The Impact of New Developmentalism on High-Tech Industrialization:

A Key Condition for Economic Convergence among Middle Income Countries

In Latin America

By

Ji-Hye Lee

THESIS

Submitted to

KDI School of Public Policy and Management

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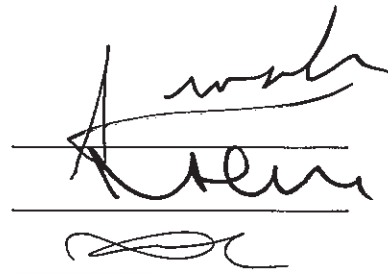in partial fulfillment of the requirements

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PUBLIC POLICY Committee in

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ABSTRACT

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Why do Latin American countries fail to converge with advanced countries while

Asian countries successfully achieve economic catch-up? This paper aims at

answering this question based on the Keynesian and structuralist approach. On the

one hand, by analyzing economic growth pattern in terms of BOP constrained growth

model from Keynesian theory, Latin American countries have not been categorized

into sustainable convergence from 1960 to 2004. On the other hand, the structuralist

theory asserts that the specialization of economic structure in each country reflects

the economic growth pattern above, in that industrial specialization pattern

determines the income elasticity ratio between export and import in the equilibrium

growth rate(y^*) of the Thirlwall's Law. Therefore, there is strong correlation between

structural change favoring sectors with higher Schumpeterian-Keynesian efficiency

and economic growth. It is supported by the evidences which explain the positive

relationship between high-tech industries and economic growth due to higher

Schumpeterian efficiency in high-tech export industries, and that high-tech exports

entails Keynesian efficiency and ensures competitiveness in the international market. Therefore, sectorial diversification into high-tech industry explains the difference in the economic growth trajectory between Latin American region and Asian countries.

Based on the validity of fostering high-tech export for sustainable economic convergence in Latin American countries, this paper estimates the effectiveness of New developmentalism which suggests that fostering high-tech industries with higher Schumpeterian and Keynesian efficiency is valid as a key condition for sustainable economic catch-up. Especially, considering that New Developmentalism has been brought to Latin American countries after the observation of the successful fast-growing experience in Asian countries, this hypothesis test aims to figure out not only the effectiveness of the development paradigm in the Latin American region but its policy effect in Latin America by comparison with Asian industrialized economies.

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I.   Introduction

Why do Latin American countries fail to converge with developed economies while Asian countries successfully achieve economic convergence since 1960s? According to the Keynesian-structuralist approach, one of the distinctive factor which makes the difference between the two regions is that Latin American countries did not succeed to foster high-tech industries which have higher Schumpeterian and Keynesian efficiency, while Asian countries transform their sectors favoring with them. On the other hand, the industrial specialization pattern and economic growth trajectory of Latin American economies has been influenced by three different kinds of development paradigms, National developmentalism, Conventional orthodoxy and New developmentalism over the last decades."[1] Therefore, the economic growth pattern since 1960s in this region which is characterized with economic divergence with advanced countries could be explained based on the impact of the developmental paradigms.

In the Latin American region, "New Developmentalism" has emerged since the early 2000s. It seeks the strategic alternatives from Keynesian-structural macroeconomics in order to wipe out the problems of Washington Consensus such as the repeated balance of payment crisis and the failure of improvement in the living standard.[2] So, one of its strategic objective is to catch up with developed countries by implementing industrial policies which intended to increase the technology

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[1] Luiz Carlos and Bresser-Pereira *From old to new developmentalism in Latin America* (London: Oxford Press, 2011).

[2] IBID

intensity in the manufacturing sectors for higher international market competitiveness.

In this sense, this paper has two objectives. First, it aims to explain Keynesian and structuralist approach in New Developmentalism which suggests that fostering high-tech industries with higher Schumpeterian and Keynesian efficiency is valid as a key condition for sustainable economic catch-up. Second, this paper will estimate the effectiveness of New developmentalism since early 2000s in terms of high tech export increase which is a function of levering factors for competitiveness shift. Especially, considering that New Developmentalism has been brought to Latin American countries after the observation of the successful fast-growing experience in Asian countries, this hypothesis test aims to figure out not only the effectiveness of the development paradigm in the Latin American region but its policy effect in Latin America by comparison with Asian industrialized economies.

This paper consists of five sections including the introduction. To begin with, in the second part, three subsections explain the validity of fostering high-tech industries as a key condition for sustainable economic catch-up, based on the Keynesian and structuralist approach in New Developmentalism. Specifically, in the first subsection, four phases of economic growth based on BOP constrained growth model will be addressed. Also, economic growth pattern in Latin America will be explained based on BOP constrained growth model. In the second subsection, the relationship between structural change with higher Schumpeterian and Keynesian efficiency and sustainable growth will be verified based on the structuralist approach, and the strategy to foster high-tech export for economic catch-up will be assessed. In the third subsection, the role of the New Developmental paradigm for high-tech export increase will be explained, based on the fact that the industrial specialization pattern and economic growth trajectory of Latin American economies has been

influenced by the past development paradigms so far. In the third section, the Hypothesis for testing will be developed and the chosen empirical Analysis model will be addressed. The fourth section focuses on the results of hypothesis testing and, finally, the conclusion is presented in the last section of this paper.

II. Economic growth in Latin America based on BOP constrained growth model

A. Economic growth and BOP constrained growth model

Why Latin American economies fail to achieve economic convergence with advanced countries since 1960's? According to Keynesian Structuralist theory, the economic growth pattern in each country can be analyzed by Balance of Payment (BOP) constrained growth model. The model is briefly explained in Appendix 1, but for more details refer to Thirlwall and Hussain, 1982; McCombie and Thirlwall, 1994, chapter3; Setterfiled, 2002. In this model, the economic growth rates among countries rely on the ratio between the income elasticities of exports and imports. "The key result of BOP constrained growth model is presented in equation (1), which explains that the long run rate of growth compatible with external equilibrium (y*) is given by:

$$y^\star = \frac{(1 + a\phi + \psi)(p - p^\star - e) + a\varepsilon z + (1 - a)f}{\pi} \tag{1}$$

$$y^\star = \frac{\varepsilon z}{\pi} = \frac{x}{\pi} \tag{2}$$

Equation(1) gives the country's equilibrium rate of growth(y*) as a function of price and income elasticities for exports(ϕ and ε) and imports(ψ and π) as well as the rate

of growth of world income(z), net capital inflows(f) and the real exchange rate(e) and share of total imports that are paid with exports(a) and domestic prices(p) and foreign prices(p*).

Based on the equation (1), equation (2) refers to Thirlwall's Law. It is the BOP-constrained rate of growth in the specific case where purchasing power parity holds (p − p* − e=0) and there is no net external debt (a = 1). Assuming that the equilibrium growth rate y* refers to a developing economy, equation (2) sets forth that the relative rate of growth of the developing country with respect to the rest of the world depends on the ratio between the income elasticities of exports and imports. If this ratio is higher than 1, there will be convergence; otherwise, there will be divergence. It is assumed that population growth is similar in both countries and hence a higher real GDP growth in the developing countries amounts to convergence in GDP per capita as well. On the other hand, in the equation (2), assuming (a = 0) implies that in the long run the external debt cannot grow unboundedly, although in the short run capital inflows may have a strong impact on growth." [3]

i. Four phases of economic growth based on BOP constrained growth model

In figure1, each quadrant A, B, C, and D presents four different types of economic growth pattern based on BOP Constrained Growth Model.

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[3] Mario Cimoli, Gabriel Porcile and Sebastia´n Rovira, "Structural change and the BOP constraint: why did Latin America fail to converge?" (Cambridge Journal of Economics 34, 389–411, 2010,)

Thirlwall, A. P. The balance-of-payments constraint as an explanation of international growth rates differences, (Banca Nazionale de Laboro Quaterly Review, March, 45–53, 1979)
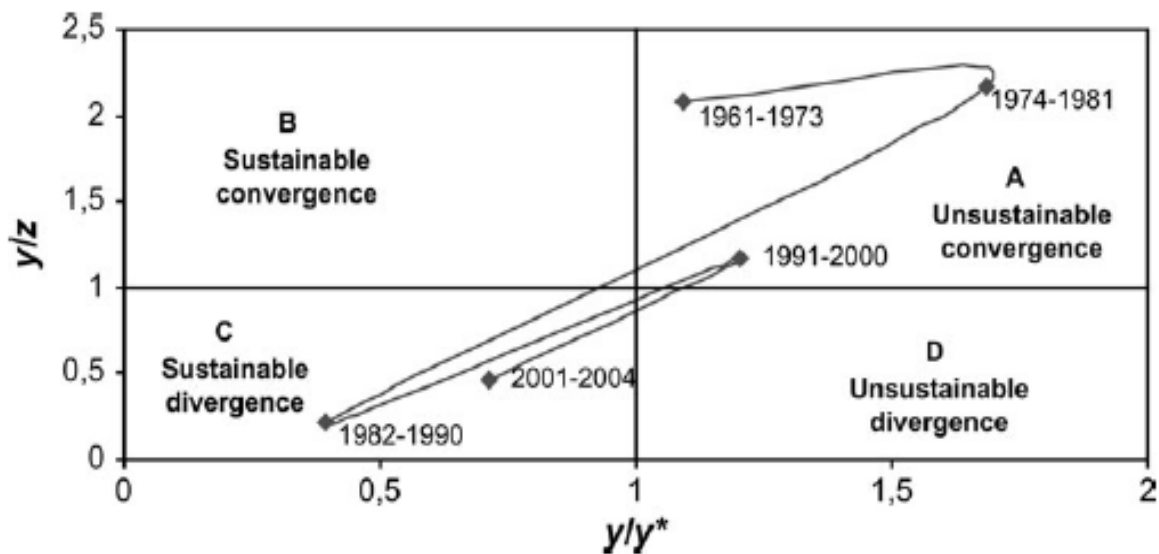
Fig.1.Latin America: sustainable and unsustainable convergence based on income elasticities of demand for imports and growth rates estimations.

Source: Cimoli et al. (2010)

In figure1, horizontal axis is y over y*, the ratio between the effective rate of growth(y) and the equilibrium rate of growth in Latin America (y*, where y* is given by the ratio 'x /π' in equation (2)). If y/y* is more than 1, it means that the amount of y* is smaller than y, based on the fact that income elasticity of demand for import (π) is larger than x in y*(=x/π). Therefore, y/y* refers to the sustainability or unsustainability in the growth pattern of a region, based on π (more explanations on this below). On the other hand, vertical axis refers to y/z, the ratio between the effective rate of growth (y) and the rate of growth of the rest of the world (z). If y/z is more than 1, it means that the growth rate of a country or region(y) is higher than the rest of the world (z).Therefore, if the country or region has y/z which is more than 1, it has economic convergence with respect to the rest of the world, and if the country or region has y/z which is less than 1, it has economic divergence compared to the rest of the world.

According to these two criterions in terms of 'sustainability/unsustainability' in the horizontal axis of figure1 and 'convergence/divergence' in the vertical axis of figure1, Each quadrant A, B, C, and D in Figure1 presents four different types of economic growth pattern based on BOP Constrained Growth Model. Firstly, **Sustainable convergence** (Figure1, Northwest quadrant B) occurs when the effective rate of growth of the developing country with respect to the rest of the world (y/z) is higher than 1 which refers to the economic convergence with rest of the world. Also, at the same time y/y* is lower than or equal to 1, meaning that the current account is either in equilibrium or shows a surplus in that π is smaller than x. On the other hand, **Sustainable divergence** (Figure1, Southwest quadrant C) occurs when the effective rate of growth of the developing country with respect to the rest of the world (y/z) is less than 1 which refers to the economic divergence with rest of the world, while at the same time y/y* is lower than or equal to 1, keeping the current account in equilibrium or a surplus in that π is smaller than x, in y*(=x/π).

Unsustainable convergence(Figure1, Northeast quadrant A) is found when 'y/z' is higher than 1, but y/y* is larger than or equal to 1, keeping the current account in equilibrium or a deficit in that π is larger than x, in y*(=x/π). Finally, there is the case of **Unsustainable divergence** (Figure 1, Southeast quadrant D), in which the effective rate of growth of the developing country with respect to the rest of the world (y/z) is less than 1 which refers to the economic divergence with rest of the world, while at the same time y/y* is higher than or equal to 1, keeping the current account in equilibrium or a deficit in that π is larger than x, in that y* is the ratio between x and π in equation(2).

ii. Economic growth in Latin America and BOP constrained growth model

A plethora of empirical studies have been conducted for assessing the validity of the BOP constrained growth model for capturing the typology of economic growth pattern in a certain country or region. According to McCombie(1997)[4], the hypothesis that the long run growth rate in Latin America is given by the BOP-constrained rate of growth is fully justified. Therefore, the taxonomy of economic growth in Latin American countries from 1960's can be reproduced based on the four phases in figure1.

In this sense, figure1 represents the characteristics of the economic development path in Latin America starting from the 1960's in terms of the BOP constrained growth model. In 1960's, Latin American countries were located in quadrant A, which represents unsustainable convergence. However, the distance from the vertical line, which represents the unit in y/y*, is not far in comparison with the 1970's which is also in the quadrant A with modest economic convergence. Therefore, it demonstrates that the external disequilibrium is not severe in 1960's, compared to 1970's.

On the other hand, in the 1980s, Latin American countries fell into the quadrant C which represents sustainable divergence, meaning that they grew less than their growth potential according to the current account equilibrium during the so-called "lost decade". Specifically, in the 1980's this region started to pay debts which had accumulated as a result of macroeconomic policies such as liquidity and

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[4] McCombie, J. S. L. " Empirics of balance-of-payments constrained growth" Journal of Post-Keynesian Economics,, vol. 19, no. 3, 345–75

unilateral trade liberalization in the 1970's. Therefore, they lost their growth engine by using economic surplus for paying debts, rather than investing in technology intensive and innovative sectors which have Schumpeterian and Keynesian efficiency. This finding is significant in that technology intensive and innovative sectors with higher Schumpeterian and Keynesian efficiency positively transforms economic structures in a country according to the Keynesian-structuralist approach as will be discussed later.

In the 1990's, this region was located in the quadrant A, with a relatively lower convergence rate compared to the 1960's and 1970's. Also, in the early 2000's, they were back to sustainable divergence in quadrant C, but the divergence rate is not acute with comparison to the 1980's in the same quadrant. As a whole, the sustainable convergence (Northwest quadrant A) remains empty for Latin American countries from the 1960's up to 2004.

B. Schumpeterian and Keynesian efficiency and BOP constrained growth model

What causes the difference in the elasticity ratio of the BOP constrained growth model which represents the variance of economic growth rate among countries? According to the structuralist traditions, this ratio is influenced by the specialization of the economic structure and the efforts for innovation and international technology diffusion in a country, which represents its productivity and export dynamism (Thirlwall, 1997; Setterfield, 1997; McCombie and Roberts, 2002; Palley, 2002). Therefore, if a country transforms its structure favoring sectors with more technological externalities; at the same time, the sector has higher rates of demands

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from internal and international market-Keynesian efficiency, it brings about higher elasticity ratio in the BOP constrained growth model. Specifically, Dosi, Pavitt and Soete clarified that these sectors, which have higher Schumpeterian and Keynesian efficiency, lead to a higher elasticity ratio between income elasticity of demand for exports and income elasticity of demand for imports. In turn, it ends up locating the economic growth rate of a country in the quadrant A of Figure1, which refers to sustainable and convergence growth pattern of a country.[5]

Specifically, countries are assumed to have Schumpeterian efficiency in their Sectors on the condition that they create more technological externalities, which have higher technological opportunities and exhibit higher rates of innovation possess. On the other hand, Keynesian efficiency refers to the phenomena where higher demand from external and internal market brings about higher expansion of investment as well as production. According to Lall(2000), the positive relationship between technological intensity, which represents higher Schumpeterian efficiency in a sector, and competiveness in the international market, which refers to the Keynesian efficiency, is evidenced by the portion of high-tech exports in the international trade evolution.[6]

Table 1. Technology content in total world exports

Definition of High-technology exports: products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery.

Source: Based on TradeCAN (2006)

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[5] Dosi, G., Pavitt, K. and Soete, L, Technology and International Trade (Cheltenham: Edward Elgar, 1990)

[6] Lall, S. "The Technological Structure and Performance of Developing Country Manufactured Exports", 1985–1998', Queen Elizabeth House, QEHWorking Paper no. 44, 2000 June

Products	1985 (mill)	2004 (mill)	Annual growth rate	1985 (%)	2004 (%)
All products	1,689	7,350	7.6	100	100
Primary products	391	1,018	4.9	23.2	14.7
Manufactured products	1,244	6,063	8.2	76.8	85.3
Resource based	327	1,148	6.5	19.4	15.6
Low technology	239	1,962	7.9	14.2	15
Medium technology	480	2,169	7.8	28.5	29.5
High technology	196	1,643	11.2	11.6	22.4

Table1. shows that the share of manufactured products in total world exports amounts to 85.3% in 2004, compared with 76.8% in 1985; at the same time, primary products exports account for 14.7% in 2004 and 23.2% in 1985. Specifically, among manufacturing products, the biggest portion of export goes to Medium tech exports; however, the high tech export growth ranked second as 22.4% of the total manufactured products in 2004, with an annual growth rate of 11.2% which is the fastest export increase. Therefore, this table shows that structural change with higher technology-intensive sectors will bring about not only Schumpeterian efficiency but also Keynesian efficiency, in that high-tech export makes it possible to exploit and respond to the increased investment and production from the large portion of market share of the sector.

C. Macroeconomic policy and economic convergence and divergence in Latin American Countries

By analyzing economic growth pattern in terms of BOP constrained growth model from Keynesian theory, Latin American countries have not been categorized into sustainable convergence from 1960 to 2004, as shown in figure1. In addition, the structuralist theory asserts that the specialization of economic structure in each country reflects the income elasticity ratio between export and import in BOP

constrained growth model. Also, there is strong correlation between structural change favoring sectors with higher Schumpeterian-Keynesian efficiency and economic growth as mentioned in the previous sections.

Then, why have Latin American countries not achieved structural change favoring sectors with Schumpeterian and Keynesian efficiency, such as high-tech industries? The development strategies that they implemented for economic growth during three periods since 1960's cannot be a single and definitive explanation but could be part of the answer. According to Luiz Carlos Bresser-Pereira, developmentalism in Latin America is divided into three categories, such as National developmentalism, Conventional orthodoxy and New Developmentalism.[7] Since economic divergence in the Latin American region started and prevailed in 1980's, while Asian countries had successfully converged with the developed world in the same period, the variance in developmental strategies between the two regions in terms of fostering high-tech industries which have higher Schumpeterian-Keynesian efficiency possibly played an important role to make the difference. Therefore, Conventional orthodoxy since the 1980's and New Developmentalism which is implemented in the Latin American region since the 2000's as an alternative for the former need to be underscored.

Conventional orthodoxy asserts that the market is an institution that "coordinates production optimally if there is no intervention. However, Factor

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[7] Luiz Carlos and Bresser-Pereira From old to new developmentalism in Latin America (London: Oxford Press ,2011).

allocation is the task that it performs best, but even here it faces problems."[8] Specifically it does not stimulate sufficient innovation and investment which is necessary for structural change with Schumpeterian and Keynesian efficiency, because it cannot offset the two structural tendencies in the Latin American countries: the tendency of overvaluation in exchange rate resulting from the so-called Dutch disease and the tendency of wage increase which amounts to less than the productivity due to plenty of labor force.

Therefore, as an alternative New Developmentalism has been implemented in middle income countries within the Latin American region since the 2000s, though Conventional orthodox is still dominant in a certain degree. Contrary to Conventional orthodoxy, New Developmentalism believes that the role of the government and strategic industrial policy is crucial for stimulating investment and innovation. In other words, it puts high-tech industries as the first priority due to its high per capita value added as well as positive technology externalities, by addressing the structural tendencies that hindered stimulating investment and innovation. Therefore, by implementing industrial policies based on New developmentalism, Latin American countries are expected to become following suit the structural change with high-tech industries favoring with higher Schumpeterian and Keynesian efficiency, as it did in newly industrialized Asian countries since 1980's.

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[8] IBID

III. Hypothesis and empirical Analysis

A. Hypothesis development and analytical model

Then, what is the effectiveness of New Developmentalism for economic catch-up? As mentioned above, New Developmentalism aims at fostering high-tech industries by taking advantage of the best technologies available in the world. Therefore, the hypothesis for measuring the effectiveness of New Developmentalism for economic catch-up is that the more countries utilize best and available technologies, the more the countries can transform its sectors specializing in high-tech industries. As a result, its volume of high-tech export will increase in the international market, and the country will have much higher competitiveness in the international market and have more large potential for economic catch-up.

Then, through what channel are countries enabled to utilize state of the art technologies? According to Alvarez and Marin (2013), there are internal and external factors that affect high-tech industries competitiveness in the international market. In other words, countries' specialization in high-tech industries is the interaction between technology innovation as an internal factor and FDI flow as an external factor.[9] Especially, according to Dunning and Narula,[10] multinational companies change business strategies for efficiency and knowledge-seeking, and this trajectory

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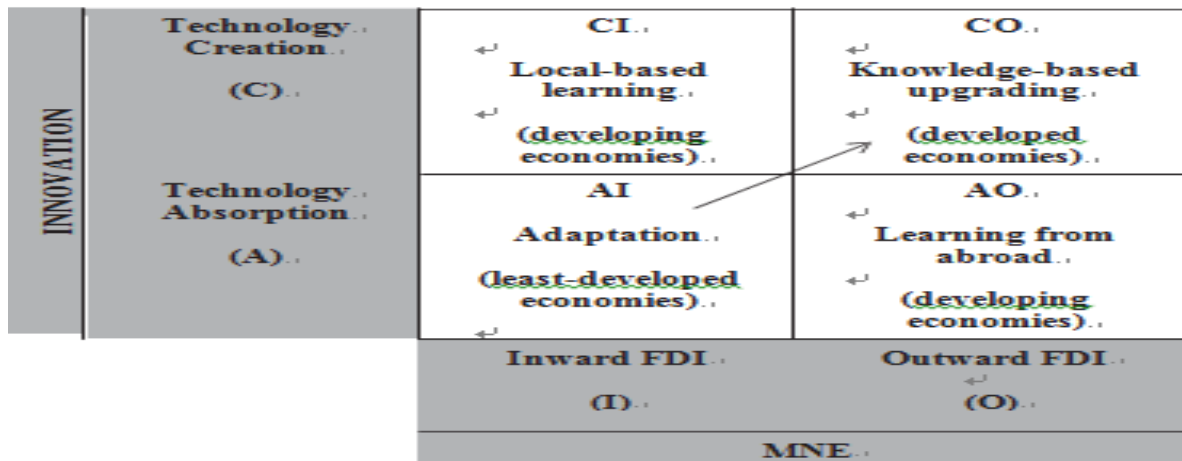[9] Isabel Alvarez and Raquel Marin "FDI and technology as a levering factor of competitiveness in the developing countries" Journal of International Management 19 (2013) 232–246

[10] Narula, R.,*Multinational Investments and Economic Structure*. (London:Routledge, 1996) Narula, R., "R&D collaboration by SMEs: new opportunities and limitations in the face of globalization" Technovation 24, 153–161. 2004

contributes to technology spillover effects in the FDI home countries,[11]and in this reason, FDI flows are a significant external factor for hypothesis testing.

Fig.2. FDI and Technology for competitiveness

Source: "FDI and technology as a levering factor of competitiveness in the developing

countries" (Isabel Alvarez and Raquel Marin)

Fig2. depicts the analytical model by showing how internal and external factors, as mentioned above, influence the type of grasping technology among countries. First of all, CO cell represents the pattern of developed countries for grasping technologies, that is, knowledge-based learning with technology creation as an internal factor and outward FDI as an external factor. Also, CI and AO shows how developing countries achieve competitiveness in the high-tech industries with internal and external factors. On the one hand, the CI cell refers to Local-based learning in developing countries which have sufficient national technology capability with technology creation and FDI inflows with technology spillover effects. On the

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[11] Dunning, J.H... "Towards a paradigm of development: implications for the determinants of international business activity" Transnational Corporations 15 (1), 173–227 2006.

other hand, AO cell refers to learning from abroad among developing countries which are levering FDI outflow in order to participate in the international market, though they still have a technology gap with countries in the knowledge frontier.[12]

B. the econometric model

According to pioneers in development economics, a suitable development strategy among Latin American region would correspond to the level of development of each country.[13] In this sense, the New Developmentalism strategy is appropriate only for countries which have "a modern business class, a large professional middle class, a large wage earning class, and the basic institutions for economic growth"[14] and which are considered as middle income countries. So, in order to test the hypothesis, middle income economies or above need to be differentiated from low income countries in the region, and only middle income countries should be used for empirical analysis for the purpose. Therefore, the analysis included six Latin American countries (Argentina, Brazil, Chile, Mexico, Uruguay, and Costa Rica) which satisfied the condition to be considered as middle income countries, as suggested above.

Also, six Asian countries (Republic of Korea, Malaysia, Singapore, Indonesia, Thailand, and Philippines) which are considered as developing countries specialized

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[12] Isabel Alvarez and Raquel Marin "FDI and technology as a levering factor of competitiveness in the developing countries" Journal of International Management 19 (2013) 232–246

[13] Lee, Keun. Schumpeterian analysis of economic catch-up : knowledge, path-creation, and the middle-income trap (Cambridge, United Kingdom ; New York : Cambridge University Press, 2013)

[14] Luiz Carlos and Bresser-Pereira From old to new developmentalism in Latin America (London: Oxford Press ,2011).

in manufacturing goods with diverse technological sophistication, and successfully converged with developed world, are included for the comparison. By adding six Asian countries and comparing the differences between the results of both groups, the effectiveness of the New Developmentalism will be further clarified, considering that the fast growing experience in Asian countries since the 1970s encouraged the middle income countries in Latin American region to adopt New Developmentalism and persuaded them to expect the similar economic growth trajectory with Asian countries. For all countries, the time span is from 2005 up to 2013 and all data are available from the World Bank and UNCTAD.

Based on the theory from hypothesis development in third section, we know that high-tech exports which show competitiveness in the international market depends on internal and external factors. Specifically, internal factors refer to those variables which are related to the national technology absorptive and creative capabilities. Therefore, the proxy for internal factors are such as R&D, Patent, and royalty receipt. Also, royalty payment is included as a proxy of technology acquisition of a country.

On the other hand, external factors include FDI inflow and outflow as a proxy, because technology transfer and diffusion from FDI host countries into FDI home countries occur through multinational companies and these two variables capture a country's integration and commitment in the international trade[15]. In addition, the relative position of countries in the industrial global chains determines the intra-trade

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[15] Isabel Alvarez and Raquel Marin "FDI and technology as a levering factor of competitiveness in the developing countries" Journal of International Management 19 (2013) 232–246

pattern of a country, and it is significant because it reveals the position of the countries in the global value chain as well as the degree of integration in the international market. Therefore, the high-tech import from developing countries are also included as a factor affecting the high-tech exports.

In sum, the econometrics model is defined as following by Isabel Alvarez ,Raquel Marin(2013) :

$$hightechX = F(MNE\_in, MNE\_out, GVC, TECH\_crea, TECH\_abs)$$

However, for the estimation purpose, this model needs to be divided into specific factors. That is, Patent and Royaltyreceipt are variables for technology creation. On the other hand, Royalty payment and R&D are variables for technology absorption ability. In addition, high-tech import is variable for the global value chain, and FDI inward and outward flows are relevant variables for MNE_in and MNE_out, respectively. Lastly, the Dependent variable is high-tech export as a percentage of total manufacturing export in the model.

$$LogHightech_{it} = \beta 0 + \beta 1 LogFDIinward_{it} + \beta 2 LogFDIoutward_{it} + \beta 3 LogImporhigh_{it} + \alpha 1 LogR\&D_{it} + \alpha 2 LogPatents_{it} + \alpha 3 LogRoypayment_{it} + \alpha 4 LogRoyreceipt_{it} + \eta_i + \gamma_{t} + \varepsilon_{it}$$

Where the subscript it represents the country i in period t, and ηi and γt refers to the individual and time effects, respectively.

For estimation purposes, system GMM is used because of the inherent endogeneity and autocorrelation problem of the model. Firstly, the percentage of high-tech export in the total manufacturing export as a dependent variable has its lags as a regressor, because past results between the dependent variable and

regressors may affect the present results. Therefore, the econometrics model in this paper is a so-called dynamic panel model. According to Arellano and Bond, 1991**, [16]**dynamic panel model needs to be estimated with GMM[17], The Generalized methods of moments, in that it uses all possible lags of regressor as instruments after transforming its original model into first differenced model to remove the correlation between the differenced form of the first lag in the dependent variable as a regressor and the differenced form of first lag in the error term.

Secondly, the autocorrelation problem is given in this model, because patents variable does not describe a sporadic but a cumulative process.[18] Therefore, this regressor could be affected by past results and be predetermined. In this case, Arellano,Bover(1995) and Blundell, Bond(1998)[19] suggest System GMM with additional moments conditions. Specifically, in order to have asymptotically efficient and consistent GMM estimator, the first differences for predetermined variables are used as instruments for level equations. Therefore, System GMM model adds one more instrument variable in comparison with first differenced GMM model.

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[16] Arellano, M and Bond, S., "Some tests of specification for panel data" Journal of Econometrics 59, 87–97 1991..

Arellano, M and Bover, O. "Another look at the instrumental variable estimation of error-components models." Journal of Econometrics 68, 29–51 1995.

[17] 민인식 and 최필선, Stata를 이용한 고급 패널 데이터 분석, (서울: 한국STATA학회: 지필미디어, 2012)

[18] Isabel Alvarez and Raquel Marin "FDI and technology as a levering factor of competitiveness in the developing countries" Journal of International Management 19 (2013) 232–246

[19] IBID

Table 2. Definition of variables

Variable	Definition
Hightech (dependent variables)	High technology exports(as the percentage of the total manufacturing exports), country i, year t
FDI inward	FDI inward stock(as the percentage of the GDP), country i, year t
FDI outward	FDI outward stock(as the percentage of the GDP), country i, year t
Importhigh	High technology imports from high-income countries(as the percentage of the total imports), country i, year t
R&D	R&D expenditure(as the percentage of GDP), country i, year t
Patents	Number of total patents(per 1000 habitants), country I, year t
Roypayment	Royalty and license fees, payments(current US$ by thousands of inhabitants), country i, year t
Royreceipt	Royalty and license fees, receipts(current US$ by thousands of inhabitants), country i, year t

IV. Discussion of the results

As explained earlier, this estimation was conducted for the hypothesis that the more countries utilize best and available technologies, the more the countries can transform its sectors specializing in high-tech industries-a key structural condition for economic catch-up, which aims to measure the effectiveness of New Developmentalism in Latin America, especially in terms of transformation into high-tech industrialized economies.

For estimating the case of six middle income countries in Latin America, the model was assessed without Logroyreceipt and Logroypayment variable. However, it is still justifiable according to the analytical model as suggested above in section 3, in that it focuses on the impact of FDI flow and technology absorption and creation

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ability. Therefore, Logpayment which is proxy for technology acquisition ability is not necessary for the purpose of the regression model which focuses on the relationship between high-tech export and technology creation-absorption ability in Latin American countries.[20] Also, Logroyreceipt was not included, because the impact of Logroyreceipt on high technology was not significant among Latin American countries in the previous study from Alvarez, et al., 2013[21]

Table3. Estimation result on six Latin American countries (Argentina, Chile, Brazil, Costa Rica, Mexico, and Uruguay) as well as six industrialized Asian Countries (Republic of Korea, Indonesia, Malaysia, Philippines, Singapore, and Thailand)

loghightech	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
loghightech L1.	.821077***	.10609257	7.74	0.000	.6131395	1.029014
logimport	.7661213*	.3994804	1.92	0.055	-.016846	1.549089
logrd	.069616	.1038845	0.67	0.503	-.1339939	.2732258
logpatent	.1577442	.060598	2.60	0.009	.0389742	.2765141
logroypayment	.0817279	.0744808	1.10	0.273	-.0642517	.2277076
logroyreceipt	-.0443284	.048118	-0.92	0.357	-.1386379	.0499811
logfdiinflow	.119119	.173784	0.69	0.493	-.2214914	.4597293
logdioutflow	-.0685589	.0844394	-0.81	0.417	-.234057	.0969392
Countrydummy	.5513378**	.2528482	2.18	0.029	.0557645	1.046911
_cons	-3.126369	1.940685	-1.61	0.107	-6.930042	.6773044
Sargan Test Chi^2			23.64215			
Arellano-bond			-1.6622*			

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[20] Wooldridge, Jeffrey M. *Introductory econometrics: a modern approach / Jeffrey M. Wooldridge.* (n.p.: Mason, OH : South Western, Cengage Learning, c2013., 2013)

[21] Álvarez, Isabel, Bruno B. Fischer, and José Miguel Natera. "Internationalization and technology in MERCOSUR." CEPAL Review no. 109 (April 2013)

test for AR(1)	
Arellano-bond	-.16577
test for AR(2)	
N of	59
observations	

All variables are included in natural logarithms

*Significant at 10% level   ** Significant at 5% level   *** Significant at 1% level

Based on the result, Table3. shows the increase of high technology export (as the percentage of the total manufacturing exports) in six Latin American countries compared to that of six industrialized Asian countries, as followed by the original model. This result is significant, in that the fast growing experience in Asian countries since 1970s encouraged the middle income countries in Latin American region to adopt the New Developmentalism and persuaded them to expect the similar economic growth trajectory with Asian countries. In other words, the result represents the expected outcome of the New Developmentalism. That is, how much Latin American countries transform its sectors into high-tech manufacturing industries which entail higher Schumpeterian and Keynesian efficiency and in turn give rise to the sustainable economic growth. According to Table3. countrydummy refers to the difference of high-tech export increase between two regions. Based on Asian countries, six middle income countries in Latin American region have 0.55% more increase in the high-tech export than Asian countries with 0.05% significance level. In other words, New Developmentalism functions well in the given time and brought them into positive competitive shift with 0.55% point in the international market compared to that of Asian countries.

On the other hand, table 4. represents the impact of internal and external factors to high-tech export among six middle income countries in the Latin American

region. According to the result, High tech export increased by 0.6% as they import high tech manufacturing products from manufacturing industries by 1% more with 10% significant level. This variable is added to measure intra trade pattern among the countries, and this figure reveals the position of the countries in the global value chain as well as the degree of integration in the international market. So, the six Latin American countries are assumed to be on the process of changing the production structure into high-tech industries, and do not mainly have inter trade pattern but show their intra trade pattern in the global market. This fact is crucial, in that if the middle income countries in Latin American region still suffer from Dutch disease, which was bought from the specialization pattern not with diverse sectors including manufacturing exports, but rather with primary items, and for that reason, they show a difference between current equilibrium and the industrial equilibrium exchange rate, they end up losing market competitiveness due to a lack of price competitiveness in the industrial goods. So, it will impede them to have transformation from simple to sophisticated industries with higher Schumpeterian and Keynesian efficiency, as mentioned above.[22] It is also agreeable as Jose Antonio Ocapo and Rob Vos(2008:34)[23] pointed out, "productivity growth in developed countries mainly relies on technological innovation. For developing countries, however, growth and development are much less about pushing the technology frontier and much more about changing the structure towards activities with higher

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[22] Luiz Carlos and Bresser-Pereira From old to new developmentalism in Latin America (London: Oxford Press ,2011).

[23]Ocampo,J.A., and Parra,M.A. "The Dual Divergence Successes and Collapses in the Developing World Since 1980',

levels of productivity.

Table 4. Estimation results on Latin American Countries (Argentina, Chile, Brazil, Costa Rica, Mexico, and Uruguay)

Loghightech	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
loghightech						
L1.	.5951438***	.1489831	3.99	0.000	.3031423	.8871454
logimport	.6046688*	.329105	1.84	0.066	-.0403651	1.249703
logrd	.1333778	.1395674	0.96	0.339	-.1401692	.4069248
logpatent	.1065831	.0704124	1.51	0.130	-.0314227	.244589
logfdiinflow	-.0475477	.1017804	-0.47	0.640	-.2470337	.1519383
logfdioutflow	-.115783*	.0632621	-1.83	0.067	-.2397744	.0082084
_cons	-.4892347	1.206038	-0.41	0.685	-2.853026	1.874557
Sargan Test Chi^2			18.42558			
Arellano-bond test for AR(1)			-1.6666*			
Arellano-bond test for AR(2)			-.79366			
N of observations			37			

Source: Based on World Development Indicator from World Bank and UNCTAD

All variables are included in natural logarithms

*Significant at 10% level   ** Significant at 5% level   *** Significant at 1% level

Also, Table4. Shows the impact of FDI outflow against high-tech export among Latin American countries. Specifically, a 1% increase in the volume of FDI outward stock has reduced 0.11% of high-tech export with 10% significant level. This results can be explained based on the study from Stevens and Lipsey.[24] In this study, there are two

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[24] Sadig, Ali J.. "Outward foreign direct investment and domestic investment the case of developing countries." Washington, D.C.: International Monetary Fund, 2013

ways in which FDI outflows may influence the home country's domestic investment. The first mechanism occurs when the company seeks the funds internally for the purpose of investing abroad, and this situation makes domestic companies to struggle for getting funds under the imperfect financial market and scarce financial resources of the developing countries. Therefore, it will weaken the investment activity in the FDI home country. The second mechanism happens when companies move their production facilities overseas. However, depending on the motives for investing abroad, such as efficiency-seeking, market-seeking, and strategic asset–seeking[25], the net impact of FDI outflow into home countries differs.

If the motive is market-seeking, especially for serving the FDI host country's domestic and neighboring markets, the result of FDI outflow is based on whether FDI outflow "displaces exports"(IMF), or not. For instance, if a company changes its manufacturing facilities from domestic to a FDI host country or FDI outflow from home countries replaces exports, outward FDI clearly has negative impact on domestic investment. Considering that Latin American countries have been assumed to have an imperfect financial market[26]and a lack of domestic savings, the first mechanism plausibly gives rise to the negative impact on the high-tech export, besides the second mechanism which results in ambiguous outcomes.[27]

On the other hand, the significant impact of FDI is important, in that it reveals

[25] Dunning, John H., and Sarianna M. Lundan. Multinational Enterprises and the Global Economy. Cheltenham, (UK: Edward Elgar, 2008.)

[26] Torre, Augusto de la, Juan Carlos Gozzi, and Sergio L. Schmukler. "Capital Market Development: Whither Latin America" n.p.: University of Chicago Press, 2008.

[27] IBID

that Latin American countries shows the pattern of AO cell in Figure2. Specifically, they have "learning from abroad pattern with technology absorption ability" which is assumed with significant FDI outflow from Latin America as well as insignificance of other factors which reveals the technology creation ability such as R&D and Patent variables. Therefore, to enhance competitiveness, Latin American countries need to build up technology creating abilities.

V. Conclusion

Why do Latin American countries fail to converge with advanced countries while Asian countries successfully achieve economic catch-up? This paper aims at answering this question based on the Keynesian and structuralist approach. Specifically, from this point of view, transforming industrial sectors favoring with sophisticated and state-of the-art technology is verified as key condition for sustainable economic catch up with advanced economies. It is supported by the evidences which explain the positive relationship between high-tech industries and economic growth due to higher Schumpeterian efficiency in high-tech export industries. Also, high-tech exports entails Keynesian efficiency and ensures competitiveness in the international market as shown in the previous chapter; therefore, sectorial diversification into high-tech industry explains the difference in the economic growth trajectory between Latin American region and Asian countries.

On the other hand, based on the validity of fostering high-tech export for sustainable economic convergence in Latin American countries, this paper estimate the effectiveness of New developmentalism in terms of the competitiveness shift

which is measured by high-tech export increase as a percentage of total manufacturing export. Assessing this policy's effectiveness is conducted with two objectives. Firstly, how do Latin American countries increase their high-tech export compared to Asian countries. Secondly, which factors affects high-tech export among Latin American countries in order to measure the specific characteristic which transform its sectors into high-tech industries with higher Schumpeterian and Keynesian efficiency.

According to the result of the hypothesis testing, Latin American countries perform better than Asian countries in terms of high-tech export increase by 0.55%, which refers to the positive effect of New developmentalism in Latin American countries regarding sectorial diversification into high-tech industries. Also, the import of high-tech products from the developed world has positive impact, reflecting that intra trade pattern with developed countries is significant among developing countries, because intra trade pattern in developing countries refers to the competitiveness in the international market from sectorial diversification into high-tech industries. Lastly, FDI outflows also explains the specific and unique influence for sectorial diversification into high-tech industries.

Especially, considering the imperfect financial market and the lack of domestic savings in Latin American countries, the negative impact on high-tech exports from FDI outflow from the Latin American region is plausible. Also, from, the significance of FDI outflow, It is shown that Latin American countries gain its competitiveness with "learning from abroad pattern with technology absorption ability" rather than the technology creation ability with FDI inflows. In other words, it reflects the necessity of technology creation ability in the Latin American countries to step forward into

developed countries.

APPENDICES

Appendix 1. The BOP-constrained growth model

The balance of payments constrained growth model basically has two demand equations. That is, it firstly contains demand for exports (equations A1) and demand for imports (equation A2). Also, secondly it has the balance-of-payments (BOP) equilibrium condition (equation A3).

In the equations A1, A2, and A3, Y refers to the real product of the country, Z the real product of the rest of the world, X the quantity of exports, M the quantity of imports, P domestic prices, P* foreign prices, E the nominal exchange rate, F net inflows of foreign capital. In addition, parameter Φ and Ψ are the price elasticity of exports and imports respectively, and ε and π are the income elasticity of the demand for exports and imports, respectively.

$$X = \left(\frac{P}{P \star E}\right)^{\Phi} Z^{\varepsilon} \tag{A1}$$

$$M = \left(\frac{P \star E}{P}\right)^{\Psi} Y^{\pi} \tag{A2}$$

$$PX + PF = PM \tag{A3}$$

A dynamic system is presented in equation A4, A5, and A6, by transforming the equations A3, A2, and A1 with natural logarithms and in turn differentiating with respect to time. Compared to the level variables shown as Capital letters in A1, A2, and A3, small letters in A4, A5, and A6 represent proportional rates of growth.

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$$a(p+x) + (1-a)(p+f) = p + m \tag{A4}$$

$$m = \psi(p^\star + e - p) + \pi y \tag{A5}$$

$$x = \phi(p - p^\star - e) + \varepsilon z \tag{A6}$$

"Substituting equations A5 and A6 into A4, we can solve for the rate of growth of domestic income consistent with balance of payments equilibrium which we shall call the balance of payments equilibrium growth rate. Equation (A7) gives the country's equilibrium rate of growth as a function of income and price elasticities for exports and imports, along with the rate of growth of world income, net capital inflows and the real exchange rate. In A7, a means the share of total imports that are paid with exports.

$$y^\star = \frac{(1 + a\phi + \psi)(p - p^\star - e) + a\varepsilon z + (1-a)f}{\pi} \tag{A7}$$

Equation A8 (Known as Thirlwall's Law) is the BOP-constrained rate of growth in the specific case in which purchasing power parity holds (p – p* – e=0) and there is no net external debt (a = 1).

$$y^\star = \frac{\varepsilon z}{\pi} = \frac{x}{\pi} \tag{A8}$$

Assuming that the equilibrium growth rate y* refers to a developing economy, equation (2) sets forth that the relative rate of growth of the developing country with respect to the rest of the world depends on the ratio between the income elasticities of exports and imports. If this ratio is higher than 1, there will be convergence; otherwise, there will be divergence. It is assumed that population growth is similar in both countries and hence a higher real GDP growth in the developing countries amounts to convergence in GDP per capita as well. On the other hand, in the equation A8, assuming (a = 0) implies that in the long run the external debt cannot grow unboundedly, although in the short run capital inflows

may have a strong impact on growth."[28]

Appendix 2.

Graph1. R&D expenditure as share of GDP

Source: Own elaboration, World Development Indicators, World Bank
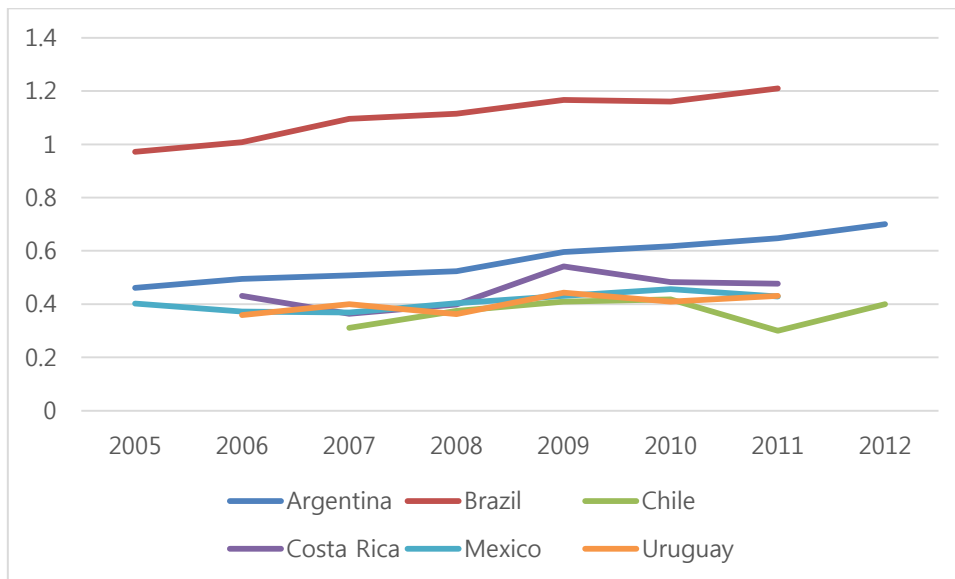
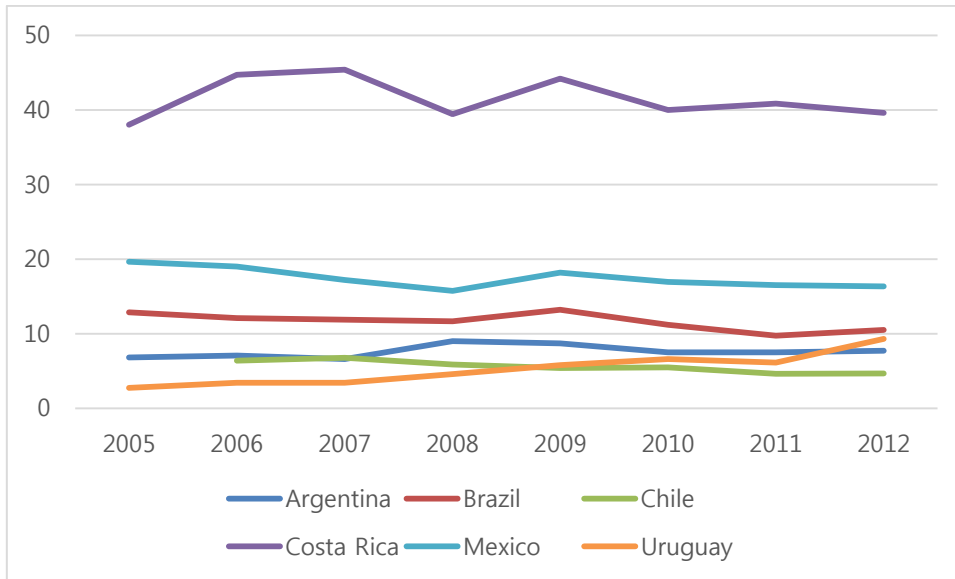Graph2. High technology exports as percentage of total manufacturing exports

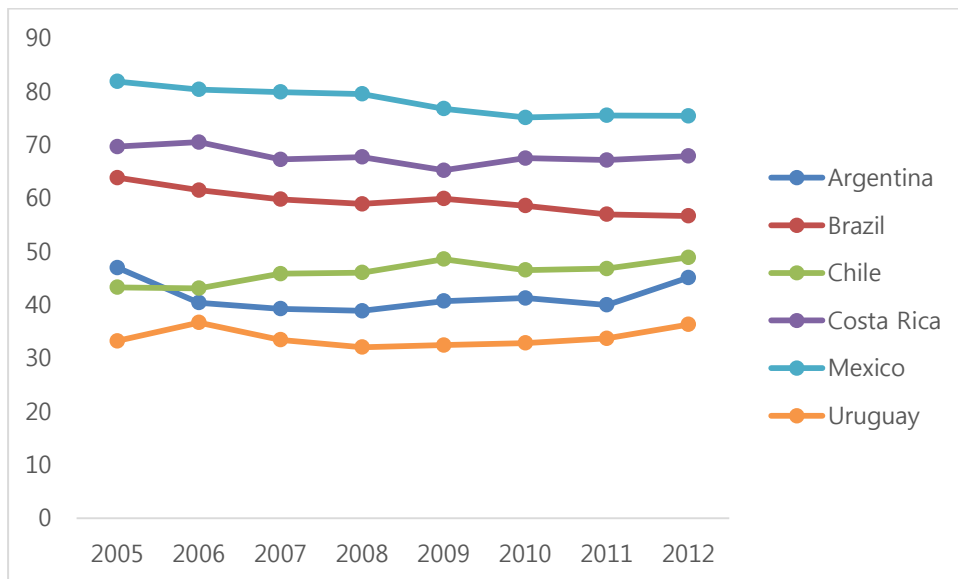Source: Own elaboration, World Development Indicators, World Bank

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[28] Thirlwall, A. P. "Reflections on the Concept of Balance-of-Payments-Constrained Growth." Journal of Post Keynesian Economics, 1997. 377, JSTOR Journals

Mario Cimoli, Gabriel Porcile and Sebastia´n Rovira, "Structural change and the BOP constraint: why did Latin America fail to converge?" Cambridge Journal of Economics 2010, 34, 389–41
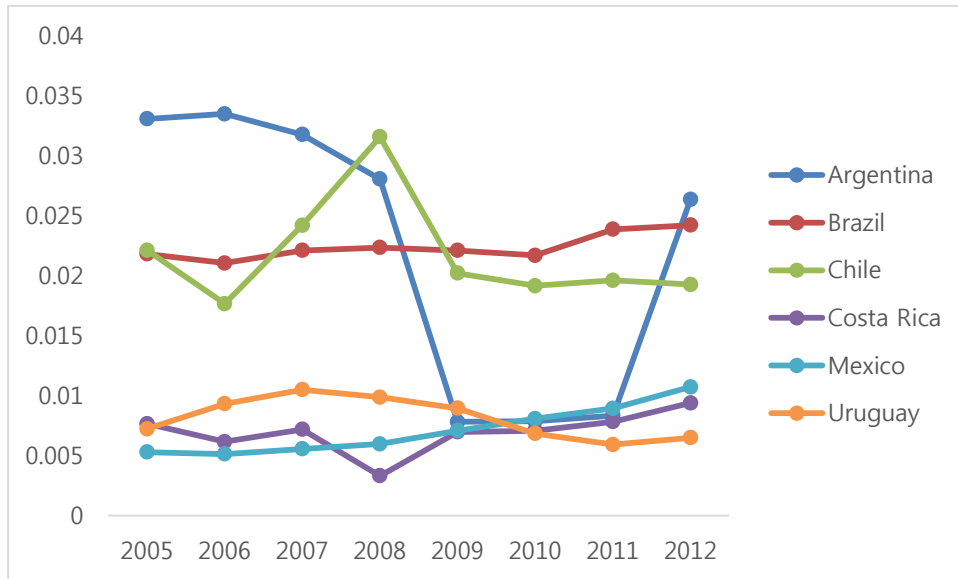
Graph3. High technology imports from developed countries (as percentage of total imports)

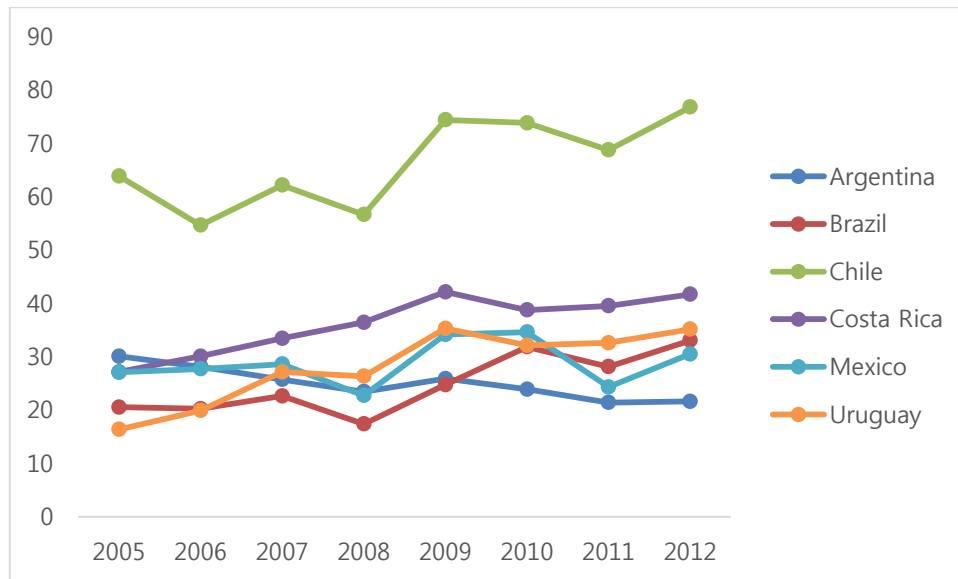Source: Own elaboration, World Development Indicators, World Bank

Graph4. Number of Total Patents (per 1000 habitants)

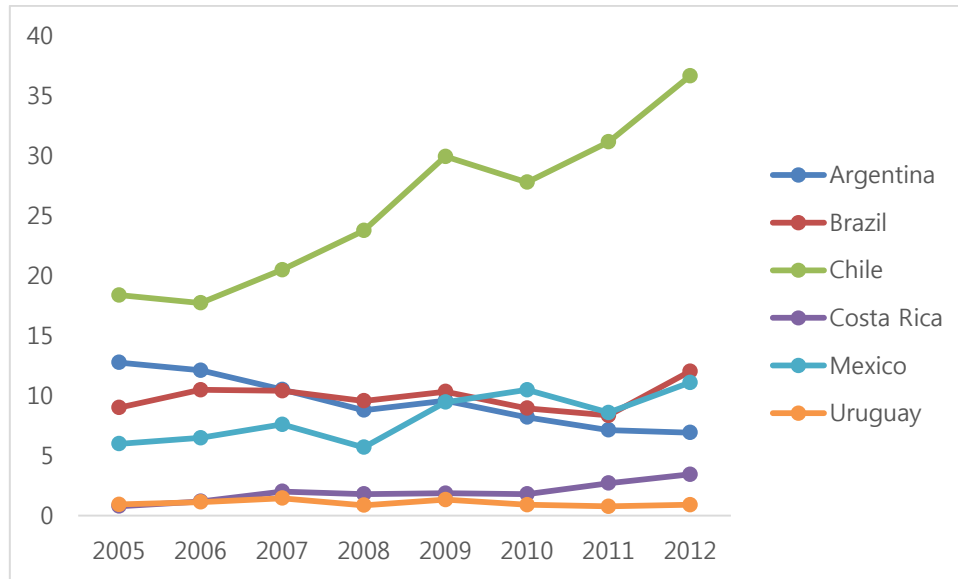Source: Own elaboration, World Development Indicators, World Bank

Graph5. FDI inward stock (as the percentage of GDP)

Source: Own elaboration, UNCTAD

Graph6. FDI outward stock (as the percentage of GDP)

Source: Own elaboration, UNCTAD

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