Sources of Productivity and Economic Growth in Latin America and the Caribbean, 1990-2013

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ABSTRACT

This article examines growth experiences of 23 Latin American and English-speaking Caribbean countries from 1990 to 2013. We carry out three types of exercises. The first exercise for the 23 countries in the region uses the traditional methods to measure capital, labour, and efficiency or total factor productivity (TFP). The second exercise focuses on the Latin American countries only. The labour measure (L) is improved through the introduction of a quality adjustment to hours worked, while the capital measure includes capital services. The exercises reveal that as the input measures improve, the efficiency measure (TFP), which is usually positive and statistically explains a large share of observed growth, becomes increasingly negative for all groups of countries and all sub-periods. The only exception is the boom period of 2003–2008. A third exercise uses the LA-KLEMS database to disaggregate the data into nine industries. For each industry, we identify three characteristics of the labour factor and eight types of capital assets. The disaggregated data are only available for Argentina, Brazil, Chile, Colombia, and Mexico. Based on this more disaggregated analysis, we put forward hypotheses on the factors that determine growth and discuss implications for public policies.

In this article, we address recent efforts to quantitatively measure what pushes our economies towards growth and, ultimately, towards development. These studies use a growth accounting framework to identify elements that could guide public policies in terms of promoting measures that sustainably increase growth rates in 23 economies of Latin America and the English-speaking Caribbean (LAC).

In the international literature on growth accounting, the discussion is generally structured around an approach that can be expressed as follows (Caselli, 2004):

Income = F (inputs, efficiency)

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That is, income or production, generally measured in per capita terms, is a function of certain inputs (usually some measure of capital and labour) and the efficiency with which those inputs are used (namely, total factor productivity, or TFP). TFP is a measure of the shift in the production function (of an economy, production facility, or economic sector) at a given level of capital and labour. Intuitively, we could say that it measures the movement of the production function over and above what can be explained by the capital and labour inputs. Many factors can cause this shift or "addition": technical innovations, organizational or institutional changes, demand fluctuations, changes in the allocation of capital and labour, scale effects, and changes in labour intensity, as well as measurement errors (Hulten, 2001).

TFP is often associated with technological progress, but this is a mistake. To illustrate, consider a change in a productive process based on a consultant's recommendation. The consultant will (ideally) be paid the present value of the innovation, in which case the innovation (or the part paid for it) will be accounted as an input. However, if the same innovation is made by an employee who (in the extreme case) receives no additional payment whatsoever for having discovered the innovation, the innovation will be included in TFP and thus will not be recorded in the firm's economic accounts. The same happens with most R&D spending, which tends to be associated with TFP when, in fact, we are simply not measuring R&D correctly. Further examples include free inputs or inputs that are not recorded in the economic accounts. One of these, which we consider below, is the quality of macroeconomic policies.

This leaves us with two alternatives. We can try to improve the estimation of the input content, or we can take the more difficult path of trying to determine what explains efficiency. As Maddison (1987: 651) states, "Growth accounting of this type cannot provide a full causal story. It deals with "proximate" rather than "ultimate" causality and registers the facts about growth components; it does not explain the elements of policy or circumstance, national or international, that underlie them, but it does identify which facts need more ultimate explanation."

LA-KLEMS has been working in conjunction with the Groningen Growth and Development Centre, the Valencian Institute of Economic Research, and Harvard University through the World KLEMS Initiative, led by Dale Jorgenson, to develop a database that allows a better identification of the proximate causes of economic growth in Latin America. The work has resulted in a consistent statistical database, known as the LA-KLEMS database for Latin America. Like the EU-KLEMS database for Europe, LA-KLEMS identifies and measures five inputs: capital (K), labour (L), energy (E), materials (M), and services (S).

The project collected data on 23 LAC countries from 1990 to 2013, with the sample period broken into four sub-periods: 1990–1997, 1997–2003, 2003–2008, and 2008–2013. The first subperiod covers the economic recovery following the region's "lost decade" of the 1980s, which was characterized by a strong macroeconomic adjustment and a significant decrease in investment, especially public investment. This subperiod ended with the Russian and Asian financial crises, which pushed the world economy into a recession. Given that the LAC region only started recovering from the recession in 2003, the second sub-period spans the recession years from 1997 to 2003. Towards the end of this subperiod, a new boom cycle began, with a substantial increase in commodity prices.

The third sub-period encompasses the boom in commodity prices from 2003 to 2008 and ends with the Great Recession of 2008–2009, detonated by the subprime crisis in the United States. Due to better management of the eco-

nomic boom, such as the building up of reserves, a number of LAC countries were able to withstand the international recession through countercyclical policies. Finally, the 2008–2013 subperiod comprises the recovery of the world economy and the slowdown in China from double-digit growth rates to a "new normal," which appears to be between 6 per cent and 8 per cent in annual terms. Commodity prices are expected to remain low in the medium term, while interest rates are returning to more normal levels, making access to credit more difficult and more costly.

Based on the data availability, we designed three types of exercises. The first covers 23 countries in the region, including 18 from Latin America (LA) (from Mexico to Argentina, plus the Dominican Republic) and five from the English-speaking Caribbean (Bahamas, Barbados, Belize, Jamaica, and Trinidad and Tobago). For this group of 23 countries, we use traditional measures of capital, labour, and TFP.

The second exercise focuses on the 18 Latin American countries only. We improve the labour measure (L) by introducing a quality adjustment to hours worked (namely, years of education), while the capital measure includes a capital services measure. We are thus able to measure flows in the same way we measure labour and output shares. Finally, the third exercise uses the LA-KLEMS database to disaggregate the data into nine industries. For each industry, we identify three characteristics of the labour factor (sex, age, and level of education) and eight types of capital assets. The disaggregated data are only available for five countries: Argentina, Brazil, Chile, Colombia, and Mexico.

The exercises reveal, as discussed in detail below, that as the input measures improve, the efficiency measure (or TFP), which is usually positive and statistically explains a large share of observed growth, becomes increasingly negative for all the groups of countries and in all subperiods. The one exception is the boom period of 2003–2008, when, because of high growth rates, the contribution of TFP decreases but remains positive. This result is consistent with the findings of other studies, which show that TFP displays a procyclical behaviour: since the capital stock does not adjust quickly, in a period of low growth the increase in idle capacity tends to be reflected in a decrease in productivity.

To explore what is happening in these results, we performed an exercise on the five countries for which disaggregated data are available (Aravena and Hofman, 2014). For these countries, it is possible to determine the contribution of the five productive factors used in the KLEMS approach (capital, labour, energy, materials, and services) in nine industrial branches. Based on this more disaggregated analysis, we extract hypotheses on the factors that determine growth and that can be addressed through public policies.

We find that while the growth rates of the capital stock (K) are not far below more industrial countries, investment rates (capital accumulation) are much lower, and the improvement of the quality-adjusted labour input is lower than recorded in the high-growth Asian countries. In addition, dispersion indicators on labour productivity and TFP by economic sector in our countries are much higher than in developed countries, whereas the dispersion of capital per labour unit is not so different, pointing to problems in the allocation of investment. Thus, our relatively low long-term growth rates could be associated with a slower accumulation process, as well as TFP-related factors such as a misallocation of productive resources across firms or industries. This would support the Hsieh-Klenow hypothesis, which argues that "the misallocation of inputs across firms and industries may be an important determinant of differences in residual TFP, but it remains to be seen what the

forces behind the misallocation are" (Hsieh and Klenow, 2010).

The rest of this article is organized as follows. The first section discusses the development of the LA-KLEMS database and presents the results of the aggregate exercise for the 23 LAC countries. The results are presented separately for the improved L and K measures and for each of the sub-periods identified above. This section also describes the empirical regularities for the LAC region and for each of the three subgroups of countries: the English-speaking Caribbean, Mexico and Central America, and South America. The second section presents the more detailed study of Argentina, Brazil, Chile, Colombia, and Mexico, countries for which it is possible to disaggregate the data into nine industries and differentiate the contribution of the different components of capital to analyse the consequences for TFP. Section 3 provides a comparative analysis of the five countries vis-à-vis developed countries. Section 4 concludes with some hypotheses on the factors that could help explain the TFP residual. Based on these hypotheses, we make some policy suggestions that could help improve TFP in Latin America and the English-speaking Caribbean. We thus hope to contribute to the design of policies aimed at increasing the long-term growth rates of the economies in Latin America and the English-speaking Caribbean.

The Contribution of Productivity to Growth in Latin America: Growth Accounting

The basic growth accounting framework allows us to measure the contribution of increases in inputs and efficiency to output growth. The analysis starts with a production function which defines gross domestic product (GDP) as a function of total factor productivity (TFP) and factor inputs (capital and labour).

Methodology

We use three approaches to estimate GDP growth contributions. In the first, which is used in studies based on the "traditional" growth accounting framework, the capital stock is taken from the gross capital formation series at constant prices,[2] while employment is introduced as the total number of actual hours worked. We calculate GDP growth contributions for 18 Latin American countries and five Caribbean countries using this approach.

In the second approach, based on the recommendations of SNA (2008), hours worked are structured according to education level (primary, secondary, and tertiary) and adjusted for their respective rates of return. As an additional innovation, capital is disaggregated and estimated based on the available capital stock over time.[3] Once the capital stock has been estimated, we calculate the respective cost of use, which is then used to aggregate the different types of assets into a capital services index. This approach is used to estimate GDP growth contributions for 18 Latin American countries.

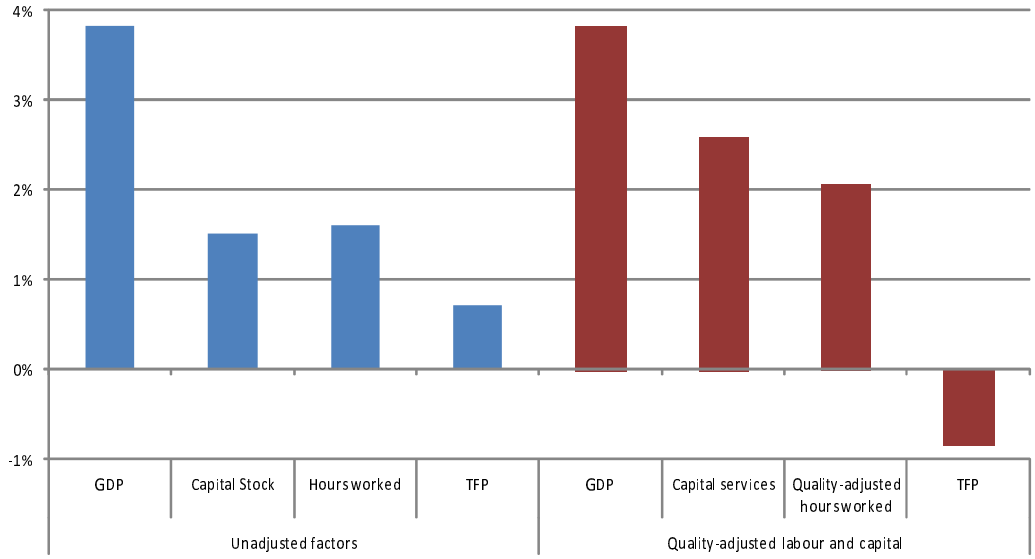
Finally, the third approach draws on the LA-KLEMS database to disaggregate the data into nine economic industries.[4] For each industry, we identify three characteristics of the labour factor (sex, age, and level of education) and eight types of capital assets. These disaggregated data are only available for Argentina, Brazil, Chile, Colombia, and Mexico. We estimated the residual TFP series for each approach by subtracting the weighted sum of the growth of capital and labour inputs from GDP growth, where the

2 Known as the perpetual inventory method. See Hofman (2000).

3 Aravena and Fuentes (2013) perform the same calculation for the determinants of labour productivity.

4 On the LA-KLEMS database, see Aravena and Hofman (2014).

Chart 1: Sources of GDP Growth in Latin America, Traditional versus SNA-2008 Based Growth Accounting, 1990–2013 (average annual percentage point contribution)



Source: Authors' estimates.

weights are the share of each input in income in the national accounts.[5]

Main Results

When we compare the capital estimates in which the asset aggregation is based on the respective cost of use with the estimates from the traditional method, we find that capital services account for a larger contribution to GDP growth than the traditional estimates. In other words, the traditional approach underestimates the contribution of capital or investment, because the quality adjustment increases the contribution of capital.

A comparison of the decomposition of the determinants of GDP under the two methods, (Chart 1), shows that the traditional method generates a larger increase in TFP, relative to the adjusted methodology. This is because in the second exercise, the contribution or — in other words — the explanatory power of capital and hours worked, adjusted for human capital, is greater.

In particular, the contribution of hours worked increases in all countries, except for Argentina, after the quality adjustment (as a comparison of the results in Table 1 and Table 2 show). This rise is mainly due to the increase in years of education since the rates of return are fairly stable. At the same time, the results suggest that when the market value, rather than the user's cost of capital, is used as a weight in the aggregation of assets, the contribution of capital to the productive process is underestimated, and thus the residual (TFP) is overestimated.

The positive effect of the capital adjustment is especially favourable in higher-growth countries (Bolivia, Chile, Colombia, El Salvador, Panama, and, to a lesser extent, Costa Rica and Peru). This suggests that not only the amount, but also the quality of investment as reflected in this case in the adjustment that takes into account the

5 Given that it is not possible to distribute mixed income, it was allocated to labour payments. The data are from Aravena and Fuentes (2013).

Table 1: Latin America and the Caribbean: Contributions to GDP Growth, According to the Traditional Method of Growth Accounting, 1990-2013 (average annual percentage point contribution)

	GDP	Capital stock	Hours worked	TFP
Argentina	3.9	1.0	1.0	2.0
Bolivia	4.0	1.6	3.6	-1.2
Brazil	2.5	0.9	1.2	0.4
Chile	4.9	2.3	0.8	1.8
Colombia	3.6	1.2	1.4	1.0
Costa Rica	4.6	2.4	1.3	0.9
Ecuador	3.3	1.6	1.2	0.5
El Salvador	4.2	1.8	1.5	0.9
Guatemala	3.7	1.4	1.8	0.4
Honduras	3.5	1.6	2.2	-0.4
Mexico	2.8	1.6	0.8	0.4
Nicaragua	3.1	0.5	2.8	-0.2
Panama	6.0	2.9	1.6	1.6
Peru	4.4	1.4	1.9	1.1
Paraguay	3.1	1.4	1.9	-0.3
Dominican Rep.	4.9	1.9	1.7	1.2
Uruguay	3.4	0.7	0.7	2.0
Venezuela	2.8	0.8	1.4	0.7
Latin America	**3.8**	**1.5**	**1.6**	**0.7**
Bahamas	1.5	1.1	1.0	-0.6
Barbados	0.9	0.1	0.5	0.3
Belize	4.1	1.6	2.0	0.5
Jamaica	0.7	1.0	0.6	-0.8
Trinidad and Tobago	4.5	0.0	1.3	3.2
Caribbean (1990-2012)	**2.3**	**0.8**	**1.1**	**0.5**

Source: Authors' estimates.

capital composition and especially the use of ICT is an important source of productivity (TFP). Moreover, the aggregate analysis of the 18 countries shows that in all cases, there was a favourable (and fairly similar) contribution of higher-quality labour.

The estimation of TFP suggests that it is procyclical: its contribution is positive in countries with high GDP growth, but negative when GDP decreases sharply. The pattern of contraction and "resurrection" of TFP during contractionary and expansionary periods, as documented in previous studies, has given rise to the hypothesis that these large variations in estimated TFP derive not from technological factors, but rather from financial frictions (Calvo, Izquierdo, and Talvi, 2006). They could also reflect changes in factor utilization. For example, during an economic slowdown (expansion), there could be a reduction (increase) in hours worked, such that the economy produces less (more) with the same capital endowment. The labour market structure could also be part of the explanation. Given that there is little unemployment insurance in LAC countries, during economic downturns the unemployment rate does not increase as much as in developed countries. Instead, people are employed in less productive activities. This phenomenon could partially explain the procyclicality of TFP.

Table 2: Latin America: Contributions to GDP Growth, According to the SNA-2008 Method of Growth Accounting, 1990-2013 (average annual percentage point contribution)

	GDP	Capital services	Quality-adjusted hours worked	TFP
Argentina	3.9	1.7	0.9	1.4
Bolivia	4.0	3.0	4.0	-3.0
Brazil	2.5	2.3	2.0	-1.8
Chile	4.9	3.6	1.2	0
Colombia	3.6	3.1	2.1	-1.6
Costa Rica	4.6	3.2	1.8	-0.5
Ecuador	3.3	1.2	1.5	0.6
El Salvador	4.2	3.6	1.9	-1.2
Guatemala	3.7	2.5	2.4	-1.2
Honduras	3.5	4.0	2.8	-3.3
Mexico	2.8	2.4	1.2	-0.8
Nicaragua	3.1	1.6	3.5	-2.0
Panama	6.0	3.5	2.0	0.6
Peru	4.4	2.2	2.4	-0.3
Paraguay	3.1	2.5	2.3	-1.8
DominicanRep.	4.9	3.8	2.1	-1.0
Uruguay	3.4	1.5	1.1	0.9
Venezuela	2.8	0.9	1.9	0
Latin America	**3.8**	**2.6**	**2.1**	**-0.8**

Source: Authors' estimates.

Observations on the Growth Accounting Results

This section provides five observations on the the growth accounting results presented in the previous section.

- *The GDP growth cycle is similar in Latin America*

GDP growth follows the same cycle in Mexico and Central America and in South America. In contrast, the English-speaking Caribbean recorded an increase in its growth rate in the 1997–2003 sub-period. Overall this region followed the trend in developed countries more closely than did Latin America. The subregion with the highest GDP growth rate was Mexico and Central America from 1990 to 2013 (Chart 2).

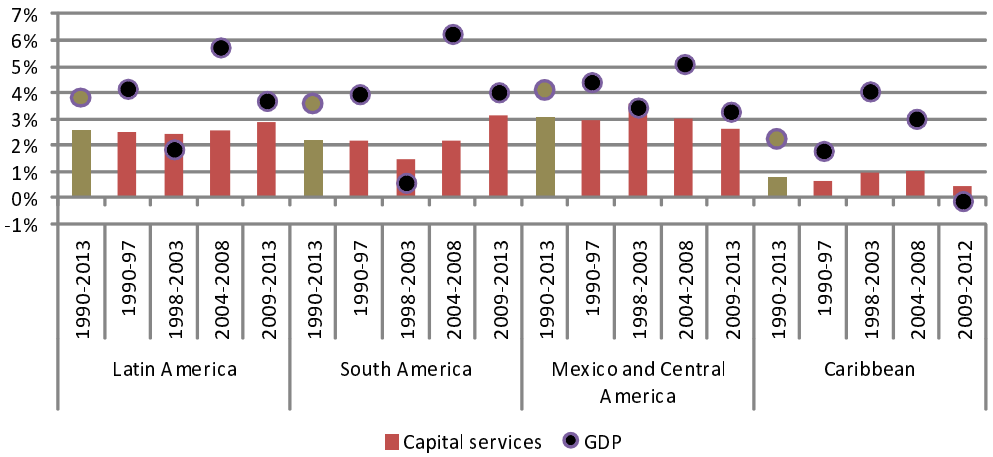
- *Capital plays a key role in the GDP growth process*

Capital services play a key role in the GDP growth process in Latin America, contributing 68 per cent of average growth in the region in 1990–2013 (Chart 2, Panel A). The difference in the regions' growth dynamics lies in labour and TFP, which contribute 54 per cent and –28 per cent, respectively to GDP growth. If the growth contribution of TFP in the Latin American economies was zero, the contributions of capital and labour would be 56 per cent and 44 per cent, respectively. By sub-period, in Latin America the capital contribution is stable at around 2.5 percentage points of GDP growth, which rises to 2.9 percentage points in the last period (2008–2013). The analysis by subregion reveals that the capital contribution was the most volatile in South America, due to a drop in 1997–2003 followed by a strong increase in 2008–2013 (Chart 2).

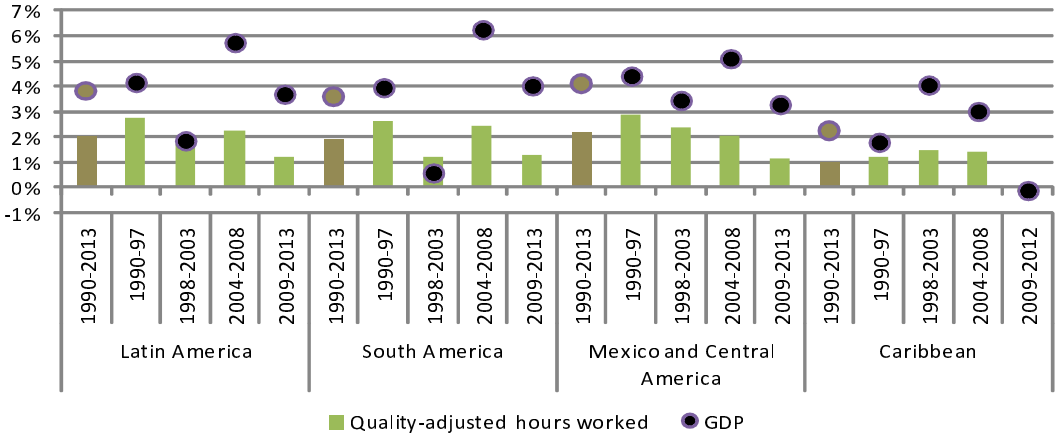
In South America, the contributions of capital and labour are similar, with the exception of the last period, when the capital contribution is nearly three times the labour contribution. In

Chart 2: Sources of GDP Growth in Latin America, SNA-2008 Based Growth Accounting by Subregion and Period, 1990–2013, (unweighted average of percentage point contribution)

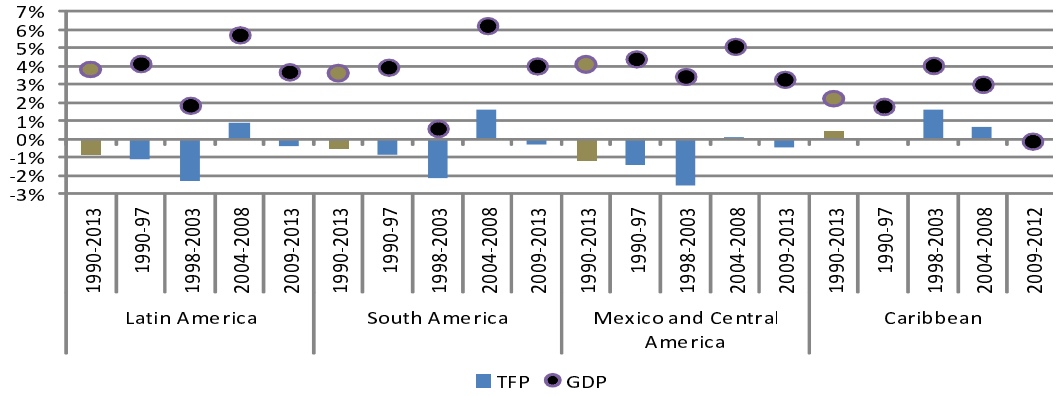
Panel A: Capital Services and GDP



Panel B: Quality Adjusted Hours and GDP



Panel C: TFP and GDP



Note: The estimates for the Caribbean are obtained through the traditional method of growth accounting. (Net capital stock and total hours worked).

Source: Authors' estimates.

contrast, in Mexico and Central America, the capital contribution always exceeds that of labour. The labour contribution was higher than capital in only four countries in 1990–2013: namely, Bolivia, Ecuador, Nicaragua, and Venezuela (Table 2).

In the English-speaking Caribbean, the contribution of capital to GDP growth is lower, ranging from 0.5 to 1.0 percentage point. This is an underestimation, however, since the data for this region do not allow the disaggregation of the capital stock into capital services.

- *Labour influences the regional growth process*

The contribution of labour is different between groups of selected countries, with a procyclical pattern in South America and the English-speaking Caribbean and a continuous decline in Mexico and Central America, due to both a smaller increase in employment in three countries (El Salvador, Guatemala, and Nicaragua) and a smaller share of wages in GDP throughout most of the subregion. The labour contribution is mainly due to an increase in total hours worked, which accounts for 77 per cent of the total (Chart 2).[6] The human capital component accounts for over 25 per cent of the total contribution in seven of the 18 countries of Latin America, where Costa Rica is the only Central American country in the group of seven. The GDP contribution of labour is generally less than that of capital, both across countries and over time (Charts 1 and 2).

- *The growth contribution of total factor productivity is negative and procyclical*

The only period in which TFP has a positive GDP contribution is 2003–2008, when the two Latin American subregions recorded higher GDP growth rates. The TFP performance was systematically worse in Mexico and Central America than in South America (Chart 2). The GDP growth contribution of TFP in Latin America was the most negative in 1997–2003. This is the same period in which the growth contribution of TFP was highest in the English-speaking Caribbean, at about 40 per cent, reflecting its procyclical nature. The analysis of the evolution of productivity in the sample of countries tends to confirm that TFP is procyclical, and it is the main determinant of the difference between higher or lower economic growth (Chart 2).

- *The increase in the capital contribution generates higher total factor productivity*

The countries with a positive TFP contribution are those that also recorded increases in the contribution of capital to GDP growth (Chart 3). That is, the greater investment and the more intensive use of capital increase TFP and thus growth.

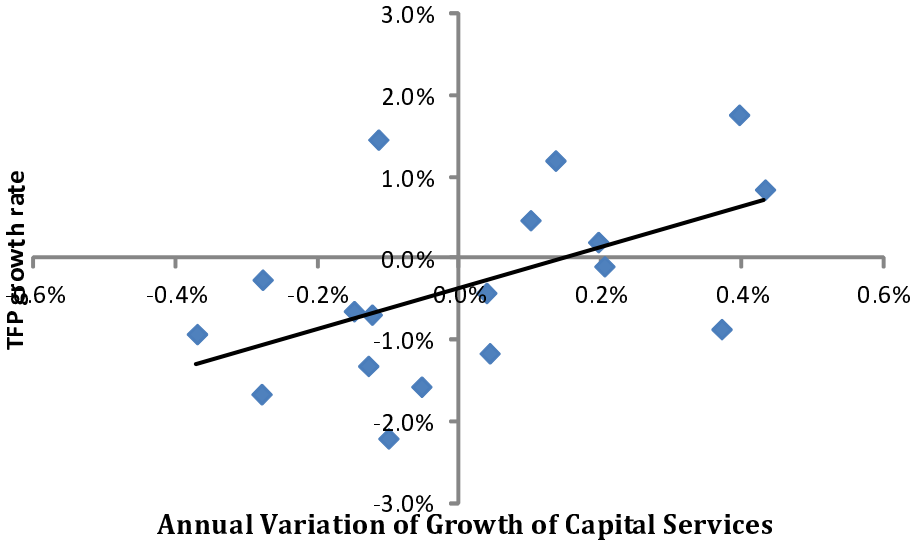
Sectoral Analysis of the Determinants of Productivity

Thus far, we have looked at the evolution of productivity at the aggregate level. This section analyses economic growth, productivity, and their determinants for nine industries in five countries (Argentina, Brazil, Chile, Colombia, and Mexico) in the 1990–2012 period. The exercise draws on the new LA-KLEMS database.

The database provides the employment, capital services, and production series by sector. In the case of employment, the database includes factors associated with the change in the composition of the labour force, while for capital, it includes the effects of the speed of the investment shift towards information and communication technologies (ICTs) in recent years.

6 The contribution of labour to GDP growth is the sum of the contributions of actual hours worked and human capital.

Chart 3: Relationship between TFP Growth and Annual Variation of Growth of Capital Services in Selected Latin American Countries, 1990-2013



Source: authors' estimates.

- *Sectoral growth is highest in the tertiary sector*

Chart 4 shows that the growth rate of the tertiary sector (services) was higher, on average, than the primary and secondary sectors, with the exception of Brazil where the primary sector (agriculture, livestock, and mining) had the highest average growth rate, followed by services.[7] For the five countries analysed, the unweighted average economic growth rate in 1990–2012 was 3.7 per cent. Chile had the best performance in the period, at 5.0 per cent.

Surprisingly, the industry output data in Table 6, found later in the article, show that the transport and communications industry had the highest sectoral growth rate in all five countries. The lowest-growth industry was manufacturing in Argentina, Brazil, Chile, and Colombia.

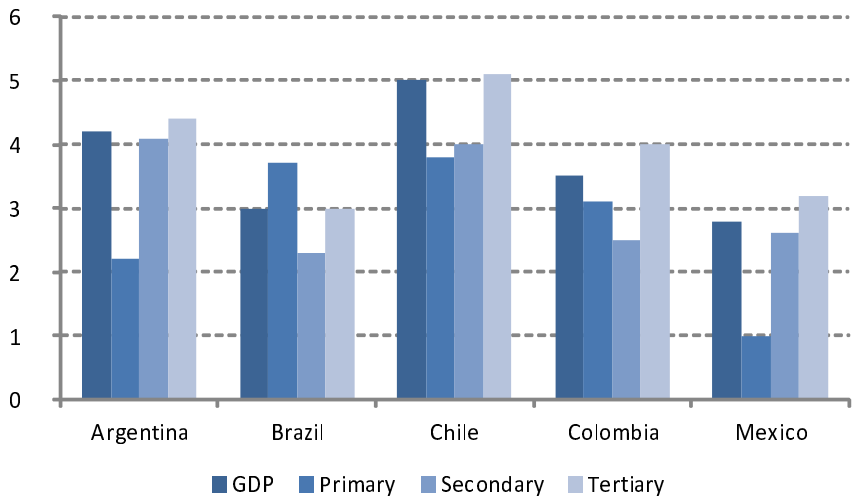
In Mexico, total average growth was low. These results could be explained, in part, by the macro- and microeconomic policies in the countries of the region. For example, from a macroeconomic perspective, real exchange rate fluctuations can generate uncertainty about the expected returns in industries with strong international competition. In terms of microeconomics, market failures or regulations can impose costs that act as a wedge or tax, distorting relative prices and reducing the return on investment in the industry (Restuccia and Rogerson, 2013).

The finding that manufacturing is the least dynamic industry in Latin America, while the services industry is the most dynamic, raises a number of important questions.[8] How can policies be designed to accelerate growth? If the problem stems from the misallocation of capital due to the way the sector and the markets operate, what measures can be adopted to reverse the

7 Primary sector: agriculture, livestock, forestry and fishing and mining; secondary sector: manufacturing, electricity, gas and water and construction and tertiary sector: trade, restaurants and hotels, transport and communications, financial, business and community services, social and personal services.

8 Of course, the service sector is very heterogeneous and some service sector industries are not dynamic, as shown in Table 6.

Chart 4: Total and Sectoral GDP Growth: Primary, Secondary and Tertiary Sectors in Argentina, Brazil, Chile, Colombia and Mexico, 1990-2012 (average annual rate of change)



Source: authors' estimates.

misallocation? Or must the future growth of Latin America and the English-speaking Caribbean be based on non-manufacturing industries? The answers are not obvious and require more detailed research.

- *Latin American countries are characterized by low investment, relative to both developed countries and other emerging regions*

In 1990–2013, investment in Latin America was equivalent to around 20 per cent of GDP, versus about 35 per cent in developing Asia. The low investment rates have made it impossible to achieve higher growth rates in Latin American economies.

Like the rest of the region, the five countries generally saw a reduction in the investment rate in the late 1990s and early 2000s, in part due to the Asian crisis of 1998–1999 and/or the slowdown of 2001–2002. By the end of 2010, however, all of the countries recorded the strongest investment effort of the last 20 years, with the exception of Chile (Table 3). The highest rates were in Argentina (25.4 per cent) and Brazil (24.7 per cent), while the rest of the countries were above 20 per cent.

One of the major advances of the LA-KLEMS database is the inclusion of estimates of ICT gross fixed capital formation. The database includes three ICT assets — office and computing equipment, communication equipment, and software — for Argentina, Brazil, Chile, Colombia, and Mexico. Table 3 shows the disaggregation of gross fixed capital formation into ICT and non-ICT assets. As the table shows, the share of ICT assets as a percentage of real GDP is largest in Brazil, at twice the rate of Colombia, the country with the second-highest share of ICT assets. Chile has made the biggest improvement in ICT investment, moving up from the lowest level in the sample in 1995 to quickly overtake Argentina and Mexico. In the full sample period, meaning the average for every year from 1995 to 2010, ICT investment accounted for around 7 per cent of the total investment effort in Argentina, Chile, and Mexico, versus

Table 3: Disaggregation of Gross Fixed Capital Formation in Argentina, Brazil, Chile, Colombia, and Mexico, by Type of Asset (percentage of real GDP)

	1995			2000		
	Total	ICT	Non-ICT	Total	ICT	Non-ICT
Argentina	19.1	1.2	17.9	17.2	1.8	15.4
Brazil	22.2	4.0	18.2	21.0	3.9	17.1
Chile	26.0	0.3	25.7	22.1	1.3	20.8
Colombia	19.3	2.0	17.3	12.7	1.6	11.0
Mexico	18.2	1.0	17.2	21.5	1.9	19.6
	2005			**2010**		
	Total	ICT	Non-ICT	Total	ICT	Non-ICT
Argentina	23.2	1.6	21.6	25.4	1.4	24.0
Brazil	20.0	4.1	15.9	24.7	4.9	19.7
Chile	23.9	1.5	22.4	24.0	2.1	22.0
Colombia	18.3	2.6	15.7	20.2	2.0	18.1
Mexico	21.4	1.4	19.9	22.5	1.7	20.8

Note: The investment rates presented here are not official statistics from the countries' national accounts, because the ICT investment series were deflated using hedonic price deflators. For details, see Aravena and Hofman (2014).
Source: Authors' estimates.

12 per cent in Colombia and 19 per cent in Brazil.

Table 4 disaggregates non-ICT investment by type of asset. The largest investment share is non-residential construction in Chile, Colombia, and Mexico, and residential buildings in Argentina for the years 1995, 2000, 2005 and 2010. Only Brazil concentrates investment in non-construction assets, namely, other machinery and equipment. Residential investment is still significant, however, at only slightly less than other machinery and equipment.

Given that investment incorporates technological progress, the allocation to different types of assets is relevant. In terms of the size of productive non-ICT investment (excluding residential investment) as a share of the total, the countries can be classified in three levels: in Argentina, just 60 per cent of total investment is allocated to productive investment; in Brazil and Mexico, 70 per cent; and in Chile and Colombia, 80 per cent.[9] The latter two countries also have a higher contribution of capital to GDP and have recorded the largest improvements in productivity.

By economic sector, gross capital formation was highest in the tertiary or services sector in 1990–2010 in all five countries, followed by the secondary and then the primary sector (Table 5). More specifically, Argentina and Brazil have a large share of investment in manufacturing and a very low share in electricity, gas and water (EGW), while Chile, Colombia, and Mexico split the bulk of investment between manufacturing, mining, and community and personal services, with a substantial share for EGW as

9 Residential construction is the non-productive investment as only investments that add to the capital stock that is used in the production process are considered "productive" here.

Table 4: Gross Fixed Capital Formation in Argentina, Brazil, Chile, Colombia, and Mexico, by non-ICT Assets, 1995, 2000, 2005 and 2010 (percentage of real GDP)

	1995					2000				
	Total non-ICT assets	Residential buildings	Non-residential construction	Transport equipment	Other machinery and	Total non-ICT assets	Residential buildings	Non-residential construction	Transport equipment	Other machinery and
Argentina	17.9	7.2	4.9	2.0	3.8	15.4	6.3	4.5	1.8	2.8
Brazil	18.2	5.1	4.0	3.4	5.6	17.1	5.4	4.2	2.2	5.2
Chile	25.7	6.5	8.7	2.3	8.1	20.8	4.6	8.5	1.6	6.1
Colombia	17.3	2.1	11.4	1.0	2.8	11.0	1.9	5.6	1.0	2.6
Mexico	17.2	4.6	5.4	1.3	5.9	19.6	6.0	6.3	2.5	4.9
	2005					**2010**				
	Total non-ICT assets	Residential buildings	Non-residential	Transport equipment	Other machinery	Total non-ICT assets	Residential buildings	Non-residential	Transport equipment	Other machinery
Argentina	21.6	8.8	5.2	3.0	4.5	24.0	9.7	4.9	3.4	6.0
Brazil	15.9	4.4	3.5	2.5	5.6	19.7	5.0	3.9	3.8	7.0
Chile	22.4	4.6	8.8	2.4	6.6	22.0	3.8	9.5	1.7	7.0
Colombia	15.7	3.7	7.2	1.7	3.0	18.1	4.0	8.8	2.1	3.1
Mexico	19.9	6.5	6.6	2.1	4.8	20.8	6.5	7.2	1.9	5.3

Source: Authors' estimates.

well (Table 5). The investment shares of transport and communications are similar. Trade, restaurants and hotels has a notably larger weight in Argentina than in the other countries.

- *Investment in non-ICT capital explains most of the increase in total value added, as well as the growth of the fastest-growing industry: transport and communications*

In four of the five countries, investment largely accounts for the growth of total value added, as well as the growth of the most dynamic industry, namely, transport and communications (Table 6). The one exception is Brazil, where the labour contribution, especially hours worked, explains the largest share of total value added growth, including value added in the transport and communications industry.

- *In terms of labour, the largest contribution to the growth of value added came from hours worked, and the industries that contributed the most were services (mainly trade and financial and business services) and construction*

The total contribution of labour essentially derives from hours worked, with a much smaller contribution from job quality. In manufacturing, hours worked grew very little in four countries and fell in Mexico. Job quality improved in all industries in four of the countries. Only Colombia recorded a negative contribution from the change in the composition of employment—and only in some industries. In the primary sector,

Table 5: Distribution of Total Gross Fixed Capital Formation in Argentina, Brazil, Chile, Colombia, and Mexico, by Industry, 1990-2010

	Argentina	Brazil	Chile	Colombia	Mexico
Agriculture, livestock, forestry, and fishing	6.6	6.3	4.8	4.7	5.6
Mining	2.0	3.9	15.7	16.7	11.0
Manufacturing	27.3	34.9	15.5	15.8	21.9
Electricity, gas, and water	0.6	2.9	8.3	16.0	10.2
Construction	2.3	5.4	1.8	1.7	5.7
Trade, restaurants, and hotels	16.0	6.4	8.6	6.4	9.2
Transport and communications	15.9	11.1	14.9	14.3	13.3
Financial and business services	6.4	4.9	10.6	4.5	5.1
Community, social, and personal services	23.1	24.3	19.8	19.9	18.0
Total	100	100	100	100	100

Source: Authors' estimates.

there was generally a very low or negative contribution from hours worked. The improvement in the quality of labour compensated this negative contribution in all countries with the exception of Colombia.

The results for TFP are less clear, although the aggregate effect on growth was negative in all economies. Even in the case of transport and communications, TFP was positive and significant only in Argentina.

Again, in four of the five countries analysed, the industries with the lowest TFP growth were those with the largest capital contribution to the growth of value added: the mining industry in Argentina and Brazil; electricity, gas, and water en Chile; and transport and communications in Colombia. In Mexico, these two factors do not coincide. This could be an indication that the problem of low value added growth in the countries of the region is due not only to low investment, but also to the allocation of investment, as discussed earlier.

Comparative Analysis of the Determinants of Labour Productivity

In order to formulate hypotheses about how Latin American economies perform relative to more developed economies, we designed a comparative exercise using seven of the largest industrialized countries: France, Germany, Italy, Japan, Spain, the United Kingdom, and the United States. The comparison analysed labour productivity over the 1995–2007 period. The main results are presented below.

- *The growth rate of labour productivity varies significantly among both the Latin American and developed countries*

The highest growth rates of labour productivity over the 1995-2007 period are found in two Latin American countries, such as Chile (2.6 per cent per year) and Colombia (2.0 per cent) followed by certain benchmark countries, Japan (2.1 per cent), the United Kingdom (2.1 per cent), and the United States (2.0 per cent) (Table

Table 6: Sources of the Growth of Value Added in Argentina, Brazil, Chile, Colombia, and Mexico, by Economic Sector, 1990-2009 (average annual percentage points contribution)

	Value added	Hours worked	Job quality	ICT capital	Non-ICT capital	TFP
Argentina (1993–2008)						
Total	3.1	1.1	0.5	0.6	1.6	–0.7
Agriculture, livestock, forestry, and fishing	3.0	-0.1	3.1	0.0	1.2	–1.2
Mining	2.7	0.7	0.9	0.2	9.2	–8.4
Manufacturing	2.4	0.0	0.2	0.5	1.3	0.4
Electricity, gas, and water	5.1	0.4	0.5	0.7	1.3	2.2
Construction	3.8	1.7	0.4	0.2	-1.7	3.2
Trade, restaurants, and hotels	2.7	0.6	0.2	1.0	0.6	0.4
Transport and communications	6.4	1.9	0.3	0.2	2.5	1.5
Financial and business services	3.1	1.2	0.1	1.3	3.3	–2.8
Community, social, and personal services	2.5	2.3	0.6	0.5	0.4	–1.3
Brazil (1996–2009)						
Total	2.6	1.8	1.0	0.8	0.4	–1.4
Agriculture, livestock, forestry, and fishing	3.5	-0.8	1.0	0.3	0.6	2.4
Mining	3.9	1.1	0.8	2.7	1.6	–2.4
Manufacturing	1.1	1.3	0.7	1.1	0.2	–2.2
Electricity, gas, and water	2.9	0.3	0.5	1.4	1.2	–0.6
Construction	2.0	2.0	0.8	0.2	0.8	–1.8
Trade, restaurants, and hotels	2.5	2.2	1.0	0.2	0.1	–1.1
Transport and communications	4.0	1.5	0.6	1.2	0.7	0.0
Financial and business services	3.5	4.0	0.5	0.6	0.0	–1.6
Community, social, and personal services	2.6	1.3	1.6	0.9	0.6	–1.7
Chile						
Total	4.3	1.4	0.9	0.3	2.0	–0.3
Agriculture, livestock, forestry, and fishing	4.6	-0.9	0.9	0.1	-0.7	5.3
Mining	4.2	-0.1	0.7	0.3	4.3	–1.0
Manufacturing	3.3	0.2	1.2	0.2	2.1	–0.3
Electricity, gas, and water	4.1	0.3	0.1	0.4	6.2	–2.8
Construction	4.2	2.5	1.1	0.1	0.4	0.1
Trade, restaurants, and hotels	5.7	1.9	1.1	0.3	1.1	1.4
Transport and communications	6.8	1.7	0.9	0.4	3.7	0.0
Financial and business services	5.8	4.6	0.6	0.5	2.0	–1.9
Community, social, and personal services	3.3	1.3	1.5	0.3	1.3	–1.0

Table 6: Sources of the Growth of Value Added (continued)

	Value added	Hours worked	Job quality	ICT capital	Non-ICT capital	TFP
Colombia						
Total	3.2	2.3	0.4	0.5	2.5	–2.4
Agriculture, livestock, forestry, and fishing	1.9	–0.1	–2.1	0.0	2.5	1.6
Mining	3.6	0.6	0.2	0.7	9.4	–7.3
Manufacturing	1.9	1.2	0.8	0.1	3.0	–3.2
Electricity, gas, and water	2.3	–0.9	–1.0	0.0	10.4	–6.3
Construction	3.5	3.1	–1.0	0.0	1.3	0.1
Trade, restaurants, and hotels	2.4	3.2	1.6	0.3	1.4	–4.1
Transport and communications	4.4	2.3	1.7	4.2	3.4	–7.1
Financial and business services	3.6	4.9	1.4	0.3	1.1	–4.2
Community, social, and personal services	5.1	0.3	–1.1	0.1	1.7	4.1
Mexico						
Total	1.8	1.2	0.5	0.4	1.2	–1.4
Agriculture, livestock, forestry, and fishing	1.0	0.0	0.4	0.1	1.6	–1.0
Mining	0.4	–0.4	0.6	0.1	2.0	–1.9
Manufacturing	1.6	–0.1	0.4	0.2	1.1	0.0
Electricity, gas, and water	2.9	0.3	0.1	0.5	1.0	1.1
Construction	1.6	2.3	1.0	0.4	1.3	–3.3
Trade, restaurants, and hotels	1.6	3.5	1.1	0.8	0.9	–4.7
Transport and communications	3.9	1.1	0.7	0.6	1.1	0.5
Financial and business services	2.9	1.2	0.0	0.4	1.8	–0.5
Community, social, and personal services	0.5	1.1	0.1	0.4	0.5	–1.5

Source: Authors' estimates.

Notes: It should be noted that the numbers in the columns after value added refer to percentage point contributions to value added, not the growth rates of the variable. Value added = GDP-taxes.

7). At the other end of the spectrum are Italy (0.5 per cent) and Spain (0.7 per cent), together with Brazil (0.6 per cent) and Argentina (1.7 per cent).

The level of labour productivity (measured in 1995 PPP U.S. dollars) in Latin America is about a third the level of the benchmark countries. Labour productivity is especially low in Brazil and Colombia, while Argentina and Mexico have the highest levels among the five countries in the region for which data are available. In most countries, the most productive industry is electricity, gas, and water. Three of the exceptions have substantial mining and oil and gas resources: namely, Chile, Mexico, and the United Kingdom. The fourth is Colombia, where the most productive industry is finance, insurance, and business services. Nevertheless,

Table 7: Comparison of Labour Productivity in Latin American Countries and Developed Countries, 1995 and 2007(US$ PPP dollars, 1995)

	France	Germany	Italy	Spain	United Kingdom	United States	Japan	Argentina	Brazil	Colombia	Chile	Mexico
Annual growth rate of labour productivity in the total economy												
1995–2007	1.53	1.55	0.51	0.67	2.06	2.02	2.10	1.68	0.63	2.04	2.56	1.21
Labour productivity in the total economy (value added/ hours worked) (US$ PPP 1995)												
1995	25.59	25.76	23.95	22.76	20.71	25.80	19.88	10.97	6.27	6.60	7.79	10.02
2007	30.83	31.03	25.44	24.45	26.74	33.32	25.66	13.51	6.74	8.43	10.92	11.70
Standard deviation of the log of sectoral labour productivity												
1995	0.49	0.50	0.65	0.56	0.84	0.59	0.73	0.81	0.91	1.00	0.91	0.94
2007	0.58	0.54	0.68	0.71	0.79	0.69	0.86	0.61	0.86	0.93	0.85	0.94
Max-min ratio (nine industries)												
2007	6.49	6.46	7.88	10.56	9.40	12.01	20.58	5.53	14.68	12.13	12.87	14.19
Industry with the highest labour productivity in 2007 (US$ PPP 1995)												
Industry	E	E	E	E	C	E	E	E	E	JtK	C	C
Labour productivity	124.05	102.09	118.26	176.83	151.12	163.52	190.95	51.05	42.26	43.12	72.93	46.17
Industry with the lowest labour productivity in 2007 (US$ PPP 1995)												
Industry	AtB	AtB	AtB	F	F	F	AtB	GtH	AtB	GtH	AtB	AtB
Labour productivity	19.12	15.81	15.00	16.74	16.08	13.61	9.28	9.24	2.88	3.56	5.66	3.25

Source: EU-KLEMS (2011), LA-KLEMS (2013), and authors' estimates.
Notes: TOT = Total economy; AtB = Agriculture and fishing; C = Mining; D = Manufacturing; E = Electricity, gas, and water; F = Construction; GtH = Trade; hotels and restaurants; I = Transport and communications; JtK = Finance, insurance, and business services; LtQ = Personal, community, and social services.

electricity, gas, and water is the second-most-productive industry in Chile, Colombia, and the United Kingdom. At the other end, the least productive industry in most countries is agriculture and fishing.

These relationships are interesting because labour productivity determines the level of wages. Thus, sectors that are highly capital intensive — that is, with a high K/L ratio, such as electricity and mining — tend to have higher productivity and better wages.

- *The K/L ratio increased more in the industrialized countries than in Latin America*

The developed countries underwent a significant intensification of the K/L ratio between 1995 and 2007, with an average increase of around 32 per cent in the period (Table 8).

Although the five Latin American countries, as a whole, recorded a larger increase in the K/L ratio (72 per cent), this trend is mainly explained by strong growth in the ratio in Colombia and, to a lesser extent, Chile. In contrast, the intensification of capital was fairly modest in Argentina (13 per cent), Brazil (15 per cent), and Mexico (19 per cent). In these three countries, the increase in the K/L ratio was only half that of the

Table 8: Comparison of Capital Per Hour Worked in Latin America and Developed Countries, 1995 and 2007(1995 PPP dollars)

Panel A: K/L ratio

	France	Germany	Italy	Spain	United Kingdom	United States	Japan	Argentina	Brazil	Chile	Colombia	Mexico
Annual growth rate of the K/L ratio in the total economy												
1995–2007	2.49	3.48	2.33	2.56	3.97	3.71	3.45	1.82	0.79	6.05	15.5	1.64
Capital-labour ratio in the total economy												
1995	52.88	50.30	99.21	45.92	31.55	40.87	46.04	15.87	9.23	10.80	4.63	20.03
2007	62.18	66.28	113.47	57.39	45.99	60.02	65.37	17.99	10.58	21.83	29.89	23.81
Standard deviation of the log of the capital-labour ratio												
1995	1.03	1.02	1.24	1.02	1.60	1.45	1.30	0.55	1.17	1.40	1.91	1.73
2007	1.03	1.11	1.15	1.15	1.49	1.37	1.39	0.76	1.27	1.55	1.85	1.56
Max-min ratio (nine industries)												
2007	41.28	50.52	32.89	40.43	135.94	74.06	164.66	11.42	34.18	155.70	266.49	126.35
Industry with the highest capital-labour ratio in 2007												
Industry	E	E	E	E	C	E	E	C	E	E	E	E
K/L ratio	568.82	582.90	911.76	785.04	1113.84	888.16	163341	27.64	84.81	375.28	144656	645.86
Industry with the lowest capital-labour ratio in 2007												
Industry	F	F	F	F	F	F	F	F	GtH	F	GtH	AtB
K/L ratio	13.78	11.54	27.72	19.42	8.19	11.99	9.92	2.44	2.48	2.41	5.43	5.11

Panel B: Non-ICT K/L ratio

	France	Germany	Italy	Spain	United Kingdom	United States	Japan	Argentina	Brazil	Chile	Colombia	Mexico
Annual growth rate of the non-ICT K/L ratio in the total economy												
1995–2007	1.63	2.09	1.64	1.61	1.44	1.26	2.74	1.08	–1.03	5.23	15.7	0.79
Non-ICT capital-labour ratio in the total economy												
1995	50.88	47.93	96.91	43.65	29.46	37.78	43.93	15.22	7.96	10.72	4.19	19.39
2007	57.50	57.65	106.87	50.82	34.99	45.66	60.18	15.51	7.30	19.94	24.17	21.13
Standard deviation of the log of the non-ICT capital-labour ratio												
1995	1.04	1.04	1.25	1.03	1.63	1.48	1.31	0.54	1.24	1.41	1.91	1.74
2007	1.05	1.16	1.17	1.19	1.59	1.50	1.42	0.77	1.30	1.62	1.87	1.65
Max-min ratio (nine industries)												
2007	43.27	54.15	35.35	41.95	159.22	98.08	171.86	12.50	43.57	208.09	312.23	124.09
Industry with the highest non-ICT capital-labour ratio in 2007												
Industry	E	E	E	E	C	E	E	C	E	E	E	E
Non-ICT K/L ratio	540.25	559.55	900.28	755.59	1109.78	825.58	1600.0	26.97	60.29	367.47	1445.59	618.58
Industry with the lowest non-ICT capital-labour ratio in 2007												
Industry	F	F	F	F	F	F	F	F	JtK	F	GtH	AtB
Non-ICT K/L ratio	12.49	10.33	25.47	18.01	6.97	8.42	9.31	2.16	1.38	1.77	4.63	4.99

benchmark countries, pointing to a growing lag

Panel C: ICT K/L ratio

	France	Germany	Italy	Spain	United Kingdom	United States	Japan	Argentina	Brazil	Chile	Colombia	Mexico
Annual growth rate of the ICT capital-labour ratio in the total economy												
1995–2007	7.72	10.75	8.80	8.85	13.86	12.82	8.18	8.90	7.96	27.23	14.01	11.92
ICT capital-labour ratio in the total economy												
1995	2.00	2.37	2.30	2.27	2.09	3.08	2.11	0.64	1.26	0.07	0.44	0.64
2007	4.68	8.63	6.60	6.57	11.0	14.36	5.19	2.48	3.28	1.89	2.35	2.67
Standard deviation of the log of the ICT capital-labour ratio												
1995	1.74	1.14	1.76	2.00	1.65	1.36	1.48	2.44	1.17	1.04	2.42	1.92
2007	1.51	1.18	1.25	1.68	1.66	1.21	1.64	1.98	1.39	1.08	2.49	1.46
Max-min ratio (nine industries)												
2007	164.8	24.92	82.45	219.45	208.15	30.32	159.05	439.72	54.34	32.88	1412.3	215.18
Industry with the highest ICT capital-labour ratio in 2007												
Industry	E	JtK	I	E	E	E	E	LtQ	C	E	I	E
ICT K/L ratio	28.57	23.96	25.07	29.45	58.12	62.58	33.40	3.40	44.23	7.81	19.73	27.27
Industry with the lowest ICT capital-labour ratio in 2007												
Industry	AtB	AtB	AtB	AtB	AtB	AtB	AtB	AtB	AtB	AtB	AtB	AtB
ICT K/L ratio	0.17	0.96	0.30	0.13	0.28	2.06	0.21	0.01	0.81	0.24	0.01	0.13

Source: EU-KLEMS (2011), LA-KLEMS (2013), and authors' estimates.
Notes: TOT = Total economy; AtB = Agriculture and fishing; C = Mining; D = Manufacturing; E = Electricity, gas, and water; F = Construction; GtH = Trade; hotels and restaurants; I = Transport and communications; JtK = Finance, insurance, and business services; LtQ = Personal, community, and social services.

in labour productivity.

Distinguishing between ICT and non-ICT capital contributions provides a way to assess the speed with which the Latin American economies have incorporated ICT capital relative to the developed countries. A comparison of the ICT K/L ratio in the five Latin American countries with the average of the industrialized group reveals that the gap between the two has decreased somewhat, from 3.8 to 3.2 times. However, when Chile is excluded from the Latin American group, the ICT-K/L gap was stable, given that the ratio increased by 27 times in Chile, versus about four times for the remaining countries. Thus, with a few exceptions, Latin America did not reduce the lag in the incorporation of ICT capital in the period under consideration.

The level of the capital/labour ratio (measured in 1995 PPP US dollars) for the five Latin American countries is a little more than a quarter (31 per cent) of the level in the benchmark countries, and it is fairly stable. If Chile and Colombia are excluded, however, Latin America is seen to be lagging further and further behind the industrialized countries in terms of the K/L level. In other words, the productivity gap between Latin America and the developed countries will tend to widen in the absence of a strong and sustained effort.

- *The negative contribution of TFP was the main cause of low productivity growth in Latin America*

Table 9 presents the descriptive statistics on TFP. As expected, the TFP level is much lower in the Latin American economies (around half the level of the comparator countries). There is no common pattern in TFP by economic industry among the countries. The highest TFP levels are in electricity, gas, and water (France, Spain, and Argentina); manufacturing (Germany, United Kingdom, and the United States); mining and quarrying (Italy, Japan, and Chile); and finance and insurance (Brazil, Colombia, and

Table 9: Total Factor Productivity (TFP) in Latin America and Developed Countries, 1995 and 2007 (United States = 100 in 1995)

	France	Germany	Italy	Spain	United Kingdom	United States	Japan	Argentina	Brazil	Chile	Colombia	Mexico
TFP, total economy												
1995	94.4	95.9	75.6	86.3	86.3	100.0	75.4	61.5	37.4	94.4	95.9	75.6
2007	99.6	100.8	71.4	79.5	92.8	109.7	78.0	66.7	33.0	99.6	100.8	71.4
Standard deviation of the log of TFP												
1995	0.2	0.3	0.3	0.2	0.3	0.2	0.4	0.8	0.7	0.2	0.3	0.3
2007	0.3	0.2	0.3	0.3	0.3	0.4	0.4	0.7	0.6	0.3	0.2	0.3
Max-min ratio												
2007	2.4	2.0	2.6	2.0	2.0	4.4	4.6	8.9	5.5	2.4	2.0	2.6
Sector with the highest TFP in 2007												
Sector	E	D	C	E	D	D	C	E	Jtk	C	JtK	JtK
TFP	153.4	142.5	133.6	140.2	134.0	180.1	126.6	367.3	107.6	153.4	142.5	133.6
Sector with the lowest TFP in 2007												
Sector	AtB	AtB	AtB	LtQ	LtQ	C	AtB	LtQ	GtH	LtQ	GtH	E
TFP	64.9	70.0	51.2	70.2	66.9	40.7	27.5	41.5	19.6	64.9	70.0	51.2
Annual growth rate of TFP in the total economy												
1995-2007	0.5	0.4	–0.5	–0.7	0.6	0.8	0.3	0.7	–1.0	0.5	0.4	–0.5

Source: EU KLEMS (2011), LA KLEMS (2013), and authors' estimates.
Notes: AtB = Agriculture and fishing; C = Mining; D = Manufacturing; E = Electricity, gas, and water; F = Construction; GtH = Trade, hotels, and restaurants; I = Transport and communications; JtK = Finance, insurance, and business services; LtQ = personal, community, and social services.

Mexico). The lowest are in agriculture and fishing (France, Germany, Italy, and Japan); personal, community, and social services (Spain, United Kingdom, Argentina, and Chile); and trade, hotels, and restaurants (Brazil and Colombia).

- *Relative to the benchmark countries, the Latin America economies display greater dispersion of TFP*

As shown in Table 9, the dispersion of TFP is clearly higher in Latin America (around twice that of the developed countries) according to both measures (standard deviation and max/min). In fact, this is the variable where dispersion is clearly higher in the Latin American economies. This means that the differences in sectoral efficiency are very large in the Latin American countries. That is, most of the dispersion in labour productivity levels across sectors can be attributed to TFP.

Furthermore, TFP declined between 1995 and 2007 in two, Mexico and Brazil, of the five Latin American countries, increasing slightly in Argentina, Chile and Colombia. In contrast, TFP increased in five of the seven comparator countries, and the two countries with decreases — Spain and Italy — are the least developed countries in the group.

- *The intra-sectoral change in the productivity variables under consideration is the driver of growth in these economies. For labour productivity, the (inter-sectoral) structural change component has a larger positive impact in Latin America than in the benchmark countries*

The process of economic development involves not only growth per se, but also structural change, that is, inter-sectoral changes or changes in the distribution of production by industry.[10]

The algebraic shift-shares decomposition for the growth rate of labour productivity is given by equation 1.

$$\frac{VA_t}{L_t}-\frac{VA_0}{L_0}=\sum_j \theta_{j0}\left(\frac{VA_{jt}}{L_{jt}}-\frac{VA_{j0}}{L_{j0}}\right)+ \sum_j(\theta_{jt}-\theta_{j0})\frac{VA_{j0}}{L_{j0}}+\sum_j(\theta_{jt}-\theta_{j0})\left(\frac{VA_{jt}}{L_{jt}}-\frac{VA_{j0}}{L_{j0}}\right) \quad (1)$$

Where θ_{jt} is the weight of employment of sector j in total employment in year t. The first term is the within component, the second refers to the structural change component and the third, and last, the dynamic component. The subscript 0 refers to the initial year, 1995. Even though this is the precise decomposition, the last term of the expression is of no direct economic interpretation since its sign can be either positive or negative depending on the simultaneous combination of positive (negative) structural change component combined with positive (negative) variations of the within component.

The standard practice is either to directly dismiss the dynamic component term (as in McMillan and Rodrik, 2012) or keep it without making any reference to its economic meaning. Here we have opted to show only the within and the structural change component. However, in order to make the decomposition exact after dropping the dynamic component, the total variation of labour productivity is broken down into the within and structural change components according to the weight of each component in the sum of these two. In the rest of the shift-shares analysis the procedure has been analogous. When changes in employment share are positively correlated with productivity levels, the structural change term will be positive meaning that the structural change increases economy wide productivity growth.[11]

Table 10 presents the shift-share decomposition between the within and the structural change components for the five variables analyzed, namely labour productivity, capital per hour worked —distinguishing between ICT and non-ICT capital— and TFP. The main results of the shift-share analysis are the following.

With a few exceptions, the main contributor to growth in both the Latin American and comparative samples, for all variables, is the intra-sectoral effect. The structural change component of labour productivity has, on average, a positive contribution, which is eight times higher in the Latin American economies than the comparator countries. Nevertheless, it is smaller than the intra-sectoral effect, and it is not uniform within the four Latin American economies, being very high Brazil and Argentina and low in Chile. In terms of the K/L ratio, including both the ICT and non-ICT K/L ratios, the structural change component is significant for Brazil, but not for the rest of the Latin American economies. Thus, the intra-sectoral component is the main determinant of K/L growth.

For TFP, the intra-sectoral component of change is negative in three Latin American countries, especially Brazil (Argentina is the exception). Thus, the main responsibility for the negative TFP contribution lies within each sector and is not the result of technology transfers in the form of labour reallocations from industries with above average levels of labour productivity to those with below average levels. This suggests that it is necessary to identify the bottlenecks to raising productivity within each sector.

10 Kuznets (1966) highlights the role of structural change in the distribution of economic growth; Maddison (1987) emphasizes the importance of structural change as a source of growth and productivity improvements.

11 For details on the methodology, see Aravena, Fernández, Hofman, and Más (2014).

Table 10: Shift-Share Analysis of the Sources of Labour Productivity Growth in Latin America and Developed Countries, 1995-2007 (percentage point contribution)

	Labour productivity growth rate			Capital / labour ratio			ICT capital / labour ratio			Non-ICT capital / labour ratio			TFP		
	Total	Intra-sectoral change	Structural change	Total	Intra-sectoral change	Structural change	Total	Intra-sectoral change	Structural change	Total	Intra-sectoral change	Structural change	Total	Intra-sectoral change	Structural change
France	1.53	1.46	0.06	2.49	2.78	–0.29	7.72	7.60	0.13	1.63	1.89	–0.27	0.45	0.45	0.00
Germany	1.55	1.37	0.18	3.48	3.36	0.13	11.03	10.67	0.36	2.09	2.02	0.08	0.42	0.40	0.02
Italy	0.51	0.36	0.16	2.33	0.21	2.12	8.03	7.73	0.29	1.64	-0.17	1.82	-0.47	–0.64	0.17
Spain	0.67	0.69	–0.02	2.56	3.06	–0.51	8.77	8.79	–0.02	1.61	2.09	–0.48	-0.68	–0.72	0.04
United Kingdom	2.06	2.22	–0.16	3.97	4.45	–0.48	12.51	12.42	0.09	1.44	1.86	–0.42	0.61	0.79	–0.19
United States	2.02	2.10	–0.08	3.71	4.10	–0.39	12.46	12.49	–0.03	1.26	1.56	–0.30	0.77	0.82	–0.05
Japan[a]	2.10	1.89	0.20	3.45	3.39	0.06	8.03	7.34	0.69	2.74	2.73	0.02	0.31	0.41	–0.10
Argentina	1.68	1.22	0.46	1.82	1.93	–0.11	8.90	8.60	0.30	1.08	1.64	–0.56	0.67	0.35	0.32
Brazil	0.63	0.10	0.53	0.79	0.53	0.26	7.56	7.04	0.52	–1.03	–1.92	0.89	-1.04	–1.28	0.24
Chile	2.56	2.34	0.23	6.05	6.23	–0.18	26.79	26.75	0.04	5.23	5.42	–0.18	-0.46	–0.41	–0.06
Mexico	1.21	0.88	0.33	1.64	1.64	0.00	13.13	12.82	0.32	0.79	0.81	–0.02	-0.44	–0.30	–0.14

Source: EU KLEMS (2011), LA KLEMS (2013), and authors' estimates.
Notes: Japan 1995-2006.

Conclusions

This article has reviewed the empirical evidence on growth in Latin America and the English-speaking Caribbean during the 1990–2013 period. The study used the growth accounting paradigm, in the tradition of economists such as Solow (1956, 1957), Denison (1967, 1985), Jorgenson and Griliches (1967), and Maddison (1987). Depending on data availability, we presented three exercises to explain the immediate causes of economic growth in the region:

- A traditional method, in which we use easily available data on hours worked and the capital stock (inputs) and calculate a measure of efficiency (TFP) for a sample of 23 countries—five in the English-speaking Caribbean and 18 in Latin America;
- An improved method, in which we disaggregate labour into hours worked and a job quality measure and calculate capital not as the stock of capital but as the flow of capital services, an exercise for which data are available only for the 18 Latin American countries; and
- A method based on the World KLEMS database (called LA-KLEMS in the case of the region), which supports a finer measure and disaggregation of the inputs that might explain the growth of the total economy and of nine industries, where — for both the economy as a whole and for the nine industries — the labour factor is broken down into hours and quality, the capital factor (measured as capital services) into ICT capital and non-ICT capital, and the residual is

TFP, for the five largest economies in the region (Argentina, Brazil, Chile, Colombia, and Mexico).

The story told by the data is that because the traditional growth accounting method is too aggregated, it cannot measure the labour and capital inputs very well and thus leaves a large positive residual, reported as TFP. As the input measures are improved by disagregating labour into hours worked and job quality and measuring capital as a flow of services, the TFP residual decreases and indeed turns negative. Interestingly, TFP improves — becoming less negative or even positive — when there is a cyclical increase in the utilization of resources, especially capital, as happened in the 2008–2013 sub-period.

The finding that TFP is negative, in general, for the 24-year period under analysis is confirmed by the more disaggregated exercise that looks at nine industries in five countries. The main exception to this pattern is Argentina, where five of the nine industries have a positive TFP, although TFP is negative for the economy as a whole.

The negative TFP growth indicates that some factors are interfering with the productive processes, creating a drag on the economy's growth that diminishes the capital and labour contributions. Identifying these factors requires the use of econometric exercises that are beyond the scope of this article.

Based on the data analysis, we presented a series of observations, or stylized facts, in the text. The region is facing a significant challenge in the short and medium terms with regard to stimulating economic growth. As policies are formulated to address this challenge, the most pertinent observations would appear to be the following.

- In Latin America, GDP in the different countries moves together and is strongly influenced by the commodity price cycle. In the English-speaking Caribbean, the economic cycle depends fundamentally on the cycle in developed countries.
- Capital explains over half of the region's growth, but investment is very volatile, moving in line with export prices. The largest component of the capital contribution is non-ICT capital. However, the countries in the region invest less than their counterparts in the high-growth Asian economies.
- Investment is largely directed to non-tradable services industries and, in many cases, regulated industries with guaranteed profits. To the extent that investment is concentrated in protected, nontradable, or regulated industries, it is being allocated to industries with a lower long-term growth potential because, in general, these industries are less exposed to competition and therefore have less incentive to innovate.
- The contributions of labour and TFP to GDP growth are procyclical, which indicates that people work fewer hours or shift into less productive industries during economic downturns, resulting in idle capital. In the case of labour, the largest contribution comes from hours worked. To date, labour quality has contributed less.
- The dispersion of productivity among industries is much higher in the five LA countries than in the benchmark developed economies, which points to greater production inefficiencies in certain industries.
- Although long-term growth reflects a change in the sectoral composition of the economy, improvements in intra-sectoral productivity have a larger impact on growth and the development of productive sectors.

With regard to the policy challenges facing the region, the stylized facts point to some tentative recommendations.

- Countercyclical macroeconomic policies are critical for maintaining the level of installed

capacity utilization and thus for sustaining labour productivity and income.[12]

- Macroeconomic policies should place a strong emphasis on promoting and protecting investment.[13] As the above exercises show, productivity and income cannot increase without an investment effort.
- Macroeconomic policies must also aim to safeguard the competitiveness of the tradable industries of the economy so as to be able to raise productivity in industries where competition and innovation are more likely to materialize.[14] While some services, such as telecommunications, can contribute to the growth of productivity, it can be difficult to improve productivity in certain services. Moreover, once a certain production level has been reached, there may be limited opportunities to continue growing at high rates.
- Macroeconomic policies must further aim to improve labour productivity and TFP in key industries. This can take many forms, from identifying barriers to production and competition, in order to eliminate them, to improving workers' training, in order to raise labour productivity per unit of capital invested. The average productivity of Latin American economies is, at most, one-third of the level of the industrialized countries. One of the primary obstacles to growth in the region is access to credit for small and medium-sized businesses (ECLAC, 2008 and 2012). Facilitating their access to working capital should thus be a central part of a strategy for strengthening growth.

That is not to say that there is a "recipe" for achieving and sustaining high growth rates. The experience of other regions suggests that the policy combinations that have allowed a small group of countries to achieve large leaps to higher income levels include a lot of "sweat and sacrifice" (namely, high investment rates and the postponement of current consumption). The available evidence for Latin America and the English-speaking Caribbean appears to confirm this hypothesis, although the existing low levels of productivity also offer opportunities to stimulate growth.

Much research remains to be done to answer some fundamental questions. What are the obstacles contributing to the consistently negative TFP growth? What is going on in the region's manufacturing industry, which traditionally was the high-growth sector of economies that are now developed? These economies have transitioned towards the services sector, and the Latin American economies show signs of doing the same. Finding ways to promote growth in this sector, which has a high employment absorption, could be a major advantage. Answering these questions will be key to raising living standards in the region.

12 Macroeconomic factors contribute to lower productivity when the utilized capacity of economies decreases. In periods of deceleration, a greater proportion of the capital invested is not used and with the same endowment of capital we obtain a smaller product. That is, the degree of "inefficiency" of the economy increases. In times of cyclical declines in production, the phenomenon of "misallocation" of productive resources increases. Capital is underutilized and labour is employed in activities where it is less productive. Lack of unemployment benefits forces workers to lower productivity activities, included informal activities.

13 Public investment in innovation in key industries for competitiveness is reduced in times of crisis.

14 The other industry that is an obvious candidate to raise productivity and economic growth is the manufacturing industry. However, this industry is uncompetitive both because of relative (and in some cases absolute) advantages of Asian countries in this industry and because of the adverse effect of cycles on exchange rate appreciation and the level of investment. The evidence points out that all efforts to reduce growth volatility are important. In this sense, the development of anti-cyclical fiscal capacities point in the right direction. In addition, it would seem desirable to strengthen efforts to isolate the impact of high commodity prices on the rest of the economy. For example, by strengthening policies and instruments to limit exchange appreciation.

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