Project Document

Growth versus development: different patterns of industrial growth in Latin America during the 'boom' years

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Abstract

Between 2003 and 2008 Latin America and the Caribbean (LAC) experienced its most remarkable expansionary period since the 1970s. Yet, LAC countries' productivity gaps widened during this period vis-à-vis industrialized countries (here represented by the United States' manufacturing sector) as revealed in CEPAL (2010). The paper splits up this process and examines the different outcomes observed at the national level for the cases of Argentina, Brazil, Chile, Colombia and Mexico during these "boom" years. It examines the composition of productivity divergence in terms of sectoral factor intensity following the Katz-Stumpo taxonomy and examines external productivity gaps, analyzes internal structural heterogeneity and carries out a shift-share analysis of manufacturing labor productivity for the five case studies.

I. Introduction

After half a decade of virtually no economic growth (1998-2002), between 2003 and 2008 Latin America and the Caribbean (LAC) experienced its most remarkable expansionary period since the 1970s —a "boom" to a large extent founded on high commodity prices and extraordinary international financing conditions (Ocampo, 2007; Izquierdo et al., 2008).

During this period LAC countries' growth surpassed that of advanced economies but fell short of developing countries' average rate. This relatively feeble performance *vis-à-vis* the developing world —particularly as regards some Asian economies— seems to be rooted in the absence of a more consistent set of productive policies in the presence of deep structural heterogeneity (Infante, 2009). A rather "anti-developmental" bias built into conventional macroeconomic policies as applied in LAC might have also had something to do with this disappointing performance (CEPAL, 2010).

Indeed, despite extraordinary growth rates, LAC countries' productivity gap in comparison with industrialized countries seems to have widened during the boom years. As shown in Table 1, LAC countries' labor productivity gap in the manufacturing sector in comparison with the United States' rose by 31% between 1998 and 2007. This decline was particularly severe between 1998 and 2002, when LAC countries' weak overall performance concurred with United States' strong productivity growth, but —noticeably— continued during the "boom" years, when the speed of relative decline diminished yet not altering the overall negative trend. To the extent that development is associated with convergence in productivity the boom years may be characterized as a period of growth without (much) development.

This paper explores the different patterns of manufacturing productivity growth as experienced in a number of LAC economies (Argentina, Brazil, Chile, Colombia and Mexico) during the 'boom' years (2003-2007).[1] Our focus on the manufacturing sector's performance has its roots in the classical development literature on the relationship between manufacturing growth and development, as well as in the more recent evolutionary approach, which stresses the significance of the composition of manufacturing growth.

[1] The 'boom' period span until III.08, before Lehman Brothers' collapse. We cover the 2003-2007 period due to lack of complete (i.e. regionally consistent) data for 2008.

TABLE 1
VARIATION IN MANUFACTURING SECTOR
LABOR PRODUCTIVITY GAPS, LAC COUNTRIES VS. US
(Percentage variation)

	1998-2007	1998-2002	2003-2007
Argentina	-22	-19	-8
Brazil	-43	-24	-14
Chile	-19	-1	-14
Colombia	-10	-5	-3
México	-12	-6	-3
Latin America	-31	-18	-9

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI)

The paper is organized as follows. Section 2 briefly reviews the main strands in the literature that stresses the relationship between manufacturing sector growth, structural change and development. Section 3 examines the composition of productivity divergence in terms of factor intensity, following the Katz-Stumpo taxonomy (Katz & Stumpo, 2001). Section 4 examines external productivity gaps, internal structural heterogeneity (or internal gaps) and carries out a shift-share analysis of overall manufacturing labor productivity for the five study cases. Section 5 concludes.

II. Manufacturing (still) matters

Classical development economists have consistently argued that economic growth is intrinsically linked to structural change (Rosenstein-Rodan, 1943; Nurkse, 1953; Lewis, 1954; Hirschman, 1958; Prebisch, 1962). While productivity growth in advanced economies typically involves technological innovation, i.e. the expansion of the technological frontier, in developing countries it tends to rely more on changing the structure of production towards activities with higher levels of productivity and faster productivity growth.

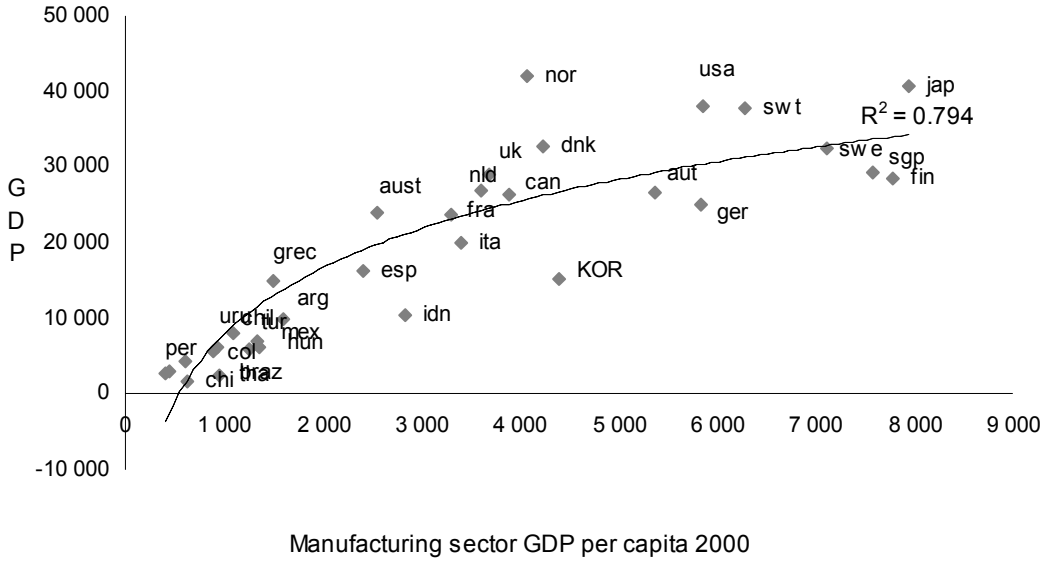
According to this view, changing the structure of production —i.e. the reallocation of labor from to low-to high-productivity activities— typically involves industrialization (Ros, 2000). Indeed, in the classical development economics tradition industrialization is the driver of technical change par excellence. A modern industrial sector enhances output growth since productivity is expected to grow faster in the manufacturing sector fostered by increasing returns to scale and gains from innovation and learning by doing (Kaldor, 1966). From a Lewisian perspective (Lewis, 1954) it can still be argued that the underemployed population in the rural areas, and as of most recently —and increasingly— the underemployed population in the urban informal sector tend to provide an elastic supply of labor that allows industrialization to proceed without facing serious constraints with regard to the supply of labor.

Of course, modern service sectors are also a source of productivity growth —all the more so as international trade for services expands persistently. Yet, the extent of industrialization is closely correlated with the overall level of economic development. Figure 1 describes the close relationship between the level of overall economic development as illustrated by per capita GDP (vertical axis) and the degree of industrialization as represented by per capita manufacturing sector GDP (horizontal axis).

Two features stand out in Figure 1. First, the fact that advanced economies are highly industrialized economies —they exhibit a high per capita manufacturing GDP. Indeed, countries grouped in the NE quadrant in Figure 1, such as the United States, Japan, Germany and Northern European countries (e.g. Sweden, Finland), with the highest per capita GDP levels, are also those which reveal the highest per capita manufacturing GDP levels. Conversely, LAC countries are located on the SW quadrant, where lower per capita GDPs coincide with low manufacturing per capita GDPs.

Most European countries, as well as Canada, Australia and some Asian countries (e.g. South Korea) stand in the middle, albeit closer to the advanced group.[2]

FIGURE 1
PER CAPITA GDP VS PER CAPITA MANUFACTURING GDP IN 2008
(2000 USD)



Source: Economic Commission for Latin America and the Caribbean (ECLAC) and World Bank.

Second, the fact that the data shown in Figure 1 fit a logarithmic function suggests that the impact of an increase in the weight of the manufacturing sector in the economy depends very much on initial conditions. That is to say, the effect of further industrialization on overall development will be much larger in countries with relatively low per capita GDPs-cum-low manufacturing per capita GDPs (e.g. LAC countries) than in more advanced countries.[3]

This means that in the case of LAC, where industrialization is still to a large extent incipient (though there are many "semi-industrialized" countries), convergence with advanced economies will most likely require pushing the industrialization process a bit further. Yet, a dynamic process of structural change requires much more than a growing manufacturing sector. It involves the ability to engender new economic activities as well as the capacity of existing economic activities to integrate domestically into a more compact network of intra and inter-sectoral linkages. And it should, of course, show evidence of consistent productivity growth. In the following section we look into these two variables —manufacturing production and productivity growth— for the cases of Argentina, Brazil, Chile, Colombia and Mexico.

[2] There has been intense debate as regards the progress of modern services and the ensuing decline of the manufacturing sector's role as the driver of technological change and productivity growth. However, based on Graph 2.1., it may still be the case that a "post-industrial" modern services society requires substantial industrial development as an "evolutionary" prerrequisite ("[T]he ongoing process of deindustrialization […] is not the resulta of cheap Chinese products but rather of the long-term workings of the normal transformation for an economy that, as it becomes richer, moves from manufacutirng to services"; Syrquin, 2008, p. 56).

[3] That is why the debate regarding a "post-industrial" society based on modern services makes sense in the case of advanced countries.

III. Manufacturing sector: production and productivity growth

Let us first look at manufacturing sector growth. Between 1998 and 2002 feeble growth characterized the manufacturing sector throughout the region. With the exception of Argentina, where the manufacturing sector's GDP fell by 7.6% between 1998 and 2002 due to the lengthy recession that preceded the 2001-02 crisis, yearly growth rates vary very little from a low of 1.2% in Colombia to a high of 1.7% in Brazil and Chile (see Table 2).

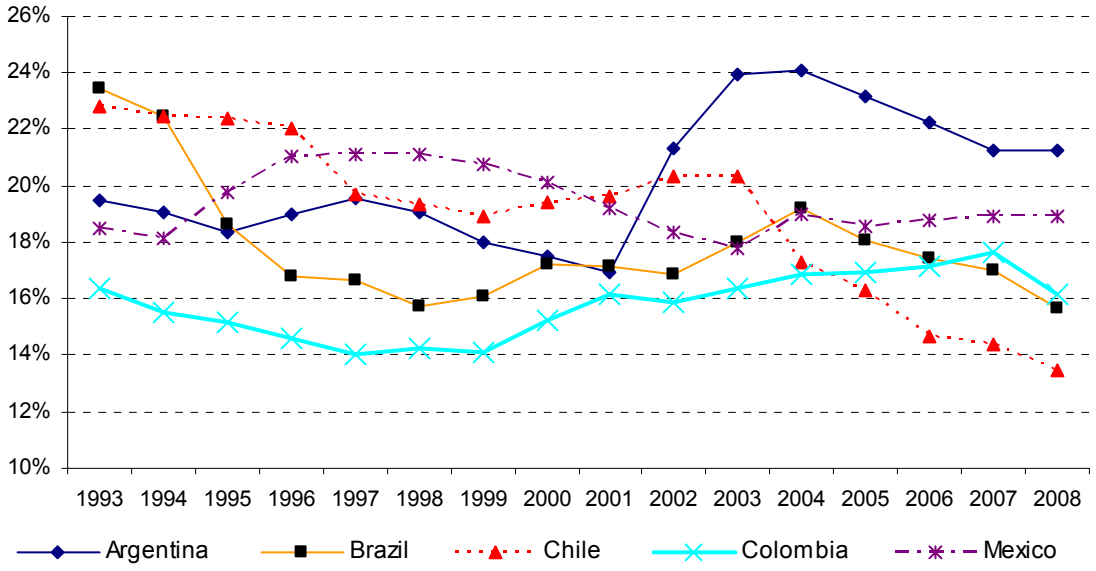
TABLE 2
MANUFACTURING SECTOR'S AVERAGE ANNUAL GROWTH
(Percentage variation)

	Argentina		Brasil		Chile		Colombia		México	
	1998-2002	2003-2007	1998-2002	2003-2007	1998-2002	2003-2007	1998-2002	2003-2007	1998-2002	2003-2007
Knowledge-intensive (KI)	-14.9	16.9	2.8	8.7	-0.8	5.4	1.0	9.9	3.5	9.8
Automobile	-16.2	20.8	6.0	10.7	0.3	12.7	3.0	17.4	6.1	12.9
KI ex/ auto	-13.7	14.2	1.8	8.0	-1.0	3.8	0.4	7.5	0.8	5.7
Natural Resource-intensive (NRI)	-8.6	7.6	1.5	1.3	2.7	5.9	2.0	7.2	1.3	1.6
Food & beverage	-8.4	8.4	1.3	1.3	3.2	5.4	0.8	4.4	2.9	1.2
Labor-intensive	2.2	7.8	0.5	1.8	0.0	-0.1	-0.2	6.5	-0.8	-2.8
Total	-7.6	9.0	1.7	4.0	1.7	4.8	1.2	7.3	1.6	3.8

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

Manufacturing sector growth fell short of overall GDP growth in all cases,[4] bringing about a general reduction in manufacturing coefficients (manufacturing sector value added expressed as a percentage of GDP; see Figure 2). During the boom years (2003-2007) manufacturing sector growth increased significantly in all five cases, with Argentina and Colombia leading with 9.0% and 7.3% annual cumulative growth rates, respectively. In these two cases manufacturing sector growth exceeded that of real GDP, providing signs of reindustrialization (i.e. increase in the manufacturing coefficient). Brazil also shows some recovery in its manufacturing coefficient (albeit at lower growth rates), while Chile and Mexico maintain the previous downward trend.[5]

FIGURE 2
MANUFACTURING COEFFICIENT, 1993-2008
(Manufacturing GDP/Total GDP, current prices)



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Let us look into the boom period in some more detail. Table 2 above disaggregates the manufacturing sector into three sub-sectors, according to whether industries are Knowledge-, Natural Resource- or Labor-intensive. This sectoral differentiation is of great significance from an evolutionary perspective, since different economic activities engender different learning and technological capabilities.[6] Therefore different sectoral compositions of growth generate different productivity growth rates and, most importantly, different endogenous innovative processes. The seminal work that pointed out the need to identify and analyze sectors according to their technological capabilities and potential externalities is due to Pavitt (1984).[7] In the empirical analysis that follows we rely on this approach as developed methodologically by Katz & Stumpo (2001).

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4 In the case of Argentina, manufacturing sector decline exceeded that of GDP, also rendering a decrease in the manufacturing coefficient.

5 It should be noted that, despite their lower coefficients, Brazil and Mexico explain the bulk of the LAC region's overall manufacturing coefficient.

6 This is particularly the case in high-tech industries and other knowledge-intensive economic activities (Cimoli and Porcile, 2009; Cimoli, Porcile and Rovira, 2010).

7 See also Katz (1984) and Cimoli (1988).

Between 2003 and 2007, Knowledge-intensive (KI) industries' growth surpassed that of the other industries in all five cases. In Argentina KI industries grew 16.9% annually; in Brazil 8.7%; in Chile 5.4%; in Colombia 9.9%, and in Mexico 9.8% (Table 2). However, with the exception of Brazil and to some extent Argentina, this KI growth was not widely spread and is to a large extent attributable to the automobile industry —largely an assembling industry, in most cases characterized by weak upstream domestic linkages. As regards Natural Resource-intensive (NRI) industries, Argentina, Chile and Colombia tend to pick up the pace (*vis-à-vis* the 1998-2002 period) and lead the group, while Brazil and Mexico maintain their NRI industries' growth rates at fairly low levels. In the case of Labor-intensive (LI) industries, only Argentina and Colombia report significant growth rates. Interestingly, LI industries in Mexico (where maquila-type processes are prominent) retreat during both periods (1998-2002 and 2003-2007).

Dynamism and high growth do not necessarily imply significance. In Brazil and Mexico, where overall manufacturing sector growth rates were pretty mild between 2003 and 2007 (4.0% and 3.8% respectively), manufacturing sector growth was mainly explained by KI industries (76.7% and 93.5% respectively), with automobile industry explaining the bulk of KI industries' growth in Mexico (see Table 3 below). On the opposite extreme lies Chile —which as in the case of Brazil and Mexico reveals relatively low manufacturing sector growth— where NRI industries explain 87.4% of overall manufacturing sector growth. Argentina and Colombia comprise intermediate and rather paradoxical cases: While they reveal the highest overall manufacturing growth rates (9.0% and 7.3% respectively) and outstanding performances regarding KI industries' growth rates (16.9% and 9.9% respectively), NRI industries explain more than 50% of overall manufacturing sector growth between 2003 and 2007. Argentina and Colombia also depict a relatively more balanced manufacturing sector growth pattern.

TABLE 3
MANUFACTURING SECTOR'S GROWTH ACCOUNTING
(Percentage variation)

	Argentina		Brasil		Chile		Colombia		México	
	1998-2002	2003-2007	1998-2002	2003-2007	1998-2002	2003-2007	1998-2002	2003-2007	1998-2002	2003-2007
Knowledge-intensive (KI)	31.3	27.4	52.1	76.7	-5.7	13.0	9.4	15.8	72.2	93.5
Automobile	16.3	13.6	25.8	24.3	0.3	5.7	6.6	6.9	64.3	69.9
KI ex/ auto	15.0	13.8	26.3	52.4	-6.0	7.3	2.8	8.9	7.9	23.6
Natural Resource-intensive (NRI)	74.1	51.7	41.7	15.1	105.8	87.4	95.6	59.6	38.4	19.9
Food & beverage	41.0	32.7	11.6	4.5	56.7	34.0	21.4	17.9	40.7	6.9
Labor-intensive	-5.4	20.9	6.2	8.1	-0.1	-0.4	-5.0	24.6	-10.7	-13.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

What about productivity? As mentioned above, LAC countries' manufacturing sector productivity gap in comparison with the US widened consistently between 1998 and 2007. Between 1998 and 2002, when overall productivity gaps widened most considerably, absolute labor

productivity growth in LAC countries proved weak and heterogeneous (Table 4): Argentina and Brazil performed very poorly (the latter actually showing negative productivity growth), whereas Chile, Colombia and Mexico did pretty well. Chile, in fact, was able to keep pace with US labor productivity growth, as shown in Table 1 (Chile's productivity gap widened by only 1% between 1998-2002, compared to LAC average reduction of 18% in that same period).

Between 2003 and 2007 Argentina recovered substantially and increased its overall labor productivity growth pace from a meagre 0.09% to 2.18%, Brazil was able to achieve positive growth (albeit at a very minor annual growth rate of 0.24%), Colombia and Mexico receded slightly (from a rate of 4.03% to 3.42% and from one of 3.80% to 3.49%, respectively) but nevertheless remained at the top of the ranking, and Chile suffered a severe drop (from 5.13% to 0.52%).

In Argentina between 2003 and 2007 labor productivity growth was lead by KI industries (especially automobile) followed by NRI industries. In Brazil only KI industries showed productivity growth (also lead by the automobile sector) during this period, while there was negative productivity growth in NRI and practically none at all in LI industries. In Chile, which as in the Brazilian case did not perform well with regard to overall productivity growth between 2003 and 2007, only NRI industries reported positive productivity growth. Colombia shows much better and balanced figures: all three types of industries report solid labor productivity growth (3.41%, 5.35% and 1.72% in KI, NRI and LI industries, respectively). Together with Mexico, Colombia ranks first with reference to productivity growth. But as opposed to Mexico —where only KI industries (again, mostly automobile) perform performed well— Colombia portrays a much more balanced picture. However, it should be noted that Colombia's KI and LI industries diminish their productivity growth rates vis-à-vis the 1998-02 period.

TABLE 4
MANUFACTURING ANNUAL AVERAGE PRODUCTIVITY GROWTH
(Percentage variation)

	Argentina		Brazil		Chile		Colombia		México	
	1998-2002	2003-2007	1998-2002	2003-2007	1998-2002	2003-2007	1998-2002	2003-2007	1998-2002	2003-2007
Knowledge-intensive (KI)	-4.58	4.80	-0.95	1.65	4.41	-0.15	6.92	3.41	6.30	8.54
Automobile	1.13	7.13	4.22	4.02	7.49	14.75	8.54	7.51	8.63	10.25
KI ex/ auto	-7.12	2.91	-2.55	0.81	3.78	-3.03	6.41	1.86	3.64	5.20
Natural Resource-intensive (NRI)	3.36	3.23	-0.97	-2.50	4.79	0.49	4.81	5.35	2.28	0.76
Food & beverage	-1.18	5.01	-1.36	-4.08	4.50	1.30	5.09	2.81	2.88	-0.24
Labor-intensive	-1.20	0.74	-2.79	0.25	4.94	-0.86	1.59	1.72	2.19	-1.18
Total	0.09	2.18	-1.41	0.24	5.13	0.52	4.03	3.42	3.80	3.49

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

In order to sketch out the underlying nature of these heterogeneous productivity growth rates labor market figures ought to be considered as well. Productivity growth can be inclusive —when productivity and employment grow in tandem— or inequitable —when the former tends to grow to the detriment of the latter. Inclusive productivity growth seems to occur during high-growth phases with proper macro-prices when expansion of production outperforms productivity growth, thus requiring new hires; while the second tends to portray defensive corporate strategies, typically during contractionary phases or on account of adverse macro-prices (e.g an appreciated exchange rate; see CEPAL 2010).

Argentina is a good case in point. Between 1998 and 2002 average manufacturing productivity growth was very slight and for the most part the result of drastic employment reduction —a typical case of defensive strategy (Holland and Porcile, 2005). During this period productivity growth ranks first in NRI industries —the same industry where employment destruction ranks first.[8] Between 2003 and 2007 productivity grew much faster and in conjunction with intense job creation. Note that during this period it is in the KI industries where both productivity and employment grow faster. In NRI productivity growth maintains its momentum between 2003 and 2007 *vis-à-vis* the 1998-02 period, but as opposed to this period in the context of positive employment growth. In LI industries employment also increases significantly, but productivity growth is not quite as strong.

TABLE 5
ARGENTINA. PRODUCTIVITY AND EMPLOYMENT:
AVERAGE ANNUAL GROWTH RATES
(Percentage variation)

	Productivity		Employment	
	1998-2002	2003-2007	1998-2002	2003-2007
Knowledge-intensive (KI)	-4.58	4.80	-10.80	11.52
Automobile	1.13	7.13	-17.13	12.77
KI ex/ auto	-7.12	2.91	-7.06	11.01
Natural Resource-intensive (NRI)	3.36	3.23	-11.53	4.24
Food & beverage	-1.18	5.01	-7.29	3.22
Labor-intensive	-1.20	0.74	3.45	6.98
Total	0.09	2.18	-7.63	6.67

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

Between 1998 and 2002 labor productivity falls in Brazil (especially in LI industries), in conjunction with employment growth. Only the automobile industry reports positive productivity growth during this period. In turn, between 2003 and 2007, when productivity growth speeds up a bit, employment growth accelerates much more, especially in KI industries (particularly automobile), but also in NRI and LI industries, where productivity falls or remains fairly stable.

Chile is where productivity grew most rapidly —and homogeneously— in the 1998-02 period, alongside wide-ranging job destruction —another defensive stance—, particularly in KI and LI industries. As mentioned above, between 2003 and 2007 Chile is where productivity growth rates decrease most sharply (from an average yearly rate of 5.13% in 1998-02 to one of 0.52% in 2003-2007) but in a context of positive employment growth, especially in KI and NRI industries.

[8] However, it must be recalled that this was a very identifiable period in Argentina's economic history, characterized by a protracted recession which wound up as an awfully profound balance-of-payments-cum-financial crisis. During the previous five-year period productivity grew much faster together with job destruction (Coremberg, 2006).

TABLE 6
BRAZIL: PRODUCTIVITY AND EMPLOYMENT:
AVERAGE ANNUAL GROWTH RATES
(Percentage variation)

	Productivity		Employment	
	1998-2002	2003-2007	1998-2002	2003-2007
Knowledge-intensive (KI)	-0.95	1.65	3.77	6.93
Automobile	4.22	4.02	1.67	6.45
KI ex/ auto	-2.55	0.81	4.50	7.12
Natural Resource-intensive (NRI)	-0.97	-2.50	2.47	3.92
Food & beverage	-1.36	-4.08	2.70	5.61
Labor-intensive	-2.79	0.25	3.39	1.56
Total	-1.41	0.24	3.14	3.79

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

TABLE 7
CHILE. PRODUCTIVITY AND EMPLOYMENT:
AVERAGE ANNUAL GROWTH RATES
(Percentage variation)

	Productivity		Employment	
	1998-2002	2003-2007	1998-2002	2003-2007
Knowledge-intensive (KI)	4.41	-0.15	-5.01	5.59
Automobile	7.49	14.75	-6.69	-1.77
KI ex/ auto	3.78	-3.03	-4.63	7.00
Natural Resource-intensive (NRI)	4.79	0.49	-2.01	5.42
Food & beverage	4.50	1.30	-1.22	4.06
Labor-intensive	4.94	-0.86	-4.72	0.76
Total	5.13	0.52	-3.26	4.23

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

As in the case of Chile, in Colombia productivity grows significantly and homogeneously between 1998 and 2002, in the context of considerable job destruction, and between 2003 and 2007 productivity growth slows down slightly but in the context of high employment growth, especially in KI and LI industries.

TABLE 8
COLOMBIA. PRODUCTIVITY AND EMPLOYMENT:
AVERAGE ANNUAL GROWTH RATES
(Percentage variation)

	Productivity		Employment	
	1998-2002	2003-2007	1998-2002	2003-2007
Knowledge-intensive (KI)	6.92	3.41	-5.54	6.31
Automobile	8.54	7.51	-5.57	9.22
KI ex/ auto	6.41	1.86	-5.67	5.51
Natural Resource-intensive (NRI)	4.81	5.35	-2.72	1.73
Food & beverage	5.09	2.81	-4.08	1.56
Labor-intensive	1.59	1.72	-1.76	4.66
Total	4.03	3.42	-2.71	3.75

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

Mexico's case resembles those of Chile and Colombia. Between 1998 and 2002 productivity growth is intense and mostly due to KI industries (particularly automobile) and parallel to significant job destruction. Between 2003 and 2007 productivity growth is also largely due to KI industries, albeit in this case with modest job creation. Mexico is where employment grows the least between 2003 and 2007.

TABLE 9
MEXICO. PRODUCTIVITY AND EMPLOYMENT:
AVERAGE ANNUAL GROWTH RATES
(Percentage variation)

	Productivity		Employment	
	1998-2002	2003-2007	1998-2002	2003-2007
Knowledge-intensive (KI)	6.30	8.54	-2.60	1.13
Automobile	8.63	10.25	-2.29	2.38
KI ex/ auto	3.64	5.20	-2.74	0.50
Natural Resource-intensive (NRI)	2.28	0.76	-0.94	0.88
Food & beverage	2.88	-0.24	0.06	1.41
Labor-intensive (LI)	2.19	-1.18	-2.89	-1.62
Total	3.80	3.49	-2.14	0.27

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

IV. Mind the gap

From a dynamic perspective, what really matters is productivity growth in comparison with that of industrialized countries —i.e. the evolution of productivity gaps. As mentioned above LAC countries' average labor productivity gap widened between 1998 and 2002 in the manufacturing sector. This widening was not homogeneous across industries: while KI and LI industries' productivity gap *vis-à-vis* the US widened all of our five case studies, NRI industries were able to catch up (see Tables 10 to 14 below). This was particularly the case in Argentina, Chile, Colombia and to a lesser extent Mexico, although not in Brazil, where productivity gaps widened across the board.

TABLE 10
ARGENTINA. PRODUCTIVITY GAPS VIS A VIS US MANUFACTURING

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998 2007 (perc var.)	1998-2002 (perc var.)	2003-2007 (perc var.)
Knowledge-intensive (KI)	29.9	24.9	23.6	22.1	18.3	18.8	19.2	19.0	19.8	19.7	-34	-39	5
Automobile	60.7	53.3	58.4	56.2	54.8	50.8	55.4	57.8	61.0	59.7	-2	-10	18
KI ex/ auto	22.9	19.3	17.5	16.9	12.1	13.8	13.8	13.3	13.6	13.4	-41	-47	-3
Natural Resource-intensive (NRI)	58.2	58.0	61.5	65.8	63.5	67.4	64.4	64.7	64.1	64.6	11	9	-4
Food & beverage	62.0	63.1	64.4	63.8	59.1	65.3	65.7	71.9	70.0	68.8	11	-5	5
Labor-intensive (LI)	53.1	49.0	48.7	57.0	43.4	47.1	42.0	40.5	39.6	40.1	-24	-18	-15
Total	46.6	43.9	42.6	42.6	37.7	39.1	37.3	36.9	36.9	36.1	-22	-19	-8

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

During the boom years (2003-2007), the different countries show different patterns. In Argentina the productivity gap tends to narrow in KI but not in NRI industries (though there is positive progress in "foods & beverages"). Brazil experiences once again a general widening of productivity gaps, although relatively less intensely in KI industries (indeed, there is positive progress in the

automobile industry). In Chile productivity gaps widen across the board, especially in the NRI industries.[9] In Colombia productivity gaps also tend to widen, with the exception of NRI industries. In Mexico the KI industries tend to close the productivity gap (driven by the automobile industry). In short, there no clear pattern —yet it is pretty clear that there is no technological breakthrough whatsoever.

TABLE 11
BRAZIL. PRODUCTIVITY GAPS VIS A VIS US MANUFACTURING

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007 (perc. var.)	1998-2002 (perc. var.)	2003-2007 (perc. var.)
Knowledge-intensive (KI)	19.8	17.0	16.8	16.6	14.0	13.0	13.9	13.7	13.0	12.1	-39	-29	-7
Automobile	28.2	28.8	32.8	32.6	28.7	23.2	28.0	27.8	25.2	24.2	-14	2	5
KI ex/ auto	18.4	15.2	14.6	14.4	11.9	11.6	11.8	11.7	11.4	10.4	-44	-36	-11
Natural Resource-Food & beverage	26.7	26.4	26.6	26.4	24.5	21.9	20.6	19.0	17.6	16.7	-37	-8	-24
Labor-intensive (LI)	17.2	17.3	16.4	16.5	16.3	14.3	14.0	13.2	11.7	10.5	-39	-5	-27
Total	16.2	15.3	14.0	13.3	12.4	10.1	9.7	9.6	8.9	8.5	-48	-2	-17
	19.5	18.0	16.9	16.5	14.9	13.0	13.0	12.6	11.9	11.1	-43	-24	-14

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

TABLE 12
CHILE. PRODUCTIVITY GAPS VIS A VIS US MANUFACTURING

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007 (perc. var.)	1998-2002 (perc. var.)	2003-2007 (perc. var.)
Knowledge-intensive (KI)	18.8	19.3	18.9	18.9	16.5	15.6	14.6	14.8	14.0	13.4	-29	-12	-14
Automobile	26.3	26.2	37.0	30.9	30.3	29.9	30.4	35.7	33.4	46.2	76	15	55
KI ex/ auto	17.3	17.7	16.3	16.8	14.3	13.3	12.2	12.1	11.5	10.2	-41	-17	-23
Natural Resource-Food & beverage	39.0	41.2	44.5	47.3	44.9	44.0	40.7	38.1	39.1	37.8	-3	15	-14
Labor-intensive (LI)	30.3	32.3	33.6	36.3	36.2	33.9	32.9	31.8	33.8	30.9	2	19	-9
Total	32.2	33.7	34.0	34.2	33.5	32.7	30.3	29.1	27.7	26.1	-19	4	-20
	29.9	30.8	30.5	31.6	29.5	28.1	26.5	25.4	25.9	24.3	-19	-1	-14

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

[9] The automobile industry's major improvement is the exception —but it is not a relevant industrial sector in Chile.

TABLE 13
COLOMBIA. PRODUCTIVITY GAPS VIS A VIS US MANUFACTURING

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007 (perc. var.)	1998-2002 (perc. var.)	2003-2007 (perc. var.)
Knowledge-intensive (KI)	12.7	11.2	11.9	13.4	12.3	11.6	11.9	11.6	11.5	11.5	-10	-4	-1
Automobile	23.9	17.5	25.1	35.1	28.6	25.5	29.8	31.4	29.7	30.4	27	20	19
KI ex/ auto	10.9	10.0	10.1	10.6	10.0	9.6	9.5	9.0	9.1	8.9	-18	-8	-7
Natural Resource-	33.4	34.9	37.5	39.4	38.5	39.5	38.8	39.8	38.8	41.0	23	15	4
Food & beverage	31.5	32.3	33.4	36.4	38.4	39.2	38.8	41.9	39.3	37.9	20	22	-3
Labor-intensive (LI)	21.7	20.1	23.2	23.6	19.9	19.6	16.9	16.7	16.8	17.3	-20	-9	-12
Total	21.4	20.6	21.5	22.3	20.2	19.9	18.7	18.8	18.9	19.3	-10	-5	-3

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

TABLE 14
MEXICO. PRODUCTIVITY GAPS VIS A VIS US MANUFACTURING

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007 (perc. var.)	1998-2002 (perc. var.)	2003-2007 (perc. var.)
Knowledge-intensive (KI)	11.8	11.5	11.6	11.7	11.1	10.6	10.5	10.9	11.9	12.8	9	-6	20
Automobile	30.4	32.6	38.2	39.6	36.5	35.7	36.6	36.9	40.9	47.0	55	20	32
KI ex/ auto	7.8	7.2	6.9	6.8	6.4	6.2	6.0	6.4	6.7	6.5	-16	-18	6
Natural Resource-	27.6	27.8	29.2	29.9	28.8	28.9	27.1	27.2	26.0	25.1	-	4	-13
Food & beverage	22.8	23.3	24.3	25.6	25.5	26.1	25.8	27.0	24.9	22.4	-2	12	-14
Labor-intensive (LI)	20.4	20.5	20.3	20.6	19.1	18.4	17.3	16.8	15.9	14.5	-29	-6	-21
Total	17.9	17.6	17.4	17.7	16.8	16.3	15.7	15.9	16.1	15.8	-12	-6	-3

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

So far we have concentrated on the so-called external gap, which reflects the asymmetries between the technological capabilities of countries in the region and those found on the international frontier. In the following subsection we concentrate on the internal gap (See ECLAC, Chapter III, 2010).

1. The internal gap (structural heterogeneity)

The internal gap, or structural heterogeneity, i.e. the large productivity dispersion among sectors in a given country —much larger than that found in developed countries— is also characteristic in the LAC region (Infante, 2009). Structural heterogeneity means that segments with very low labor productivity exist alongside others whose labor productivity is in the middle or high ranges.

Below we present a particular estimate of structural heterogeneity, which reports the relative coefficient of variation of sectoral productivity gaps *vis-à-vis* the US (Table 15). Structural heterogeneity worsens if the coefficient of variation increases, which would mean that leading

industries —those closer to the international frontier— are closing the productivity gap faster than backward industries.

TABLE 15
COEFFICIENT OF VARIATION OF RELATIVE PRODUCTIVITY GAPS

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-02 (Average)	2003-07 (Average)
Argentina	78.8	83.9	102.4	95.6	99.5	93.5	85.5	80.7	79.5	87.4	92.0	85.3
Brazil	132.9	150.3	259.1	279.1	276.7	281.2	274.2	164.7	147.1	144.1	219.6	202.3
Chile	137.9	151.5	169.7	187.1	157.8	163.2	141.8	140.2	146.9	161.1	160.8	150.6
Colombia	27.6	42.3	38.5	43.1	29.6	30.5	33.6	33.8	32.3	37.8	36.2	33.6
México	87.1	86.9	86.0	83.8	88.9	87.4	85.6	86.3	89.5	96.4	86.5	89.0

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

Such has been precisely the case for our five case studies between 1998 and 2002. The relative coefficient of variation of sectoral productivity gaps as portrayed in Graph 4.1.1 tends to increase during this period in all five cases —i.e. structural heterogeneity worsens. This is a typical depiction of the dual nature of LAC economies, characterized by a small number of dynamic industries which tend to catch up with the international frontier coexisting with a majority of backward industries whose productivity gap tends to widen over and over. However, during the boom years (2003-2007) things change a bit. In Argentina, Brazil and Chile the internal gap as measured by the coefficient of variation of relative productivity gaps tends to narrow; whereas in Colombia and Mexico structural heterogeneity remains pretty much unchanged.

2. Productivity growth accounting (shift-share analysis)

Shift-share analysis identifies the different sources of productivity growth. As in Holland & Porcile (2005), who carried out a similar shift-share analysis for the 1970-2002 period,[10] we follow the methodology presented in Fagerberg (2000), as expressed in the following equation:

$$\frac{\Delta P}{P} = \Sigma\left[P\frac{P_{io}\Delta S_i}{P_o} + \frac{\Delta P_i \Delta S_i}{P_o} + \frac{S_{io}\Delta P_i}{P_o} \right]$$

where P_i stands for labor productivity in industry i, S_i for the share of industry i in total employment, Δ for the variation undergone by the different variables and P_0 for average productivity in the base year.

The first term within the square brackets indicates the contribution of the reallocation of workers among different industries to overall productivity growth, referred to as Effect 1 as in Holland & Porcile (2005). This term will be positive if employment grows in high-productivity industries and falls in low-productivity industries. Even if a positive Effect 1 should come forth, it should be noted that it does not necessarily mean that workers are being reallocated to the most dynamic sectors. In

[10] Holland and Porcile (2005) examined the cases of Argentina, Brazil, Chile, Colombia, Mexico and Uruguay.

developing countries productivity is typically high in primary sector production, where productivity growth need not be substantial.

The second term in brackets is an interaction term which indicates the extent to which industries where employment is growing coincide with those where productivity is growing. This term, referred to as Effect 2, captures workers reallocation from a more dynamic perspective. A positive Effect 2 means that employment is being reallocated to the economy's most dynamic sectors with regard to labor productivity growth. While Effect 1 relates productivity levels to changes in the employment pattern, Effect 2 connects productivity growth rates to changes in the employment.

The third term in brackets indicates the contribution of productivity growth in each industry weighed by the share of each industry in total employment. This term, referred to as Effect 3, accounts for the individual contribution of each industry to overall productivity growth. It does not depend on structural change or the reallocation of workers among the various industries, but on each industry's individual technological path.

To sum up, Effect 1 indicates the contribution resulting from the reallocation of workers from low to high productivity industries to overall productivity growth, Effect 2 indicates the contribution resulting from the reallocation of workers from slow- to fast-growing productivity industries, whereas Effect 3 indicates each industry's individual contribution to productivity growth, given the employment structure. In an economy that undergoes no structural change whatsoever, productivity growth would be entirely due to Effect 3. In an economy where labor is being reallocated from low to high productivity sectors (which may or may not be dynamic sectors; e.g. from low productivity agricultural tasks to high productivity mining activities), productivity growth would be mostly due to Effect 2. In an economy where labor is being reallocated from relatively slow to dynamic industries, i.e. in an economy undergoing structural change, Effect 1 would explain a significant share of overall productivity growth.

Table 16 reports our results for the 1998-2002 and 2003-2007 periods. In addition to computations for Effects 1, 2 and 3 for our five case studies, for the sake of clarity Table 16 presents also the overall growth rate of employment (GE) and of average productivity (GP) in the manufacturing sector. After performing the necessary computations for the 2003-2007 period we arrive at a similar result as Holland & Porcile (2005), who analyzed the 1970-2002 period —there seems to be no substantial evidence of structural change. Productivity growth during the boom years is still largely explained by Effect 3, i.e. productivity growth has not involved major shifts in the employment structure. Moreover, with the exception of Brazil (where evidence is not decisive anyhow), Effect 2 is negative across the board not only between 1998 and 2002 but also between 2003 and 2007.

Such is the case in Argentina, where individual industries' productivity increases explain the bulk of productivity growth in both periods. It must be noted, however, that the negative values assumed by Effects 1 and 2 diminish significantly between 2003 and 2007, when both productivity and employment growth in the manufacturing sector (GP and GE, respectively) seem remarkable (the highest among the five case studies). Brazil portrays a significant negative Effect 3 between 1998 and 2002, which largely explains overall negative productivity growth in this period. Between 2003 and 2007 Effects 1 and 2 shift to positive territory and, somewhat surprisingly, Effect 3 remains in negative territory (albeit not as negative as between 1998 and 2002). No other country shows a positive Effect 2 during in any of the two periods accounted for in Table 16. In Chile high productivity growth between 1998 and 2002 is almost entirely explained by Effect 3. Between 2003 and 2007 Chile undergoes a substantial decline in its productivity growth rate (GP), from 22.2% to 2.1 %, entirely explained by Effect 1.[11] In Colombia productivity growth is in both periods explained by Effect 3. In fact, while productivity growth is able to maintain momentum between 2003 and 2007,

[11] Effect 1 is largely explained by the mining industry. In Chile, when the same exercise is run excluding the mining industry both Effects 1 and 2 diminish considerably.

Effects 1 and 2 decline significantly. In Mexico, finally, productivity growth is also largely explained by Effect 3 in both periods.

TABLE 16
PRODUCTIVITY GROWTH ACCOUNTING
(Percentage variation)

	Effect 1	Effect 2	Effect 3	G_E	G_P
Argentina					
1998-2002	-4.28	-6.63	11.26	-23.4	0.35
2003-2007	-1.85	-0.37	11.23	29.5	9.01
Brazil					
1998-2002	-0.31	-0.17	-5.03	12.56	-5.51
2003-2007	1.35	0.14	-0.54	15.16	0.95
Chile					
1998-2002	0.43	0.04	21.69	-10.60	22.15
2003-2007	3.55	-0.63	-0.84	18.00	2.08
Colombia					
1998-2002	0.51	-0.31	16.91	-7.9	17.12
2003-2007	-2.36	-0.68	17.42	15.9	14.38
México					
1998-2002	0.46	0.04	15.56	-12.4	16.06
2003-2007	0.98	0.04	15.57	1.1	16.59
América Latina					
1998-2002	-0.71	-0.36	10.42	5.0	9.06
2003-2007	-0.14	0.31	8.00	12.3	8.15

Source: Economic Commission for Latin America and the Caribbean (ECLAC). Programa de Análisis de la Dinámica Industrial (PADI).

V. Summary and conclusions

Between 2003 and 2008 Latin America and the Caribbean experienced remarkable growth along with high commodity prices and extraordinary international financing conditions. Yet, despite an encouraging overall macroeconomic performance, most LAC countries' productivity gaps widened during this period in relation to industrialized countries (here represented by the United States' manufacturing sector). There are, however, different outcomes at the national level that might be of some interest for future research.

Argentina experienced very significant growth between 2003 and 2007 (Table 17), ranking first among our five study cases. The manufacturing sector also expanded significantly, outperforming overall GDP thus resulting in a considerable increase of the manufacturing coefficient vis-à-vis the 1998-2002 period. The manufacturing sector expanded in a fairly balanced way during the boom, with some prevalence of RNI industries. Productivity growth picked up during the 2003-07 period in comparison to the previous five years, although it did not match the pace achieved by Colombia and Mexico during the same period. Productivity increased in all three types of industries, although especially in the knowledge- and natural resource-intensive industries. Anyway, as in the other cases —except Brazil— overall productivity growth was mostly due to individual sectoral improvement rather than structural change (Effect 3). Argentina also ranks first as regards employment generation in manufacturing (over 6.5% yearly growth on average between 2003 and 2007). But, as was the case in the other four countries, the external gap broadened in Argentina between 2003 and 2007 —albeit at a slower pace than in the previous period. It should be noted, however, that the external gap actually narrowed in the automobile and foods and beverages sectors between 2003 and 2007. The internal gap (structural heterogeneity) improved in comparison with the 1998-2002 period but not too significantly, as in the other cases (with the exception of Mexico, where the internal gap actually worsened).

Brazil experienced relatively modest growth vis-à-vis other countries in the region between 2003 and 2007. Its manufacturing GDP also grew moderately, pretty much in line, yet a bit more slowly than total GDP —hence the gentle downward tendency in Brazil's manufacturing coefficient during this period. In Brazil industrial growth was mostly related to KI industries between 2003 and 2007, including —yet not exclusively due to— the automobile industry. Nonetheless overall productivity growth was almost stagnant —the slowest among the five case studies between 2003 and 2007. Only KI industries experienced noteworthy productivity growth during this period. Yet, Brazil is the only country among our five study cases where productivity gains are due to some structural transformation (Effects 1 and 2). Still, as in all other cases, the productivity gap broadened significantly —while it narrowed in the automobile industry, it widened in the remaining sectors.

Structural heterogeneity (the internal gap), as measured by the relative coefficient of variation of relative productivity gaps, went down very little. Employment also grew between 2003 and 2007, though not as rapidly as in other countries (e.g. Argentina and Chile).

Chile experienced significant growth between 2003 and 2007, keeping in line with the region's average performance. Manufacturing sector growth, however, did not match overall GDP growth —hence the sharp reduction in Chile's manufacturing coefficient. In Chile manufacturing growth was largely pushed by NRI industries, including considerable job creation. Overall manufacturing productivity growth fell sharply *vis-à-vis* the previous period. Even in the NRI industries productivity growth decelerated. Interestingly, overall productivity gains seem to have been largely due to the reallocation of resources towards mining industries (Effect 1). However, the overall productivity gap broadened (even in NRI industries) between 2003 and 2007.[12] This poor but homogenous performance allowed for some improvement as per structural heterogeneity, as low productivity sectors' seem to have outperformed high productivity sectors with regard to productivity growth.

Colombia experienced pretty high GDP growth between 2003 and 2007, close to Argentina's (Table 17). Manufacturing sector growth matched up with GDP growth and in fact Colombia's manufacturing coefficient grew slightly during this period. Sectorally speaking, manufacturing sector growth was pretty balanced, with a slight predominance of RNI industries. KI industries production did well also, but mostly pertaining to the automobile sector. Overall manufacturing productivity growth was also considerable, though a little lower than the 1998-2002 period, but mostly due to individual sectoral improvement (Effect 3). Indeed, productivity increased in all subsectors and in a fairly balanced manner, although especially in RNI industries. As in the other cases, Colombia's productivity gap vis-à-vis the United States broadened between 2003 and 2007, though the tendency reversed slightly as of 2005, when a minor narrowing of the gap occurs (as a matter of fact both NRI industries and the automobile sector were able to narrow their productivity gaps between 2003 and 20007). Finally, structural heterogeneity remained comparatively unchanged. As per employment, job creation was also fairly strong during the boom years.

TABLE 17
REAL GDP AVERAGE ANNUAL GROWTH RATES. 2003-2007
(Percentage variation)

	2003	2004	2005	2006	2007	Average 2003-07	Average 1998-02
Argentina	8.8	9.0	9.2	8.5	8.7	8.8	-4.9
Brazil	1.1	5.7	3.2	4.0	5.7	4.6	2.1
Chile	3.9	6.0	5.6	4.6	4.7	5.2	2.3
Colombia	4.6	4.7	5.7	6.9	7.5	6.2	0.8
Mexico	1.4	4.0	3.3	5.0	3.4	3.9	2.7

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Mexico experienced modest growth between 2003 and 2007 (the lowest among the five case studies; see Table 17). Its manufacturing GDP also grew moderately and along the lines of total GDP, so that there was no significant change in its manufacturing coefficient. Between 2003 and 2007 industrial growth was mostly due to KI industries, particularly the automobile sector (largely an assembly industry). Productivity growth was considerable (very much concentrated in the KI industries), even with respect to the other four case studies, but came together with feeble job creation and was largely

[12] The resulting fall would be much sharper if the automobile industry were excluded from the computation.

due to individual industries' productivity increases (Effect 3) rather that structural transformation (Effects 1 and 2). The productivity gap, however, broadened —the overall result was not so bad due to significant catching up in the automobile industry. It is precisely due to this remarkable performance in the automobile industry that structural heterogeneity (the internal gap) increased.

In short, despite exceptional high spots during the "boom" years (e.g. Argentina and Colombia's increased manufacturing coefficient and vibrant job creation; Brazil's incipient symptoms of some structural change), the overall picture remains one of embryonic development at most. To the extent that development is associated with convergence in productivity the boom years may be characterized for the region as a whole as a period of growth without (much) development (CEPAL, 2010).

Bibliography

Capdevielle, Mario (2005), "Globalización, especialización y heterogeneidad estructural en México", in Mario Cimoli (ed.), *Heterogeneidad Estructural, Asimetrías Tecnológicas y Crecimiento en América Latina*, Santiago, BID-CEPAL.

CEPAL (2007), "Progreso técnico y cambio estructural en América Latina ", *Colección documento de proyecto*, IDRC –CRDI.

_____ (2010), *La Hora de la Igualdad. Brechas por Cerrar, Caminos por Abrir,* (LC/G.2432(SES.33/3)), Santiago de Chile.

Cimoli, Mario and Giovanni Dosi (1995), "Technological paradigms, patterns of learning and development: an introductory roadmap", *Journal of Evolutionary Economics*, vol. 5, N° 3.

Cimoli, Mario (1988), "Technological gaps and institutional asymmetries in a north-south model with a continuum of goods", *Metroeconomica*, vol. 39.

Coremberg, Ariel (2006), "Productividad, costo laboral y excedente en la Argentina durante 2003 y 2004", *Working Document*, Series de Trabajo, Ocupación y Empleo, N°2, Subsecretaría de Estudios Laborales y Programación Técnica, Ministerio de Trabajo, Empleo y Seguridad Social,.

Crespi, Gustavo (2006), "Productivity and firma heterogeneity in Chile", Freeman Centre, University of Sussex, *Working Paper* Nº36.

Fagerberg, Jan (2000), "Technological progress, structural change and productivity growth: a comparative study", *Structural Change and Economic Dynamics*, vol. 11.

Hirschman, Albert (1958), *The Strategy of Economic Development*, New Haven, Conn.: Yale University Press.

Holland, Marcio and Gabriel Porcile (2005), "Brecha Tecnológica y Crecimiento en América Latina", in Mario Cimoli (ed.), *Heterogeneidad Estructural, Asimetrías Tecnológicas y Crecimiento en América Latina*, Santiago, BID-CEPAL.

Infante, R. (2009), "Contribución al documento del trigésimo tercer período de sesiones de la CEPAL", Santiago de Chile, inédito.

Kaldor, Nicholas (1966), *Causes of the Slow Rate of Economic Growth in the United Kingdom*, Cambridge, Cambridge University Press.

Katz, Jorge and Giovanni Stumpo (2001), "Regímenes competitivos sectoriales, productividad y competitividad internacional", Serie *Desarrollo Productivo* Nº 103, Santiago de Chile, CEPAL.

Katz, Jorge (1986), *Desarrollo y crisis de la de la capacidad tecnológica Latinoamericana: el caso de la industria metalmecánica*, Oficina Buenos Aires CEPAL.

Kupfer, David and Frederico Rocha (2005), "Productividad y Heterogeneidad Estructural en la industria Brasileña", in Mario Cimoli (ed.), *Heterogeneidad Estructural, Asimetrías Tecnológicas y Crecimiento en América Latina*, Santiago, BID-CEPAL.

Lewis, Arthur (1954), "Economic Development with Unlimited Supplies of Labor", *The Manchester School*, Vol. 22, pp. 139-91.

Nurkse, Ragnar (1953), *Problems of Capital Formation in Underdeveloped Countries*, New York, Oxford University Press.

Palma, Gabriel (2007), "Four sources of de-industrialization and a new concept of the Dutch disease", presentado en Human Sciences Research Council (HSRC) - Employment Growth and Development Initiative (EGDI) Roundtable: "The Changing Character of Industrial Development: What Implications for Growth, Employment and Income Distribution?", 21 mayo de 2007, Universidad de Cambridge.

Pieper, Ute (2003), "Sectoral regularities of productivity growth in developing countries – a Kaldorian interpretation", *Cambridge Journal of Economic*, vol 27.

Porcile, Gabriel (2009), "Heterogeneidad estructural y desarrollo", Proyecto Desarrollo Inclusivo, CEPAL-Naciones Unidas, Documento de Trabajo.

Prebisch, Raúl (1962), "The Economic Development of Latin America and its Principal Problems" *Economic Bulletin for Latin America*, Vol. 7, N° 1, pp. 1-22.

Ros, Jaime (2000), Development Theory and the Economics of Growth, Ann Arbor, Michigan: University of Michigan Press.

Rosenstein-Rodan, Paul (1943), "The Problem of Industrialization of Eastern and South-Eastern Europe", *Economic Journal*, Vol. 53, pp. 202-11.

Schumpeter, J.A (1934), "The theory of Economics Development", Cambridge, Harvard University Press.

Syrquin, Moshe (2008), "Structural change and development", in Dutt, Amittava and Kaime Ros (eds.), *International Handbook of Development Economics*, Volume 1, pages 48-67.

Timmer, Marcel P. and Adam Szirmai (2002), "Productivity growth in Asian manufacturing: the structural bonus hypothesis examined", *Working Paper*, Eindhoven Center for Innovation Studies.

Verspagen, Bart and Bart Los (2004), "The evolution of productivity gaps and specialization patterns", TEG Research Project University Eindhoven, Groningen and Maastrich.

Yoguel Gabriel and Verónica Robert (2010), "La dinámica compleja de la innovación y el desarrollo económico", in Cristiano Antonelli (ed), *Handbook on the Economic Complexity of Technological Change*.