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Structural change in four Latin American countries

An international perspective

Claudio Aravena
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ECLAC

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Abstract

This paper compares structural change in four Latin American countries (Argentina, Brazil, Chile and Mexico) and seven additional countries which are taken as a reference: 5 European countries (France, Germany, United Kingdom, Italy and Spain), United States and Japan. It considers nine industries and covers the period 1995-2007. The information comes from EU KLEMS and LA KLEMS databases. It starts presenting, in section 2, the growth accounting results, decomposing labor productivity growth in the contribution of four sources of growth (Information and Communication Technologies (ICT) capital and non-ICT capital; labor qualification; and Total Factor Productivity (TFP)). Section 3 shows a set of descriptive statistics in order to help understand what happens inside each country as well as its implication for the shift-share analysis which is presented in section 4. The shift-share methodology is applied to each individual variable: (*i)* Labor productivity; (*ii)* Capital per worker —distinguishing between ICT and non-ICT capital—; and (*iii)* Total Factor Productivity. This section also analyses the sensitivity of the shift-share results to the level of industry disaggregation, taking Mexico and the reference countries as illustration.

Introduction

Structural change has received great attention, especially in Latin America. A central insight in development economics is that development entails structural change. The main argument of the so-called structuralist school is that the economic structure is very relevant, so that structural change is the clue for explaining growth and convergence from a Schumpeterian perspective (CEPAL 2007, 2008 and 2012).

One of the best documented patterns of structural change is the shift of labor and capital from production of primary goods to manufacturing and later to services. This featured prominently in explanations of divergent growth patterns across Europe, Japan, and the US in the post WWII period (Denison 1962, 1967; Maddison 1980, 1987; Jorgenson 1995a, 1995b; Timmer et al. 2010). In Latin America the relevant literature goes back to the works of Raúl Prebish and Fernando Fajnzylber whose ideas have been revised from many different perspectives.

More recently an important number of Latin American (LA) as well as non-Latin American authors have focused on the role played by structural change in LA productivity growth. Among Latin American authors which need to be mentioned (just to indicate a few) are Jürgen Weller (2001), Mario Cimolli (2009), Carmen Pagés (2010), Margarida Duarte and Diego Restuccia (2009, 2012), and regarding non-LA authors, Dani Rodrik and Margaret McMillan (2012), Marcel Timmer and Gaaitzen de Vries (2009, 2012), among others. Recent literature has focused on productivity determinants by using micro data. The results highlight the relevance of structural change even for developed economies (Eric Bartelsman and Marc Doms 2000; Chad Syverson 2011). In what follows we will take McMillan and Rodrik (2012) work as reference. Our results are very close to the ones obtained by Restuccia (2012) following a somehow different path.

McMillan and Rodrik (2012) address the structural change issue making use of the information provided by the Groningen Growth and Development Center (GGDC) 10-Sector database for 38 countries of which: 9 pertain to the group of high income countries; 10 to Asia; 1 to Middle East (Turkey); 9 located in Africa and another 9 in Latin-America (Argentina, Chile, Mexico, Venezuela (Bolivarian Republic of), Costa Rica, Colombia, Peru, Brazil and Bolivia (Plurinational State of). The variable analyzed is labor productivity for the period 1990-2005. The methodology followed is shift-share analysis (Fabricant 1942) applied to a 9 industries level of disaggregation.

According to McMillan and Rodrik (2012) the bulk of the difference between Asia and Latin-American countries´ productivity performance is accounted for by differences in the pattern of structural change —with labor moving from low to high productivity sectors in Asia, but in the opposite direction in LA and Africa. In countries with a relative large share of natural resources in exports, structural change has typically been growth reducing because those sectors have very high productivity but they cannot absorb the surplus of labor coming from agriculture. Developing countries are characterized by large productivity gaps between different parts of the economy. They are indicative of the allocative inefficiencies that reduce overall labor productivity. The upside of these allocative inefficiencies is that they can potentially be an important engine of growth. When labor and other resources move from less to more productive activities, the economy grows even if there is no productivity growth within sectors. Taken all together their main result is that countries that do well are those that start out with a lot of workers in agriculture but do not have a strong comparative advantage in primary products.

This paper compares the structural change behavior followed by four LA countries (Argentina, Brazil, Chile and Mexico) and seven additional countries which are taken as a reference: 5 EU countries (France, Germany, UK, Italy and Spain), USA and Japan. It considers nine industries and covers the period 1995-2007. The information comes from EU KLEMS and LA KLEMS[1] databases. It starts presenting, in section 2, the g*rowth accounting* results, decomposing labor productivity growth in the contribution of four sources of growth (ICT and non-ICT capital; labor qualification; and TFP). Section 3 shows a set of descriptive statistics in order to help understand what happens inside each country as well as its implication for shift-share analysis which is presented in section 4. The shift-share methodology is applied to each individual variable: *(i)* Labor productivity; (*ii)* capital per worker -distinguishing between ICT and non-ICT capital-; and (*iii)* Total Factor Productivity (TFP). This section also illustrates the sensitivity of the shift-share results to the level of industry disaggregation taking Mexico and the reference countries as illustration. The major drawback of the results here presented is that Asian countries are not included (yet) in the exercise for lack of comparable data. Therefore, we cannot conclude, as McMillan and Rodrik (2012) do, that Asian countries have performed better in terms of structural change productivity gains than Latin American's.

[1] The LA KLEMS database elaborated at ECLAC is an initiative to estimate productivity at the industry level using the EU-KLEMS methodology and involves 7 Latin American countries. For further information and reference to database see Aravena and Hofman (2014) and www.cepal.org/la-klems.

I. Growth accounting results

Table 1 and Figure 1 present the results of applying the growth accounting methodology (Hulten 2001, 2010; Jorgenson, Gollop and Fraumeni 1987; Jorgenson 1995a, 1995b; Timmer et al 2010) to four major Latin American countries (Argentina, Brazil, Chile and Mexico) and the seven reference countries (France, Germany, Italy, Spain, United Kingdom, United States and Japan) together with the EU-15 aggregate for the labor productivity variable and period 1995-2007.

The main results obtained from the comparison of Latin American countries and those taken as reference are the following. First, there exists a great array of labor productivity growth rates among *reference* and Latin American countries. High labor productivity growth rates were shown by Latin American countries, with Chile enjoyed a high 2.6%, and some reference countries such as Japan (2.1%), United Kingdom (2.1%) and the United States (2.0%). On the opposite side of the spectrum, two European Union countries —Italy (0.5%) and Spain (0.7%)— experienced low growth rates, similar to Brazil (0.6%) and Argentina (0.8%). Secondly, the contributions of the changes in labor composition (human capital) were higher in Latin American countries (as expected due to the relative laggard position of Latin America). Thirdly, the contribution of capital deepening (K/L) was more heterogeneous in Latin America than in the reference countries: rather modest in Brazil, Argentina and Mexico and very high in Chile. The distinction between the contributions of ICT and non-ICT capital allows us to check that the contribution of ICT capital per hour worked (ICT K/L) was in line with the European Union average, while the contribution of non ICT K/L was again more heterogeneous in Latin America than in reference countries. It was very high in Chile but negative in Brazil. Finally, TFP contribution was negative in three out of four Latin American countries (the exception is Argentina).

Negative TFP contribution was the main cause for low productivity growth. If TFP growth would have been zero (instead of negative), labor productivity growth would have been almost three times higher in Brazil; 21.5% higher in Chile, and 18.2% higher in Mexico. It is also important to notice that the "reallocation effect" —which is a measure of structural change—, was positive in Latin American countries and higher than in reference countries. In the United Kingdom, United States and Spain it was even negative.

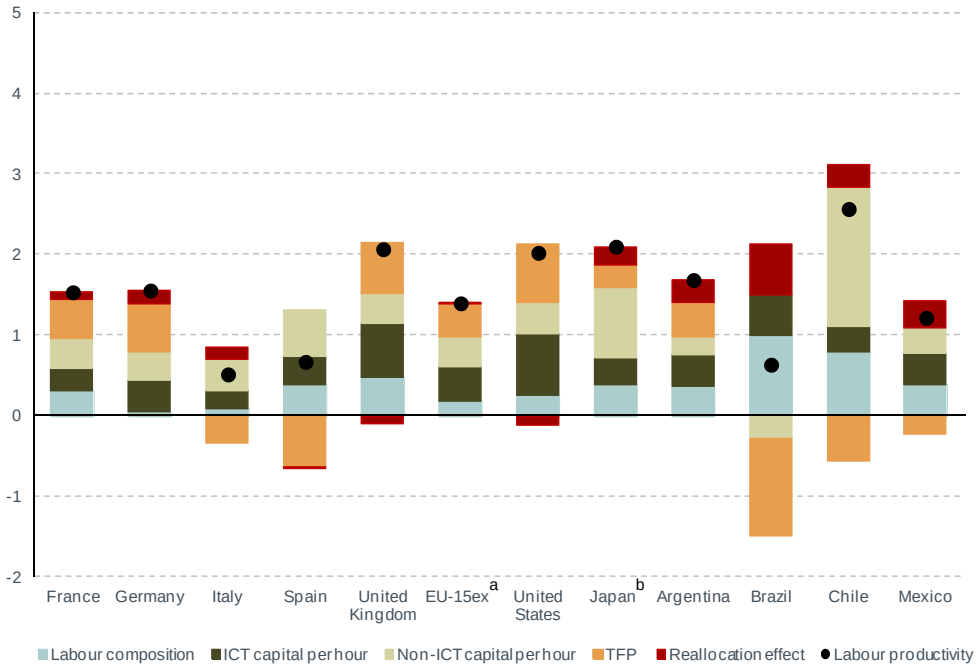
TABLE 1
GROWTH ACCOUNTING RESULTS: LABOR PRODUCTIVITY, 1995-2007
(Percentages)

	Labor productivity growth rate	Contributions (percentage points) to labor productivity growth					Reallocation effect
		Changes in labor composition	Total capital per hour worked	ICT capital per hour worked	Non-ICT capital per hour worked	TFP	
France	1.53	0.31	0.64	0.27	0.37	0.49	0.08
Germany	1.55	0.05	0.75	0.39	0.36	0.59	0.15
Italy	0.51	0.09	0.61	0.22	0.39	-0.34	0.15
Spain	0.67	0.38	0.93	0.36	0.56	-0.63	-0.02
United Kingdom	2.06	0.48	1.04	0.66	0.39	0.63	-0.09
EU-15ex[a]	1.39	0.19	0.80	0.42	0.38	0.40	0.01
United States	2.02	0.26	1.15	0.76	0.39	0.72	-0.11
Japan[b]	2.10	0.39	1.20	0.34	0.86	0.28	0.23
Argentina	1.68	0.37	0.61	0.40	0.21	0.44	0.27
Brazil	0.63	0.94	0.24	0.55	-0.31	-1.17	0.62
Chile	2.56	0.80	2.04	0.32	1.71	-0.55	0.28
Mexico	1.21	0.39	0.69	0.38	0.31	-0.22	0.34

Source: EU KLEMS (2011), LA KLEMS (2013) and own elaboration.

[a] EU-15ex is formed by Germany, Austria, Belgium, Denmark, Spain, Finland, France, Italy, Netherlands and UK.
[b] 1995-2006.

FIGURE 1
GROWTH ACCOUNTING RESULTS: LABOR PRODUCTIVITY, 1995-2007
(Percentages)



Source: EU KLEMS (2011), LA KLEMS (2013) and own elaboration.

[a] EU-15ex consist of Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Spain and United Kingdom.
[b] 1995-2006 period for Japan.

II. Descriptive statistics

Tables 2 to 4 show some descriptive statistics which are relevant for the interpretation of the results of the shift-share analysis performed in the next section. Table 2 presents the descriptive statistics for labor productivity.

As can be seen, the level of labor productivity in Latin American countries (measured in terms of 1995 PPPs) is around 1/3 of the reference countries. It is especially low in Brazil while Argentina and Mexico present the highest levels. In the majority of the countries the sector with the highest level of labor productivity is *Electricity, gas and water supply*. The exceptions are the three countries with relevant natural resources endowments: United Kingdom, Chile and Mexico for which it is *Mining and Quarrying.* On the other hand, in most countries the sector with the lowest level of labor productivity is *Agriculture and Fishing*. In Argentina it is *Wholesale and retail trade; hotels and restaurants*, while in Spain, the United Kingdom, and the United States it is the *Construction* industry. Table 2 presents also two index of dispersion: the standard deviation of logs and the ratio max/min. According to the first, the dispersion of industry labor productivities —as measured by the standard deviation of logs— is higher in three LA countries than in the *reference* countries. The same result holds when using the ratio max/min as dispersion indicator (except for Argentina). Thus, the result that labor productivity dispersion is relatively higher in LA countries —reflecting allocative inefficiencies— is confirmed by the 9 industry disaggregation that we are using.

Table 3 presents similar indicators for the capital/labor ratio (measured in hours worked) in panel A, in non-ICT (panel B) and ICT capital in panel C. The main messages resulting from this table are the following: First, the level of capitalization —as measured by the three ratios— is lower in Latin America than in the reference countries. The sector with the highest K/L and Non-ICT K/L ratio is, in almost all countries, *Electricity, gas and water supply*, while in the UK and Argentina it is *Mining and quarrying.* These results confirm that, generally speaking, the higher the K/L ratio, the higher the labor productivity. On the other hand, the sector with the lowest level of K/L and Non-ICT K/L ratio is *Construction*. In Brazil it is *Finance, insurance, real estate and business services,* and in Mexico, *Agriculture and fishing.* For ICT K/L the lowest level corresponds, in all countries, to *Agriculture and fishing.*

TABLE 2
DESCRIPTIVE STATISTICS: LABOR PRODUCTIVITY
($ PPP 1995)

	France	Germany	Italy	Spain	United Kingdom	United States	Japan	Argentina	Brazil	Chile	Mexico
Economy-wide labor productivity											
1995	25.59	25.76	23.95	22.76	20.71	25.80	19.88	10.97	6.27	7.79	10.02
2007	30.83	31.03	25.44	24.45	26.74	33.32	25.66	13.51	6.74	10.92	11.70
Standard deviation of log of sectoral labor productivity											
1995	0.49	0.50	0.65	0.56	0.84	0.59	0.73	0.81	0.91	0.91	0.94
2007	0.58	0.54	0.68	0.71	0.79	0.69	0.86	0.61	0.86	0.85	0.94
Max-min ratio											
2007	6.49	6.46	7.88	10.56	9.40	12.01	20.58	5.53	14.68	12.87	14.19
Sector with highest labor productivity in 2007											
Sector	E	E	E	E	C	E	E	E	E	C	C
Labor prod.	124.05	102.09	118.26	176.83	151.12	163.52	190.95	51.05	42.26	72.93	46.17
Sector with lowest labor productivity in 2007											
Sector	AtB	AtB	AtB	F	F	F	AtB	GtH	AtB	AtB	AtB
Labor prod.	19.12	15.81	15.00	16.74	16.08	13.61	9.28	9.24	2.88	5.66	3.25
Compound annual growth rate of econ. wide labor productivity											
1995-2007	1.53	1.55	0.51	0.67	2.06	2.02	2.10	1.68	0.63	2.56	1.21

Source: EU KLEMS (2011), LA KLEMS (2013) and own elaboration.

Note: TOT = TOTAL ECONOMY; AtB = Agriculture and fishing; C = Mining and quarrying; D = Manufacturing; E = Electricity, gas and water supply; F = Construction; GtH = Wholesale and retail trade; hotels and restaurants; I = Transport and communications; JtK = Finance, insurance, real estate and business services; LtQ = Community social and personal services.

TABLE 3
DESCRIPTIVE STATISTICS: CAPITAL PER HOUR WORKED
($ PPP 1995)

A. K/L ratio

	France	Germany	Italy	Spain	United Kingdom	United States	Japan	Argentina	Brazil	Chile	Mexico
Economy-wide capital / labor ratio											
1995	52.88	50.30	99.21	45.92	31.55	40.87	46.04	15.87	9.23	10.80	20.03
2007	62.18	66.28	113.47	57.39	45.99	60.02	65.37	17.99	10.58	21.83	23.81
Standard deviation of log of capital / labor ratio											
1995	1.03	1.02	1.24	1.02	1.60	1.45	1.30	0.55	1.17	1.40	1.73
2007	1.03	1.11	1.15	1.15	1.49	1.37	1.39	0.76	1.27	1.55	1.56
Max-min ratio											
2007	41.28	50.52	32.89	40.43	135.94	74.06	164.66	11.42	34.18	155.70	126.35
Sector with highest capital / labor ratio in 2007											
Sector	E	E	E	E	C	E	E	C	E	E	E
Capital / Labor ratio	568.82	582.90	911.76	785.04	1113.84	888.16	1633.41	27.64	84.81	375.28	645.86
Sector with lowest capital / labor ratio in 2007											
Sector	F	F	F	F	F	F	F	F	GtH	F	AtB
Capital / labor ratio	13.78	11.54	27.72	19.42	8.19	11.99	9.92	2.44	2.48	2.41	5.11
Compound annual growth rate of econ. wide capital / labor ratio											
1995-2007	2.49	3.48	2.33	2.56	3.97	3.71	3.45	1.82	0.79	6.05	1.64

B. Non-ICT K/L

	France	Germany	Italy	Spain	United Kingdom	United States	Japan	Argentina	Brazil	Chile	Mexico
Economy-wide non-ICT capital / labor ratio											
1995	50.88	47.93	96.91	43.65	29.46	37.78	43.93	15.22	7.96	10.72	19.39
2007	57.50	57.65	106.87	50.82	34.99	45.66	60.18	15.51	7.30	19.94	21.13
Standard deviation of log of non-ICT capital / labor ratio											
1995	1.04	1.04	1.25	1.03	1.63	1.48	1.31	0.54	1.24	1.41	1.74
2007	1.05	1.16	1.17	1.19	1.59	1.50	1.42	0.77	1.30	1.62	1.65
Max-min ratio											
2007	43.27	54.15	35.35	41.95	159.22	98.08	171.86	12.50	43.57	208.09	124.09
Sector with Highest non-ICT capital / labor ratio in 2007											
Sector	E	E	E	E	C	E	E	C	E	E	E
non-ICT Capital / Labor ratio	540.25	559.55	900.28	755.59	1109.78	825.58	1600.01	26.97	60.29	367.47	618.58
Sector with Lowest non-ICT capital / labor ratio in 2007											
Sector	F	F	F	F	F	F	F	F	JtK	F	AtB
non-ICT Capital / Labor ratio	12.49	10.33	25.47	18.01	6.97	8.42	9.31	2.16	1.38	1.77	4.99
Compound annual growth rate of econ. wide non-ICT capital / labor ratio											
1995-2007	1.63	2.09	1.64	1.61	1.44	1.26	2.74	1.08	-1.03	5.23	0.79

C. ICT K/L

	France	Germany	Italy	Spain	United Kingdom	United States	Japan	Argentina	Brazil	Chile	Mexico
Economy-wide ICT capital / labor ratio											
1995	2.00	2.37	2.30	2.27	2.09	3.08	2.11	0.64	1.26	0.07	0.64
2007	4.68	8.63	6.60	6.57	11.00	14.36	5.19	2.48	3.28	1.89	2.67
Standard deviation of log of ICT capital / labor ratio											
1995	1.74	1.14	1.76	2.00	1.65	1.36	1.48	2.44	1.17	1.04	1.92
2007	1.51	1.18	1.25	1.68	1.66	1.21	1.64	1.98	1.39	1.08	1.46
Max-min ratio											
2007	164.81	24.92	82.45	219.45	208.15	30.32	159.05	439.72	54.34	32.88	215.18
Sector with highest ICT capital / labor ratio in 2007											
Sector	E	JtK	I	E	E	E	E	LtQ	C	E	E
ICT Capital / Labor ratio	28.57	23.96	25.07	29.45	58.12	62.58	33.40	3.40	44.23	7.81	27.27
Sector with lowest ICT capital / labor ratio in 2007											
Sector	AtB	AtB	AtB	AtB	AtB	AtB	AtB	AtB	AtB	AtB	AtB
ICT Capital / Labor ratio	0.17	0.96	0.30	0.13	0.28	2.06	0.21	0.01	0.81	0.24	0.13
Compound annual growth rate of econ. wide ICT capital / labor ratio											
1995-2007	7.72	10.75	8.80	8.85	13.86	12.82	8.18	8.90	7.96	27.23	11.92

Source: EU KLEMS (2011), LA KLEMS (2013) and own elaboration.

Note: TOT = TOTAL ECONOMY; AtB = Agriculture and fishing; C = Mining and quarrying; D = Manufacturing; E = Electricity, gas and water supply; F = Construction; GtH = Wholesale and retail trade; hotels and restaurants; I = Transport and communications; JtK = Finance, insurance, real estate and business services; LtQ = Community social and personal services. Japan: 2007 not available, data correspond to 2006.

Finally, the dispersion of the K/L and Non-ICT K/L ratio is (only slightly) higher in Latin American countries (with the exception of Argentina) than in EU countries. For ICT K/L ratio the dispersion in LA countries is not different from the other countries. The main feature is a high variability of the dispersion indicators among all countries without any clear pattern between LA and reference countries.

Table 4 offers the same set of descriptive statistics for Total Factor Productivity (TFP). Levels of TFP have been calculated following Hulten and Schwab (1993) using a reference country to obtain a transitive indicator which is comparable across sectors, countries and years. The reference used is the total US economy in the initial year (1995). TFP is calculated according to the following expression:

$$\ln TFP_{itk} = \left(\ln Y_{itk} - \ln Y_0\right) - \sum_j \frac{1}{2}\left(s_{jitk} + s_{j0}\right)\left(\ln X_{jitk} - \ln X_{j0}\right) \quad (1)$$

where: *i* sector; *t* year; *k* country. Subscripts *0* refer to the values of each variable in the total US economy in 1995. *Y*: Value added; *s*: factor share; *Xj*: production factors (Labor quantity and quality, K ICT and K non-ICT). TFP is calculated as the *exp*(*ln*TFP)*100 and takes the value 100 for the reference country (US).

Main facts highlighted by Table 4 are the following. First, the level of TFP is lower in LA countries (around half that of the reference countries). Second, there is not a common industry pattern among countries. The highest TFP corresponds to *Electricity, gas and water supply (*France, Spain, Argentina); *Manufacturing* (Germany, UK, US); *Mining and quarrying* (Italy, Japan, Chile); or *Finance and insurance* (Brazil, Mexico). The lowest TFP corresponds to *Agriculture and fishing* (France, Germany, Italy, Japan); *Community, social and personal services* (Spain, UK, Argentina, Chile); and *Wholesale and retail trade, hotels and restaurants* (Brazil). Third, the dispersion —as measured by the standard deviation of logs— is clearly higher in LA countries (around twice that of the reference countries). The same is true for the max/min ratio (more than double in LA countries than in the reference countries). In fact, this is the variable for which the dispersion is clearly highest in LA countries. This means that the differences in the levels of efficiency achieved by the different sectors in LA countries are very high. In fact, most of the dispersion found in labor productivity can be attributed to TFP.

TABLE 4
DESCRIPTIVE STATISTICS: TOTAL FACTOR PRODUCTIVITY (TFP)
(US 1995=100)

	France	Germany	Italy	Spain	United Kingdom	United States	Japan	Argentina	Brazil	Chile	Mexico
Economy-wide TFP											
1995	94.37	95.92	75.59	86.26	86.31	100.00	75.39	61.53	37.41	46.03	49.57
2007	99.61	100.84	71.42	79.50	92.82	109.72	77.99	66.69	33.00	43.55	47.01
Standard deviation of log of TFP											
1995	0.24	0.34	0.30	0.18	0.25	0.24	0.40	0.84	0.65	0.57	0.71
2007	0.26	0.19	0.25	0.26	0.25	0.43	0.42	0.65	0.58	0.51	0.66
Max-min ratio											
2007	2.36	2.04	2.61	2.00	2.00	4.42	4.61	8.86	5.48	5.99	9.66
Sector with highest TFP in 2007											
Sector	E	D	C	E	D	D	C	E	Jtk	C	JtK
TFP	153.36	142.54	133.56	140.15	133.98	180.06	126.57	367.31	107.63	134.63	186.52
Sector with lowest TFP in 2007											
Sector	AtB	AtB	AtB	LtQ	LtQ	C	AtB	GtH	GtH	LtQ	E
TFP	64.86	69.96	51.22	70.19	66.85	40.72	27.47	41.46	19.63	22.48	19.30
Compound annual growth rate of econ. wide TFP											
1995-2007	0.45	0.42	-0.47	-0.68	0.61	0.77	0.31	0.67	-1,04	-0.46	-0.44

Source: EU KLEMS (2011), LA KLEMS (2013) and own elaboration.

Note: TOT = TOTAL ECONOMY; AtB = Agriculture and fishing; C = Mining and quarrying; D = Manufacturing; E = Electricity, gas and water supply; F = Construction; GtH = Wholesale and retail trade; hotels and restaurants; I = Transport and communications; JtK = Finance, insurance, real estate and business services; LtQ = Community social and personal services. Japan: 2007 not available, data correspond to 2006.

III. Shift-share analysis

The algebraic shift-shares decomposition for the growth rate of labor productivity is given by equation 2.

$$\frac{VA_t}{L_t} - \frac{VA_0}{L_0} = \underbrace{\sum_j \theta_{j0}\left(\frac{VA_{jt}}{L_{jt}} - \frac{VA_{j0}}{L_{j0}}\right)}_{\text{Within component}} + \underbrace{\sum_j \left(\theta_{jt} - \theta_{j0}\right)\frac{VA_{j0}}{L_{j0}}}_{\text{Structural change component}} + \underbrace{\sum_j \left(\theta_{jt} - \theta_{j0}\right)\left(\frac{VA_{jt}}{L_{jt}} - \frac{VA_{j0}}{L_{j0}}\right)}_{\text{Dynamic component}} \quad (2)$$

Where θ_{jt} is the weight of employment of sector *j* in total employment in year *t*. 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 labor productivity is broken down in the *within* and *structural change* component according to the weight of each component in the sum of these two. In the rest of the shift-shares 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.

Table 5 presents the shift-share decomposition between the *within* and the *structural change* components for the five variables analyzed, namely labor 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. First, the main contributor to growth for all countries —Latin American or *reference* countries— and all variables is the *within* effect. The *structural change* component for labor productivity has, on average, a positive and higher contribution in LA countries than in the *reference* ones. However, it is not homogenous within LA countries: very high in Brazil and Argentina and low in Chile. For the K/L ratio, as well as for ICT K/L and non ICT K/L ratio, the *structural change* component is only relevant for Brazil but not for the rest of LA countries. Thus, the *within* component is the main determinant of K/L growth.

TABLE 5
SHIFT-SHARE DECOMPOSITION, 1995-2007

	Labour productivity growth rate			Capital / labor ratio			ICT capital / labor ratio			Non-ICT capital / labor ratio			TFP		
	Total	Within	Structural change	Total	Within	Structural change	Total	Within	Structural change	Total	Within	Structural change	Total	Within	Structural change
France	1.53	1.46	0.06	2.49	2.78	-0.29	7.72	7.60	0.13	1.63	1.892	-0.267	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	2.016	0.079	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	-0.171	1.815	-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	2.088	-0.478	-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	1.856	-0.417	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	1.559	-0.296	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	2.727	0.017	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	1.637	-0.556	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	-1.918	0.886	-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	5.417	-0.183	-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	0.806	-0.020	-0.44	-0.30	-0.14

Source: EU KLEMS (2011), LA KLEMS (2013) and own elaboration.

[a] Japan: 1995-2006.

It is important to notice that the *within* component for TFP is negative in three LA countries, especially in Brazil (Argentina is the exception). Thus, the main responsibility for the negative contribution of TFP must be found inside the individual sectors and not that much as the result of technological spillovers from the more productive industries to the ones showing low labor productivity levels.

However, it is also worth noticing that the structural change component for the TFP variable is positive in Brazil and Argentina, indicating the existence of positive spillover effects among industries in these two countries. For Mexico and Chile the structural change effect is negative though negligible in the second.

The last question that we would like to address is if the relevance of the structural change contribution depends on the level of industry disaggregation considered by the shift-share analysis. Labor productivity is available for 65 industries in the case of Mexico and for 31 industries in the case of the reference countries. Table 6 presents the shift-share decomposition for three levels of industry disaggregation: 9 industries as before, 31 industries for Mexico and the reference countries, and 65 industries for Mexico which has the highest level of disaggregation of all the countries considered.

As can be seen from table 6, for the reference countries the level of disaggregation does not really affect the shift-share results, except for Spain and Italy. For the former, the 31 industries disaggregation generates a higher, and positive, *structural change* component. The opposite happens for Italy. For Mexico, the *structural change* component increases continuously with the level of industry disaggregation. For the 9 industries disaggregation represents 27.5% of the total labor productivity variation, while for the 65 industries it reaches 45.8%.

TABLE 6
SHIFT-SHARE ANALYSIS FOR DIFFERENT LEVELS OF INDUSTRY DISAGGREGATION

	France		Germany		Italy		Spain		UK		US		Japan[a]		Mexico		
	31	9	31	9	31	9	31	9	31	9	31	9	31	9	65	31	9
Total variation	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Within	97.7	95.77	82.8	88.13	101.7	69.52	49.7	103.16	103.4	107.78	103.1	104.07	97.6	90.41	54.18	67.6	72.51
Structural change	2.3	4.23	17.2	11.87	-1.7	30.48	50.3	-3.16	-3.4	-7.78	-3.1	-4.07	2.4	9.59	45.82	32.4	27.49

Source: Author's own elaboration.

[a] 1995-2006.

VI. Conclusions

The analysis of the importance of structural change in Latin America's growth performance has a long lasting tradition especially thanks to the work by ECLAC. This paper contributes to this tradition making use of the LA KLEMS database for four LA countries (Argentina, Brazil, Chile and Mexico) and for seven developed countries to which we have referred to as reference countries (EU, France, Germany, Italy, Spain, UK, US and Japan) using the EU KLEMS database, for the period 1995-2007. It takes three complementary perspectives: 1. Growth accounting; 2. Descriptive statistics; 3. Shift-share analysis.

The main conclusions can be summarized as follows. First, according to the growth accounting decomposition applied to labor productivity growth no standard pattern can be observed: some reference countries present high growth rates (i.e. Japan [2.10%], UK [2.06%]) but also Chile (2.56%), while some others have very low growth rates both in reference and LA (i.e. Italy [0.51%], Spain [0.67%] or Brazil [0.63%]). The main source of labor productivity growth in LA arises from improvements in human capital, as should be expected according to its level of development. The contribution of capital accumulation (K/L) has been very uneven among countries, without sharing a common pattern in reference or LA countries. In three LA countries (the exception is Argentina) TFP contribution was negative. This variable has been the main burden for LA labor productivity growth. It is remarkable that the four LA countries present a relatively high and positive reallocation effect, which is another way of looking at (positive) structural change.

Second, the descriptive statistics presented in section 3 inform that LA countries have lower levels of labor productivity, K/L ratios (both non-ICT K/L and ICT K/L) and also lower levels of TFP than the reference countries. The dispersion of industry labor productivity is (slightly) higher in LA countries than in the reference countries. However, the pattern of industry dispersion is not that clear for K/L, but very clear in terms of TFP (more than doubling that of EU countries). Here is where the main difference can be found. Overall, the sectors with better performance are: *Energy, gas and water supply, Mining and quarrying,* and *Manufacturing* and those with the worse performance: *Agriculture and fishing* together with *Construction.*

Third, the shift-share analysis performed in section 4 allows to conclude that for all variables and countries the *within* effect is the driver of growth. For labor productivity the *structural change* component has a higher and positive impact on LA countries than in the other countries considered.

However, its magnitude is very different between countries (the highest in Brazil and Argentina, and the lowest in Chile). The contribution of the *structural change* component increases with the level of industry disaggregation as Mexico's data shows. This is not so for the reference countries (with the exceptions of Spain and Italy). Additionally, it is remarkable to notice that in three LA countries (Argentina is the exception) the TFP *within* component had a highly negative contribution indicating that the efficiency problems shown by LA countries rely, mainly, inside the sectors.

We can summarize the above results in the following terms. First, the *within* effect is the most relevant for all variables and countries' growth. Second, the results seem to indicate that LA countries have benefited from positive, though small, *structural change* in comparison with the reference countries. Only after comparing with Asian countries included in the WORLD KLEMS project we will be able to conclude if structural change has been less important in LA as McMillan and Rodrik (2012) conclude. The results for Mexico indicate that structural change analysis should widen the scope moving from the traditional Agriculture/Manufacturing/Services sequence, to a more detailed industry analysis. What is relevant, at least for that country, is to which manufacturing or service sector labor is moving (not the general move). Forth, the relatively low productivity growth in LA had its origin in the (negative) TFP contribution in three out of four LA countries (Argentina is the exception). This negative TFP contribution must be blamed on the *within* component in the three countries, and not on the *structural change* component which was positive in Argentina and Brazil, and (slightly) negative in Chile and Mexico.

Taken all together the results indicate that Latin American countries need to improve the efficiency of their production process through measures that go beyond standard tangible capital accumulation.

They need to take measures to accomplish improvements *within* the sectors. These measures include enhancing the functioning of the labor markets, increasing R&D, improving human capital, at the school but especially at the workplace, and most of the intangibles assets which help to obtain more efficient results from the same quantity of capital and labor. They also need to intensify the structural change but taking into account that a mere movement from agriculture to manufacturing and services is not enough. Both manufacturing and services aggregates are very heterogeneous, so the focus should move to the most productive industries within these two big aggregates.

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