Exchange rate and Structural Change: evidences for Latin America

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Abstract

The objective of this work is to test empirically the relationship between exchange rate and the structural change for the Latin American countries over the period 1975-2017. For this purpose, it is employed four variables to represent the structural change; the sectoral share of GDP of industry, services and primary sectors, the economic complexity index, and the growth of industrial share of employment. Two different specifications are performed. The empirical findings of first specification suggest that a devalued (overvalued) exchange rate promotes the industrialization (a structural change towards services) and the sophistication of productive structure. Yet, the results of the second specification point that an overvalued exchange rate promotes the deindustrialization, but a devalued exchange rate does not necessarily promote the industrialization. Therefore, in Kaldorian terms, an overvalued exchange rate hurts the long-run growth of Latin American economies, but a devalued exchange rate does not necessary boosts the long-run growth via the indirect effects in the structural change towards industry.

Keywords: Exchange rate, Structural change and Latin America

Resumo

O objetivo deste trabalho é testar empiricamente a relação entre a taxa de câmbio e mudança estrutural para os países da América Latina no período entre 1975 e 2017. Para tanto, quatro variáveis foram utilizadas para mensurar o processo de mudança estrutural: a parcela do PIB da indústria, serviços e setores primários, o índice de complexidade econômica e o crescimento da parcela industrial do emprego em duas diferentes especificações. Os resultados da primeira especificação indicam que uma taxa de câmbio desvalorizada (valorizada) promove um processo de industrialização (mudança estrutural em direção aos setores de serviço) e a sofisticação da estrutura produtiva. No entanto, os resultados da segunda especificação sugerem que uma taxa de câmbio valorizada contribui para o processo de desindustrialização, ao passo que uma taxa de câmbio desvalorizada não gera necessariamente um processo de industrialização. Deste modo, em termos kaldorianos, uma taxa de câmbio valorizada reduz o crescimento de longo prazo, mas uma taxa de câmbio desvalorizada não impulsiona necessariamente o crescimento de longo prazo via os efeitos indiretos na mudança estrutural.

Palavras chave: Taxa de câmbio, Mudança estrutural e América Latina

Código JEL: O11, L16

Área: Crescimento, Desenvolvimento Econômico e Instituições

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1.   Introduction

Structural change is an engine of growth within the heterodox economics. In so far as the manufacturing sectors are characterized by the higher ability to generate innovative activities than other sectors, the increasing returns to scale and the backward/forward linkages, growing manufacturing sectors boost the productivity and the long-run growth. There exist some stylized facts according which manufacturing sectors play a central role in promoting the productivity and the long-run growth widely known as the Kaldor's laws. Specifically, the manufacturing sectors play a special role in promoting the long-run growth for the developing countries as its productivity growth depends on the access to the technology of developed countries and the promotion of structural change towards modern sectors (Ocampo and Vos, 2008).

The exchange rate policy comes up as a tool for development of developing countries as far as it makes the access to northern innovative activities possible by means of changes in the profitability of tradable sectors and its effects in the capital accumulation. Also, an exchange rate policy orientated towards the development allows for the structural change (Gabriel and Missio, 2018) and industrial diversification (Rodrik, 2006) as it protects the infant industries and promotes the capital accumulation of tradable sectors.

This paper aims at testing empirically the relationship between exchange rate movements and structural change for Latin American countries over the period 1975-2017.[3] For this, it is employed various variables to represent its structural change; the sectoral share of GDP in terms of industry, primary sectors and services, the economic complexity index and the industrial share of employment. Controlling other variables, it is performed two alternative specifications in a panel setting considering the measure of exchange rate misalignment calculated by Couhard (2017). The first specification introduces the exchange rate misalignment variable directly in order to test the effects of exchange rate movements in the structural composition. The second specification splits up the exchange rate overvaluations from the devaluation movements with a view to test the effects of exchange rate movements in the structural composition separately. Both estimates are tested employing short-panels using five-year averaged database and long-panels using yearly database.

The results of the first specification showed that devaluations (overvaluations) of exchange rate are associated to structural changes towards the industry (services) in terms of GDP share and employment and to a productive structure (less) more sophisticated. In turn, the results of second specification displayed that exchange rate overvaluations are associated to the deindustrialization process in terms share of GDP and employment, but exchange rate devaluation are not an enough policy to promote the industrialization of Latin American economies.

This paper has four sections besides this short introduction. Second section discusses the relationship between structural change and long-run growth. Third section presents the arguments in literature according which the exchange rate affects the structural change.

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[3] This paper does not aim to test the empirical validity of Kaldor's law or the importance of industry to long-run growth. There is a vast empirical literature on this topic. Important papers of this literature comprise Drakopoulous and Theodossiou (1991), Fingleton and McCombie (1998), Leon-Ledesma (2000), Rodrik (2008), Timmer and Vries (2008), Alexiadis and Tsagdis (2010), Szirmai (2012), Szirmai and Verspagen (2015), Su and Yao (2016), Romero and Britto (2017), Gabriel and Ribeiro (2019) among others.

Fourth presents the empirical strategy and the database employed in this paper. Fifth section presents the empirical findings. Lastly, the conclusions end the paper.

2.   Structural change and long-run growth: the structuralist perspective

The relationship between sectoral composition of economy and long-run growth is controversial within the economics. A strand of literature states that structural change stems from growth. The economic growth is accompanied by changes in sectoral composition of output so that structural change is a consequence instead of growth's cause.[4] In this view, the expansion of economy and markets reconfigures the structural composition of economies from primary sectors to secondaries and, then, to tertiary sectors in terms of contributions to output, employment and investment (Ocampo *et al*, 2009). In developed economies (or in high-income economies) the industrial sectors play a timid role in terms of contribution to GDP to detriment of service sectors. Meanwhile, the poorest economies are essentially dominated by primary sectors with serious constrains to access modern technology and unable to provide increasing returns to scale (Ocampo *et al*, 2009). According to this view structural change does not matter or simply has a passive role.

Other strands of economics see the structural change as the engine of long-run growth. Within the structuralist perspective, the long-run growth is a dynamic process characterized by a continuing transformation of the productive structures based upon the creative destruction in the Shumpeterian sense (Ocampo, 2005). Or, within classical development economics *a la* Lewis (1954), higher long-run growth rates may be achieved through the reallocation of labor from low- (non-industrial sectors) to higher-productivity activities (industrial sectors).

From this angle, the key point is the sectoral specificities with respect to ability to generate innovative activities, to boost the productivity growth and to integrate the domestic sectors. The industrial sectors play a central role in the promotion of long-run growth because of its higher productivity growth to extent that they are more dynamic in terms of innovative activities and have increasing returns to scale (Ocampo *et al*, 2009). Besides, manufacturing sectors have a larger potential to induce the domestic integration via the backward and forward linkages with other sectors of the economy *a la* Hirschman (1958) in a manner that the manufacturing growth exerts a pulling effect in the economy (Tregenna, 2008).

Szirmai (2012) offers a summary on the theoretical arguments in favor of industrialization as the main engine of long-run growth. First, manufacturing sectors require more capital accumulation than other sectors. Second, manufacturing sectors present economies of scale and encompass more embodied and disembodied technological progress. Third, manufacturing sectors have more backward and forwards linkages than other sectors. Those arguments suggest that manufacturing is more productive than other sectors so that a structural change towards manufacturing sectors boosts the long-run growth (Szimai, 2012). Su and Yao (2016) showed empirically that, in the case of middle-income economies, the manufacturing sectors are associated to higher savings, faster pace of technological accumulation and stronger contributions of human capital and institutions to growth.

In this line, the manufacturing sectors play a crucial role to explain the differences of long-run growth between countries within the Kaldorian growth theory. The first law of Kaldor states that faster growth in industry lead to faster growth of the economy. The ability

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[4] Such view on the structural change dynamic is represented by Chenery (1979) among others.

to promote the structural change to industry is associated to success or failure concerning the long-run growth. Developed countries are those that promoted the industrialization of its productive structure, whereas the developing countries are those trapped in a primary productive structure.

The Kaldorian growth theory, anchored in the circular cumulative causation *a la* Myrdal (1957), puts the presence of increasing returns to scale at the center of growth explanation (Ros, 2015). Following Ros (2015), the growth of aggregated labor productivity *p* is a weighted sum of industrial productivity growth p_{ind} and non-industrial productivity growth p_{nind}:

$$p = ap_{ind} + bp_{nind} \tag{1}$$

The second law of Kaldor, in turn, states that manufacturing productivity growth p_{ind} is a positive function of industrial production growth q_{ind} in a manner that:

$$p_{ind} = \alpha_0 + vq_{ind} \tag{2}$$

where the constant α_0 is the autonomous rate of capital accumulation per worker, and *v* is the Verdoorn's coefficient – or the pace of capital accumulation induced by demand growth and the pace of technical progress incorporated in capital accumulation (Dixon and Thirlwall, 1975). As the growth rate of industrial labor productivity is the difference between the growth rate of output q_{ind} and industrial employees e_{ind}, equation (2) may be re-written as:

$$p_{ind} = \frac{\alpha_0}{1-v} + \frac{v}{1-v}e_{ind} \tag{3}$$

The Verdoorn's coefficient is supposed to be less than one in order to exist a positive relationship between industrial employment growth and industrial productivity growth (increasing returns to scale) (Ros, 2015).

In contrast, as the non-industrial sectors are unable to generate increasing returns to scale, its productivity growth p_{nind} is determined residually as the difference between output growth q_{nind} and employment growth e_{nind} (Ros, 2015). It is assumed that there exists a linkage between non-industrial and industrial sectors, so that the output growth of non-industrial sectors is a function of industrial output growth:

$$q_{nind} = c_0 + c_1 q_{ind} \tag{4}$$

The non-industrial employment growth is defined as the difference between the labor supply growth *n* and industrial employment growth e_{ind}:

$$e_{nind} = n - e_{ind} \tag{5}$$

Representing the employment growth *e* as the following identity:

$$e = \psi_{ind}e_{ind} + \psi_{nind}e_{nind} \tag{6}$$

where ψ_{ind} and ψ_{nind} are respectively the share of industrial and the non-industrial employment in the overall employment. Assuming that *n* equals *e*, and introducing (6) into (5):

$$e_{nind} = \frac{1}{\psi_{nind}}n - \frac{\psi_{ind}}{\psi_{nind}}e_{ind} \tag{5.1}$$

Ros (2015)'s formalization leads to following determination of productivity growth of non-industrial sectors:

$$p_{nind} = [c_0 + c_1 q_{ind}] - [\frac{1}{\psi_{nind}}n - \frac{\psi_{ind}}{\psi_{nind}}e_{ind}] \tag{7}$$

Introducing (3) and (7) into (1):

$$p = a\left[\frac{\alpha_0}{1-v} + \frac{v}{1-v}e_{ind}\right] + b[(c_0 + c_1 q_{ind}) - (\frac{1}{\psi_{nind}}n - \frac{\psi_{ind}}{\psi_{nind}}e_{ind})] \tag{1.1}$$

Equation (1.1) represents the third Kaldor's law and states that the productivity of the economy is a function of industrial production via the Verdoorn's mechanism (second law

of Kaldor) and via the classical development's mechanism represented by the structural change promoted by the reallocation of employment from non-industrial to industrial sectors inasmuch as the industrial production is positively associated with industrial employment (Ros, 2015). Besides, the industrial expansion increases the non-industrial productivity indirectly via the linkage's effect (Ros, 2015). In another words, equation (1.1) shows that the long-run performance represented by overall labor productivity growth depends positively (negatively) on industrial production and on structural change towards manufacturing (population growth) (Ros, 2013).

Yet, structural change is a broader process than the growth of industry and modern services, it is about the ability to create new activities and to integrate the domestic sectors (Ocampo and Vos, 2008). In a hand, recent literature moved forward incorporating other aspects of structural change besides the industrial share of employment. Tregenna (2008) highlights the importance of understanding the structural change not only in terms of the share of industrial employment, but also in terms of share of industry in GDP as far as the Kaldorian processes operate via employment and output. Hidalgo *et al* (2007), in turn, put into the picture a discussion on structural change and economic performance in terms of economic complexity. Growing economies sophisticate its products and exports towards goods that require infrastructure, institutions, and human and physical capital (Hidalgo *et al*, 2007). The economic complexity is associated to useful knowledge embedded in its productive structure in a manner that higher the complexity of economy, faster the growth (Hausmann, Hidalgo *et al* 2011).

In another, the Kaldorian literature moved on discussing other aspects associated to Verdoorn's mechanism. Setterfield (1995) argues that the returns to scale are obtained under a specific technological state-of-the-art, human capital and institutions which creates a lock-in point. Growing economies under an obsolete technological paradigm generate endogenously the conditions for a lock-in point in a period with lower increasing returns to scale and labor-productivity (Setterfield, 1995). Setterfield and Cornwall (2003) endogenized the parameters α_0 and v of second law of Kaldor with respect to institutional regime connecting historical elements and institutional differences to economic performance in Kaldor (1970) model. In a similar fashion, Ocampo (2005) endogenized the parameters α_0 and v regarding the technological capabilities, the degree of innovativeness, the incentives and institutions of economies.

Naastepad (2005), Hein and Tarassow (2010) and Hartwing (2013) associated the Verdoorn's mechanism to the effects of income distribution into demand growth *a la* Baduhri and Marglin (1990). Those authors concluded that income distribution has different effects on productivity growth via Verdoorn's mechanism depending on the demand regime of economy (wage- or profit-led). Romero and Britto (2017), in turn, combined the Kaldorian and the Schumpeterian traditions associating the research intensity and knowledge accumulation with the size of Verdoorn's coefficient. Iasco-Pereira and Romero (2017) associated the size of Verdoorn's coefficient to colonial institutions for the Brazilian municipalities case. In a nutshell, the recent literature within Kaldorian literature supports the vision according which the Verdoorn's mechanism is more complex than simply increasing demand growth as far as the increasing returns to scale are associated to supply-side elements.

In sum, in the structuralist perspective the structural composition of economy matters for the long-run growth. The structural change, as a broader process in which demand growth and elements of supply side are interwoven, is the engine of long-run growth instead of

consequence. Policies that promote the structural change toward modern sectors (in terms of industrial share of employment/GDP or economic complexity) are the key for the long-run growth. Next section discusses briefly the literature on the profitability/development channel through which an exchange rate policy for development affects the labor productivity growth.

3.   Why does the exchange rate matter for long-run growth?

There exists a vast empirical literature that documented the effects of exchange rate movements on economic growth. The bulk of this literature states that exchange rate undervaluation boosts the growth whilst overvaluation hurts it (Razin and Collins, 1997, Easterly, 2001, Acemoglu *et al*, 2003, Hausmann, Pritchett and Rodrik, 2005, Vieira and MacDonald, 2012, Glüzmann, Levy-Yeyati and Sturzenegger, 2012, among others). In a hand, part of this literature confirmed that this relationship is especially valid for developing countries (Gala, 2008, Rodrik, 2008, Rapetti, Skott, and Razmi, 2011). In another, some authors (Ros and Skott, 1998, Frenkel and Ros, 2006, Rodrik, 2008, Ros, 2013) indicate that the transmission channel from exchange rate movements to growth is the profitability of tradable sectors in which the production has increasing returns to scale (manufacturing sectors). Such transmission channel is the profitability-development channel (Ros, 2013).

Ros and Skott (1998) modelled the effects of trade liberalization/exchange rate overvaluation in a theoretical model with two assumptions: a sluggish wage adjustment and increasing returns to scale in tradable sectors. They concluded that the first assumption means that trade liberalization leads to an overvaluation of domestic currency whilst the second assumption creates the possibility of multiple equilibria. The existence of multiple equilibria points that overvaluations (devaluations) have contractionary (expansionary) effects in long-run growth due to reduction (expansion) of capital accumulation (Ros and Skott, 1998).

Frenkel and Ros (2006) examined the role played by the exchange rate in determining employment performance and its channel's transmissions. They pointed the existence of three channels. The macroeconomic channel suggests that higher competitiveness sparked by devaluations leads to higher exports, demand, output and employment even with the co-existence of contractionary effects caused by falls in real wage (Frenkel and Ros, 2006). The labor intensity channel adds a further variable in determining the effects of devaluation in unemployment; the negative effects on labor costs of tradable sectors. This channel is associated to the effects of exchange rate movements in the structural composition of economies via changes in its relative prices. In a hand, devaluations boost the profitability of tradable sectors and encourage the more intensive labor use. In another, overvaluations cut off the profitability but encourage firms to increase its competitiveness via reducing the labor use (Frenkel and Ros, 2006). The development channel associates the devaluations to the export promotion industrialization as the exchange rate establishes the relative prices of tradable and non-tradable goods and acts as a uniform tariff (subside) on imports (exports). A competitive exchange rate then rises the profitability of tradable sector and encourages its production, employment and investment, promoting a structural change towards those sectors (Frenkel and Ros, 2006).

In a similar fashion, Rodrik (2008) argues that devaluations boost the profitability of tradable sectors, especially the manufacturing sectors, increasing its importance in productive structure. Rodrik (2008) offers two explanations for the causal link between exchange rate devaluation, profitability of tradable sectors and growth. The first explanation is the idea that bad institutions of low-income countries act as a higher tax on tradable sectors, resulting in

a misallocation of resources in terms of investment. Accordingly, by increasing profitability, exchange rate devaluations increase investment and efficiency. The second explanation is that one according which undervaluation acts as a substitute for industrial policy to remediate the market failures of tradable sectors. Rodrik (2008) argues that, insofar as the economic development is a process of structural change towards a productive structure more diversified and complex and that market failures are more severe in new lines of production, devaluations of exchange rate induce the production of new products and entails higher long-run growth.

Although the literature supports the view according which exchange rate affects directly long-run growth, some authors indicate the existence of an indirect effect via structural change. The exchange rate is connected to the profitability of tradable sectors and to its investment and employment decisions. As devaluations (overvaluations) distort the relative prices in favor of tradable (non-tradable) sectors and decrease (increase) the real wage, the higher (lower) profitability enhances (lowers) its production and investment promoting the reallocation of resources towards tradable (non-tradable) sectors. Therefore, as the tradable (non-tradable) sectors encompass the manufacturing sectors (services), devaluations (overvaluations) of exchange rate boost (hamper) the long-run growth directly and indirectly via its effects on profitability and then on structural composition of economy.

Next section discusses the empirical strategy and the database employed in estimates.

4.   Empirical strategy

To the best of our knowledge, there are few works that assessed empirically the relationship between the exchange rate and structural change performance.

Vaz and Baer (2013) documented the effects of exchange rate movements on the output growth of industrial sectors for 39 countries, including Latin America, in a panel setting. They concluded that exchange rate devaluations may be part of a growth strategy in promoting the growth of industrial output and that its effects are stronger in Latin American economies.

Gabriel and Missio (2018) assessed the effects of exchange rate movements on industry, primary and services sectors in terms of its values added in GDP and on the economic complexity index for 118 countries in a panel setting. Their results pointed that an undervalued exchange rate affects positively the industrial sectors specially in in developing countries. In addition, their results also showed that an undervalued exchange rate affects positively (negatively) the primary sectors of developed (developing) countries, but, in another hand, the exchange rate was not significant in the regressions estimated to explain the services sectors. Lastly, a devalued exchange rate was positively associated with economic complexity.

The empirical strategy of this paper consists of estimating two different specifications in a panel data setting using a five-years average database and a yearly database. The database comprises 14 countries[5] and covers the period 1975-2017 or 9 five-years periods from 1975-1979 to 2015-2017. The structural change (dependent variable) is represented by three sets of variables: (1) the GDP share of industry, primary and services sectors provided by the World Bank, (2) the economic complexity index calculated by the observatory of economic

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[5] Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Panama, Peru, Paraguay and Uruguay.

complexity, and (3) the growth rate of industrial employment share from GGDC 10-sector database. The movements of exchange rate are represented by the exchange rate misalignment mis_{it} calculated by Couharde et al (2017). This measure of exchange misalignment is calculated as the difference between the indeed exchange rate and the equilibrium exchange rate.[6] Negative values are associated with undervaluation episodes whilst positive values with overvaluation episodes.

The two specifications are presented as follow:

$$structural\ change_{it} = \alpha + \beta mis_{it} + \delta controls + f_i + f_t + u_{it} \tag{8}$$

$$structural\ change_{it} = \alpha + \beta_{over} over_{it} + \beta_{dev} dev_{it} + \delta controls + f_i + f_t + u_{it} \tag{9}$$

where i and t represent country and time dimensions, respectively. Both specifications are performed with a constant α and a full set of countries and time dummies (f_i and f_t). The first specification employs the exchange misalignment mis_{it} as an explanatory variable in estimates. A negative (positive) signal of β means that devaluations are positively (negatively) associated to structural change whilst overvaluations are negatively (positively) associated to structural change.

The second specification splits the exchange misalignment mis_{it} into two new variables; $over_{it}$ that results from the multiplying mis_{it} by a dummy variable that represents the overvaluation episodes (1 for positive values of mis_{it}, zero otherwise) and dev_{it} which results from the multiplying mis_{it} by a dummy variable that represents the devaluation episodes (1 for negative values of mis_{it}, zero otherwise). The aim of second specification is to test the effects of devaluation and overvaluation episodes in structural change separately.

Moreover, the regressions control other variables. The profit-share of GDP is introduced in the right side of estimates in order to capture the effects of profitability channel on the measures of structural change. This variable is calculated by subtracting the values of wage-share calculated by Tosoni (2017) from one hundred.

Following the structuralist perspective, the terms of trade are controlled in the regressions. The idea is that the international trade between southern and northern economies is distinguished by a deterioration of the terms of trade according to which there is an upward trend of manufacturing prices and a downward trend of agricultural prices (Prebisch-Singer hypothesis) (Di Filippo, 2009). Insofar as the structural change towards modern sectors of southern economies depends on the imports of capital and technologies from northern economies, the deterioration of the terms of trade entails lack of international reserves to carry over a structural change process (Cimoli and Porcile, 2011).

Further variables are introduced to control the possible effects of trade openness, government consumption, inflation rate and the level of income. Table 1 describes and presents the sources and the basic statistics of all variables used in estimates.

[TABLE 1 AROUND HERE]

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[6] Couharde et al (2017) considered three variables as the fundamentals of the real effective exchange rate to calculate the equilibrium exchange rate: the income per capita (Balassa-Samuelson effect), the net foreign asset position and the terms of trade.

The regressions were performed employing the current and the lagged values of exchange rate variables. All controlling variables were employed in lagged values (except for the terms of trade and the inflation rate). The first set of regressions was performed using the 5-years average of database in level. In turn, the second set of regressions was performed using the yearly database and the econometric method of Panel Corrected Standard Errors (PCSE) to handle with the residual correlation (over time and across panels). It should highlight that all variables were employed in first difference to assure its stationarity (except the exchange rate misalignment measure).[7] Next section presents the empirical findings.

5.   Empirical findings

The estimates of first and second specifications are presented in this section. The estimates employing the 5-years average database are estimated with robust errors to heteroskedasticity. In turn, the estimates employing the yearly database are estimated considering robust errors to heteroskedasticity, and the residual correlation are modelled as an AR (1) process for each panel.

5.1.   Estimates with 5-years average database

Table 2 presents the estimates of first specification. The parameter of mis_{it} is statistically significant in all regressions except when the GDP share of primary sectors is the dependent variable. Yet, the signal of β differs across the different measures of structural change. In terms of GDP share, the parameter of mis_{it} is negative for industry and positive for services, meanwhile it is negative for the complexity index and industrial employment. In a hand, these results suggest that exchange rate devaluations are associated with increasing (decreasing) share of industry (services) of GDP, as well as with increases of industrial share of employment and with a more sophisticated productive structure in terms of complexity. In another, they also suggest that exchange rate overvaluations are associated with increasing (decreasing) GDP share of services (industry), with falls of industrial share of employment and with a less sophisticated productive structure. The parameter β of mis_{it-1} is statically significant and negative in the regressions employing the complexity index as the dependent variable.

[TABLE 2 AROUND HERE]

Table 3 presents the results of second specification. The parameter β_{dev} is not statistically significant in all regressions performed. However, the parameter β_{over} is statistically significant at 1% critical values and negative in the regressions performed to explain the industrial share of GDP and the growth of industrial share of employment. Interestingly, the results of second specification suggest that exchange rate devaluations are not an enough condition to promote the structural change towards industry. Nonetheless, they suggest that exchange rate overvaluations have deleterious effects on the industrial share in terms of GDP and employment.

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[7] The panel unit root tests Levin-Lin-Chu, Hadri LM, Harris-Tzavalis, (to balanced variables), and Im-Pesaran-Shin and Fisher (to unbalanced variables) pointed that all variables of yearly database are I(1), except the exchange rate misalignment which is I(0).

[TABLE 3 AROUND HERE]

The controlling variables of first and second specifications tell the same story. The parameters of profit-share of GDP, trade openness and inflation rate are not statistically significant at 5% or 1% critical values in all regressions. The parameter of terms of trade is statistically significant and negative in all regressions, except in the case of the sectoral share of services in GDP and the growth of industrial employment share. Such result means that improvements in terms of trade are negatively associated with the performance of industrial and primary sectors in terms of GDP share and with the sophistication of structure productive. The parameter of the government consumption variable is significant and positive in the regressions of GDP share of services and complexity index. The parameter of income level, in turn, is statistically significant only in the regressions performed considering the GDP share of industry and primary sectors as the dependent variable with, respectively, negative and positive signals. Therefore, higher the income-level, lower (higher) the industrial (primary) share of GDP.

The results of estimates of first specification using the 5-years average database suggested that an undervalued exchange rate promotes the structural change of Latin American economies to industry in terms of industrial share of GDP and employment and economic complexity. It also suggested that an overvalued exchange rate favors the service sectors. In another hand, the effectiveness of a policy for structural change to industry based on a devalued exchange rate was not corroborated by the results of second specification. That is, its results suggested that episodes of a devalued exchange rate are not statistically significant for any variable of structural change. Yet, episodes of overvalued exchange rate are statistically significant with a negative parameter for the industrial share of GDP and the growth of industrial share of employment. This way, those results suggest that an overvalued exchange rate promotes the deindustrialization, but a devalued exchange rate does not promote the industrialization or the sophistication of productive structure.

5.2- *Estimates with yearly database*

Table 4 presents the results of first specification employing the yearly database. The parameter of mis_{it} is statistically significant in all regressions except when the GDP share of primary sectors and the complexity index are the dependent variable. The signal of β is negative in the regressions performed to explain the GDP share of industry and the growth of industrial share of employment. Meanwhile, the signal of β is positive in the regressions performed to explain the GDP share of services. As previously obtained, those results suggest that exchange rate devaluations are associated with increasing (decreasing) share of industry (services) in GDP and with positive variations of industrial share of employment. Plus, it also suggests that exchange rate overvaluations are associated with increasing (decreasing) share of services (industry) in GDP and with decreasing growth of industrial share of employment. The parameter β of mis_{it-1} is statistically significant and negative only in the regressions of growth of industrial share of employment.

[TABLE 4 AROUND HERE]

Table 5 presents the results of second specification employing the yearly database. As previously obtained, the parameter β_{dev} is not statistically significant in all regressions performed. However, the parameter β_{over} is statistically significant and negative in the regressions performed to explain the industrial share of GDP and the growth of industrial share of employment anew. Once more these results suggest that exchange rate devaluations do not promote the industrialization by itself, but that exchange rate overvaluations promotes the deindustrialization in terms of GDP and employment share. The parameter β_{over} of $over_{it-1}$ is statistically significant and negative only in the regressions performed to explain the growth of industrial share of employment.

[TABLE 5 AROUND HERE]

Regarding the controlling variables of first and second estimates, the regressions displayed that the parameter of profit-share of GDP is statistically significant and positive only for the industrial share of GDP. The parameter of terms of trade is statistically significant and negative in the regressions performed to explain the GDP share of industry and the complexity index. The variable trade openness is statistically significant for the GDP share of primary and services sectors and the complexity index. However, its signal is positive for the GDP share of primary sectors and for the complexity index, and negative for the GDP share of services sectors. The parameter of government consumption is not significant in all regression. The inflation rate is significant for industrial and primary sectors in terms of GDP share and its signal is, respectively, positive and negative.

The results of first specification using the yearly database are attuned to the empirical findings of section 5.1. They showed that an undervalued exchange rate is associated to the promotion of structural change to industry in terms of industrial share of GDP and employment and the reduction of services sectors. In turn, an overvalued exchange rate increases the importance of services in GDP rather than industry in terms of GDP and employment. The foregoing results of second specification are also corroborated. Episodes of overvalued exchange are associated to deindustrialization meanwhile episodes of devalued exchange rate are not associated to industrialization. On the other hand, estimates of both specifications employing the yearly database suggested that the profitability channel is valid to explain the industrial performance in terms of GDP share. Then, policies that boost the profit-share of GDP seems to be associated to the industrialization in terms of GDP share.

Final Remarks

In the kaldorian-structuralist perspective, the structural change towards industry is the engine of long-run growth. The manufacturing sectors have special properties, such as higher ability to generate innovative activities, increasing returns to scale and backward/forward linkages, so that its added value and employment contribute more to growth than other sectors. The policies of promotion of structural change are the key for the long-run growth.

In this respect, the exchange rate become essential in the promotion of industrialization or sophistication of productive structure. Even though the literature supports the view according which exchange rate affects directly the long-run growth, recently some authors point the existence of an indirect channel via its effects in the structural change. The argument is that exchange rate is connected to the profitability of tradable sectors and, then, to its investment and employment decisions. The positive effects of exchange rate devaluations in

the profitability take place through the distortions of relative prices in favor of tradable sectors and by reducing the real wage. A devalued exchange rate promotes the reallocation of resources towards tradable sectors by increasing its profitability and, then, its production and investment. Into the extent that tradable sectors encompass the manufacturing sectors, devaluations of exchange rate boost the long-run growth directly and indirectly via its effects on profitability and then on structural change toward manufacturing sectors.

This paper performed econometric regressions following two different specifications and using two databases, a five-years averaged and a yearly. Controlling for other variables, the empirical findings of first specification suggest that an undervalued (overvalued) exchange rate affects positively (negatively) the industry in terms of share of GDP and employment. It also suggested that an overvalued (devalued) exchange rate affects positively (negatively) the services in terms of GDP share. Therefore, in the kaldorian-structuralist outlook, the exchange rate devaluations boost the long-run growth of Latin American economies by promoting an industrialization process. On the other hand, the empirical findings of first specification point that an overvalued exchange rate hampers the long-run growth of Latin American economies due its positive effects in the services to the detriment of its negative effects in the industry. Furthermore, the results of first specification displayed that exchange rate devaluations raise the economic sophistication of Latin American economies (only the regressions employing the five-years averaged database).

However, the effectiveness of a policy for structural change towards the industry based on a devalued exchange rate has been put in doubt by the the empirical findings of second specification. The episodes of a devalued exchange rate are not statistically significant to explain any variable of structural change. However, the episodes of overvalued exchange rate are statistically significant with a negative parameter to explain the industrial share of GDP and the growth of industrial share of employment. Thus, the results of second specification point that an overvalued exchange rate promotes the deindustrialization, but a devalued exchange rate does not promote the industrialization or the sophistication of productive structure. Or, in another words, an overvalued exchange rate hampers the long-run growth of Latin American economies, but a devalued exchange rate does not necessary boosts the long-run growth via the indirect effects in the structural change towards industry.

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Appendix A

Table 1- Database: basic information and descriptive statistics

Variable	Unit of measure and coverage	Source	Obs.	$\bar{x}$	σ
industry	Ratio of industry value add to GDP (%) (1975-2017)	World Bank	581	16.96	4.39
primary	Ratio of primary value add to GDP (%) (1975-2017)	World Bank	582	12.04	12.04
services	Ratio of services value add to GDP (%) (1975-2017)	World Bank	582	53.34	7.66
complexity index	Economic complexity index (1975-2017)	OEC	588	-0.20	0.51
industrial employment	Growth rate of the industrial employment share (1975-2010)	GGDC 10 sector database	257	-0.005	0.04
mis	Exchange misalignment calculated as the actual exchange rate minus the equilibrium exchange rate (1975-2017)	CEPII	602	0.001	0.22
profit-share	One hundred minus the wage-share (1975-2014)	Tosoni (2017)	480	63.28	7.97
terms of trade	Percentage ratio of the export unit value indexes to the import unit value indexes (2000=100) (1980-2017)	World Bank	531	112.8	35.37
openness	The sum of exports and imports (% of GDP) (1975-2017)	World Bank	602	58.85	30.34
government	Government consumption (% of GDP) (1975-2014)	PWT 9.0	560	15.24	5.78
Inflation	Consumer prices (annual %) (unbalanced)	World Bank	596	79.12	615.3
income level	GDP per capita (constant local currency and constant 2010 U.S dollar) (1975-2017)	World Bank	602	5,238	3,002

Table 2- Structural change, exchange misalignment and covariates: first specification (5-years)

	industry		primary		services		complexity index		industrial employment	
mis	-4.54*** (1.99)		-2.32 (1.84)		5.31** (2.47)		-0.17*** (0.06)		-0.05*** (0.01)	
mis_{t-1}		1.40 (2.25)		-2.08 (1.66)		-1.92 (2.27)		-0.11** (0.05)		-0.01 (0.02)
profit-share	0.02 (0.06)	0.06 (0.06)	0.07 (0.05)	0.08 (0.05)	-0.07 (0.07)	-0.13* (0.07)	-0.003 (0.003)	-0.002 (0.003)	-0.0005 (0.001)	-0.0008 (0.001)
terms of trade	-0.03** (0.01)	-0.02* (0.01)	-0.03*** (0.01)	-0.02*** (0.01)	0.02* (0.01)	0.02 (0.01)	-0.001*** (0.0007)	-0.001** (0.0007)	-0.0001* (0.0001)	-0.0001 (0.0001)
openness	0.05* (0.02)	0.05* (0.03)	-0.03 (0.02)	-0.04** (0.02)	0.01 (0.03)	0.01 (0.04)	0.001 (0.001)	0.001 (0.001)	-0.0006 (0.0005)	-0.0006 (0.0007)
government	-0.08 (0.07)	-0.13* (0.08)	0.08 (0.06)	0.08 (0.06)	0.32*** (0.09)	0.38*** (0.09)	0.01*** (0.003)	0.01*** (0.003)	0.0009 (0.0006)	0.001 (0.0008)
inflation	0.001 (0.0007)	0.0005 (0.0006)	-0.0009 (0.0007)	-0.001 (0.0009)	-0.0001 (0.001)	0.0004 (0.001)	0.0001 (0.0004)	0.00009*** (0.00003)	-0.00001 (0.00001)	-0.00002** (0.00001)
income level	-8.68*** (2.76)	-8.68*** (2.76)	5.65*** (2.06)	5.36*** (2.15)	-0.65 (2.92)	-1.28 (3.05)	0.07 (0.11)	0.09 (0.12)	-0.03 (0.03)	-0.0007 (0.05)
constant	76.07*** (22.24)	68.67*** (24.35)	-32.27** (15.36)	-30.36* (15.85)	47.16** (21.56)	56.39*** (22.38)	-1.37 (0.91)	-1.58* (0.95)	0.34 (0.30)	0.11 (0.43)
Sample	94	94	94	94	94	94	96	96	49	49
R^2	0.74	0.72	0.90	0.90	0.86	0.85	0.95	0.95	0.64	0.54

Notes: * significant at 10% of critical level, ** significant at 5%, *** significant at 1%. The standard deviation is between the parenthesis.

Table 3- Structural change, exchange misalignment and covariates: second specification (5-years)

	industry		primary		services		complexity index		industrial employment	
over	-11.36*** (4.12)		-2.13 (3.72)		6.88 (4.68)		-0.08 (0.17)		-0.12*** (0.03)	
dev	3.61 (4.53)		-2.56 (3.26)		3.44 (4.50)		-0.25* (0.15)		0.02 (0.03)	
over$_{t-1}$		-0.31 (5.15)		-3.68 (2.54)		0.92 (4.54)		0.008 (0.16)		0.01 (0.04)
dev$_{t-1}$		3.83 (4.87)		0.17 (3.23)		-5.94 (5.76)		-0.23 (0.15)		-0.04 (0.04)
profit-share	0.01 (0.06)	0.07 (0.06)	0.07 (0.05)	0.08 (0.05)	-0.07 (0.07)	-0.13* (0.07)	-0.002 (0.003)	-0.002 (0.003)	-0.0007 (0.001)	-0.0009 (0.002)
terms of trade	-0.02* (0.01)	-0.02* (0.01)	-0.03*** (0.01)	-0.02*** (0.01)	0.02* (0.01)	0.02 (0.01)	-0.001*** (0.0007)	-0.001** (0.0007)	-0.0001 (0.0001)	-0.0001 (0.0001)
openness	0.05* (0.02)	0.05* (0.03)	-0.03 (0.02)	-0.04* (0.02)	0.01 (0.03)	0.01 (0.04)	0.001 (0.001)	0.001 (0.001)	-0.0004 (0.0005)	-0.0007 (0.0007)
government	-0.06 (0.07)	-0.13* (0.08)	0.08 (0.06)	0.08 (0.06)	0.32*** (0.09)	0.38 (0.09)	0.01*** (0.003)	0.01*** (0.003)	0.001* (0.0008)	-0.001 (0.008)
inflation	0.001* (0.0007)	0.0007 (0.0007)	-0.0009 (0.0007)	-0.001 (0.0009)	-0.0002 (0.001)	0.0002 (0.09)	0.0001*** (0.00004)	0.00008*** (0.00003)	-0.00001* 9.46e-06	-0.00002** (0.00001)
income level	-7.24*** (3.02)	-8.04*** (2.99)	5.61** (2.29)	5.49** (2.15)	-0.98 (2.92)	-1.52 (3.09)	0.05 (0.12)	0.07 (0.11)	-0.008 (0.03)	-0.003 (0.05)
constant	66.43*** (1.19)	67.70*** (24.49)	-31.99* (16.99)	-31.26* (15.86)	49.37** (21.87)	58.00*** (22.96)	-1.23 (0.98)	-1.44 (0.91)	0.16 (0.28)	0.15 (0.43)
Sample	94	94	94	94	94	94	96	96	49	49
R^2	0.75	0.72	0.90	0.90	0.86	0.85	0.95	0.95	0.67	0.55

Notes: * significant at 10% of critical level, ** significant at 5%, *** significant at 1%. The standard deviation is between the parenthesis.

Table 4- Structural change, exchange misalignment and covariates: first specification (yearly database)

	industry		primary		services		complexity index		industrial employment	
mis	-0.55** (0.27)		0.23 (0.33)		1.16** (0.61)		-0.01 (0.04)		-0.03*** (0.01)	
mis$_{t-1}$		-0.35 (0.27)		0.58* (0.32)		-0.82 (0.60)		0.05 (0.04)		-0.03*** (0.01)
profit-share	0.05*** (0.02)	0.05*** (0.02)	0.003 (0.02)	0.003 (0.02)	-0.03 (0.04)	-0.04 (0.04)	-0.0006 (0.002)	-0.0002 (0.002)	-0.0009 (0.001)	-0.0009 (0.001)
terms of trade	-0.003** (0.001)	-0.003** (0.001)	0.001 (0.002)	0.002 (0.002)	0.002 (0.003)	0.0005 (0.003)	-0.0008*** (0.0003)	-0.0008** (0.0003)	-0.0001 (0.0001)	-0.0001 (0.0001)
openness	0.002 (0.006)	0.003 (0.006)	0.02*** (0.009)	0.02*** (0.009)	-0.03*** (0.01)	-0.03*** (0.01)	0.002** (0.0009)	0.002** (0.0009)	0.001 (0.0008)	0.001 (0.0008)
government	0.05 (0.05)	0.04 (0.05)	0.01 (0.04)	0.02 (0.04)	-0.07 (0.10)	-0.07 (0.10)	-0.002 (0.004)	-0.002 (0.004)	-0.001 (0.002)	-0.001 (0.002)
inflation	0.0005*** (0.00006)	0.0005*** (0.00006)	-0.0001** (0.00007)	-0.0001** (0.00007)	-0.0001 (0.0001)	-0.00009 (0.0001)	9.28e-06 (7.04e-06)	8.15e-06 (6.80e-06)	-8.51e-06* (4.64e-06)	-9.15e-06* (4.53e-06)
constant	-0.04 (0.37)	-0.04 (0.37)	-1.44*** (0.43)	-1.47*** (0.43)	0.49 (0.79)	0.97 (0.79)	-0.69*** (0.07)	-0.70*** (0.07)	0.02 (0.02)	0.02 (0.02)
Sample	412	412	414	414	414	414	430	430	221	221
R^2	0.25	0.25	0.18	0.18	0.16	0.16	0.80	0.80	0.30	0.30

Notes: * significant at 10% of critical level, ** significant at 5%, *** significant at 1%. The standard deviation is between the parenthesis.

Table 5- Structural change, exchange misalignment and covariates: second specification (yearly database)

	industry		primary		services		complexity index		industrial employment	
over	-0.85** (0.41)		0.38 (0.59)		0.46 (1.10)		-0.04 (0.07)		-0.14*** (0.04)	
dev	-0.19 (0.62)		0.06 (0.61)		2.00 (1.38)		0.002 (0.06)		0.04 (0.03)	
over$_{t-1}$		-0.38 (0.41)		0.04 (0.60)		0.57 (1.04)		0.09 (0.07)		-0.14*** (0.04)
dev$_{t-1}$		-0.33 (0.62)		1.20** (0.62)		-2.44* (1.34)		0.01 (0.06)		0.03 (0.02)
profit-share	0.05*** (0.02)	0.05*** (0.02)	0.002 (0.02)	0.006 (0.02)	-0.03 (0.04)	-0.04 (0.04)	-0.0005 (0.002)	-0.0003 (0.002)	-0.001 (0.0001)	-0.0009 (0.001)
terms of trade	-0.003** (0.001)	-0.003** (0.001)	0.001 (0.002)	0.002 (0.002)	0.002 (0.003)	8.45e-07 (0.003)	-0.0008** (0.0003)	-0.0008** (0.0003)	-0.00004 (0.0001)	-0.00004 (0.0001)
openness	0.003 (0.006)	0.003 (0.006)	0.02*** (0.009)	0.02*** (0.009)	-0.02** (0.01)	-0.03*** (0.01)	0.002** (0.0009)	0.002** (0.0009)	-0.001 (0.0008)	0.0017 (0.0008)
government	0.04 (0.05)	0.04 (0.05)	0.02 (0.04)	0.01 (0.04)	-0.08 (0.10)	-0.06 (0.10)	-0.002 (0.004)	-0.002 (0.004)	-0.002 (0.002)	-0.001 (0.002)
inflation	0.0005*** (0.00007)	0.0005*** (0.00007)	-0.0001** (0.00007)	-0.0001** (0.00007)	-0.0001 (0.0001)	-0.0001 (0.0001)	0.00001 (7.16e-06)	-0.002 (0.004)	-5.73e-06 (4.52e-06)	-8.07e-06* (4.24e-06)
constant	0.08 (0.38)	-0.04 (0.38)	-1.47*** (0.44)	-1.42*** (0.44)	0.60 (0.81)	0.83 (0.80)	-0.69*** (0.08)	-0.70*** (0.07)	0.03 (0.02)	0.02 (0.02)
Sample	412	412	414	414	414	414	430	430	221	221
R^2	0.26	0.25	0.18	0.19	0.16	0.16	0.80	0.79	0.35	0.34

Notes: * significant at 10% of critical level, ** significant at 5%, *** significant at 1%. The standard deviation is between the parenthesis.