Annexes

Annex I

1.   Indicators of structural change

The different indicators of structural change used in chapter II have both advantages and disadvantages. The classic indicators of technological effort (research and development) and outcomes (patents) do not capture the minor, incremental innovations produced by firms in developing countries in the course of the production process—sometimes referred to as "informal R&D". This sort of innovation arises out of idiosyncratic technological efforts that are not related to formal R&D (Research and Development) departments; often the firms themselves do not even think of it as innovation. Incremental innovations in developing countries are frequently a form of troubleshooting, i.e. responses to localized production problems. They generate no patents, but they do lead to secondary innovations and productivity gains which, though small when counted individually, can give a firm a significant comparative advantage over time. The evidence suggests that when developing-country firms adapt imported technology to local technological conditions and markets, they generate specific technological assets which can give rise to competitive advantages in other developing-country markets through exports or FDI (Katz, 1997).

The technological intensity of the manufacturing sector is measured by two indicators: the share of medium- and high-tech manufacturing exports in total exports (X_MHT/T) and the relative share of the engineering-intensive sectors in total manufacturing value added (EIS). These indicators are biased, since they do not capture innovations in agriculture and, especially, in services, which have become important vectors of technical progress in the past few years. It is not yet clear how the new technologies will affect the position of industry within technology networks in the future. Nevertheless, manufacturing has been and remains a hub of technical progress and some of its segments —especially engineering and electronic engineering— represent a stock of technological capacities and human capital which complements and often leads innovation and

learning in other areas.[1] For that reason, and notwithstanding their limitations, X_MHT/T and EIS reflect a set of capacities which go beyond manufactures and may be considered useful proxies for the capacities existing within an economy.

At the same time, X_MHT/T has major disadvantages compared with EIS. This is because X_MHT/T refers to products, not processes, and therefore cannot distinguish higher-technology exports based on local capacities from exports based on the vertical subdivision of the production process (in which the simplest, least-skilled activities are transferred to developing economies). Accordingly, countries which export electronics goods under a maquila system display a high X_MHT/T, but this does not reflect a knowledge-intensive production structure.

The adaptability index (AI) seeks to capture a purely Keynesian dimension of efficiency. It is disaggregated to a three-digit level and captures the intensity of demand growth for different sectors in the international economy. Despite its breadth, it has some problems. First, Keynesian efficiency depends not only on export growth, but also on the ability to compete in the domestic market with goods that have a high income elasticity of demand. Buoyant export growth can signify little growth (and little Keynesian efficiency) if imports are growing faster than exports. In other words, indicator AI captures only one side of the equation that defines Keynesian efficiency.[2]

Second, in the short run technology is given and the commodity lottery may affect the dynamism of exports. But, in the long run, AI depends on technological capabilities. Keynesian (growth) and Schumpeterian efficiencies are linked and countries with more knowledge-intensive structures will be able to enter fast-growing markets offering higher returns. This being so, indicator AI may not be viewed as being purely demand-side, especially when used in an analysis that considers a period of several years.

Indicator EXPY (measuring the sophistication level of exports), too, reflects the structure's capacities only partially, since it covers only exports and overestimates capacity in countries —such as Mexico and the Central American countries— whose maquila and duty-free export industries are significant.

Identifying the difficulties of each indicator is a necessary step towards correctly interpreting the results of the empirical analysis. These difficulties do not invalidate the indicators, but they make it necessary to look at them in conjunction and find the overlaps and complementarities between the information they provide.

2.   Convergence, divergence and balance of payments

The long-term rate of growth (LTG) which is compatible with external equilibrium in an economy can be estimated by finding the income elasticity of imports of goods and services, combined with the growth rate of exports. As noted earlier, this growth rate is not necessarily obtained at each point in time. Growth in the short run may differ from the long-run equilibrium rate of growth, and much of the history of economic cycles has to do with the resulting lags. However, LTG provides useful information about changes in growth patterns and the production structure over the long term.

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[1]   For example, a recent study on the use of digital technologies in the European Union found that the largest users were industrial sectors. Within services, only financial services were among the main users. What is more, the gap between industry and finance and the rest of the sectors in the economy is not narrowing, but widening (Friedrich and others, 2011).

[2]   Analysis of the ratio of the income elasticities of demand for exports and imports corrects this problem (see later for more details).

A classic way to perform this estimate is to cross information on the pattern of specialization, performance and cyclical dimensions (principally the balance of payments) of growth as shown in figure I.A-1. Underlying this figure is the idea that long-term external equilibrium requires goods and services exports to grow at the same pace as imports. For that to happen, the following equality must be satisfied:[3]

$$\frac{y^E}{z} = \frac{\varepsilon}{\pi}$$

(1)

In equation (1) y^E is LTG, z is growth in the rest of the world, ε is the income elasticity of exports and π is the income elasticity of imports. When the actual growth rate is equal to LTG, then $y = y^E$, and equation (1) holds. This equality, which is satisfied over the long run, has been called the "45-degree rule" (Krugman, 1988). If the relative growth rate (y/z) is denoted on the ordinate axis and the ratio of the income elasticities of exports and imports on the abscise axis (ε/π), we obtain a 45-degree straight line on which all points correspond to sustainable growth, inasmuch as no external deficits are being accumulated that could later force a downward adjustment of growth. If actual growth exceeds the growth rate of the global economy, then convergence with the rest of the world is given by ($y/z > 1$). The concept of convergence employed here is defined with reference to the global economy, not just developed countries.

Combining the 45-degree straight line (whose points represent the case in which the effective relative rate of growth is equal to LTG, $y/z = \varepsilon/\pi$) and the horizontal line at the unity (which represents the case in which the country grows at the same rate as the world economy, $y/z = 1$), four quadrants are identified as shown in figure I.A-1.

The upper-left quadrant (above the 45-degree line and with a relative growth rate higher than unity) represents an area of unsustainable convergence (UC): here the country is growing faster than the world average, but is generating deficits and debt liabilities which, in the long run, may pull growth down. An economy in this quadrant will not be able to sustain its rate of growth in the future.

The upper-right quadrant represents sustainable convergence (SC), since the economy is growing faster than the rest of the world without generating deficits. An economy should ideally be close to the 45-degree line, where it will be growing at the highest rate compatible with external equilibrium. Too far below the 45-degree line, a mercantilist pattern of growth prevails in which persistent surpluses can generate disequilibria in other parts of the world. This pattern can also cause problems symmetrical to those of unsustainable convergence; the rest of the world (or, more specifically, the economies running deficits) may be forced to react with a drop in growth rates (lower z), by sharpening currency depreciation ("currency wars"), or by taking protectionist measures. A virtuous pattern should lie in the area of convergence and not too far above or below the 45-degree line, so that disequilibria will not become unmanageable.

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[3] The discussion assumes that terms of trade remain stable over the long term or that the sum of the price elasticities of imports and exports (absolute values) does not differ from unity. It also assumes that the debt-to-GDP ratio is approximately constant. For discussions on this equation see Rodríguez (1977), Thirlwall (1979), Cimoli (1988); and Dosi, Pavitt and Soete (1990). A number of empirical studies have been conducted for Latin American countries, especially Brazil; see, for example, Jayme (2003), Pérez (2009), and Holland, Vieira and Canuto (2004). Thirlwall (2011) offers a thorough review of the broad literature existing on the subject.
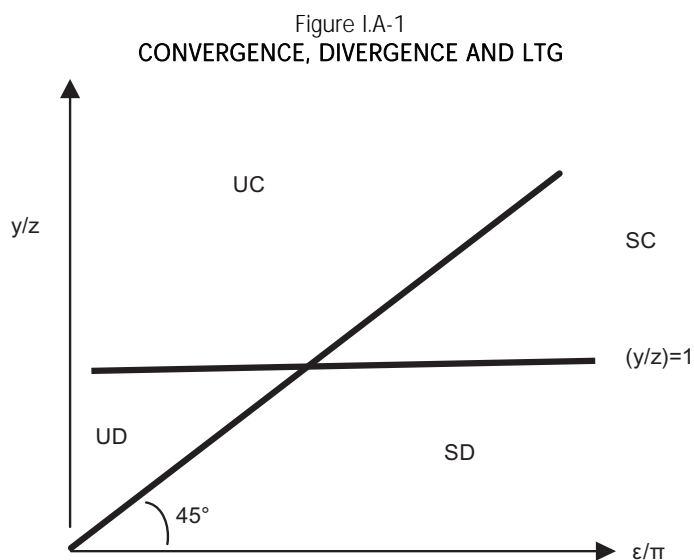
Figure I.A-1
CONVERGENCE, DIVERGENCE AND LTG

Note: C = convergence (above the horizontal line); D = divergence (below the horizontal line); S = sustainable (below the 45-degree line); U = unsustainable (above the 45-degree line).

The lower-left quadrant represents unsustainable divergence (UD): the country is unable to match the growth rate of the world economy, even while running a goods and services trade deficit. This is a sign of a very weak production structure that cannot retain even the small momentum it captures from the global market. Lastly, the lower-right quadrant represents sustainable divergence (SD), since the economy is growing more slowly than the rest of the world but exhibits a surplus. This sort of surplus is not at all positive, because it is associated with lower growth rates and a growing lag with the rest of the world. The lower-right quadrant (SD) should, in fact, be interpreted in combination with the upper-left (UC), since the first corresponds to a downturn in which the economy is exporting resources and reducing growth and investment to pay for the higher growth rates achieved (at the cost of trade deficits and debt) during the period of unsustainable convergence (UC).

3.   Economic growth and Keynesian and Schumpeterian efficiencies

This section presents an econometric exercise which attempts to quantify the role of Keynesian (growth) and Schumpeterian efficiencies in determining the long-term growth rate. On the basis of a broad panel of countries, a regression was performed with economic growth as the dependent variable, and Keynesian efficiency, Schumpeterian efficiency, world economic growth and terms-of-trade variation in 1985-2007 as explanatory variables. The estimation methodology used finite mixtures to form groups of countries that are more homogeneous (based on GDP per capita) and then obtain different parameters for each group. This made the estimates more efficient (Catela and Porcile, 2012).

The proxy for Keynesian efficiency in the econometric model is the share of exports whose demand grows at higher rates than average world demand for exports; the proxy for Schumpeterian efficiency is the proportion of high-technology sectors in the country's total exports. The results are shown in table I.A-1. Keynesian efficiency and Schumpeterian efficiency are significantly and positively correlated. The group corresponding to Latin America shows the highest growth response to Schumpeterian efficiency indicators.

Table I.A-1
ECONOMIC GROWTH, FINITE MIXTURES OF REGRESSIONS, 1985-2007 [a]

	Group 1	Group 2	Group 3
β_0 [b]	9.5473**	4.1235**	8.9835**
	(0.5682)	(0.7891)	(0.4876)
K [c]	0.0735**	0.0821**	0.1030**
	(0.0185)	(0.0265)	(0.0206)
S [d]	0.3192**	0.5116**	0.2233**
	(0.0165)	(0.0176)	(0.0128)
Z [e]	0.0699*	0.0523	0.0721**
	(0.0211)	(0.0502)	(0.0183)
TOT [f]	-0.5456**	-0.7365**	0.8058*
	(0.1214)	(0.0986)	(0.0656)

Source: Eva Catela and Gabriel Porcile, "Keynesian and Schumpeterian efficiency in a BOP-constrained growth model", *Journal of Post Keynesian Economics*, vol. 34, No. 4, M.E. Sharpe, 2012.

[a] Latin America is included in group 2. Levels of significance: * is significant to 5%; ** is significant to 1%.
[b] β_0: constant.
[c] K: share of sectors for which demand grows faster than the world average for all exports.
[d] S: share of high-technology sectors in total exports.
[e] Z: world GDP growth.
[f] TOT: variation in terms of trade.

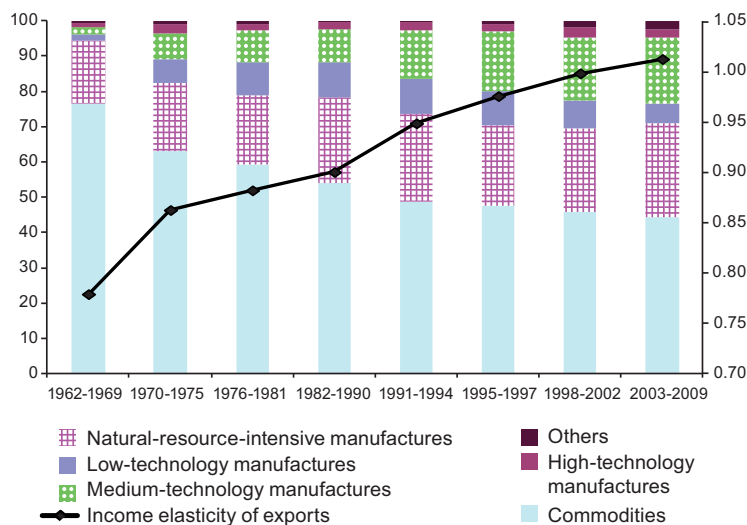## 4.   Export and import elasticities: the multisectoral model

The income elasticities of exports and imports for five countries are presented below, estimated by using the multisectoral model. A discussion of the results can be found in section C of chapter II. The analysis considers the following aspects: (i) the relationship between changes in income elasticities and changes in the composition of exports and imports classified by technology intensity; (ii) the impact on structural change and income elasticities of the policies adopted in the five countries in different periods; and (iii) the higher intensity of structural change in the countries of Asia as compared to Latin America, which has led to a higher ratio between the income elasticities of exports and imports in the former countries.

Figure I.A-2
ARGENTINA: INCOME ELASTICITIES OF EXPORTS AND IMPORTS, 1962-2009
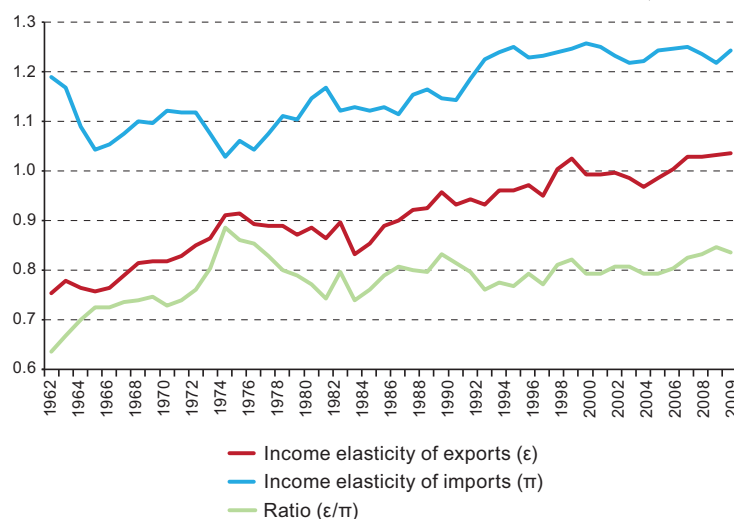
— Income elasticity of exports (ε)
— Income elasticity of imports (π)
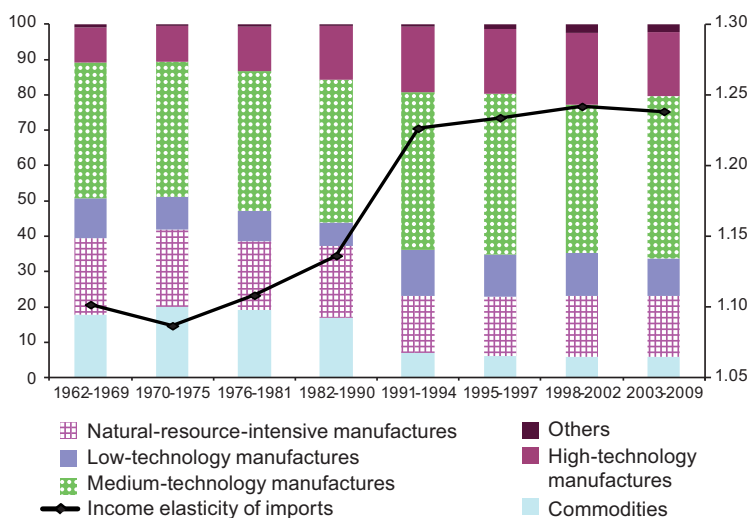— Ratio (ε/π)

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators (WDI) [online database] http://databank.worldbank.org/; and United Nations Commodity Trade Statistics Database (COMTRADE) [online database] http://comtrade.un.org/db/default.aspx, 2012.

Figure I.A-3
ARGENTINA: SHARE OF THE DIFFERENT SECTORS IN TOTAL EXPORTS, 1962-2009

☷ Natural-resource-intensive manufactures   ■ Others
▨ Low-technology manufactures   ■ High-technology
☷ Medium-technology manufactures   manufactures
◆— Income elasticity of exports   ▨ Commodities

Figure I.A-4
ARGENTINA: SHARE OF THE DIFFERENT SECTORS IN TOTAL IMPORTS, 1962-2009

☷ Natural-resource-intensive manufactures   ■ Others
▨ Low-technology manufactures   ■ High-technology
☷ Medium-technology manufactures   manufactures
◆— Income elasticity of imports   ▨ Commodities

Figure I.A-5
BRAZIL: INCOME ELASTICITIES OF EXPORTS AND IMPORTS, 1962-2009

— Income elasticity of exports (ε)
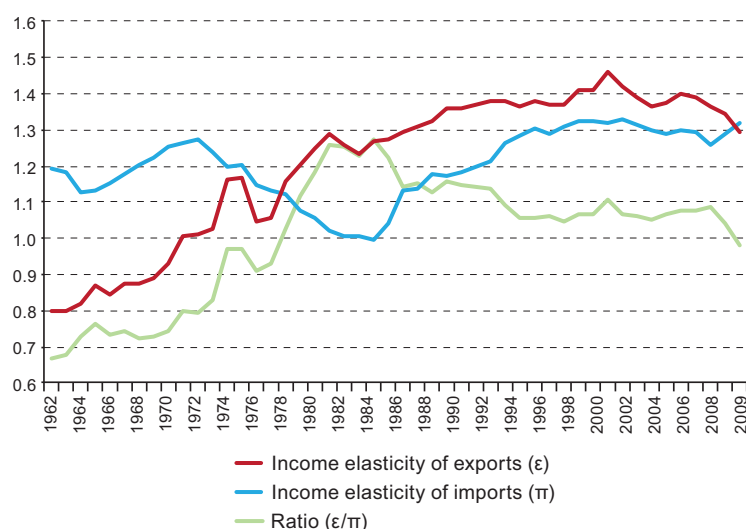— Income elasticity of imports (π)
— Ratio (ε/π)

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators (WDI) [online database] http://databank.worldbank.org/; and United Nations Commodity Trade Statistics Database (COMTRADE) [online database] http://comtrade.un.org/db/default.aspx, 2012.

Figure I.A-6
BRAZIL: SHARE OF THE DIFFERENT SECTORS IN TOTAL EXPORTS, 1962-2009

Natural-resource-intensive manufactures
Low-technology manufactures
Medium-technology manufactures
— Income elasticity of exports

Others
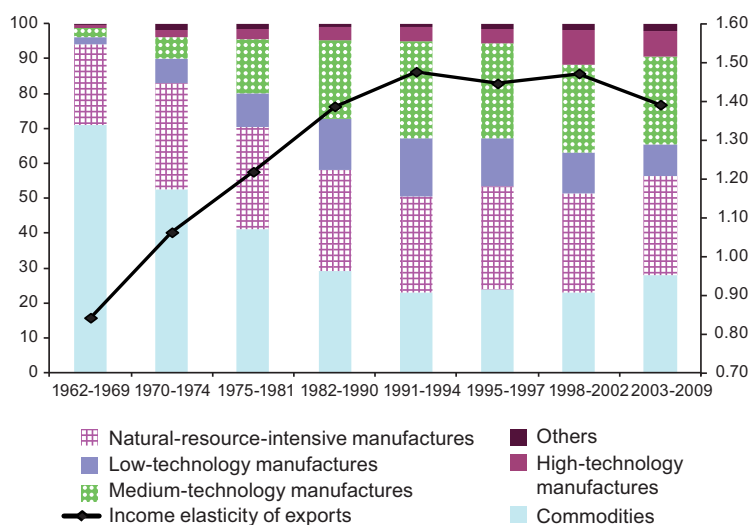High-technology manufactures
Commodities

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators (WDI) [online database] http://databank.worldbank.org/; and United Nations Commodity Trade Statistics Database (COMTRADE) [online database] http://comtrade.un.org/db/default.aspx, 2012.

Figure I.A-7
BRAZIL: SHARE OF THE DIFFERENT SECTORS IN TOTAL IMPORTS, 1962-2009

- Natural-resource-intensive manufactures
- Low-technology manufactures
- Medium-technology manufactures
- Income elasticity of imports
- Others
- High-technology manufactures
- Commodities

Figure I.A-8
MEXICO: INCOME ELASTICITIES OF EXPORTS AND IMPORTS, 1962-2009

- Income elasticity of exports (ε)
- Income elasticity of imports (π)
- Ratio (ε/π)

Figure I.A-9
MEXICO: SHARE OF THE DIFFERENT SECTORS IN TOTAL EXPORTS, 1962-2009

- Natural-resource-intensive manufactures
- Low-technology manufactures
- Medium-technology manufactures
- Income elasticity of exports
- Others
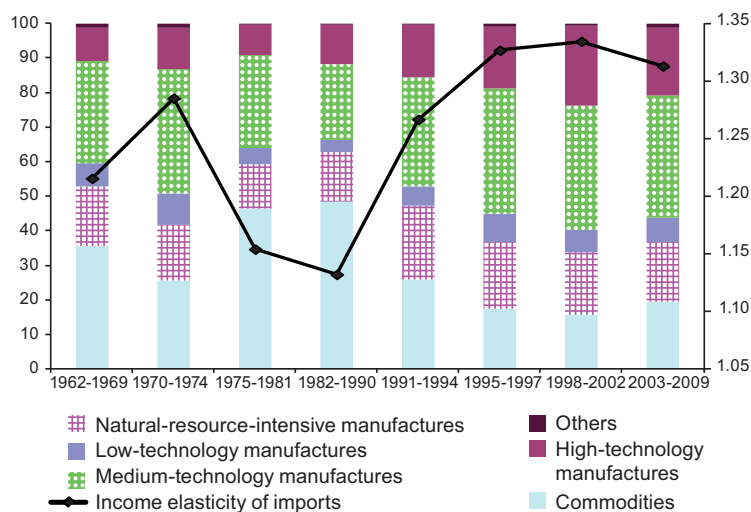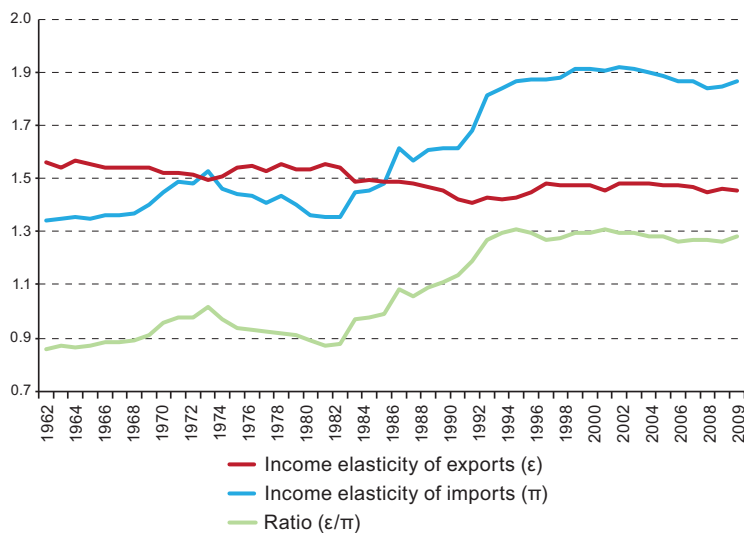- High-technology manufactures
- Commodities

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators (WDI) [online database] http://databank.worldbank.org/; and United Nations Commodity Trade Statistics Database (COMTRADE) [online database] http://comtrade.un.org/db/default.aspx, 2012.

Figure I.A-10
MEXICO: SHARE OF THE DIFFERENT SECTORS IN TOTAL IMPORTS, 1962-2009

- Natural-resource-intensive manufactures
- Low-technology manufactures
- Medium-technology manufactures
- Income elasticity of exports
- Others
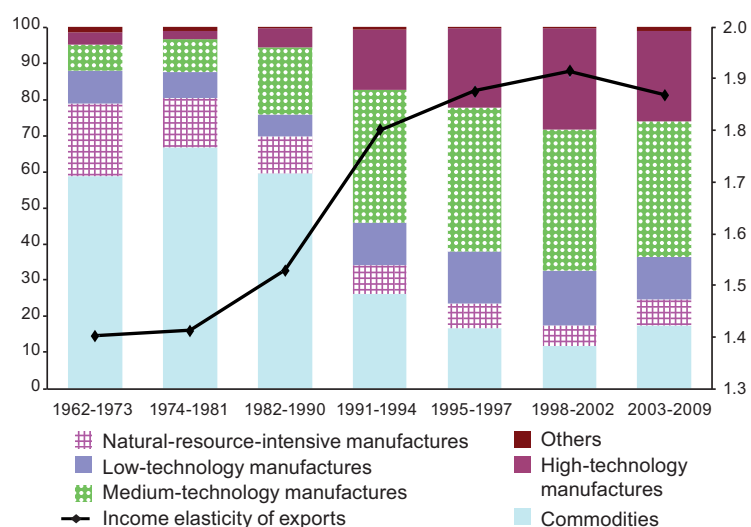- High-technology manufactures
- Commodities

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators (WDI) [online database] http://databank.worldbank.org/; and United Nations Commodity Trade Statistics Database (COMTRADE) [online database] http://comtrade.un.org/db/default.aspx, 2012.

Figure A-11
REPUBLIC OF KOREA: INCOME ELASTICITIES OF EXPORTS AND IMPORTS, 1962-2009

Income elasticity of exports (ε)
Income elasticity of imports (π)
Ratio (ε/π)

Figure I.A-12
REPUBLIC OF KOREA: SHARE OF THE DIFFERENT SECTORS IN TOTAL EXPORTS, 1962-2009

Natural-resource-intensive manufactures
Low-technology manufactures
Medium-technology manufactures
Income elasticity of imports
Others
High-technology manufactures
Commodities

Figure A-13
REPUBLIC OF KOREA: SHARE OF THE DIFFERENT SECTORS IN TOTAL IMPORTS, 1962-2009

Natural-resource-intensive manufactures
Low-technology manufactures
Medium-technology manufactures
Income elasticity of imports
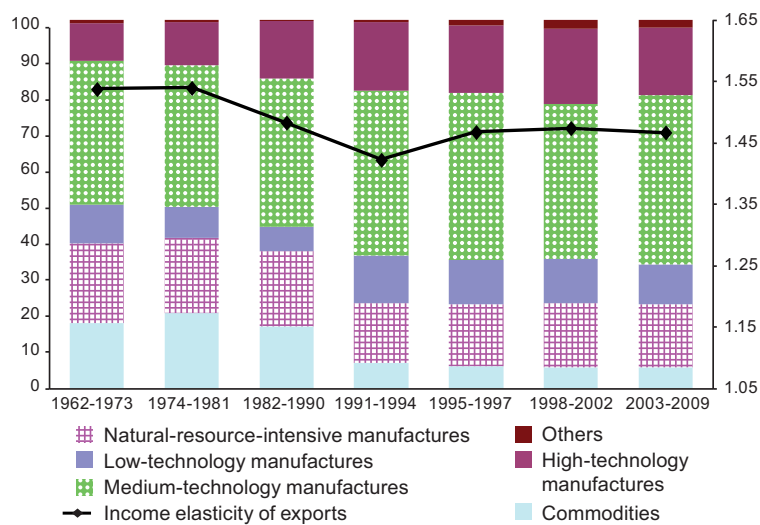
Others
High-technology manufactures
Commodities

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators (WDI) [online database] http://databank.worldbank.org/; and United Nations Commodity Trade Statistics Database (COMTRADE) [online database] http://comtrade.un.org/db/default.aspx, 2012.

Figure A-14
MALAYSIA: INCOME ELASTICITIES OF EXPORTS AND IMPORTS, 1964-2009

Income elasticity of exports (ε)
Income elasticity of imports (π)
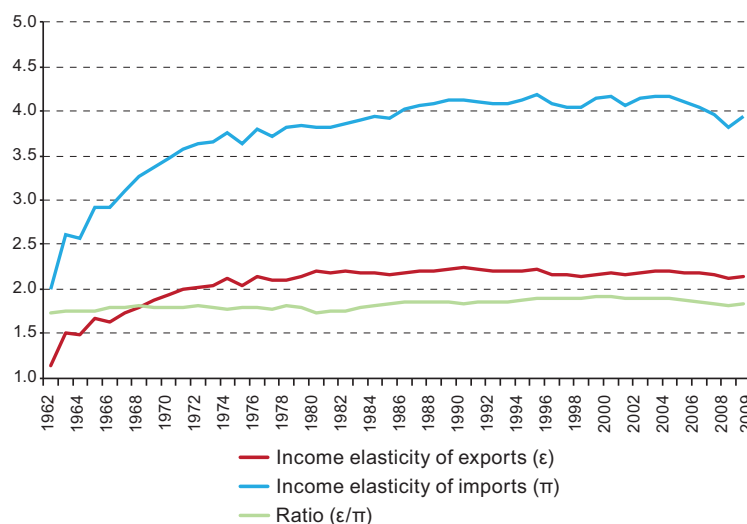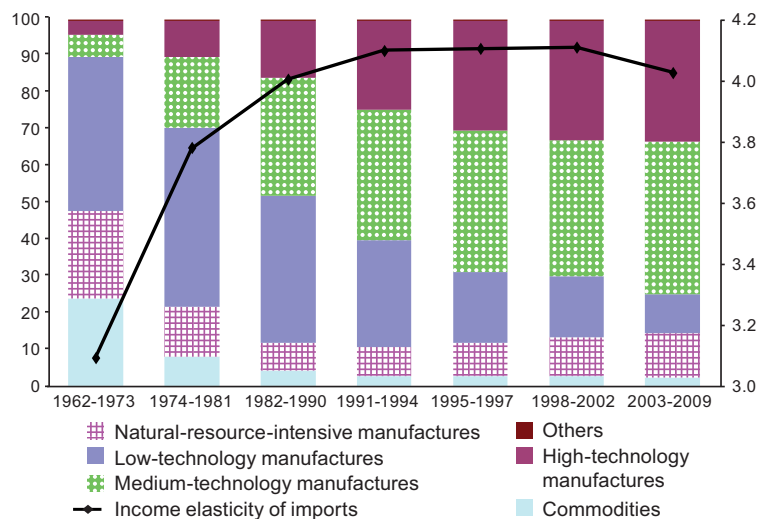Ratio (ε/π)

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators (WDI) [online database] http://databank.worldbank.org/; and United Nations Commodity Trade Statistics Database (COMTRADE) [online database] http://comtrade.un.org/db/default.aspx, 2012.

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Figure A-15
MALAYSIA: SHARE OF THE DIFFERENT SECTORS IN TOTAL EXPORTS, 1964-2009

Natural-resource-intensive manufactures   Others
Low-technology manufactures   High-technology
Medium-technology manufactures   manufactures
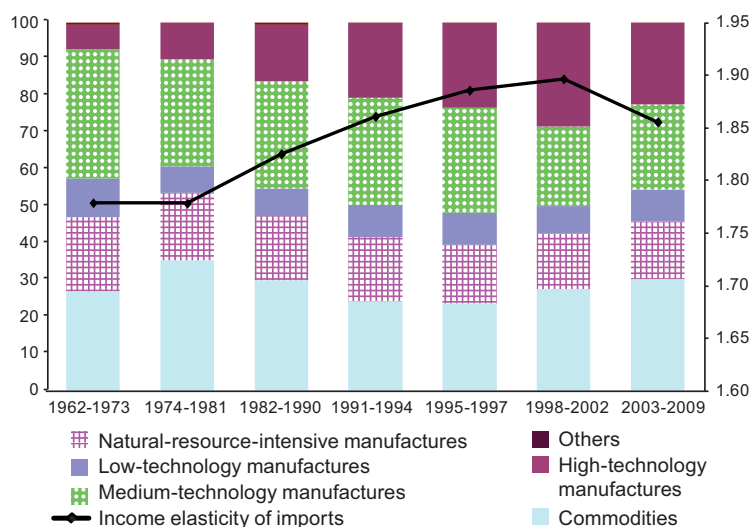Income elasticity of imports   Commodities

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators (WDI) [online database] http://databank.worldbank.org/; and United Nations Commodity Trade Statistics Database (COMTRADE) [online database] http://comtrade.un.org/db/default.aspx, 2012.

Figure A-16
MALAYSIA: SHARE OF THE DIFFERENT SECTORS IN TOTAL IMPORTS, 1964-2009

Natural-resource-intensive manufactures   Others
Low-technology manufactures   High-technology
Medium-technology manufactures   manufactures
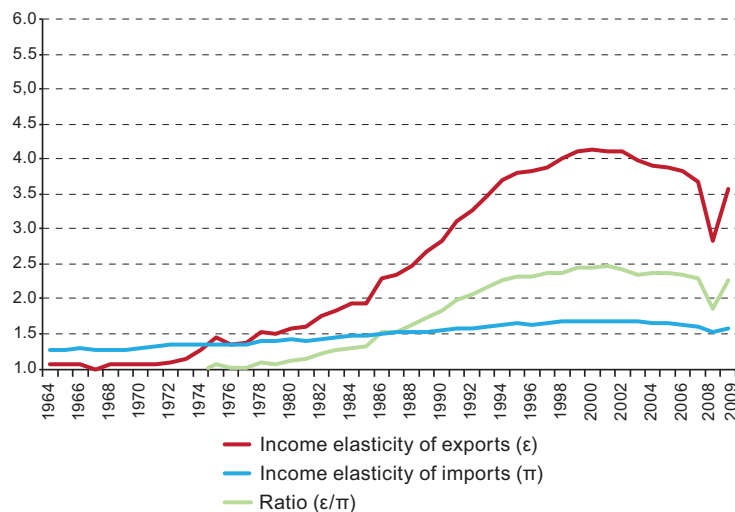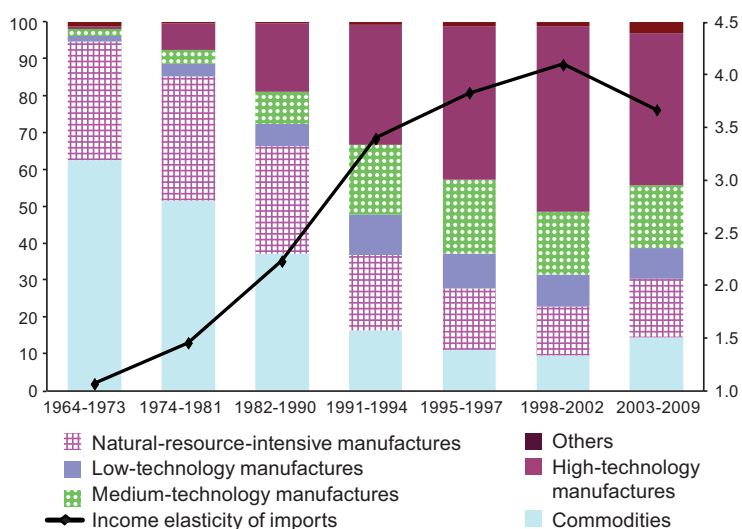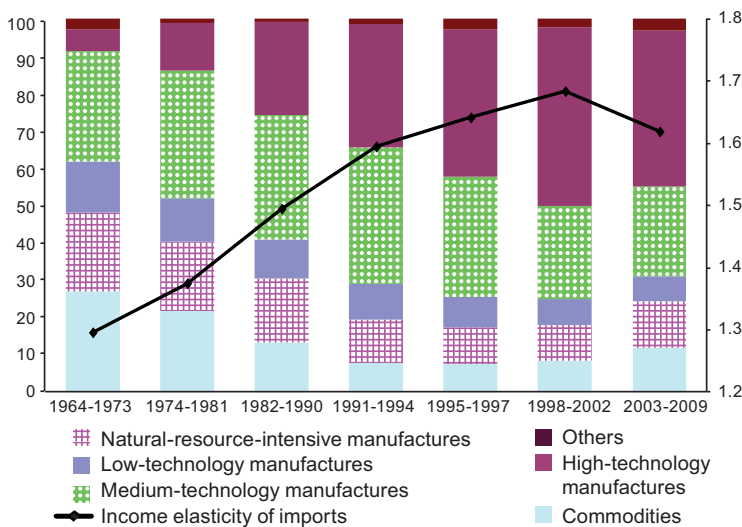Income elasticity of imports   Commodities

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators (WDI), [online] http://databank.worldbank.org/; and United Nations Commodity Trade Statistics Database (COMTRADE), [online] http://comtrade.un.org/db/default.aspx, 2012.

5.   Real exchange rate and specialization

Table I.A-2
DETERMINANTS OF EXPORT DIVERSIFICATION: GINI INDEX, 1965-2005 [a]

L. Gini (-1)	0.214***	0.241***	0.316***	0.183***	0.266***	0.184***
	(6.60)	(7.43)	(10.02)	(5.67)	(8.13)	(5.62)
Real exchange rate	-0.549***	-0.453***	-0.479***	-0.389***	-0.504***	-0.450***
	(-9.88)	(-8.41)	(-9.29)	(-7.97)	(-10.08)	(-9.43)
Per capita GDP	-0.352***	-0.283***	-0.504***	-0.0946	-0.464***	-0.0676
	(-5.49)	(-4.48)	(-7.69)	(-0.97)	(-6.76)	(-0.72)
Volatility		-0.431***	-0.129	-0.0957	-0.230*	-0.163
		(-3.29)	(-0.99)	(-0.80)	(-1.87)	(-1.40)
Openness [b]			0.667***	0.726***	0.511***	0.628***
			(9.51)	(12.09)	(7.69)	(10.54)
Human capital				-0.448***		-0.373***
				(-7.30)		(-5.87)
Physical capital				-0.179*		-0.309***
				(-1.74)		(-3.15)
Agricultural resources					59.98***	-9.065
					(3.82)	(-0.59)
Energy resources					0.0150***	0.0139***
					(6.24)	(6.13)
Mining resources					0.0336***	0.0255***
					(3.34)	(2.72)
Observations	724	724	724	724	678	678
Number of countries	111	111	111	111	106	106
AB(2)	0.488	0.637	0.574	0.558	0.559	0.43

Source: M. Cimoli, S. Fleitas and G. Porcile, "Real exchange rate and the structure of exports", *MPRA Paper*, No. 37846, University Library of Munich, 2012.

[a]   All the equations are estimated by Arellano and Bond (1991) and differ only in the control variables used in model. The first model includes only the lag of the dependent variable and the real exchange rate, while the others include different combinations of the set of control variables. The estimation is based on five-year panels for the period 1965-2005. The autocorrelation of residuals (Arellano Bond test) was used to confirm the presence of the dynamic variable and the Hansen contrast to test the validity of the instruments. Levels of significance: * is significant to 10%;** is significant to 5%; and *** is significant to 1%.

[b]   OPEN: ((X+M)/GDP).

Table I.A-3
DETERMINANTS OF EXPORT DIVERSIFICATION: HERFINDHAL INDEX, 1965-2005 [a]

L. HERF (-1)	0.0429	0.0722**	0.115***	0.211***	0.135***	0.216***
	(1.29)	(2.19)	(3.53)	(6.51)	(4.07)	(6.58)
Real exchange rate	-0.494***	-0.451***	-0.420***	-0.297***	-0.416***	-0.364***
	(-7.86)	(-7.61)	(-7.20)	(-4.77)	(-7.07)	(-5.96)
Per capita GDP	-0.0261	-0.0266	-0.0999	-0.710***	-0.114	-0.609***
	(-0.37)	(-0.37)	(-1.26)	(-5.49)	(-1.34)	(-4.89)
Volatility		-0.165	-0.0449	0.253	-0.0241	0.187
		(-1.10)	(-0.29)	(1.64)	(-0.16)	(1.24)
Openness [b]			0.113	0.243***	0.0280	0.147*
			(1.39)	(3.20)	(0.35)	(1.94)
Human capital				-0.185**		0.0139
				(-2.54)		(0.18)
Physical capital				0.517***		0.297**
				(3.83)		(2.31)
Agricultural resources					61.80***	61.29***
					(3.13)	(3.03)
Energy resources					0.0142***	0.0146***
					(4.87)	(4.99)
Mining resources					0.0250**	0.0210*
					(2.07)	(1.75)
Observations	724	724	724	724	678	678
Number of countries	111	111	111	111	106	106
AB(2)	0.0869	0.175	0.222	0.27	0.227	0.265

Source: M. Cimoli, S. Fleitas and G. Porcile, "Real exchange rate and the structure of exports", *MPRA Paper*, No. 37846, University Library of Munich, 2012.

[a] All the equations are estimated by Arellano and Bond (1991) and differ only in the control variables used in model. The first model includes only the lag of the dependent variable and the real exchange rate, while the others include different combinations of the set of control variables. The estimation is based on five-year panels for the period 1965-2005. The autocorrelation of residuals (Arellano Bond test) was used to confirm the presence of the dynamic variable and the Hansen contrast to test the validity of the instruments. Levels of significance: * is significant to 10%;** is significant to 5%; and *** is significant to 1%.

[b] OPEN: ((X+M)/GDP).

Table I.A-4
DETERMINANTS OF EXPORT DIVERSIFICATION: THEIL INDEX, 1965-2005 [a]

L. Theil (-1)	0.222***	0.259***	0.330***	0.219***	0.268***	0.218***
	(6.94)	(8.17)	(10.67)	(6.91)	(8.31)	(6.75)
Real exchange rate	-0.533***	-0.429***	-0.456***	-0.363***	-0.482***	-0.417***
	(-9.71)	(-8.12)	(-9.00)	(-7.46)	(-9.91)	(-8.87)
Per capita GDP	-0.382***	-0.213***	-0.532***	-0.187*	-0.466***	-0.137
	(-5.99)	(-4.05)	(-8.12)	(-1.92)	(-6.87)	(-1.48)
Volatility		-0.407***	-0.0645	-0.0364	-0.162	-0.0971
		(-3.15)	(-0.50)	(-0.30)	(-1.35)	(-0.84)
Openness [b]			0.666***	0.701***	0.484***	0.594***
			(9.58)	(11.68)	(7.41)	(10.07)
Human capital				-0.413***		-0.318***
				(-6.72)		(-5.07)
Physical capital				-0.119		-0.266***
				(-1.16)		(-2.72)
Agricultural resources					65.73***	2.815
					(4.24)	(0.18)
Energy resources					0.0149***	0.0140***
					(6.33)	(6.22)
Mining resources					0.0373***	0.0284***
					(3.78)	(3.06)
Observations	724	724	724	724	678	678
Number of countries	111	111	111	111	106	106
AB(2)	0.349	0.557	0.976	0.999	0.936	0.925

Source: M. Cimoli, S. Fleitas and G. Porcile, "Real exchange rate and the structure of exports", *MPRA Paper*, No. 37846, University Library of Munich, 2012.

[a]   All the equations are estimated by Arellano and Bond (1991) and differ only in the control variables used in model. The first model includes only the lag of the dependent variable and the real exchange rate, while the others include different combinations of the set of control variables. The estimation is based on five-year panels for the period 1965-2005. The autocorrelation of residuals (Arellano Bond test) was used to confirm the presence of the dynamic variable and the Hansen contrast to test the validity of the instruments. Levels of significance: * is significant to 10%;** is significant to 5%; and *** is significant to 1%.
[b]   OPEN: ((X+M)/GDP).

Table I.A-5
DETERMINANTS OF THE EXPORT SHARE OF MEDIUM- AND HIGH-TECHNOLOGY SECTORS, 1965-2005 [a]

L. HMTE (-1)	0.0430	0.0707**	0.109***	0.145***	0.141***	0.132***
	(1.31)	(2.16)	(3.31)	(4.39)	(4.16)	(3.81)
Real exchange rate	0.472***	0.393***	0.331***	0.154*	0.287***	0.200**
	(5.43)	(4.61)	(3.89)	(1.75)	(3.22)	(2.17)
Per capita GDP	1.095***	0.957***	0.762***	0.653***	0.548***	0.555***
	(9.12)	(8.21)	(6.31)	(3.51)	(4.27)	(2.91)
Volatility		0.167	0.284	0.151	0.361	0.219
		(0.75)	(1.26)	(0.68)	(1.59)	(0.96)
Openness [b]			0.204*	-0.118	0.198	-0.0360
			(1.65)	(-1.01)	(1.60)	(-0.29)
Human capital				0.412***		0.451***
				(3.78)		(3.78)
Physical capital				-0.0449		0.118
				(-0.22)		(0.57)
Agricultural resources					-59.24*	81.28***
					(-1.89)	(2.79)
Energy resources					-0.0140***	-0.0131***
					(-3.15)	(-2.95)
Mining resources					-0.0261	-0.00292
					(-1.43)	(-0.14)
Observations	701	701	701	701	661	661
Number of countries	110	110	110	110	105	105
AB(2)	0.185	0.235	0.281	0.534	0.625	0.6

Source: M. Cimoli, S. Fleitas and G. Porcile, "Real exchange rate and the structure of exports", *MPRA Paper*, No. 37846, University
Library of Munich, 2012.

[a]   All the equations are estimated by Arellano and Bond (1991) and differ only in the control variables used in model. The first
model includes only the lag of the dependent variable and the real exchange rate, while the others include different
combinations of the set of control variables. The estimation is based on five-year panels for the period 1965-2005. The
autocorrelation of residuals (Arellano Bond test) was used to confirm the presence of the dynamic variable and the Hansen
contrast to test the validity of the instruments. Levels of significance: * is significant to 10%;** is significant to 5%; and *** is
significant to 1%.
[b]   OPEN: ((X+M)/GDP).

Annex II

1.   Estimating business cycle duration and amplitude

Methodology and sample of countries

A standard method described in literature on business cycles was used to identify turning points (maxima and minima) in the real GDP series in levels. Quarterly data were used for a sample of 59 countries from regions in the developed and developing world for 1990-2010. Apart from Latin America (23 countries), the developing regions include East Asia and the Pacific (four countries) and Europe and Central Asia (seven countries). An additional 31 developed countries from North America, Europe and Asia were considered.

Table II.A-1

Region	Countries included
Latin America	Argentina, Bolivia (Plurinational State of), Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, Venezuela (Bolivarian Republic of).
Caribbean	Jamaica, Trinidad and Tobago.
East Asia and the Pacific	China, Indonesia, Malaysia, Philippines, Thailand.
Europe and Central Asia	Belarus, Bulgaria, Georgia, Kyrgyzstan, Lithuania, Russia, Serbia, Turkey.
Other emerging countries	India, Jordan, Morocco, Philippines.
Developed countries	Australia, Austria, Belgium, Brunei Darussalam, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong Special Administrative Region of China, Hungary, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Republic of Korea, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States.

By way of example, figure II.A-1 shows the GDP trend for the seven largest countries of Latin America, identifying maxima and minima and other turning points. The figure shows the major crises and contractions that have impacted the region, including the Mexican crisis (1995), the Asian and Russian crises (1997-9099), the Argentine crisis (2002) and the global crisis (2008-2009). These coincide with the troughs in the GDP series**.**

The turning points made it possible to identify GDP expansions and contractions. An expansion phase is when GDP growth is positive; a contraction is when GDP growth is negative.

Once the expansion and contraction periods had been identified, the duration and amplitude of the expansion and contraction phases of economic activity were estimated for the countries, regions and subregions. The duration of a phase is a measure of the persistence of the downswing or upswing; amplitude measures the intensity of the swings in economic activity during each phase of the cycle.

Figure II.A-1
LATIN AMERICA AND THE CARIBBEAN (7 COUNTRIES): GDP TREND AND TURNING POINTS, 1991-2010
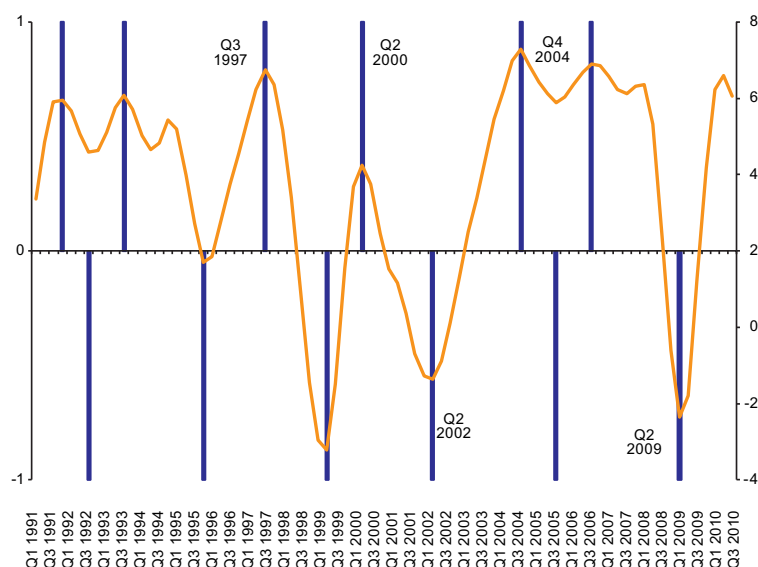
Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of official figures from the countries.

Calculating turning points

The Bry-Boschan (1971) method was used to identify turning points (tp) of the series in levels expressed in natural logarithm form, $y_{i,t}$. The algorithm identifies local maxima and minima in five-quarter windows.

Local maximum at t:

tp = 1 if $y_{i,t} > y_{i,t-k}$, $\forall k$ = -1, -2, 1, 2

Local minimum at t:

tp = -1 if $y_{i,t} < y_{i,t-k}$, $\forall k$ = -1, -2, 1, 2

tp = 0 otherwise

The requirements for identifying a turning point are as follows: (i) there can only be two consecutive maxima or minima; and (ii) the shortest duration of a transition from maximum to minimum is two quarters, and from maximum to maximum, six quarters. Turning points are calculated using the MATLAB computational algorithm developed by Male (2010).

Turning points are used to define the dichotomous variable $s_{i,t}$, to identify expansion phases:

$s_{i,t} = 1$, if the $y_{i,t}$ series is in an expansion phase.

$s_{i,t} = 0$, if the $y_{i,t}$ series is in a contraction phase.

Using the same method, the variable $c_{i,t}$ is defined for contraction phases: $c_{i,t} = 1 - s_{i,t}$. Only complete phases are considered when calculating the variable $s_{i,t}$, such that each series starts and ends either with a maximum or with a minimum. This is because it is impossible to ascertain the duration or amplitude of incomplete phases (2011 is considered a maximum).

Indicators of duration and amplitude

The average duration (D) of an expansion (or contraction) is the ratio of the total number of quarters of expansion to the total number of maxima:

$$D = \frac{\sum_{t=1}^{T} s_{i,t}}{\sum_{t=1}^{T-1}\left(1-s_{i,t+1}\right)s_{i,t}}$$

where,

$s_{i,t}$ is a dichotomous variable, and $s_{i,t} = 1$, if the $y_{i,t}$ series is in an expansion phase; and $s_{i,t} = 0$, if the $y_{i,t}$ series is in a contraction phase.

The average amplitude (A) of an expansion is the sum of the change in the variable in each quarter in which $s_{i,t} = 1$, divided by the total number of maxima:

$$A = \frac{\sum_{t=1}^{T} s_{i,t}\,\Delta y_{i,t}}{\sum_{t=1}^{T-1}\left(1-s_{i,t+1}\right)s_{i,t}}$$

where,

$y_{i,t}$ is the natural logarithm of GDP.

When y_i is expressed in logarithmic form, $\Delta y_{i,t}$ is the percentage change and A is measured as a percentage. If $y_{i,t}$ is expressed as a percentage of GDP, then A is read in percentage points.

Hodrick-Prescott method

The per capita GDP growth rate series was broken down using the Hodrick-Prescott filter, which separates series cycle and trend by applying the same weighted moving average throughout the series. Thus, by definition, the statistical filter tends to give greater weight to the most recent observations of the series when generating the cycle and trend. To put it more formally, this solves the problem of minimizing the variation in the cycle component of a series (y_t) defined as the difference between that series and its trend component μ_t subject to a smoothing condition for the latter. Formally,

$$\min_{\mu t} \sum_{t=1}^{T} [(y_t - \mu_t)^2 + \lambda(\Delta\mu_{t+1} - \Delta\mu_t)^2]$$

where λ is the Lagrange multiplier, which smooths the trend component of the series. The larger (smaller) the value of the Lagrange multiplier, the more (less) stable the trend component will be (see Hodrick and Prescott, 1997). The way that this filter methodology was developed has fuelled intense debate over the characterization of business cycles (see Kaiser and Maravall, 2001). The statistical significance of the correlation coefficient is calculated by the formula $\rho = \dfrac{r(\sqrt{n-2})}{\sqrt{1-r^2}}$ where r is the simple correlation coefficient and n is the number of observations; ρ follows a student-t distribution.

2.   Public savings and private savings

Public savings rates in Latin America and the Caribbean in 2004-2010 recovered from their 1999-2003 levels,[1] most particularly in countries that receive large tax revenues from the exploitation and export of commodities. Despite the lack of data for Latin America in the 1980s, it has been shown that the average rate of public savings was low in this period and even close to zero between 1982 and 1990 (see table II.A-2). Public savings jumped in the 1990s, fuelled by a surge in raw materials prices up to the outbreak of the Asian crisis (albeit below the levels of 2004-2010, particularly in the case of metals) and by privatizations in several of the region's countries during the first half of the decade.

Data availability at the country level varies. Some countries publish figures on gross public and private savings; others do so net of fixed-capital consumption, which is reported separately. The trend of these aggregates is shown below, showing whether the national savings figures are gross or net. Tables II.A-2 and II.A-3 show, respectively, public and private savings for countries that report gross data. Tables II.A-4 and II.A-5 show figures for net public and private savings (net of fixed-capital consumption), for countries that follow this standard.

Table II.A-2
LATIN AMERICA AND THE CARIBBEAN (10 COUNTRIES): ANNUAL AVERAGE GROSS PUBLIC SAVINGS
(Percentages of GDP at current prices, in national currency)

	1980-1981	1982-1990	1991-1994	1995-1998	1999-2003	2004-2010
Argentina			0.4	(0.9)	(1.0)	2.7
Bolivia (Plurinational State of)	(2.4)	(3.2)	2.3	3.3	(2.0)	7.4
Brazil				1.7	1.4	0.3
Colombia	2.2	2.6	5.2	2.2	(1.2)	(0.5)
Cuba						2.2
Dominican Republic				3.7	3.3	2.0
El Salvador		(0.4)	1.0	2.0	0.4	(0.2)
Guatemala		(0.6)	1.6	2.6	2.4	2.7
Nicaragua		(0.0)	0.9	4.3	(0.2)	1.5
Uruguay	1.3	(0.1)	5.1	1.5	(2.5)	(0.0)
Average (10 countries)	0.4	(0.3)	2.4	2.3	0.1	1.8

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

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[1]   The country data used for this analysis are mostly official figures from national accounts. Where these figures were not available, estimates were made wherever possible.

Table II.A-3
LATIN AMERICA AND THE CARIBBEAN (10 COUNTRIES): ANNUAL AVERAGE GROSS PRIVATE SAVINGS
(Percentages of GDP at current prices, in national currency)

	1980-1981	1982-1990	1991-1994	1995-1998	1999-2003	2004-2010
Argentina			15.5	17.5	17.2	22.1
Bolivia (Plurinational State of)	17.9	18.0	5.5	8.5	12.9	16.0
Brazil				11.6	13.0	17.5
Colombia	16.0	16.5	17.2	16.0	17.3	20.6
Cuba						
Dominican Republic				12.7	17.0	11.7
El Salvador		9.9	14.7	13.4	13.5	11.7
Guatemala		11.1	10.9	7.9	11.1	11.7
Nicaragua			(6.0)	2.6	10.3	12.1
Uruguay	9.6	11.9	9.4	12.6	14.0	15.7
Average (10 countries)	14.5	13.5	9.6	11.4	14.0	15.5

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

Table II.A-4
LATIN AMERICA AND THE CARIBBEAN (9 COUNTRIES): ANNUAL AVERAGE NET PUBLIC SAVINGS
(Percentages of GDP at current prices, in national currency)

	1980-1981	1982-1990	1991-1994	1995-1998	1999-2003	2004-2010
Chile			4.9	4.0	0.9	6.1
Costa Rica	(0.9)	4.3	2.6	2.9	2.4	4.0
Ecuador	3.7	4.9	7.9	7.2	4.2	8.0
Honduras			0.2	2.4	2.3	(0.3)
Mexico			5.6	3.2	1.5	2.1
Panama	(1.1)	(3.2)	4.5	1.8	0.4	2.1
Paraguay	3.1	0.7	2.5	2.8	1.7	4.6
Peru	1.3	(2.4)	(0.1)	1.8	(0.3)	2.9
Venezuela (Bolivarian Republic of)			11.1	5.3	1.4	5.5
Average (9 countries)	1.2	0.9	4.3	3.5	1.6	3.9

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

Table II.A-5
LATIN AMERICA AND THE CARIBBEAN (9 COUNTRIES): ANNUAL AVERAGE NET PRIVATE SAVINGS
(Percentages of GDP at current prices, in national currency)

	1980-1981	1982-1990	1991-1994	1995-1998	1999-2003	2004-2010
Chile			7.1	7.1	6.6	5.8
Costa Rica	8.7	10.5	5.8	5.4	5.5	7.8
Ecuador	7.2	(5.7)	10.3	12.2	16.1	14.1
Honduras			15.7	19.3	14.3	15.9
Mexico			1.7	7.6	8.7	13.1
Panama	20.0	20.0	14.5	14.9	10.0	14.2
Paraguay	9.6	7.6	14.4	15.8	13.7	10.8
Peru	17.6	16.8	6.7	8.6	10.3	12.4
Venezuela (Bolivarian Republic of)			(0.1)	15.7	23.0	24.3
Average (9 countries)	12.6	9.8	8.4	11.9	12.0	13.1

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

There was an overall increase in both public and private savings in 2004-2010, in annual average terms and as a percentage of GDP. It was during this period that private savings attained the highest levels in the three decades running from 1980 to 2010. The pattern of public savings was different: while this aggregate rose during 2004-2010 compared with 1999-2003, on average it is still below the levels recorded in the first half of the 1990s.

As happened with domestic and foreign savings, the growth of public savings has been concentrated largely in countries that are more specialized in producing and exporting commodities, particularly those in which the public sector owns the enterprises that produce these goods.

Corporate savings

In the countries of Latin America, operating surplus (a good proxy for corporate savings) grew as a share of the generation of income during 1990-2009 while the share of wages and salaries declined (see table II.A-6).[2] This trend is clearest in countries that specialize most heavily in primary commodities (Bolivarian Republic of Venezuela, Chile, Colombia and Uruguay) where, as a yearly average, the GDP component of operating surplus increased by between four and six percentage points in 2004-2009 compared with 1995-1999. This growth in operating surplus is not completely due to an increase in private savings because the public sector accounts for a large share of the output of such goods in the Bolivarian Republic of Venezuela, Chile and Colombia. In fact, the rise in operating surplus for 2004-2009 is linked to an increase in public savings that, in some cases, made it possible to reduce borrowing and implement countercyclical policies during the 2008-2009 financial crisis.

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[2]   Includes information for seven countries (the Bolivarian Republic of Venezuela, Brazil, Chile, Colombia, Costa Rica, Guatemala and Uruguay) that publish annual series for the generation of income account.

Table II.A-6
OPERATING SURPLUS AND EMPLOYEE COMPENSATION AS A SHARE OF TOTAL GDP
(National currency at current prices)

		1995-1999	2000-2003		2004-2009
Operating surplus/GDP					
Brazil		33.0%	34.3%		34.4%
Chile	(1996-1999)	34.5%	33.4%		39.5%
Colombia		29.3%	29.5%		33.5%
Costa Rica		44.2%	41.4%		40.3%
Guatemala		--	--		39.7%
Peru		58.2%	58.7%		61.7%
Uruguay	(1997-1999)	30.4%	32.7%	(2004-2005)	36.7%
Venezuela (Bolivarian Republic of)	(1997-1999)	41.1%	45.3%		47.5%
Employee compensation/GDP					
Brazil		41.9%	40.1%		41.2%
Chile	(1996-1999)	49.6%	46.9%		37.8%
Colombia		36.7%	34.2%		31.8%
Costa Rica		44.9%	46.9%		47.5%
Guatemala		--	--		31.2%
Peru		24.7%	24.9%		22.3%
Uruguay	(1997-1999)	40.0%	38.5%	(2004-2005)	33.6%
Venezuela (Bolivarian Republic of)	(1997-1999)	35.2%	32.9%		31.1%

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

Costa Rica displays a different trend: operating surplus as a share of GDP declined between 1995-2000 and 2004-2009 while the employee compensation share grew from 44.9% in annual average terms in 1995-1999 to 47.5% in 2004-2009. In Brazil, these aggregates have remained broadly stable in the three periods analysed.

Table II.A-7 shows the operating surplus trend for four additional countries (Argentina, Honduras, Paraguay and the Plurinational State of Bolivia). The figures match the trends described above: in 2004-2010, operating surplus, at between 34% and 53% of GDP, increased or remained at levels similar to those recorded in earlier periods.

Table II.A-7
LATIN AMERICA (4 COUNTRIES): OPERATING SURPLUS
(Percentages of GDP, national currency at current prices)

	1980-1981	1982-1990	1991-1994	1995-1998	1999-2003	2004-2010
Argentina			32,1	39,6	40,5	38,7
Bolivia (Plurinational State of)		56,1	54,1	51,2	50,5	52,8
Honduras	36,5	33,4	34,0	38,9	35,3	39,6
Paraguay	48,7	54,1	32,4	26,3	25,1	34,0

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