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Financial cycles and the macroeconomic dynamics of developing economies

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ISI GROWTH Financial cycles and the macroeconomic dynamics of developing economies

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Abstract

This paper discusses the impact of financial cycles on the macroeconomic dynamics of developing economies. The main argument is that these cycles have a strong impact on key macroeconomic prices—in particular the real exchange rate—heightening external disequilibrium. The combination of an appreciated currency with subsequent external crises compromises investment, and therefore the accumulation of production capabilities and the upgrading of the pattern of specialization. In the long run, such capabilities and upgrading are crucial for sustaining growth. This implies that financial cycles can produce persistent effects on economic growth. The cases of Brazil and Argentina are compared with Korea and China: it is argued that in Asia the RER has been managed in such a way as to privilege the objective of competitiveness in macroeconomic policy, while in Latin America was used mainly as an anti-inflationary devise. By doing so the Asian countries used macroeconomic policy as a complementary tool in the diversification of production and capabilities, and in building their National System of Innovations. Inversely, in the case of the Latin American countries, the BOP-dominance of the macroeconomic dynamics and the weakness of industrial policy reinforced the loss of capabilities and lagging behind.

I. Introduction

This paper discusses the impact of financial cycles on the macroeconomic dynamics of developing economies. The main argument is that these cycles have a strong impact on key macroeconomic prices—in particular the real exchange rate—heightening external disequilibrium. The combination of an appreciated currency with subsequent external crises compromises investment, and therefore the accumulation of production capabilities and the upgrading of the pattern of specialization. In the long run, such capabilities and upgrading are crucial for sustaining growth. This implies that financial cycles can produce persistent effects on economic growth.

The idea that short-run shocks have more than transitory effects is not new in the literature (see for instance Setterfield, 2009), and has been recently confirmed in empirical studies on the behavior of the unemployment rate (see Blanchard et al, 2015 and Blanchard, 2016 on hysteresis in unemployment). This paper contributes to this literature by analyzing the specific case of two Latin American economies, Argentina and Brazil, which are laggards from a technological point of view and whose competitiveness depends largely on natural resources. These economies are compared to two successful cases of catching up, Korea and (more recently) China. Two main themes are developed in the paper. The first is that the interplay between the external constraint and macroeconomic policies is crucial to explain the mechanisms through which financial cycles affect poorly diversified economies with open capital accounts. Periods of high liquidity in the international markets heighten deficits in current account that overcome the ability of the fiscal and monetary policies to effectively stabilize the economy. The second theme is that the sharp drop of investment that occurs during external crises leads to a loss of capabilities and regressive structural change, which exceeds the capabilities built in the expansionist phase of the cycle. As a result, the knowledge intensity of the production structure of the developing economy exhibits stagnation or even regression (falling behind).

The paper consists of 3 sections besides the introduction and the concluding remarks. Section II briefly reviews the literature on the mechanisms linking the financial cycle with external crisis and long run growth. Section III identifies international financial cycles since 1970 and analyzes their impacts on the RER, trade and growth. Section IV focuses on the behavior of investment as a crucial link between the financial cycle and the evolution of the production structure (and

hence of the equilibrium rate of growth). The latter is analyzed by combining different indicators of the technological-intensity of the production structure. A last section concludes.

II. Financial cycles and structural change: from BOP-dominated macroeconomics to the BOP-constraint

The trilemma and policy scenarios

A useful starting point to analyze the impact of the financial cycles is the well-known trilemma of small open economies. The trilemma states that it is not possible to have at the same time an open capital account, an autonomous monetary policy and a desired real exchange rate (RER). Policy-makers can uphold two of them, but not the three at the same time.

At least three alternative scenarios potentially emerge from the trilemma. First, monetary policy focuses on curbing inflation by raising the real interest rate at home. In an international system with substantial capital mobility, a rise in the interest rate attracts short-term foreign capital inflows which arbitrate over rates of return of titles denominated in different currencies. The ensuing appreciation of the currency compromises equilibrium in current account and may lead to an unsustainable current account deficit. Second, policy-makers aim to keep a stable, competitive RER, in which case they will accept whatever interest rate emerges from buying or selling foreign exchange in the market. Finally, policy-makers regulate capital mobility (apply capital controls or, as the IMF puts it, apply capital-management techniques) which gives more room for using the monetary policy as a stabilization tool without compromising competitiveness. These scenarios produce different growth patterns in the international economy¹. The first scenario characterizes most LA economies, while a combination of the second and third scenarios characterizes several countries in Asia.

The first scenario (open capital account with a focus on inflation target) is the one in which developing economies are most vulnerable to international financial cycles and produces a BOP-dominated macroeconomics (Ocampo, 2013). The canonical sequence of the BOP-dominated cycle begins with a period of high international liquidity and low interest rates (described in Frenkel and Rapetti, 2011; Ocampo et al, 2009). There is a surge of foreign capital inflows (both

¹ The scenarios described above are "pure types" in the Weberian sense, and assume that the economy is on one the vertex of the triangle defined by the trilemma. In actual economies it is more frequent to find various degrees of openness in capital account and combination of policies.

FDI and short-run inflows) attracted by relatively higher interest rates or higher expected rates of returns in the developing economy. Such inflows appreciate the domestic currency, raising real wages and the price of domestic assets. Poorly regulated domestic financial markets stimulate bubbles in the real estate market, a short-lived boom in consumption and, in some cases, a surge in investment, while in parallel the external debt raises. However, expectations about the sustainability of the boom gradually become less optimistic. Mounting external disequilibrium, the desacceleration of growth and / or just bad news from other developing areas make foreign capital increasingly wary about lending to already highly indebted economies. This ends up in a major depreciation and a fall in the rates of growth, or in some cases economic contraction, depending on the level of the external debt and the intensity of the reversal of expectations of foreign investors (the so-called "sudden stop" syndrome). Uncertainty and volatility of macroprices and GDP halt investment decisions.

The BOP constraint, specialization and long run growth

Although financial cycles are medium run phenomena, they have significant implications for long run growth. To understand why, it is necessary to briefly revisit the determinants of the equilibrium rate of growth in the long run. In countries that do not issue the international reserve currency, growth is Balance-of-Payments constrained as suggested by the Keynesian approach to economic growth. The rate of economic growth in equilibrium should be consistent with a stable current account to GDP ratio. Formally, this can be written as $y = \theta \epsilon y^* / (\pi + \theta - 1)$, where y is the developing country's growth rate, y^* is the growth rate of the rest of the world, θ is the ratio of the value of imports to the value of exports, π is the income elasticity of the demand for imports and ϵ is the income elasticity of the demand for exports. If trade is balanced and $\theta = 1$, the relative rate of growth of the country with respect to the rest of the world equals the ratio between the income elasticity of exports and imports, $y/y^* = \epsilon/\pi^2$.

This approach is Keynesian in spirit as it emphasizes the role of demand in economic growth: the income elasticity ratio of exports and imports define the ability of the country to capture the stimuli stemming from growth of domestic and foreign effective demand. While the parameters

² See among others, Moreno-Brid (2003); Pacheco-Lopez and Thirlwall (2006); Vera (2006); Botta (2009); Thirlwall (2011); Blecker (2011).

 ε and π come from (constant-elasticity) demand equations of exports and imports, they are embedded in the pattern of specialization. The bases of this ratio are the capabilities and skills required to compete in the international markets³. High-tech goods tend to display a higher income elasticity ratio and therefore the higher the technological-intensity of the country's pattern of specialization, the higher the income elasticity ratio ε/π . The positive association between the technological intensity of the production structure and the income elasticity ratio has been reported in empirical studies of specialization and growth⁴. There are exceptions to this general rule, of which good luck in the commodity lottery is the most apparent. However—as the recent collapse of commodity prices suggests after the so-called "super-cycle of the commodities"—, the dynamism of exports mostly reflects and evolves with technological capabilities⁵. These capabilities allow a country to respond more rapidly to new competitive challenges, to catch up in innovation, to enter new markets and / or increase their market share in those whose demand grows faster.

In other words, in a world where technological asymmetries and leads and lags in innovation and technological diffusion define international competitiveness, the Keynesian (BOPconstrained) equilibrium rate of growth is driven by Schumpeterian competition, based on leads and lags in innovation and diffusion of technology. The co-evolution between technical change and changes in the pattern of specialization shapes trade elasticities in the long run.

³ Cf. Dosi et al (1990), Verspagen (1993), Fagerberg et al (2001); Fagerberg and Verspagen (2002), Cimoli and Porcile (2014).

⁴ See for instance Castelacci (2002), Anderson and Ejemo (2006), Lima and Araujo (2007), Fagerberg and Srholec (2009), Abdon et al (2010), Gouvea and Lima (2010), ECLAC (2012), Cimoli et al (2010), Lee (2013), Dosi et al (2015), Storm and Naastepad (2015).

⁵ The evidence of a positive relationship between the income elasticity ratio and the technological intensity of the structure has been reported in the literature, and is also the central point of the literature that has sought to measure the "complexity" of the production structure. This literature argues that a more "complex" structure implies a higher variety and sophistication of skills and capabilities, which are a good predictor of future economic growth (Hausmann et al, 2013).

Investment and capabilities

How are financial cycles related to the (long run) equilibrium rate of growth? The crucial link is the impact of the financial cycle on investment, which changes the pattern of specialization over time.

There are several channels through which the financial cycle can affect investment, technical change and specialization. Investment suffers disproportionally from the higher levels of uncertainty associated with external crisis, which heightens nominal and real volatility as well as the underutilization of the stock of capital⁶. Moreover, during the crises the public sector frequently absorbs the debt of the private sector. The ensuing loss of fiscal space hampers the ability of public investment to lead and encourage private investment (as discussed in Mazzucatto, 2013). As firms delay investments in new capital goods or in adopting a new technology, they fall behind in the technological race (the "Red Queen effect").

Not only the investment rate falls on average as a result of this cyclical pattern, but also its composition varies. By changing the relative profit rate of the various sectors of the economy, financial cycles affect the structure of incentives: periods of high appreciation are more favorable for nontradable activities, while export activities are depressed. Some activities will be lost as the market share of exporting firms shrinks along with their place in global value chains⁷. Economies of scale and "learning by exporting" to more exigent external markets, which are crucial for productivity growth, will be lost. The literature increasingly confirms the existence of hysteresis in the "natural rate of unemployment"—the idea of a time-varying NAIRU—reflecting the impact of the economic cycle on the long run evolution of growth and employment.

The impact of the financial cycle varies with the reaction of domestic policies to disequilibrium. The position of each country within the limits defined by the trilemma is not destiny, but reflects policy options. While many Asian economies sought to control capital inflows (and have in general regulated more heavily their bank and credit systems) and keep the RER stable and competitive, in most Latin American countries a different pattern prevailed—with few exceptions during short periods of time. Latin America is the developing

⁶ This is a classical theme of the Kaleckian investment functions, but it is also captured by the accelerator in conventional functions.

⁷ RER appreciations mean the loss of markets and eventually of sectors that could not be easily recovered later with an equivalent depreciation. A hysteresis argument in this line was made by Baldwin (1998), Baldwin and Krugman (1989) and McMillan and Rodrik (2011), among others.

region with the most open capital account in the world (Chinn and Iito, 2008). Economic policy in the region emphasized the role of the RER in the control of inflation over its role in encouraging competitiveness and diversification (Bresser, 2008). The appreciation of the RER has been systematically used as a stabilization tool, leading to frequent and intense external crises in the region (Frenkel and Rapetti, 2011; Bertola and Ocampo, 2013). Several factors concur to explain why the RER has played this role.

First, appreciations are a powerful tool for taming high inflation. By reducing the cost of imports, it reduces wage demands and the cost of inputs and capital goods, and helps discipline firms that have to face increasing foreign competition. At least in the tradable sector, mark-ups will suffer a downward pressure (as firms try not to lose market shares at home and abroad). Second, appreciations may be expansionary, at least in the short run⁸. Falling inflation, economic expansion and rising real wages and wealth are the ingredients that make "exchange rate populism" so appealing. Last but not least, policy makers in Latin America have few instruments to neutralize the impact of low interest rates and high international liquidity. Institutional weakness makes it hard to respond with the necessary velocity and intensity to prevent large inflows of short term capital from appreciating the RER. As a result, transitory nominal stability (produced by the appreciation) may lead to a higher real instability for the process produces higher volatility in the exchange rate and in economic growth (as appreciation heightens the intensity of the boom and the crisis).

Taking stock, the link between the long run rate of growth and short run fluctuations is given by changes in the level and composition of investment. To the extent that financial cycles redefine the incentives for investment, they bring about changes in the pattern of specialization and the absorption of technology, whose effects are bound to persist over a longer period. The intensity of the disequilibrium produced by the financial cycles depends on policy decisions that define country's place within the triangle defined by the trilemma.

^S See the pioneer model by Krugman and Taylor (2008).

III. International financial cycles, the RER and the external constraint

Financial cycles in the international economy

This section identifies international financial cycles between 1970 and 2015, based on the evolution of the Federal interest rate, used as a proxy for the level of liquidity in the international financial system. The identification of financial cycles allows for analyzing their impact on the RER and trade in two Latin American economies, Argentina and Brazil. The cases of China and Korea will be considered as well in order to highlight differences between Latin America and Asia in the path followed by the RER. The shocks produced by the financial cycles generate divergent outcomes as a result of different policy responses and production structures which can be understood in the light of the different scenarios of the trilemma described in the previous section.

Graph 1 shows the effective interest rates of Federal Funds in the USA between January 1970 and February 2016. This variable displayed large swings in the late 1970s and early 1980s, followed by a downward trend with milder fluctuations after 1990, which reflects underlying changes in liquidity in the international financial system.

Graph 1 about here — Federal Effective Interest Rates, 1970-2016

At least four medium-run cycles can be identified, understood as phases of high and low interest rates⁹. The first one occurred in the 1970-77 period and it was relatively mild (if compared to the subsequent cycle). There was a peak in the interest rate in 1974-1975, in the wake of the first oil crisis, after which interest rates dropped consistently until 1977. The second cycle was very marked and occurred between 1978 and the early 1990s. There was a dramatic rise in the interest rate in 1979-80, after the second oil shock and the nomination of Paul Volcker as chairman of the Federal Reserve. Subsequently, Federal interest rates subdued during the 1980s until 1993, when a third cycle began (we ignore the short-lived increase in interest rates in 1988-89). Interest rates rose again with the tequila crisis in 1995 and the Asian, Russian and Brazilian crises of 1997, 1998 and 1999, respectively. The last cycle took place between 2000

⁹ There use of the term "cycle" in this context does not imply any assumption of regularity in the intensity or duration of the fluctuations.

and 2016, with a peak in the US federal interest rate in 2008 in the wake of the Global Financial Crisis. Interest rates fell thereafter as a result of US "quantitative easing" which has kept these rates very close to zero.

Graph 2 — Financial Account Balance, Latin America. 1980-2012

The cycles in the US Federal Effective Interest Rate broadly coincide with the cycles of inflows of foreign capital to Latin America. Graph 2 shows the financial account of Latin America from 1980. The negative balance of the 1980s turned positive in the 1990s. This positive balance began to fall in 1998 and remained at very low levels until 2004, when it moved upwards stimulated by the commodity bonanza. There was a fall in the positive balance in 2008, but it experienced a strong recovery in 2010. The intensity of the recovery probably reflects the US quantitative easing and the phenomena of decoupling of the financial and real spheres, which multiplied financial assets and derivates in a scale which has no correspondence with the increase in world GDP.

Trends in the real exchange rate (RER) and the trade balance

The impact of the financial cycles on the macroeconomic performance of Argentina, Brazil, and Korea is analyzed by looking at the evolution of the RER and the trade balance. Periods of appreciation and depreciation with respect to the equilibrium RER are identified using the Balassa correction, as suggested by Rodrik (2013). There are some elements in common in the path followed by the LA countries:

- a) The RER appreciated in the phases of low interest rates in the USA and strong capital inflows towards LA, as predicted by the trilemma in a economy with open capital account in which the exchange rate is used as a nominal anchor to curb inflation (see graph 3);
- b) Periods of appreciation tended to reproduce the cycles of international liquidity and were related to either increasing deficits or lower surpluses in the trade balance;
- c) Periods of appreciation (such as those in the 1970s and 1990s) were followed by external crises, major depreciations and sharp contractions in economic activity (1981-2 in the two LA countries, 1998-99 in Brazil and 2001-2002 in Argentina), which fostered real

instability (see graph 3 and graph 5 that show the co-movement of the trade balance with RER and the trade balance with economic growth, respectively).

Differences can be detected within the region: Brazil remained a closed economy throughout the 1970s—which explains the decoupling between the RER and the international financial cycle in this period—, while Argentina tended to keep the RER appreciated for longer periods and with more intensity than Brazil, until the dramatic depreciation of 2000. Thereafter, the two countries changed positions and Brazil was the one in which appreciation and trade deficits were higher.

Graph 3 A,B, C, K — RER and trade deficits in Argentina, Brazil and Korea

The case of China offers an interesting contrast with LA. From being appreciated in the 1970s and 1980s, the Chinese currency strongly depreciated when the country opened its economy to international trade. In other words, trade liberalization was accompanied in China by an exchange rate policy that gave priority to competitiveness. By keeping closed its capital account and highly regulated its financial markets, China managed to sustain the RER in spite of low international interest rates in the global economy in the 1990s and 2000s. The expression "currency war" precisely reflects the Chinese efforts for sustaining competitiveness. In LA, on the other hand, trade liberalization in the 1990s took place along with the appreciation of the currency, which helps explain why a major crisis incubated in this period. Appreciation cum trade liberalization heightened the intensity of the crisis.

The RER in Korea followed a similar path to that of Brazil (depreciated in the 1970s and 1980s, appreciated thereafter). There is a crucial difference between the two countries, however: appreciation in Korea in the 1990s was associated with a sophisticated, technology-intensive production structure developed in the previous decades. Industrial and innovation policies gave rise to a major reduction of the technology and productivity gaps between Korea and the countries on the international technological frontier (see also section IV). As a result, Korea was then much less dependent on the RER for international competitiveness. Evidence of this point is that Korea moved from deficits in current account until the mid-1990s towards superavits thereafter (see graph 4, which illustrates this point comparing the balance in current account of Korea and Brasil). In other words, while in LA appreciation reflected positive shocks in the terms of trade and / or favorable financial conditions abroad, in Korea appreciation mostly

reflected the country's stronger competitive position associated with higher productivity and structural transformation.

Graph 4. Current Account Balance: Korea and Brazil

Differences in industrial policy between Korea and LA received ample attention in the literature¹⁰. Less emphasis has been given to discuss differences in the financial and monetary policies of the two regions. At variance with LA, during the 1970s and 1980s Korea tightly controlled its domestic financial markets and channeled long run investments towards new industries and sectors, redefining its comparative advantages. Although Korea was not impermeable to financial shocks, as the debt crisis of 1980 and the Asian crisis of July 1997 revealed, the Korean economy was more resilient than those of LA, based on the diversification of production and skills.

Growth and real instability

The impacts of financial cycles on growth are significant. By fostering appreciation and mounting external deficits in LA, and thereby making economic policies and growth unsustainable, these cycles boosted real instability (see graph 5 A, B, C, and K). The highest coefficient of variation in growth rates is observed in Argentina (12) and the lowest in China (1.4). Growth was more stable in Brazil than in Argentina, but nevertheless Brazil's coefficient of variation (4.6) almost doubled that of Korea (2.4).

Graph 5 A,B,C and K: Real growth and the trade balance

Graph 5 shows how financial cycles and the dynamics of RER were intertwined with economic growth and disequilibrium in the external front. Data for growth and the trade balance is presented using three-year moving averages in order to smooth variations in the annual growth rate. A consistent pattern emerges in the case of LA. In the second-half of the seventies and first half of the nineties, with favorable conditions in the international financial markets, higher rates of growth along with an appreciated exchange rate gave rise to substantial deficits in current account. Inversely, in the eighties and late nineties / early 2000s the Latin American economies had to grow at a slower rate to produce the surpluses in current account needed to service the

¹⁰ See for instance Amsden (1989), Bell (2006), Kim (1997, 2011), Lee (2013) and Chang (200),

debt. The only period in which growth and current account surpluses moved hand in hand was that of the commodity boom of 2004-2008. After the 2008 Global Financial Crisis, however, the current account rapidly deteriorated while growth lost momentum and became negative in the case of Brazil

In the previous section it was shown that existed different patterns in the behavior of the RER and the trade balance in Asia and LA. In the same vein, China and Korea differ with respect to LA when it comes to the interplay of growth and the trade balance. In Korea the trade balance moved from negative to positive, in spite of appreciation and without a marked fall in the rates of economic growth until the mid-nineties, remaining well above 6 %. Although growth shows a declining trend and lost momentum after the 1997 crisis and particularly after the 2008 Global Crisis, it was always positive with the only exception of the years 1980 and 1998. In the case of China, the role of exports as an engine of growth remained unabated from the late seventies, in spite of rising pressure from other countries to make China move towards a more inward-oriented, consumption-based style of economic growth. Only *before* the process of economic opening to the world in the 1970s growth and the trade balance moved in opposite directions or showed a weak association.

In sum, the behavior of the RER, current account and economic growth in LA is compatible with the hypothesis that poorly diversified economies—heavily dependent on the exports of few commodities and whose domestic production capabilities are unable to respond to the surge of demand in the context of an appreciated RER and weak industrial policies—experience short-lived growth booms, discontinued by mounting disequilibrium in the external front. Inversely, countries which have strengthened their innovation capabilities and sustained a competitive RER were more resilient to shocks in the international system and able to attain a higher, more stable rate of economic growth.

IV. <u>The financial cycle, investment and structural change: putting together the short run</u> and the long run

Investment in the financial cycle

The level and composition of today's investment shape the production structure of the next period. If short term fluctuations have significant impacts on investment, there will be implications for the capabilities and specialization, and hence for the equilibrium rate of growth.

The effect of the expansionary phase of the financial cycle (and the ensuing overvaluation) on investment is ambiguous. From one hand, it increases firms' access to finance. In addition, a low RER implies that intermediate and capital goods are cheaper—a crucial point for developing economies which are strongly dependent on imports of capital goods. The consumption boom in one period also raises the level of activity and—via accelerator—stimulates investment in the next period. All these factors make investment in capital goods more attractive. On the other hand, a lower RER implies that domestic production becomes less competitive both at home and abroad. Market shares will fall and so will the expected rate of profit. The favorable incentives that stem from cheaper capital goods and loans will be challenged by shrinking market shares and mark-up rates. Which of these contradictory forces would prevail is an empirical matter. Non-tradable sectors intensive in foreign inputs would be the most favored, while exporting sectors that use mostly domestic inputs (such as land or labor) will be the worst affected. While in the short run investment may show a positive reaction to foreign lending and appreciation, in the long run the depressive effects are bound to prevail.

Graph 6. Gross Capital formation: ABCK. 1970-2013

The trends observed in graph 6 suggests that investment tended to be relatively higher in periods in which financial liquidity was higher, which also coincided with periods of higher economic growth. During the height of overvaluation in the 1970s, the investment rate was relatively high in the LA countries. It also experienced a recovery in the 1990s, after the collapse of the 1980s. As mentioned, however, such periods—the 1970s and 1990s—ended up with major crises and recessions which severely compromised investment. Indeed, the 1982 crisis seems to have changed in a persistent way the investment rate in the LA countries, which could never

return to the levels of the 1970s—which suggests that hysteresis phenomena in unemployment, well documented in empirical studies, may also have a correspondence in investment. The recoveries after each crisis were not strong to fully compensate the falls. The LA pattern stands in sharp contrast to that in Asia. Not only fluctuations were milder in Asia, but there was also a positive trend in Korea until the late 1990s (when the investment rate fell but remained at a much higher levels than in LA) and in China which only recently receded.

Summing up, over the financial cycle the negative impact of the crisis on growth and investment largely surpassed the positive short-term impact of the boom. A downward shift in the investment rate for such a long period necessarily has negative consequences for learning and technical change. As will be shown in the next sub-section, the indicators of structural change experienced a setback in the 1980s and 1990s, which is compatible with the idea of hysteresis phenomena in the impact of the financial cycle on economic performance.

Structural change: the proxies

Through the different financial cycles, there will be changes in the production structure of the economy, in particular with respect to its technological intensity. Different proxies will be used for measuring this variable.

The first is the Engineering Index (EI), defined as the ratio between the relative share of the engineering industries in total manufacturing value added¹¹ in a certain country, and this share in a country on the technological frontier (the USA; see graph 7). Thus, for instance, an EI = 0.5 in country *i* means that, in this country, the share in value added of the engineering industries in total manufacturing is half of that in the USA. An increase in the EI indicates a move towards a pattern of production which is more technology-intensive. The period of analysis is limited by the availability of data to compute the EI index, which is between 1970 and 2008.

The second proxy is the Economic Complexity Index (ECI) suggested by Hidalgo, Hausman et al (2014), which measures the diversity and sophistication of the export structure of a country. The index is constructed on the notion—shared in this paper—that "what you export matters", and production capabilities reflect technological capabilities. The ECI is based on trade data and

¹¹ Engineering Industries comprise in the Standard International Trade Classification (SITC): Fabricated metal products, except machinery and equipment; Machinery and equipment; Transport equipment.

computed from an iterative process which combines information about the diversification of the production structure of the country and the ubiquity of the goods it produces. As suggested by the authors (p.3), "diversity and ubiquity are (...) crude approximations of the variety of capabilities available in a country or required by a product". This index is only available from 1995.

Both proxies of the technology intensity of the production structure—EI and ECI—have advantages and disadvantages and to some extent are complementary. EI is circumscribed to manufacturing and does not capture changes in other sectors of the economy. The ECI, on the other hand, covers all traded goods in the international economy and therefore entails a broader scope than the EI. However, in certain cases the ECI overestimates technological capabilities. In particular, the vertical fragmentation of production (trade in tasks) implies that developing economies frequently participate at the very low-end of global value chains in sectors which are formally classified as high tech. From a statistical point of view, their exports are high tech; from a technological point of view, they are indeed labor-intensive segments of global value chains with little endogenous capabilities.

The third proxy is the patent ratio, in which the number of patents per million inhabitants in one LA country is compared to the same variable in Australia. Comparing LA with Australia (particularly in the case of Argentina) has been a traditional topic in the economic history literature, as there are similarities in the pattern of specialization, with a significant role of exports based on natural resources.

The last proxy of technological intensity—which covers the 1970-2012 period— is the ECLAC Index of Technological Intensity (ECLAC-ITEC), which combines trade data with production and technological data. The ECLAC-ITEC is defined as a simple average of two indicators normalized between zero and 1: the share of medium and high-tech exports in total exports, and patents per million inhabitants. Combining trade and patent data helps correct distortions in the measuring of technological intensity associated with the EI and ECI.

Outcomes: EI and ECI

The EI followed different paths in the three Latin American countries. Argentina was the country in which the EI fell more rapidly and declination began earlier. Since the late seventies it

is visible the downward trend of this indicator of technological intensity. In the case of Brazil, the EI increased until the end of the 1970s to remain more or less stable until the mid-nineties, when a downward trend emerged. These different trends are related to differences in the timing and intensity of the liberalization policy in trade and capital account.

A brief review of these policies helps to give context to the analysis. The military government that took office in Argentina in the mid-1976 dismantled the industrial policy, opened the capital account (which appreciated the currency and compromised competitiveness) and encouraged unilateral trade liberalization. Argentina was an early example of extreme use of the exchange rate as a nominal anchor in the context of the so-called "Monetary Approach to the Balance-of-Payments", which severely hit the Argentine industry in the second half of the seventies. Brazil kept its industrial policy in place until the late 1970s, after which the fiscal crisis led this country to cut down fiscal and credit support to industrialization. The collapse of investment in the 1980s in the LA countries-related to substantial transfers of resources to developed countries in order to pay for the external debt, contracted at very low interest rates in the 1970s-had a highly negative impact on catching up. After 1980, Argentina and Brazil suffered a steady process of weakening of their National Innovation System, lagging behind in technology and productivity with respect to the developed world¹². During 1990s, in Latin America in general prevailed the idea that the "best industrial policy is none at all". This took its token on competitiveness in a world where technical change had accelerated. Attempts to reconstruct the institutions for innovation in LA after 2000s were unsuccessful, in part because the commodity boom of the 2000s further strengthened specialization in natural resources (ECLAC, 2012; Stumpo and Rivas, 2013).

Graph 7: EI AB, C and K

In spite of their differences, the Latin American countries have shown in general a slow process of structural change. The increase in EI has been slow, and in the case of Argentina there was a sustained decrease in such a way that the EI in the 2000s in this country was almost half that of the beginning of the period (1970). Korea and China, on the other hand, did show a

¹² As discussed in Aldrighi and Colistete (2011) and Nasssif et al (2012, 2013).

stable, strong upward trend in its technological intensity. The EI in Korea was below the EI in Argentina in 1970, but it became five times higher in 20008.

A similar story is told by the evolution of the ECI between 1995 and 2014, years for which this indicator can be estimated (graphs 8 and 9). The evolution of ECI confirms the upper trend in Korea and China. In the case of the LA countries, the indicator suggests a fall in the technological intensity in the 2000s, probably as a result of the higher share of primary exports in total exports during the commodity boom. In that period, South American countries experienced what has been labeled a "reprimarization" of their export patterns.

Graph 8. ECI, AB

Graph 9. ECI, Korea and China

Both the EI and the ECI suggest the presence of hysteresis in the production structure as a result of the external shocks. After each crisis these indicators did not fully recover to the precrisis level—a process which is particularly visible in Argentina for the EI and for the ECI in both countries. The same hysteresis phenomenon is observed in China in the case of EI, where each "jump" was not subsequently reversed. Korea showed a sustained increase in EI and ECI, pointing out to the prevalence of increasing returns in the process of structural change.

Outcomes: Relative patenting and the ECLAC Technology Index (ECLAC-ITEC)

Patents have been widely used as reflecting the outcome of innovative efforts and capabilities in a country. A proxy for these efforts is the number of patents per million inhabitants registered at the USPTO. The measure is highly imperfect: many innovations are not patented, especially in developing economies, and many patents are not effectively used. Nevertheless, it is a useful indicator if combined and interpreted along with the other indicators presented in this section. Graph 10 shows the number of Argentina patents as compared to patents in Australia. The downward trend of this ratio is visible, as well as a cyclical pattern. While in good times the negative trend reverses, such a trend reasserts itself in the crisis and then stabilizes *at a lower level* than before the crisis. In Brazil there is no clear-cut trend. However, it should be stressed that the stability occurs in this country at a very low level of patenting relative

to Australia (slightly above 1 %). It is also visible the cyclical pattern, particularly in the 1990s, in which a rise in patenting was more than compensated by the collapse in the crisis.

Graph 10 Patent Ratio: Argentina / Australia, Brazil / Australia, Mexico / Australia, Korea / Australia

The comparison with Korea is again striking. Precisely in the period that Korea appreciated its currency, it spurred innovation capabilities (as reflected in relative patenting), surpassing Australia and closing the gap with Germany. Note that there is no cyclical pattern in the Korean case, in contrast to the experience of Argentina and Brazil.

Finally, the ECLAC-ITEC index combines data from trade and patenting. The evolution of this index shows a similar pattern to that of investment, in which in boom times the production structure becomes more knowledge-intensive, while in bad times there is a regression. All in all, the stop and go cycle of structural change implies a very weak tendency towards an improvement in the production structure of the LA economies. At the end of the period the ECLAC-ITEC index is about 0.25 in Brazil and about 0.14 in Argentina. On the other hand, China and Korea exhibited a positive trend most of the period. They began with ECLAC-ITEC values similar to those of LA in the 1970s, while in 2014 the Korea's index was six times higher than that of Brazil, while the Chinese index more than doubled the Brazilian figure. Thus, structural change has been the driving force of growth in Asia, a force that was truncated in LA.

Graph 11 (A and B) and graph 12 (K and China): ECLAC-ITEC Index

It was mentioned that learning entails a key "tacit" component which can only emerge from experience in production. While the transference of codified knowledge plays a role in learning, capabilities can only be effectively built and reproduced when they are incorporated to the organization and production capabilities of the firm. This is why learning is embedded in the existing production structure, which implies that productivity growth and industrial transformation tend to evolve hand in hand over time. Graph 13 shows the interplay between structural change and learning by looking at the co-evolution of relative labor productivity (using US labor productivity as a benchmark) and the transformation of the production structure (ECLAC-ITEC index) between 1995 and 2008.

Graph 13. ECLAC-ITEC and relative productivity

The co-movement of productivity and structural change may support vicious or virtuous circles of growth in the international economy. Reducing the technology gap and hence the productivity gap contributes to the diversification of the economy; and as the economy diversifies towards knowledge intensive sectors, there is a positive feed-back on learning and productivity. The comparison of LA countries and Asian countries illustrates very will scenarios of lagging behind (LA) and catching up (Asia): in Korea the two variables increased through time, while the picture that emerges in Argentina and Brazil is one of stagnation or falling behind. China did succeed in transforming its production structure, but its relative productivity remained rather low as compared to the USA.

In sum, the interplay between the financial cycle and the evolution of the specialization pattern seems to be associated to cumulative disequilibria emerging in the appreciation period. During the boom, the problems are less apparent and indeed investment responds to economic growth, opening room for a modest degree of diversification. The crisis exposes the problems in the form of a major shock whose effects on the structure persist, as suggested by the evolution of the various indexes of technological intensity discussed above.

Concluding remarks

This paper discusses the interrelation between financial cycles (triggered by the fall in the international interest rates or by a bonanza in the commodity lottery, which give rise to periods of RER appreciation followed by major external crises) and structural change and growth in two Latin American economies—Brazil and Argentina. Each financial cycle depresses investment, thereby reinforcing technological asymmetries with respect the advanced economies. The cases of Brazil and Argentina are compared with Korea and China: it is argued that in Asia the RER has been managed in such a way as to privilege the objective of competitiveness in macroeconomic policy, while in Latin America was used mainly as an anti-inflationary devise. By doing so the Asian countries used macroeconomic policy as a complementary tool in the diversification of production and capabilities, and in building their National System of Innovations. Inversely, in the case of the Latin American countries, the BOP-dominance of the

macroeconomic dynamics and the weakness of industrial policy reinforced the loss of capabilities and lagging behind.

GRAPHS AND TABLES



Graph 1. Federal Effective Interest Rates in the US, 1970-2016

Graph 2. Financial Account Balance: Latin America, 1980-2013



Graph 3. RER and trade balance as a percentage of GDP in Argentina, Brazil, China, and Korea



Graph 3A: RER and Trade Balance in Argentina

Source: Authors' calculation based on Penn World Tables and World Bank

Note: As in Rodrik (2008), we build an undervaluation index. If the real exchange rate is negative (as it is from 2005-2010), it means that the real exchange rate is overvalued.



Graph 3B. RER and Trade Balance in Brazil

Source: Authors' calculation based on Penn World Tables and World Bank

Note: As in Rodrik (2008), we build an undervaluation index. If the real exchange rate is negative (as it is from 2005-2010), it means that the real exchange rate is overvalued.



Graph 3C. RER and Trade Balance in China

Source: Authors' calculation based on Penn World Tables and World Bank Note: As in Rodrik (2008), we build an undervaluation index. If the real exchange rate is negative (as it is from 2005-2010), it means that the real exchange rate is overvalued.



Graph 3K. RER and Trade Balance in Korea

Source: Authors' calculation based on Penn World Tables and World Bank

Note: As in Rodrik (2008), we build an undervaluation index. If the real exchange rate is negative (as it is from 2005-2010), it means that the real exchange rate is overvalued.



Graph 4: Brazil and Korea: Current Account Balance (%GDP), 1976-2015

Graph 5: Growth and the Trade Balance, 1970-2014

















Note: Growth is on the left axis and the trade balance on the right axis. Source: World Bank



Graph 6. Gross Capital Formation: 1970-2007 (investment as a percentage of GDP)

Note: Hodrick-Prescott filter, lambda = 6.25

Source: UNCTAD

Graph 7A: Engineering Intensity: Argentina and Brazil, 1970-2007



Source: elaborated from ONUDI databank and Padiwin (ECLAC)





Source: elaborated from ONUDI databank and Padiwin (ECLAC

Graph 8: Economic Complexity Indicator: Argentina and Brazil, 1995-2014



Source: The Atlas of Economic Complexity





Source: The Atlas of Economic Complexity

Graph 10: Patenting in a comparative Perspective 1970-2014

Graph 10A: Patent per inhabitants ratio: Argentina/Australia, 1970-2014



Source: USPTO

Graph 10B: Patent per inhabitants ratio: Brazil/Australia, 1970-2014



Source: USPTO

Graph 10K: Patent per inhabitant ratio: Korea/Australia and



Korea/Germany, 1970-2014

Source: USPTO

Graph 10C: Patent per inhabitant ratio: China/Australia and



China/Germany, 1970-2014

Source: USPTO



Graph 11 : ECALC-ITEC, 1970-2014, Argentina and Brazil

Note: The ECLAC-ITEC is computed as the average of normalized patents per million of inhabitants and exports of medium and high-technology.

Note: Hodrick-Prescott filter, lambda = 6.25



GRAPH 12. ECLAC-ITEC, 1995-2012, China and Korea

Note: The ECLAC-ITEC is computed as the average of normalized patentes per million of inhabitants and exports of medium and high-technology. Note: Hodrick-Prescott filter, lambda = 6.25

Graph 13. Co-evolution of relative productivity and structural change (ECLAC-ITEC): 1970-2010



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