capital, which shows the influence of colonial relationships with hierarchies close to the centre.

VI

Associative networks and density: elements of public trust

Since not all associativity embodies social capital, but there is no social capital without associativity, it is necessary to identify the precursors of this asset besides those already examined and establish their repercussions in terms of the coordination of demands, consolidation of networks and growth of trust.

A first step is to ascertain the extent of associative density. Thus, the number of civil society organizations in relation to the total population is a vital indicator if these are the pillars on which networks generating cooperation and trust are being built. It should be noted that these claims are based on a qualitative analysis model applied by surveying civil society organizations registered with the Chamber of Commerce and the Cauca Governor's Office up to 2006. Of the 3,951 organizations registered with these two bodies, it was only possible to confirm that 2,035 were active. About 300 units were then surveyed, the informant in most cases being the legal representative or someone of managerial level.[18]

The information thus obtained yielded a regional picture in which a central zone was home to the greatest number of organizations and saw a large number of social protest movements, built however upon the axis of departmental governance on the basis of relationships of patronage that did not generate a high level of economic activity. Next comes a northern subregion that displays high levels of associative participation and density and the greatest economic dynamism, but that paradoxically functions as an enclave which, strikingly, has a relatively low distributive impact and which furthermore displays a high level of conflict and violence, both in the towns (particularly towards the border with the neighbouring Department of Valle del Cauca) and in the countryside, with struggles over land to the north-east. Then there is a southern subregion, with a recent upsurge of associative groupings seeking to improve their economic prospects on the basis of a campesino production structure. There is an eastern region with manifest problems of connectivity, where the social base is predominantly indigenous and social activity is oriented towards the recovery of identity and the voicing of social demands in the face of State neglect. Lastly, there is a western region located on the Pacific seaboard, also poorly connected, where the bulk of inhabitants are black and the main economic activity is subsistence farming, although it has recently been colonized by industrial crops such as palm, introduced by a sizeable advance guard of businesses from the Andean region (coffee industry), existing side by side with illegal crops. It presents a low level of associative activity and is in thrall to patronage networks, mingled with a paramilitary presence that has displaced the former dominance of guerrillas (see figure 4).

Thus, with connectivity inhibited by the rugged terrain and path dependency exacerbated by the

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[18] Respondents were chosen by simple random sampling. Because of the difficulties of connectivity and the difficult terrain, the interviews were carried out by telephone.

hegemony of patronage networks, governance is weak and the conditions are not conducive to the kind of political legitimacy needed for the coordination of demands and collective action. Consequently, subregional divisions seem to threaten secessionist pressures, particularly in the northern region of Cauca, which has the greatest organizational density, followed by the Massif region (see table 7), both of which are regions characterized by a large presence of ethnic, and particularly indigenous, groups. Civil society and social capital seem to be equally deficient as long-term resources for promoting sustainable growth together with improved income distribution and good governance.

Because patronage networks operate as a centrifugal force dispersing subregional interests, the competitiveness of production structures is undermined in the absence of the contribution from

FIGURE 4

Associative density in Cauca (municipal)
(Per thousand people)

Associative density
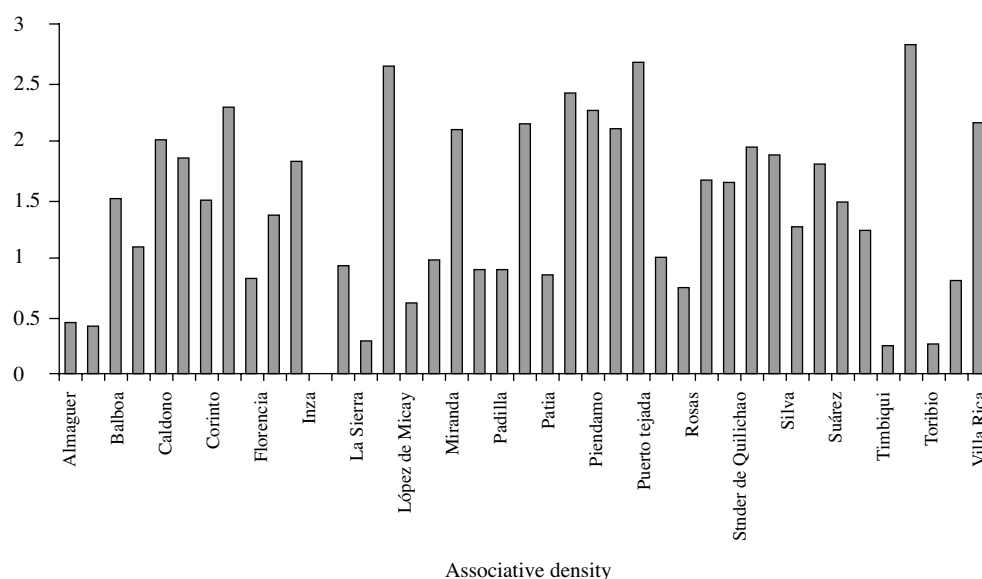
Source: authors' calculations based on survey results.

TABLE 7

Subregional density in Cauca[a]

Subregion	Total number of inhabitants in subregion	Organizations subtotal	Organizations as percentage of regional total (per 1,000 inhabitants)	Subregional density
North	363 992	526	25.85	1.45
South	216 689	241	11.84	1.11
Centre	465 032	234	11.50	0.50
Bota Caucana	76 219	88	4.32	1.15
Massif	65 068	90	4.42	1.38
Pacific	154 236	114	5.60	0.74
East	76 219	88	4.32	1.15

Source: authors' calculations.

[a] Subregional density shows the number of social organizations per 1,000 inhabitants in the different subregions of the Department of Cauca.

an empowered civil society capable of supplementing and legitimizing the action of the State. Since what is at issue is a set of personal relationships operating as an extension of mutual assistance networks, it could easily be argued that this fits within the conceptual framework of social capital described in earlier sections of this paper, but it is a vertical, asymmetrical form of "individual social capital" growing from the east and promoted by indigenous groups as a form of "inward" social capital. Both seem to create a mixture of disjointedness and conflict, of the zero sum game type. However, there needs to be a closer examination of the way networks are created around programmes

and projects to gain a better idea of the outlook for social capital in the department.

The results to some extent bear out the predictions of observations about path dependency and the shift in the tendency of mobilizations in the 1990s. Table 8 reveals weak external social capital, with over 75% of organizations acting privately; if we recall the rent-seeking mechanisms employed since the heyday of the *hacienda* system and the nature of the mining industry, what is being reproduced, it seems, is the creation of organizations to act as rent seekers.

Looking at the lifespan of organizations (see figure 5), we can establish that a bare 10% of them

TABLE 8

Linkages with community activities, institutions or projects

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	No	220	75.1	75.1	75.1
	State institutions	49	16.7	16.7	91.8
	Social institutions	24	8.2	8.2	100.0
	Total	*293*	*100.0*	*100.0*	

Source: authors' calculations.

FIGURE 5

Frequency with which social and civil organizations are created in Cauca, 2007
(Percentages)
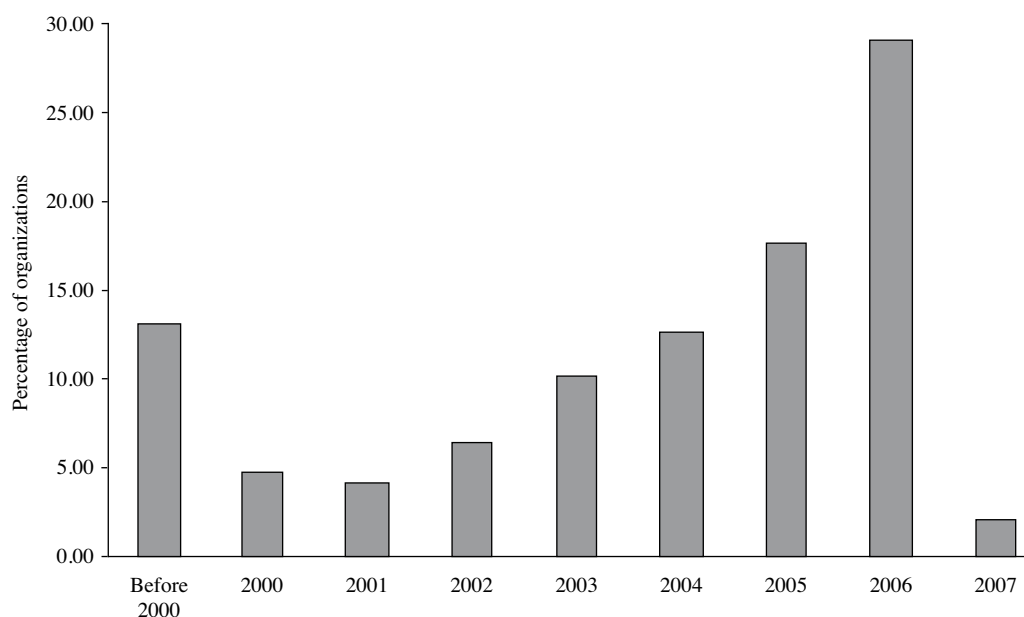
Source: prepared by the authors.

have been in existence for more than six years, meaning that most have had very little time to mature and establish the links needed to increase their production of collective goods. Furthermore, the few projects that are implemented as extensions of collaboration networks operate under the tutelage of the State, which narrows the scope for expanding the public sphere. Naturally enough, given the development levels of the department, most organizations pursue objectives associated with primary activities (agriculture, stockbreeding, mining) and some others, examples being the promotion of housing schemes and ethnic recognition, even though most projects are coordinated with State activities (see table 9).

Just 22.5% of organizations are involved in accountability mechanisms. Furthermore, only about 6.5% have at some time employed a popular participation mechanism like those provided for in the country's constitution to defend some public interest cause, although almost 53% have received instruction or training in the matter. Despite everything, within organizations a majority (83.6%) declare that they trust the members of the group. This may be due to the marked homogeneity of membership, confirming the filial nature of these bodies (see table 10).

What is ultimately surprising, however, is that when asked whether they would be willing to part with 50% of the organization's assets in the interests of undertaking a major project of public interest, most informants (62.1%) said they would (see table 11).

This question was of very particular interest, as it gave an indication of how far trust extended beyond the members of an organization. Considering how poorly resourced most organizations are, lacking even an office or a web page (about 80% of organizations), it is surprising that the bulk of them should have been willing to carry out such an act of altruism, because sound economic logic indicates that, as revenues and assets increase, so does the marginal utility for the public good of displaying greater generosity towards

TABLE 9

Cauca: participation in accountability mechanisms

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	No	227.0	77.5	77.5	77.5
	Yes	66.0	22.5	22.5	100.0
	Total	*293*	*100.0*	*100.0*	

Source: authors' calculations.

TABLE 10

Cauca: trust among members

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	No	48.0	16.4	16.4	16.4
	Yes	245.0	83.6	83.6	100.0
	Total	*293.0*	*100.0*	*100.0*	

Source: authors' calculations.

TABLE 11

Cauca: willingness to relinquish 50% of assets

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	No	111.0	37.9	37.9	37.9
	Yes	182.0	62.1	62.1	100.0
	Total	*293.0*	*100.0*	*100.0*	

Source: authors' calculations.

the community, so that having few resources ought to produce the opposite effect. On the basis of this finding, we can say that not all is gloom, as we have the explicit expression of genuine intentions to generate Putnam-style "civic republicanism", the problem being that the informal ground rules exogenously determine outcomes that are undesirable from the social coordination standpoint. This is precisely

what we see in the obstacles to their operations that organizations identify (see figure 6).

As figure 6 shows, after low incomes (29%) it is political habits and low levels of participation that trammel the scope for achieving a higher level of positive social capital, something that would translate into trust and economic well-being in the Department of Cauca.

FIGURE 6

Greatest obstacle for the organization
(Percentages)
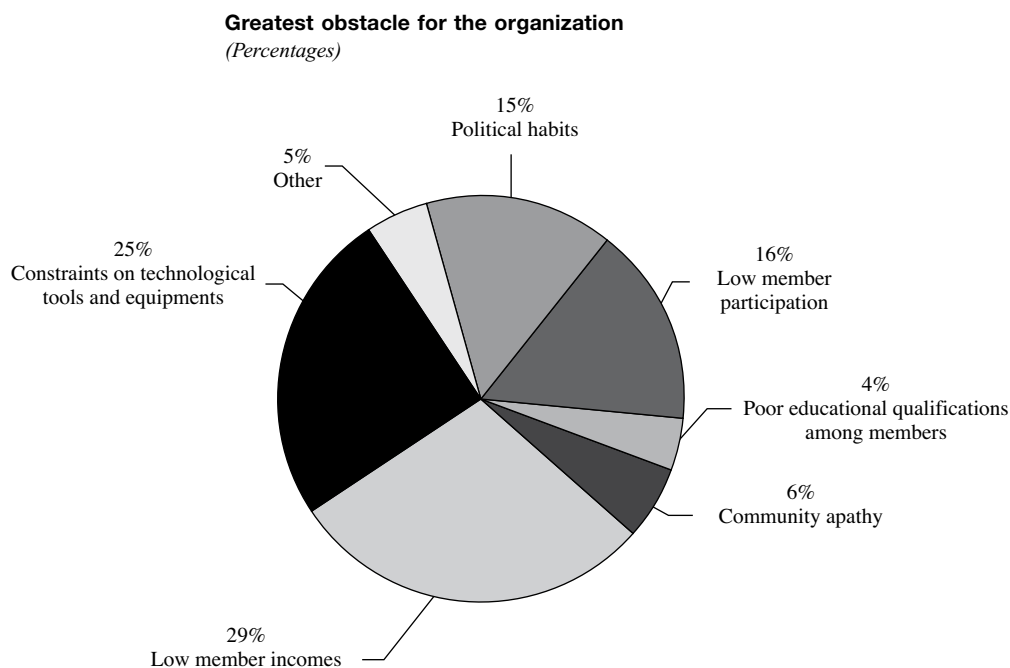
Source: authors' calculations.

VII

Conclusions

Social capital is becoming the missing link with the potential to change the concept of development and promote new forms of representation that generate circles of productivity in particular sociocultural environments. Its dynamic makes it possible to produce strong associative ties that can provide a basis for sustainable growth. Nonetheless, its application in research involves a degree of complexity, as seen in

the tension between the individual and collective levels of human behaviour.

In the case of Cauca, the diversity of organizational dynamics or social learning has given rise to groupings that act in competition or combination with other, traditional ones (parties or interest groups), forming social movements that have strong organizational structures but retain the same practices of affirming

group demands that do not necessarily represent social capital in a broad sense.

On this subject, it is important to stress that the relationship between collective actions and social capital is permeated exogenously by geographical factors and by the endogeneity inherent in institutional (historical) factors. This comes through in the divergence of economic performance. Nor is there sufficient evidence about the explicit link between the development of social mobilization and the generation of this kind of capital, given that the former derives from a desire for ethnic recognition and demands upon the State, while civil society organizations can rather be seen as appendages of the latter and not necessarily its opponents, which ties them in with the patronage practices bequeathed by colonial institutions. Where the two do coincide is in their lack of staying power over time and their limited ability to generate associative networks that transcend filial ties.

Meanwhile, indigenous communities (which to all appearances are the strongest group when it comes to mobilizations and protests) have generated mechanisms for reinforcing contracts by way of punishment and reputation that are fully functional within the ethnic groups concerned but wholly dysfunctional when it comes to strengthening the dynamic of intercourse with the rest of society. We are not unaware that the social relationships embodied in these groups have social capital characteristics; we conclude, however,

that social relationships of this type are not conducive to development (at least, not without the intervention of non-local actors), political best practices and an improved role for the public administration.

In the Department of Cauca, in fact, social organization is only really strong when applied to the construction of identity, and not when it comes to securing local public goods and better living conditions for the region, which are unquestionably key objectives for social capital. Although the right of civil society to self-determination requires obedience to the liberal principles of the rule of law, which are closely related to cultural diversity conjoined with the concept of citizenship, it cannot be at the cost of diminishing the population's quality of life, although it may well banish the hegemonic discourses resulting in underdevelopment.

Lastly, the dichotomy between the structural determinism deriving from path dependence and the capacity of public policies for transformation and change is a key implication that we would wish readers to bear in mind in their analysis. The discussion that has arisen around the exogeneity or endogeneity of the determinants of economic progress means there is an important role for the State in long-term socio-economic organization, as well as for other political and social actors that are important in today's world, without jeopardizing the relative independence of civil society.

(Original: Spanish)

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Mexico: total productivity changes at the

principal container ports

Alejandro Guerrero C. and César Rivera T.

Port performance is commonly measured using partial productivity indicators obtained by relating an output to an input. To ascertain the overall productivity of a port, however, it is more helpful to employ the concept of total productivity, which considers all the inputs employed to obtain the totality of outputs. This factor has been measured using the Malmquist index, which gives the change in total factor productivity (TFP). The present study uses this index to determine the change in the TFP of the principal container ports in Mexico. According to the results obtained, productivity gains were greater at medium-sized terminals such as Progreso and Ensenada than at hubs such as Veracruz and Altamira, even though the latter are more efficient.

Alejandro Guerrero C.

Researcher, Mexican Institute of

Transport

➥ **aguerrero@imt.mx**

César Rivera T.

Lead researcher, Mexican Institute

of Transport

➥ **crivera@imt.mx**

I

Introduction

Ports carry out activities of great importance for external trade. Consequently, measuring the performance of these activities is the first duty of any port authority. In Mexico, port performance is quantified by relating a quantity of output with a quantity of input, such as tonnage handled per crane or tons per ship-hour in port. These indicators are known as partial productivity indicators.

The use of partial indicators is helpful for comparing performance between port activities; they are not so useful, however, when it comes to ascertaining the overall productivity of the port. Accordingly, some researchers have suggested using the concept of total factor productivity (TFP) in the port industry.

TFP is obtained by relating the totality of outputs to the totality of inputs employed in the production process. This measure has only recently been applied to the port sector and the technique most employed has been the Malmquist index, which can measure the change in TFP over different periods. This index can also be used to measure changes in each of the components of total productivity: technical efficiency,

technological change and production scale efficiency. This allows the causes of possible inefficiencies to be ascertained in greater detail.

Understanding how the productivity of a port has behaved over recent years is crucial if the right measures are to be taken to correct the inefficiencies detected, and will enhance the port's strengths. Consequently, the objective of this study is to determine how the total factor productivity of the principal container ports in Mexico has changed.

To achieve this objective, the article is divided into six sections. This Introduction briefly presents the problem. Section II presents the differences between the concepts of efficiency and productivity and the methodology that will be used to develop the model for obtaining TFP. Section III describes cargo flows in Mexican ports and gives a presentation of container traffic. Apart from the sample of ports to be analysed, a decisive factor in obtaining consistent results is the selection of the outputs and inputs that will make up the sample; this is dealt with in section IV. The results obtained in the course of this study are presented in section V. Lastly, section VI offers conclusions.

II

Defining productivity and efficiency

In seeking to quantify the performance of some industry, be it public or private, the concepts of productivity and technical efficiency are commonly used. These concepts are very often —and mistakenly— used without distinction. According to González and Trujillo (2005), the confusion derives from the fact that the more efficient and productive a firm is, the better it performs. While the concepts are closely related, however, they should not be treated alike.

Productivity is defined as the ratio between the volume produced (outputs) and the resources employed to produce it (inputs), while measures of technical efficiency compare observed output with its optimal values. Again, while productivity measures the performance of a production process in the round, efficiency is a component of productivity.

To further clarify the differences between productivity and efficiency, we need to refer to the work of Farrell (1957), considered the precursor of modern efficiency measures. According to Farrell, technical efficiency will tell us whether the resources and technology available are being properly used.

Thus, to quantify technical efficiency it will be necessary to take one or another of the following approaches:
— Output orientation: with this approach, the primary objective will be to measure efficiency by considering the maximum output attainable with a given quantity of inputs.
— Input orientation: here, the standard against which efficiency is measured is the minimum combination of inputs possible for a given output.

Thus, determining efficiency requires a comparative framework that is known as the production frontier, representing the maximum output achievable with the technology available. Farrell suggested that the production frontier should be established on the basis of the highest observed efficiencies, thus employing the concept of benchmarking.

For a better grasp of the above, it is helpful to consider a production process in which just one input is used to produce an output. The relationship between output quantity and input quantity can be interpreted graphically, as we see in figure 1, where the OF curve represents the production frontier. Efficiency will be defined by comparing observed output to this frontier, i.e., firms operating over the frontier will be deemed technically efficient.

For example, if a firm operates at point A of figure 1, it is easy to deduce that it is inefficient, as it could increase its output to point B using the same quantity of inputs, or produce the same amount from fewer inputs (point C). According to the definition of productivity analysed previously, this is represented by the slope of the straight line that runs from the origin

and passes through the point concerned. Thus, it can be observed that efficient firms are also more productive since, as figure 1 shows, the straight lines OB and OC (efficient points) slope more steeply than OA.

Likewise, productivity cannot be increased simply by improving technical efficiency. For example, introducing new technologies into a port by acquiring faster, larger-capacity cranes will shift the production frontier, thereby raising productivity. This is represented graphically in figure 2, where curve OF1 shows the situation arrived at by employing new technologies, and we see that productivity is higher at OD' than at OD.

The last factor affecting productivity is the scale on which production takes place. Observing points A and B in figure 2, we can see that both are efficient, but productivity is greater at B than A since the slope is steeper. Consequently, a firm wishing to be more productive will have to adjust its output to point B.

In summary, improving technical efficiency, producing at an appropriate scale (scale efficiency) and introducing new technologies (technological change) will have a positive effect on port productivity. These

FIGURE 1
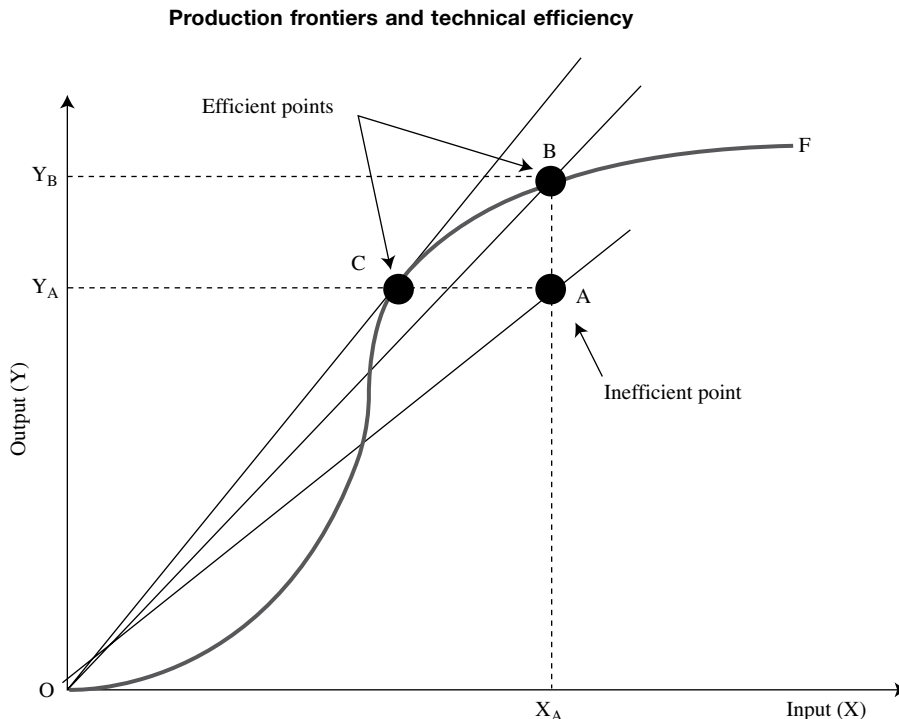
Production frontiers and technical efficiency

Source: T. Coelli, D.S. Prasada Rao and G.E. Battese, *An Introduction to Efficiency and Productivity Analysis*, Boston, Kluwer Academic Publisher, 1998.

FIGURE 2
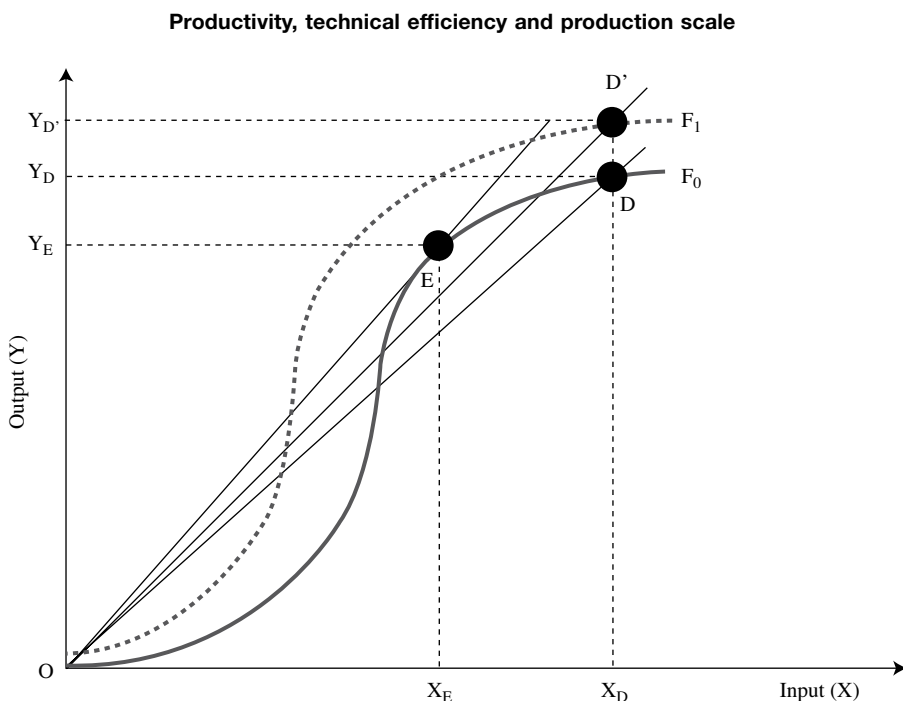
Productivity, technical efficiency and production scale

Source: T. Coelli, D.S. Prasada Rao and G.E. Battese, *An Introduction to Efficiency and Productivity Analysis*, Boston, Kluwer Academic Publisher, 1998.

three factors are known as productivity components, and they are indispensable for determining total factor productivity (TFP), which it is the purpose of this paper to obtain.

The methodology employed to measure changes in TFP is the Malmquist index, which will be described further on. This index is defined using distance functions to describe a multi-input and multi-output technology without the need for any particular behaviour target such as minimizing costs or maximizing benefits (Coelli, Prasada Rao and Battese, 1998).

This paper uses an output-oriented distance function, a technology whose purpose is to maximize the output of an input vector. In other words, the port authority obtains the greatest utility by using its existing infrastructure and equipment more efficiently, maximizing the quantity of twenty-foot equivalent units (TEUs) handled.

Changes in total factor productivity

As Estache, Tovar de la Fe and Trujillo (2004) note, port productivity, more than any other type of transport-related productivity, is related back to partial

indicators. In other words, port authorities usually measure their performance by relating the tonnage handled to the number of cranes or the number of ships turned round per unit of time. These indicators are very useful for ascertaining the productivity of a particular area of the port, but are not well suited to determining overall productivity.

Given the limitations of partial indicators, economists have mainly concentrated on measures of productivity like comparisons of changes in total outputs associated with changes in total inputs, giving rise to the concept of total factor productivity (TFP), which is defined as the ratio between some function that adds outputs and some function that adds inputs (González and Trujillo, 2005).

Mathematically, this is equivalent to applying the corresponding additions in the productivity ratio, whereby the following expression is obtained:

$$TFP = \frac{\sum_{m=1}^{M} u'_m \, y_m}{\sum_{k=1}^{K} v'_k \, x_k} \tag{1}$$

where *TFP* is total factor productivity for *M* products employing *K* inputs and *u'* and *v'* are weights, since not all inputs or outputs can be equally important.

Consequently, the change in total productivity can be estimated as the ratio of the change in TFP over a period of analysis. To clarify this, we shall once again take the example of a firm that produces one output and employs one input for the purpose. The expression that tells us how productivity changed between a starting period (t) and a final period ($t + 1$) is:

$$\frac{y_{t+1}\big/x_{t+1}}{y_t\big/x_t} \tag{2}$$

Expression (2) has two peculiarities. The first, which has already been remarked upon, is that it can only be used for production processes involving one output and one input. The second is that it only compares productivity levels observed in two periods, assuming that the technology has remained constant.

To solve this, use has been made of the Malmquist index proposed by Caves, Christensen and Diewert (1982). This index employs the distance functions introduced by Shephard (1953) to determine the distance between the entities compared and the most efficient ones.

The Malmquist productivity index has been represented by the following function:

$$M_{oc}^t\left(x^t, y^t, x^{t+1}, y^{t+1}\right) = \frac{D_{oc}^t\left(x^{t+1}, y^{t+1}\right)}{D_{oc}^t\left(x^t, y^t\right)} \tag{3}$$

where $M_{oc}^t\left(x^t, y^t, x^{t+1}, y^{t+1}\right)$ compares (x^{t+1}, y^{t+1}) with x^t, y^t, obtaining the distance between them and the best possible benchmark given the technology of period t, i.e., T_c^t. Thus, a value greater than 1 in expression (3) would indicate that the value of TFP has increased, whereas the opposite is true of values below 1.

Similarly, the corresponding ratio can be determined taking the technology of period $t + 1$ as the base, i.e., T_c^{t+1}, which gives the expression:

$$M_{oc}^{t+1}\left(x^t, y^t, x^{t+1}, y^{t+1}\right) = \frac{D_{oc}^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D_{oc}^{t+1}\left(x^t, y^t\right)} \tag{4}$$

Thus, expressions (3) and (4) assume that the technology remains the same at times t and $t + 1$. Caves, Christensen and Diewert (1982) argued that changes in technology could be determined by calculating the geometric mean of the expressions above, whence the Malmquist index:

$$M_{oc}\left(x^t, y^t, x^{t+1}, y^{t+1}\right) =$$
$$\left[\frac{D_{oc}^t(x^{t+1}, y^{t+1})}{D_{oc}^t(x^t, y^t)} \times \frac{D_{oc}^{t+1}(x^{t+1}, y^{t+1})}{D_{oc}^{t+1}(x^t, y^t)}\right]^{1/2} \tag{5}$$

The Malmquist index can be represented graphically if we once again consider the process of producing one output with one input. Figure 3 shows the "distances" that will need to be obtained to measure the change in productivity that took place between point E($t + 1$) and D(t), taking the technologies of the two periods as frontiers.

Consequently, the change in technical efficiency and technological change would be determined by the following expressions:

$$\text{Change in technical efficiency} = \frac{y_{t+1}\big/y_c}{y_t\big/y_a}$$

$$\text{Technological change} = \left[\frac{y_{t+1}\big/y_b}{y_{t+1}\big/y_c} \times \frac{y_t\big/y_a}{y_t\big/y_b}\right]^{1/2}$$

Thus, as argued by Coelli, D.S. Prasada Rao and G.E. Battese (1998), an equivalent way of writing equation (5) is:

$$M_{oc}\left(x^t, y^t, x^{t+1}, y^{t+1}\right) = \frac{D_{oc}^t(x^{t+1}, y^{t+1})}{D_{oc}^t(x^t, y^t)}$$
$$\left[\frac{D_{oc}^t(x^{t+1}, y^{t+1})}{D_{oc}^{t+1}(x^{t+1}, y^{t+1})} \times \frac{D_{oc}^t(x^t, y^t)}{D_{oc}^{t+1}(x^t, y^t)}\right]^{1/2} \tag{6}$$

In equation (6), the ratio outside the square brackets represents the change in technical efficiency, while everything inside the brackets is technological change.

To estimate the four measures of the distance given in equation (5), both econometric and linear programming methods are used. The present paper employs data envelopment analysis (DEA), based on linear programming techniques.

FIGURE 3
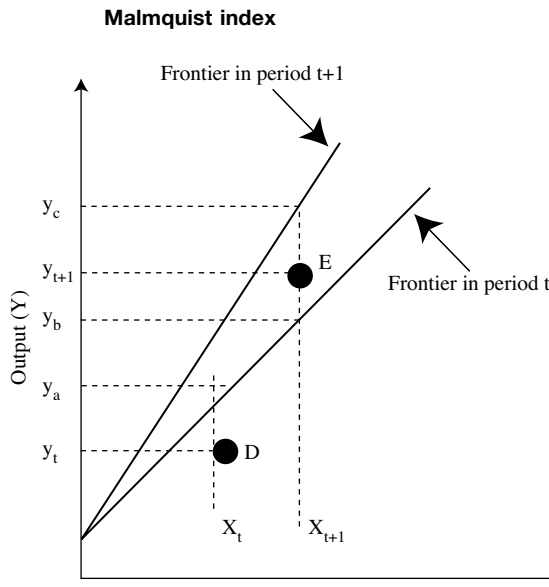
Malmquist index

Source: T. Coelli, D.S. Prasada Rao and G.E. Battese, *An Introduction to Efficiency and Productivity Analysis*, Boston, Kluwer Academic Publisher, 1998.

To address problems of linear programming, Fare and others (1994) assumed a constant scale of return and had the following linear programming problems:

$$\left[d_0^t(x_t, y_t) \right]^{-1} = \max_{\phi, \lambda} \phi,$$
$$\text{sa} \quad -\phi y_{it} + Y_t \lambda \geq 0, \qquad (7)$$
$$x_{it} - X_t \lambda \geq 0,$$
$$\lambda \geq 0$$

$$\left[d_0^{t+1}(x_{t+1}, y_{t+1}) \right]^{-1} = \max_{\phi, \lambda} \phi,$$
$$\text{sa} \quad -\phi y_{i,t+1} + Y_{t+1} \lambda \geq 0, \qquad (8)$$
$$x_{i,t+1} - X_{t+1} \lambda \geq 0,$$
$$\lambda \geq 0$$

$$\left[d_0^t(x_{t+1}, y_{t+1}) \right]^{-1} = \max_{\phi, \lambda} \phi,$$
$$\text{sa} \quad -\phi y_{i,t+1} + Y_t \lambda \geq 0, \qquad (9)$$
$$x_{i,t+1} - X_t \lambda \geq 0,$$
$$\lambda \geq 0$$

$$\left[d_0^{t+1}(x_t, y_t) \right]^{-1} = \max_{\phi, \lambda} \phi,$$
$$\text{sa} \quad -\phi y_{it} + Y_{t+1} \lambda \geq 0, \qquad (10)$$
$$x_{it} - X_{t+1} \lambda \geq 0,$$
$$\lambda \geq 0$$

As pointed out by Coelli, D.S. Prasada Rao and G.E. Battese (1998), it is possible to decompose the change in technical efficiency into a change in production scale efficiency and a change in "pure" technical efficiency. To do this, it is necessary to consider two linear programming problems by repeating problems (7) and (8) and adding the convexity constraint $(N1'\lambda = 1)$.

The distance functions thus calculated are based on a characterization of the technology in accordance with technical best practice. By measuring their Malmquist index value, we can decompose changes in total productivity into their three components, i.e., change in pure technical efficiency, change in scale efficiency and technological change (Maudos, Pastor and Serrano, 1998).

While numerous studies have set out to ascertain the technical efficiency of ports with both econometric techniques and linear programming, the application of the Malmquist index to the port industry is recent and only a few studies have addressed the subject.

As mentioned above, technical efficiency is one of the components of productivity, and it is necessary (though not sufficient) for this to be calculated in order to measure the change in total productivity. A good compilation of studies that have sought to measure technical efficiency in ports can be found in González and Trujillo (2005). The present paper will refer only

to those that have employed the Malmquist index to measure changes in total productivity.

Estache, Tovar de la Fe and Trujillo (2004) measured changes in TFP in twelve Mexican ports. The objective of that study was to ascertain whether the introduction of private-sector capital had brought improvements in the productivity and efficiency of Mexican ports. The choice both of the period for analysis and of the inputs and outputs employed took account of this objective; since private-sector capital began to be introduced between 1996 and 1999, they considered that this period would yield accurate conclusions. The output selected was tonnage handled, while inputs were represented by the length of docks available to the Integral Port Administration (API) and the number of workers it employed. The findings showed that there had been gains in TFP at the great majority of ports, with only Topolobambo and Tampico showing a decline.

In a second study, Liu, Liu and Cheng (2006) applied the Malmquist index and ascertained the change in TFP for a good many container terminals in China. This study is important because ports in Asia, and China in particular, have grown substantially over the present decade and have been displacing North American and European ports in container traffic. According to the study cited, the container terminals with the highest levels of activity improved their TFP, while the opposite happened at small terminals.

The results of the Malmquist index have been a topic of discussion in various areas, since as Coelli, Prasada Rao and Battese (1998) argue, the assumption of a constant scale of returns can lead to errors when calculating changes in efficient scale, given that in practice it is more common to assume a variable scale of returns.

Again, there are a number of considerations to be taken into account when applying this index to the complex port sector since, as Doerr and Sánchez (2006) mention, it is difficult to quantify all activities using just one indicator.

III

The Mexican port system

The system comprises 114 ports, of which only 26 handle ocean-going cargoes, i.e., they are foreign trade ports which we can classify into three groups:

Hub ports. These account for the bulk of ocean-going traffic; in 2007, Veracruz, Altamira, Lázaro Cárdenas and Manzanillo handled 64.8% of the total.

Secondary ports. These handle less cargo than the above in their role as hubs, but have a substantial market share and possess terminals capable of handling almost every type of cargo. Ensenada, Tampico, Coatzacoalcos and Progreso are in this group.

Ports that act as hubs for a single cargo type. These are specialized terminals for particular goods, such as Isla de Cedros, Isla San Marcos, Punta Santa María and Punta Venado.

Since port liberalization in 1993, the main ports have increased their market share thanks to the competitive advantages they enjoy. Traffic was less concentrated prior to liberalization, particularly at the Pacific ports, where in the late 1980s the likes of Guaymas, Mazatlán and Salina Cruz gave balance to container handling, which is now dominated by Manzanillo and Lázaro Cárdenas.

As Martner (2002) notes, the situation is somewhat different in the Gulf of Mexico, since cargo handling at its ports has always been quite heavily concentrated; the historical importance of Veracruz and Tampico always gave them a preponderance over other terminals. The great change after port liberalization came with the incorporation of the port of Altamira, which gradually displaced Tampico as a cargo hub, particularly where containers were concerned.

In summary, it transpires that the four Mexican ports handling the most cargo overall also handle the most container cargo, these being Manzanillo and Lázaro Cárdenas on the Pacific seaboard and Veracruz and Altamira on the Gulf of Mexico. These four ports have achieved this positioning in the Mexican market because they serve not just the urban centres close to them, but also other regions for which geographical proximity is not such an issue because they have a multiregional system of transport connections.

The concentration of container handling at these ports goes back a long way. Veracruz was the national leader in cargo movements of this type until 2001.

Trade with Asia began to grow substantially from that time on, so that the port of Manzanillo became the busiest. As already mentioned, Altamira gradually left Tampico behind; in 2000, Altamira handled just over 3.5 times as many containers as Tampico, whereas by 2007 it was handling almost 36 times as many. As for Lázaro Cárdenas, while it handled fewer containers than the other three hub ports in 2007, its growth since 2003 has been substantial. The figures for container traffic are given in table 1.

TABLE 1

Mexican ports: container cargo handled, 2000-2007
(TEUs^a)

Port	2000	2001	2002	2003	2004	2005	2006	2007
Pacific	*477 658*	*505 668*	*704 800*	*773 861*	*928 204*	*1 098 447*	*1 564 173*	*1 830 387*
Ensenada	26 822	26 016	53 142	46 332	39 202	75 101	123 711	120 324
San Carlos	362	-	-	-	-	-	-	-
Pichilingue	362	-	-	-	-	-	-	28
Guaymas	498	-	33	2	-	-	25	4
Mazatlán	16 813	18 315	12 900	16 394	15 954	17 559	30 111	29 363
Manzanillo	426 717	458 472	638 507	708 417	829 603	872 386	1 249 630	1 409 614
Lázaro Cárdenas	752	-	134	1 646	43 445	132 479	160 696	270 240
Salina Cruz	5 332	2 865	84	1 070	-	922	-	734
Puerto Chiapas	-	-	-	-	-	-	-	80
Gulf and Caribbean	*835 841*	*847 430*	*858 228*	*910 580*	*974 356*	*1 034 766*	*1 112 518*	*1 232 033*
Altamira	182 545	206 864	225 937	256 417	297 017	324 601	342 656	407 657
Tampico	49 472	29 531	18 848	14 347	9 862	9 001	10 243	11 040
Tuxpán	104	341	276	58	1	15	24	8
Veracruz	540 014	543 327	548 422	571 867	591 736	620 858	674 872	729 717
Dos Bocas	-	-	-	64	150	265	46	80
Seybaplaya	-	-	-	-	-	12	98	5
Progreso	56 581	60 117	57 787	60 312	68 082	71 769	75 692	75 584
Puerto Morelos	7 125	7 250	6 958	7 515	7 508	8 245	8 887	7 942

Source: prepared by the authors on the basis of data from the Department of Ports and the Merchant Navy of the Secretariat of Communications and Transport.

^{a} Twenty-foot equivalent units.

IV

Data sample for the study

A port's productivity is difficult to measure because of the array of actors and interests that meet together there. For example, a port provides a wide variety of services, such as cargo transfer from one mode of transport to another, cargo consolidation and deconsolidation and ship servicing. The inputs and outputs selected will depend on which service is to be analysed.

In the present study, we consider that the main function of a port is to move merchandise, so that the output selected was the amount of containers handled by the port. On this basis, the ports selected were those with a continuous record of container handling, namely Ensenada, Mazatlán and Manzanillo on the Pacific seaboard and Altamira, Tampico, Veracruz and Progreso on the Gulf.

The decision was taken not to include Lázaro Cárdenas in the sample because it was an outlier. In the starting year for the sample (2000), TEU throughput at this port was practically nil, whereas in 2007 the

port's container traffic represented about 9% of the total. The extraordinary growth recorded by this port causes a deviation in the sample, making its inclusion unadvisable.

Again, when selecting inputs it is necessary to bear in mind that they have to represent the three basic inputs employed in the production function, namely land, labour and capital. The port infrastructure data are very representative of the land and capital inputs, represented in the present study by storage area and length of docks, respectively. As for labour, consideration was given to the possibility of including the number of workers at the port; this information is not easy to obtain, however, so this input was represented by the amount of equipment owned by the port, since according to Herrera and Pang (2005), there is a close relationship between the number of workers and the amount of equipment in a port.

Ports have a great variety of equipment, but containers are basically moved by yard and dockside gantry cranes, and it is these that are used as inputs in the present study.

The analysis was carried out for the period between 2000 and 2007. A sample of seven ports was covered for a period of eight years, using four inputs and one output so that, given the methodology employed, we consider the data panel acceptable for the objective of this study.

V

Changes in total factor productivity (TFP)

As already noted, the Malmquist index can be used to obtain changes not just in TFP, but also in each of the components of productivity, namely technical efficiency, production scale efficiency and technological change. The Data Envelopment Analysis Program (Coelli, 1996) was used for the present study.

The change in TFP showed an improvement in almost all the ports analysed since all the ports other than Veracruz and Tampico presented improvements in TFP. Table 2 shows the cumulative index of change in TFP. To obtain this table, the starting point taken was the first productivity value obtained and productivity changes observed in subsequent periods

were measured from this base, so that a value under 1 indicates falling productivity and a value over 1 rising productivity.

The interpretation of the results is presented in figure 4, which shows that Progreso is the port with the highest value, followed by Ensenada and Manzanillo. It should be stressed that the values given in figure 4 are not a comparative measure of the productivity levels observed in each port but the cumulative change in total productivity over the period analysed. The starting value is therefore 1 for each port, and changes in total productivity are measured in relation to this.

TABLE 2

Cumulative index of change in port TFP[a]

Year	Ensenada	Mazatlán	Manzanillo	Altamira	Tampico	Veracruz	Progreso
2000	1	1	1	1	1	1	1
2001	0.963	1.059	1.073	1.131	0.612	1.006	1.440
2002	1.887	0.765	1.297	1.235	0.387	0.921	1.073
2003	1.638	0.941	1.437	0.862	0.286	0.962	1.459
2004	1.389	0.941	1.685	1	0.204	0.754	1.653
2005	1.068	1.059	1.717	1.094	0.183	0.791	1.751
2006	1.766	1.765	2.070	1.010	0.102	0.860	2.771
2007	2.128	1.707	2.124	1.357	0.215	0.930	2.771

Source: prepared by the authors.

[a] Total factor productivity.

FIGURE 4

Cumulative index of change in total productivity
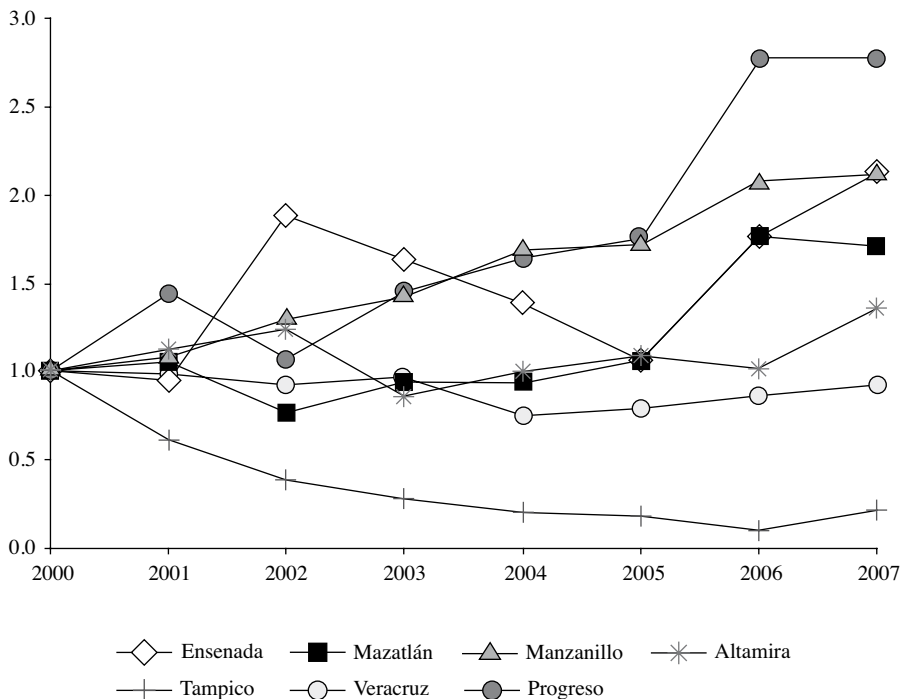
Source: prepared by the authors.

Obtaining the change in each of the components of productivity is important, as this allows us to establish possible reasons for unfavourable changes in total productivity.

Thus, analysis of each of the components of productivity showed that Manzanillo experienced no change in technical efficiency, with the value remaining unchanged at 1. This was because it was the port that presented the greatest technical efficiency throughout the period analysed; being always at the efficiency frontier, it cannot present an improvement in this factor.

Progreso and Ensenada recorded the greatest changes in technical efficiency. In the efficiency analysis, both Progreso and Ensenada had a low starting value (about 25% for both ports), while by the end of the period this value had risen to 65% and 59% for Progreso and Ensenada, respectively. The opposite is the case at the ports of Veracruz and Tampico, which had high values for technical efficiency at the beginning of the sample but lower values in the later years, most significantly in the case of Tampico. The results of this productivity component are shown in table 3.

Where changes in production scale are concerned, Ensenada and Progreso once again presented the greatest impact. Ensenada was the port that saw traffic grow the most during the period analysed, from 26,822 TEUs in 2000 to 120,324 in 2007. This substantial increase in production scale meant that the port was closer to achieving an appropriate scale by the end of the sample period.

Progreso did not present a significant increase in its TEU throughput, and the scale of operations at the port may consequently be said to be appropriate, so that a rise in production levels could mean a decline in TFP.

In 2004, Veracruz experienced a decline in both production scale and technical efficiency. This was caused by a falling-off of traffic growth at the port, and by its acquisition of port equipment that year. The values of both components rose after that year, but still finished the period lower than they began it (see tables 4 and 5).

Thus, Veracruz, having been the national leader in container movements up until 2002, not only lost this position to Manzanillo but has lost share in the

TABLE 3

Cumulative index of change in pure technical efficiency

Year	Ensenada	Mazatlán	Manzanillo	Altamira	Tampico	Veracruz	Progreso
2000	1	1	1	1	1	1	1
2001	**0.949**	1.053	1	1.125	**0.609**	1	1.395
2002	2.137	**0.843**	1	1.180	**0.415**	1	1.184
2003	1.797	1.065	1	**0.905**	**0.324**	1	1.588
2004	1.400	**0.979**	1	**0.965**	**0.212**	0.713	1.653
2005	1.089	1.114	1	1.068	**0.193**	0.756	1.771
2006	1.773	1.828	1	**0.971**	**0.106**	0.809	2.761
2007	2.211	1.645	1	1.180	**0.208**	0.894	2.468

Source: prepared by the authors.

TABLE 4

Cumulative index of change in production scale efficiency

Year	Ensenada	Mazatlán	Manzanillo	Altamira	Tampico	Veracruz	Progreso
2000	1	1	1	1	1	1	1
2001	**0.949**	1.053	1	1.074	**0.609**	1	1.361
2002	2.212	**0.843**	1	1.127	**0.415**	1	1.147
2003	1..980	1.065	1	1.026	**0.324**	1	1.667
2004	1.542	**0.979**	1	1.044	**0.212**	0.983	1.735
2005	1.374	1.114	1	1.057	**0.193**	0.985	1.855
2006	2.126	1.828	1	1.075	**0.106**	0.985	2.269
2007	2.523	1.645	1	1.127	**0.208**	0.995	2.171

Source: prepared by the authors.

TABLE 5

Cumulative index of technological change

Year	Ensenada	Mazatlán	Manzanillo	Altamira	Tampico	Veracruz	Progreso
2000	1	1	1	1	1	1	1
2001	1.015	1.006	1.073	1.006	1.006	1.006	1.033
2002	**0.883**	**0.906**	1.297	1.047	**0.934**	**0.921**	**0.906**
2003	**0.911**	**0.883**	1.437	**0.953**	**0.883**	**0.962**	**0.919**
2004	**0.992**	**0.961**	1.685	1.037	**0.961**	1.058	**0.999**
2005	**0.981**	**0.950**	1.717	1.025	**0.950**	1.047	**0.988**
2006	**0.995**	**0.964**	2.070	1.041	**0.965**	1.062	1.003
2007	**0.961**	1.036	2.124	1.152	1.034	1.040	1.123

Source: prepared by the authors.

Gulf to Altamira. This is mainly because of physical constraints at Veracruz, with lack of capacity causing it to lose business to Altamira.

The reduction in TEU throughput at Veracruz provides an example of the kind of care that needs to be taken when measuring TFP. Even though the fall-off in traffic may be due to situations unconnected with the port's productivity, the model treats it as an inefficiency, translating into a loss of productivity. To return to the

example, there is a widespread perception that Veracruz is more efficient and productive than Altamira, so that if the idea is to analyse port competitiveness the model needs to be strengthened by bringing in extra factors such as service levels, interconnection with other modes of transport, differentiation, etc.

Another limitation of the methodology was detected by Tongzon and Heng (2005), who observed when analysing the productivity of port terminals in

Europe that both Hamburg and Rotterdam presented low indices of productivity, contrary to customer perceptions. When they came to examine the causes, these authors observed that both ports had made major infrastructure investments. What the model construed as a loss of productivity, customers of these ports perceived as the opposite.

Consequently, a further line of research would consist in incorporating an analysis of the factors mentioned into the model to avoid erroneous conclusions.

VI

Conclusions

The Malmquist index is a tool that allows changes in total productivity to be determined and decomposed into each of their components. This is important for the implementation of sound strategic planning policies.

Applying the Malmquist index to Mexican ports revealed that the ports of Progreso and Ensenada (whose container throughput is not so significant) were the ones that presented the greatest changes in total factor productivity (TFP), as their superior productivity has enabled them to compete advantageously with the great hub ports and survive the competitive disadvantages they work under.

Of the hubs, Manzanillo is the one that experienced the greatest changes. It was followed by Altamira and Veracruz (the latter experienced a negative change in TFP); the two ports compete fiercely to attract flows of goods along the Gulf coast, where Veracruz is beginning to lose ground. It is important for Veracruz to attract larger flows of merchandise to recover the levels of productivity and efficiency it displayed during the early years of the analysis.

The TFP changes obtained leave out some aspects that are important for port productivity, such as service levels, the capacity to adapt to markets and other factors which would be worth analysing to obtain a fuller understanding of port competitiveness.

Another aspect deserving of attention is that while this tool is very useful for calculating productivity, it can be enhanced if supplemented with other strategic planning techniques.

(Original: Spanish)

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Economic Survey of Latin America and the Caribbean 2008-2009, LC/G.2410-P. United Nations publication, Sales No. E.09.II.G.2, ECLAC, Santiago, Chile, July 2009.

The publication of the sixty-first edition of the Economic Survey of Latin America and the Caribbean, corresponding to 2008-2009, comes at a critical point in the economic development of the Latin American and Caribbean region. A growth phase that the region's recent history cannot equal in nature and duration has come to an end and output is contracting. The toll this state of affairs is taking on the well-being of the population will inevitably be reflected in setbacks in social variables. Two traits set the current situation apart from the many crises that have beset the region in decades past. First, this crisis did not originate in the region or even in another emerging economy, but in the world's largest economy, whence the effects spread worldwide, albeit with significant differences among countries and regions. Second, since the countries have (albeit with major exceptions) reduced their debt and built up their reserves during the boom years, the region overall is better prepared than in the past, and than other regions this time around, to tackle the crisis. These traits, in turn, have two implications. First, the rate of contraction forecast for 2009 is relatively moderate although, again, with sharp differences among the countries of the region. Second, the recovery depends to a great extent on an upturn in the global economy overall.

The first part of this edition of the Economic Survey looks at the channels through which the crisis is affecting the economies of the region and its impact on variables such as economic growth, employment and external-sector indicators. It also discusses the strengths and weaknesses of the countries in dealing with the fallout from the global crisis and the economic policies they have deployed to this end. The analysis covers the performance of the region's economy in 2008 and the first semester of 2009 and concludes with a discussion of the outlook for the second half of the year. This chapter draws on an extensive statistical appendix.

The nature of the recovery will depend greatly on developments in the world economy, but also on the way the countries prepare for the challenges of the future. Macroeconomic management of the crisis is crucial, but so, as ECLAC has emphasized on many occasions, is laying the foundations for sustainable growth, based on growing systemic competitiveness, greater social cohesion and environmentally sustainable production and consumption structures. A key task for the countries of the region is therefore to develop institutions that can help achieve those objectives. This year's Economic Survey looks in particular at the fabric of labour institutions which, in the recent past, have been at the centre of polarized confrontations and hotly contested debates. Today, however, opportunities have opened up for a more balanced discussion in which is it accepted that such institutions are called upon to fulfil a number of objectives and one-sided views have no place.

The first chapter of the second part of this report reviews the historical development of labour institutions in the region, the great variety of institutions among countries and the role of their main components. The second chapter looks at recent changes in a number of specific institutions, the minimum wage, trade unions and collective bargaining, as well as unemployment protection systems. The evidence of their effects on the operation of the labour market is examined, along with alternatives for improving them. The third chapter is devoted to active labour-market policies, specifically training and skills-building, public-sector employment services, direct and indirect job creation and the promotion of own-account work. The fourth chapter discusses policy choices for promoting productive labour-market integration for young people and women, who often face exclusion and discrimination in the labour market. The fifth chapter sums up the conclusions regarding the challenges surrounding labour institutions and mechanisms for moving towards achievement of the objectives discussed.

Lastly, the individual performance of each economy in 2008 and in the first half of 2009 is analysed in the country notes. In addition to the information provided in the country notes, trends in the main economic indicators are reported in the statistical appendix. The notes, together with the statistical appendix for each country, are contained in the CD-ROM that accompanies the printed publication and are also available on the ECLAC website (www.eclac.org). The tables presented in the statistical appendix provide ready access to data for recent years and allow the creation of spreadsheets. This CD-ROM also contains the electronic versions of the first and second parts of the printed publication.

The statistical information presented in this publication reflects the data available up to 30 June 2009.

Latin America and the Caribbean in the World Economy 2008-2009. Crisis and opportunities for regional cooperation, LC/G.2413-P. United Nations publication, Sales No. E.09.II.G.62, ECLAC, Santiago, Chile, December 2009, 108 pages.

The 2008-2009 edition of Latin America and the Caribbean in the World Economy is divided into three chapters.

Chapter I offers a medium-term view of the current international economic conditions, examining in particular the variables that are most likely to shift global scenarios and affect the position of the Latin America and Caribbean economies in the world economy. The crisis has triggered or accentuated trends such as the growing significance of the emerging economies (with the resulting impact on the region's trade flows), and the differentiated patterns of world trade in manufactures, commodities and services. Chapter I also reviews the debates currently taking place in international forums on climate change and trade, and the various forms of protectionism that have arisen as a result of the crisis.

Chapter II looks at the immediate and long-term implications of the current crisis for regional trade patterns, in terms of origins, destinations and the sectoral composition of trade flows. It also analyses the behaviour of commodity prices, terms of trade, international trade in services, tourism, foreign direct investment (FDI) and remittances. Lastly, the region's trade policy responses to the crisis are discussed.

Chapter III examines opportunities for regional cooperation in Latin America and the Caribbean. The new international conditions call for greater cooperation among the countries of the region, not only to contain the fallout from this crisis, but also to improve the region's position in the global economy. With this in mind, seven areas of cooperation are proposed: infrastructure, trade facilitation, innovation, reduction of asymmetries, social cohesion, climate change and closer ties with Asia-Pacific. These are all determinants of the region's competitiveness, innovation and productivity in the medium and long terms. In this regard, the consequences of losing the global competitiveness race would be much worse than the effects of the current crisis which, painful as they may be, will be temporary. Conversely, lags in competitiveness, innovation and productivity represent a permanent obstacle to the implementation of growth-with-equity strategies.

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