From Global Value Chains (GVC) to Innovation Systems for Local Value Chains

Lee, Keun (1); Szapiro, Marina (2); Mao, Zhuqing (1)

1: Seoul National University, Korea, Republic of (South Korea); 2: Federal University of Rio de Janeiro, Brazil

Abstract

This paper has forwarded the N-shaped curve hypothesis that while at the initial stage of growth more GVC is desirable for learning from outside, functional upgrading requires some effort or stage of seeking separation and independence from the existing foreign-dominated GVC, and that the latecomer firms and economies might have to seek again for an opening to integrate back into the GVC after building up their own local value chains. This paper has tried to verify this 'N-shaped, In-Out-In again' hypothesis first by looking into cases of 'upgrading and independence' in Korea and Brazil, and second by checking the national level data of the share of foreign value-added (FVA). It is shown that the trends of FVA in successful catching-up economies, like Korea, Taiwan, and recently China, is consistent with this N-shaped or In-Out-In again pattern. The paper has also presented some regression results that confirms some correlations between the degree of local creation and diffusion of knowledge and the values of FVA. This can be regarded as an important contribution because it illustrates the linkage between the innovation system variables (knowledge localization) to the GVC variable of the FVA. This finding implies that building local innovation systems is the key to make upgrading and local value creation possible while being integrated in the GVC.

Keywords: GVC, innovation systems, local value chains, Knowledge, Korea, Brazil

1. Introduction

There has been an increasing trend of international integration of the economies and globalization of production over the last decades, particularly since the rise of the World Trade Organization (WTO) regime promoting more open international trade. Thus, as supply chains became global in scope and more intermediate goods are being traded across borders, the concept of global value chains (hereafter GVC) became more relevant in understanding the emerging economic relations (UNCTAD, 2013). The concept helps in setting a framework to understand how international supply chains link economic activities at global, regional, national, and local levels within particular industries (Gereffi, 2014). Value chain refers to the series of value-creating activities transforming raw or intermediate materials into finished products. The key issue identified in studying value chains is the question on whether amount of the value-added is high or low at each link (Gereffi, 1999).

The two pillar concepts in GVC are governance and upgrading (Gereffi, 2014). The former is about the power relations among actors involved the activities. Gereffi (2005) discusses five modes of governance, ranging from the most power-asymmetric mode of hierarchy and captive modes to less asymmetric modes of relational and modular modes, and even up to more horizontal market mode. Regarding the second core concept, upgrading, Humphrey and Schmitz (2000) and a later paper by Giuliani, Pietrobelli, and Rabellotti (2005) discuss the four types of upgrading options: process, product, functional and intersectoral upgrading. Process upgrading refers to transforming inputs into outputs more efficiently by reorganizing the production system; product upgrading means moving into higher value-added product lines; functional upgrading refers to acquiring new, superior functions in the chain, such as design or marketing; while intersectoral upgrading means applying the competence acquired in a particular function to move into a new sector.

One important conclusion by Giuliani, et al. (2005) from their studies of firms in Latin America is that process or product upgrading has been happening to some extent, but functional upgrading and intersectoral upgrading has been rare. More recently, Pietrobelli and Rabellotti (2011) observed that the GVC approach has paid less attention to how local, regional, or national institutions condition the upgrading opportunities of business activities, and pointed out the potential supplementary role by the Schumpeterian or innovation system perspectives.

The innovation systems (IS) refers to the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge at the national, sectoral and firm levels (Lundvall, 1992; Malerba, 2005; Lee, 2013). Scholars from the Schumpeterian school, such as Lundvall and Nelson, have advocated this innovation system concept, arguing that differences in the innovation systems give birth to differences in innovation and thus economic performance of countries and their firms. Compared to the GVC school of thought, they can be said to emphasize more the 'within-nation' variables than the international variables affecting economic growth.

There is an emerging call for a need to integrate the two approaches, GVC and IS, with the recent

initiatives by Lundvall (Lundvall, 2015, 2016).[1] The current study can also be considered as an attempt to seek a linkage between the two approaches or integrating the two. The integration of the two approaches is important since if an economy decides to pursue a more independent path for industrialization (industrial policy), it should arrange access to learning (foreign knowledge), which in turn means some degree of openness to the GVC (or global knowledge flow). On the other hand, just joining the GVC does not guarantee upgrading, and an economy might be stuck in low value activities, without functional upgrading.

Therefore, the key task is to find out the 'right and dynamic ' mode and ways of engagement with GVC, with the long-term goal of building and upgrading your own 'local chains for value and knowledge creation,' and thus leveraging a bigger pie from the global profit. The current study is motivated by some concern that while it is necessary to join GVC for learning, there is a risk of being stuck in the low value-added activities without making a progress toward the higher tier in the value chains and thus falling into the so-called middle income trap (World Bank, 2010; Lee, 2013). In other words, what matters more critically is who and how to capture the 'bigger share' of the value in the GVC, and there can be a battle for this among the key involved parties. It is our view that the GVC perspective is limited in providing tips for winning in this battle, because it tends to, at least implicitly, assume that the leadership (or flagship company roles) in sectors continue to remain in the hands of the firms from the North. In this sense, it seems that the GVS is still confined to the old product lifecycle theory perspective (the North is always the leader, with the South to inherit some mature segments from the North). Further, they tend to take a somewhat static view (5 governance modes) or linear view, without paying attention to dynamic changes among the 5 governance modes, and without much attention to independent upgrading by the Southern firms, and assuming a view that more integration to the GVC is always better.

An alternative theoretical framework is the 'catch-up cycle' theory (Lee and Malerba, 2017), which acknowledges the possibility and also reality that the latecomer firms and industries that used to learn from the GVC led by Northern firms may take the leadership of sectors by creating their own value chains. Along this line of thought, this paper takes a more dynamic perspective, with a shift in focus from classifications of static governance modes to variations among the modes in dynamic trajectories. This perspective considers such non-linearity: that while at the initial stage more integration to the GVC is desirable, upgrading requires that the latecomer firms and industries exert effort to enter a different stage where there is temporary separation from the existing foreign-dominated GVC, although they might have to seek for more opening to integrate once more in the GVC after upgrading. This view is consistent with observation by Amsden and Chu (2003) that some form of national ownership is needed eventually to build local value chains. This dynamic sequence

---

[1] . Lundvall (2015) is a working paper, which is subsequently published as a chapter In Lundvall (2016).

of "first In, then Out and then In again" will be the focus and hypothesis of this paper.

In what follows, section two is devoted to the theoretical discussion, centered around the possibility of functional upgrading in the three-stage model of the OEM-ODM and OBM in the manufacturing sector. Then, in section three, this study will try to illustrate this 'N-shaped, In-Out-In again' hypothesis first by looking into the cases of 'upgrading and independence' in Korea and Brazil.

Section four tries to verify the hypothesis by aggregate, national level data. We first present the results of calculating the national-level trend of the share of foreign-value-added (FVA) in selected economies. Our eventual interest is the question of what determines the share of foreign value-added, which is termed as FVA in exports, with the recognition that this question is not addressed in Fagerberg et al. (2016). Thus, we show by regression analysis that the degree of local creation and diffusion of knowledge (close to national level self-citations) measured by patent citations is an important determinant of the FVA. This can be regarded as an important contribution because it verifies the linkage between the innovation system variables (knowledge localization) to the GVC variable of the FVA. Summed together, these imply that building local innovation systems is the key to make upgrading and local value creation possible after the participation in the GVC.

2. Theoretical Perspectives: Continuing Collaboration or Fight for Independence

As mentioned in the preceding section, Giuliani, et al. (2005) find from the experiences in Latin America that functional and inter-sectoral upgrading has been happening very rarely. In contrast, Lee and Mathews (2012) and Lee (2013: 22-23) find the cases in Korea and Taiwan of successful upgrading in terms of moving into high-end segment in the same industry and into new higher value-added sectors, respectively. They called it 'double upgrading and diversification' considering its both intra- and inter-sectoral dimensions. Their argument is that Korea and Taiwan achieved this double upgrading and thereby were able to enhance their level of industrial value-added, which allowed them to match rising domestic wages and enabled them to avoid the middle income trap. As noted in Lee and Mathews (2012), while the initial success with the Own Equipment Manufacturing (OEM) at the lower tier of the GVC tends to make wage rates rise accordingly, new cheaper labor sites in "next-tier down" countries can emerge to replace a country's position in the global value-chains. This condition forces firms to move up to higher value-added activities in the same industries or they will gradually lose price competitiveness and decline eventually as the orders from the MNCs will move to other countries. The case of footwear sector in Brazil is an example, as will be discussed in next section.

In this debate on upgrading within the GVC, particularly functional upgrading, the three stages of OEM-ODM-OBM has often been the key framework of understanding (Hobday, 2003). Own Equipment Manufacturing (OEM) is the first step of catching-up among East Asian manufacturers. Own Design Manufacturing (ODM) is the second step of their catch-up where these manufacturers

can depart from simple jobs such as assembling, and begin to be involved in the production design. Own Brand Manufacturing (OBM) is the last step, as these manufacturers are now able to independently perform all the functions of production, design, marketing, channel management, and R&D. According to Hobday (2003), firms in East Asian countries followed a transition path from OEM to ODM and then to OBM.[2]

However, the transition from one mode to the next mode is not easy, especially so is the transition to OBM because it involves several risks, including counterattacks from the flagship firms in the existing GVC or the incumbents, as noted in Lee et al. (2015) for the case of the Korean SMEs trying OBM, and in Navas-Alemán (2011) for the case of footwear and furniture sector in Brazil. Thus, this stage can be prolonged with a slowdown, which may even lead to a decline of sales or market shares and, eventually, to a possible crisis for the firms trying this functional upgrading. For instance, in the case of consumer goods, former vendor companies (brand owners) often stop giving OEM orders to kill the company that has begun to sell their own competing brands (Lee et al., 2015). In the case of capital goods, the incumbent companies suddenly charge predatory prices in the market once they realize that the latecomer firms have become successful in developing their own products, posing the threat of competition against products made by the incumbent. In some cases, the incumbent reacted by filing lawsuits against the latecomers, saying that the latter copied their products. In other cases, the small supplier firms had trouble with the client firm over selling prices and delivery time, among others, which sometimes led to a sudden halt in purchasing orders from the client to the supplier firm. The aversion of former buyer firms toward their suppliers to becoming OBM is documented in earlier studies on Latin America, too, such as Giuliani, Pietrobelli and Rabellotti (2005), and Navas-Alemán (2011).

This possibility of interference by the incumbent leading firms in the GVC implies that the functional upgrading to OBM often require a fight for independence against the leading firms in the GVC. This recognition is in some degree in contrast with some studies in the GVC literature that have tended to concentrate on collaboration between the flagship firms in the West and firms in the South (Ernst and Kim, 2002; Sturgeon and Lester, 2004). Of course, the latecomer firms from the South have the option of no fight and no associated risk but choosing to stay dependent on a single or a few MNC vendor firms or a single client firm. This strategy of dependent or path-following catch-up is not totally bad as it may lead to a stable growth for a while, however, in the longer term it is often uncertain as new late entrant firms emerge from the next tier in catching up countries, offering lower wages and costs (Lee and Mathews, 2009). The limitation of this dependent catch-up strategies are

_____

[2]. As emphasized in Lee et al. (2014), it is very interesting to note that the three IT service giants in India have also gone through the similar three stages of upgrading from body shopping to offshoring, and eventually to the GDM (global delivery model).

shown in the case of other countries reported in previous studies (Van Dijk and Bell, 2007; Rasiah, 2006).

In terms of ownership of value-created in the GVC, this process of upgrading from OEM to ODM and finally to OBM is the process of creating more value locally and getting some degree of independence from the flagship firms in the exiting GVC. In addition, another critical thing is to identify as a final goal for the firms to eventually have some form of local ownership. Otherwise building something independently is not possible (Amsden and Chu, 2003); while Taiwan has been more dependent on foreign MNCs than Korea, they have also eventually created locally owned big businesses, through which Taiwan joined the status of high–income economies. Lee et al. (2013) confirms that both Korea and Taiwan have created a critical number of global big businesses relative to the size of their economy, with Taiwan having 8 companies included in the Fortune 500 class companies and Korea having 13 such companies by the early 2010s.

The above discussion leads us to formulate the N-shaped curve hypothesis that while at the initial stage more integration to the GVC is desirable for learning from foreign sources of knowledge, functional and sectoral upgrading requires some effort or stage of seeking a separation and independence from the existing foreign-dominated GVC, and that the latecomer firms and economies might have to seek again more opening or integration after building up their own local value chains. This dynamic sequence of "first In, then Out and then In again" would generate an N-shaped curve in terms of the degree of the participation in the GVC, measured by the FVA (share of foreign value-added in gross exports of an economy). The last phase of the re-increasing GVC participation tend to emerge because the firms would often become internationalized in production facing the rising domestic wages and relocating their factories to lower wage sites, as exemplified in the next section by the stories of the Korean firms, both SMEs and big businesses. So, we hypothesize that the trend of the FVA would be increasing initially (during the low income and lower middle income stage), then decline at the upper middle income when they try to create more local value-added, relying less on GVC, and finally increase again at high income stage with enhanced innovation capabilities.

The following section illustrates the points of this hypothesis by looking at the cases of firms in Korea and Brazil, which will serve as a micro-foundation for the aggregate level hypothesis and regressions.

3. Firm-Level Cases of Creating Local Values out of the GVC

3.1. The case of Korean Firms attaining independence from the GVC

Works such as Hobday (1994) and Kim (1997) in the literature has noted that the latecomer firms' involvement with the GVC in the form of the OEM has led to an unprecedented export growth in the early catch-up period in Korea and Taiwan. However, sustainability of the OEM strategy is

questioned in Lee and Mathews (2012), calling it as an "OEM trap". For example, there were more than 500 OEM plush toymakers in the mid-1980s in Korea. Currently, the number is almost zero because most of them either went bankrupt owing to the rise of domestic wages and the entrance of other cheaper wage-based OEM sites, such as Indonesia in the 1980s and China in the 1990s, or moved their factories to lower wage countries (Lee et al., 2015). Thus, by the 2000s, Korea had about 10 ODMs and only 1 OBM toymaker (i.e., *Aurora World*). The CEO (Mr. Roh) of this company explained that while he made a fortune in the 1980s via OEM, he also saw its long-term limitations and constant squeezing of the profit margin and erosion of price competitiveness with the rising wages in Korea, which is the case for the middle income trap from a national economic point of view. This forced him to take the risk of trying to become an OBM. The limitation of the OEM-based catch-up strategies are also discussed in the case of other countries, as in the cases of the pulp and paper industry in Indonesia (Van Dijk and Bell, 2007), and of the electronics industry in Malaysia (Rasiah 2006). These authors found that the latecomer firms achieved some form of catch-up in terms of sales and capital accumulation, but without technological innovation.

However, moving beyond the OEM for the ODM or OBM mode is not easy and involves lots of risks and challenges. The first challenge is to be able to sell one's product independently, as one proceeded from a contracting manufacturer to an own-brand firm (Lee et al., 2015). Thus, these firms had to adopt the sales-on-credit strategy, because no customer was willing to purchase their products. To avoid confrontation with old customers, some firms started out in emerging markets first and entered developed countries later. The emergence of new and less costly marketing channels also served as a window of opportunity for some latecomers.

Other risks involve the interfering behavior or even direct attacks from the incumbent firms. Counterattacks from incumbent firms presented several forms of significant risk, including a sudden disconnection in supplier relationship, litigation over IPRs, and price wars or dumping. Most common is the deterring actions from old buyers, who turn against their previous suppliers (latecomer firms) and attempt to curb their growth as a new rival company. When *Aurora World* began to sell its own brand in 1991, the incumbent vendors cancelled and stopped their OEM/ODM orders in an attempt to prevent this company from rising as a new brand owner. The sales of this company declined from the year 1991 when they took the road of being an OBM and then stagnated for 5 years (Lee et al 2015). We call this period the "OBM river," which must be crossed to establish oneself as an OBM company. Similar turbulence in sales is observed in other firm cases discussed in Lee et al (2015). It is interesting to note that the shape of the sales of this company is similar to the hypothesized N-shape itself (rising-decline and rising again). The FVA roses again eventually, because these firms all become internationalized; for instance, Auroral World, although a SME, had all relocated to its factories to Southeast Asia or China, with only R&D and headquarter function in Korea.

Lee et al. (2015) illustrates the cases of the risky but successful transition toward the OBM, such as Aurora World, Shimro Musical Instruments, and HJC Helmets, which produce toys, musical strings, and helmets as their main competitive items, respectively. They have eventually caught up with leading brands in the global market, such as Ty for Aurora World, Suzuki for Shimro Musical Instruments, and Shoei or Bieffs for HJC Helmets. At present, Aurora World is now ranked 2nd in North America in terms of brand recognition, Shimro Musical Instruments has gained the largest market share in U.S., and HJC Helmets is now ranked as the largest in the world market.

While the above are examples from the SMEs, the Korean success in overall industrial upgrading beyond the middle income trap was possible because many big businesses also went through the similar process of functional upgrading from OEM to OBM. A notable example is the Hyundai Motors, which started as an OEM that assembled parts for the Ford (Lee, 2005).

During its establishment in 1968, Hyundai Motor had the assembler agreement with Ford for SKD (semi-knockdown) production. However, the founder of Hyundai Motors, Mr. Chung, wanted to sell cars with its own brand and thus chose to break up with Ford to be an OBM company. His choice was to allow a 20% equity share to the Japanese firm, Mitsubishi for a licensed production of its own brand cars (Pony) with the Mitsubishi engine (Lee and Lim, 2001). Then, when Hyundai wanted to develop and produce its own engines and transmission, Mitsubishi refused to help or teach Hyundai about the engine technologies. So, Hyundai had to take another risky road for independence of developing its own engines. This eventual separation is often expected in the long-term journey of upgrading within the GVC.

The participation with the GVC is helpful as long as the forerunner firms provided product or process designs for the latecomer firms. However, as the technological capabilities of the latecomer firms grew, they felt it was increasingly difficult to buy or get license for the designs held by the forerunner firms who are concerned with the so-called "boomerang effect" of the transferred technology. In this sense, this stage can also be considered as a "crisis" for the catching-up firm (L Kim, 1998). The crisis means that there are products for the latecomers to imitate but there is no design available from the incumbent producers who are reluctant to transfer the design technology. To overcome this crisis, the latecomer firms have to acquire design technology, or to learn how to design the existing products.

3.2. The case of the footwear sector in Brazil

Brazil is the world's third largest footwear producer, with approximately 7,700 producers, and in 2015 this sector produced 944 million pairs of shoes and exported about 124 million pairs to more

than 150 countries (Grendene, 2016).[3] Although many regions of Brazil produce footwear, the province of Rio Grande do Sul in southern Brazil commands a significant part of the shoe production in Brazil with the Sinos River cluster as its core (Szapiro et al., 2015). The historical trajectory of the footwear production in the Sinos Valley can be divided into two distinct phases (Vargas and Alievi, 2003). The first phase, which dates from the 1970s to the mid 2000s, is a growth phase through increasing integration into the global value chains controlled by large international buyers. Figure 1 shows the rapid expansion of the sector's exports and the number of pairs of shoes. However, it also shows the decline since the mid 2000s, with the peak of 2004 (212 millions of shoes in 2004), at the level of not only the nation but also the region of Rio Grande do Sul. Thus, the second phase, beginning from the 2000s, is gradual decline due to the increasing competition from China and the limitations associated with the subordination of local shoe companies to large global value chains. So, this period is also a period of the search for new sources and strategies for competitiveness. In this regard, we noted two different groups of the firms (Vargas, 2000; Vargas and Alievi, 2003; Szapiro et al., 2015).

[Figure 1]

The first group of producers from Sinos Valley and other regions of Brazil have maintained their integration into the Global Value Chains and tried to compete in the low price and low-end segments based on cost-lowering and intensive use of subcontractors or informal employment. These producers are subordinated to purchasing offices of large global buyers in USA and Europe, and have limited innovative capacity in design and marketing. This group of producer presents passive learning strategies and low interaction with other actors – either along the production chain (involving suppliers, subcontractors, etc.) or with other support organizations including the local technological and training infrastructure. Although this strategy of being integrated in GVC has allowed local producers to access external markets, it was limited in the area of local knowledge creation and development of design, marketing, and own branding capabilities (Humphrey and Schmitz, 2002). Despite the existence of some infrastructure aimed at labour training and R&D in the Sinos Valley, achievement by firms tend to be limited to the sphere of production, with few upgrade in terms of functional and intersectoral upgrading and thus gradual and eventual decline as shown in the Figure 1 (Szapiro et al., 2015).[4]

---

[3] Available at http://static.grendene.mediagroup.com.br/apresentacoes/1203_2016-11-17%20-%20Grendene%20-%20APIMEC%20meeting.pdf

[4]. According to the field research that we have been doing in the last years, the firms that remained as dependent suppliers to the international shoe dealers have faced drastic reductions of the orders (about one third of the volume they used to supply).

The second group of shoe manufacturers have looked for a position in premium and higher-end markets through strategies that involve not only productive improvement, design investment, efforts to open up new market niches and new commercialization channels but also, most importantly, the development of their own brand (Gredene Report[5] and Arezzo Report[6]). These firms are more dynamic in terms of innovation, as a result of the implementation of local learning mechanisms involving either local or external sources of knowledge (Vargas and Alievi, 2003). So, this second group of firms has reached a better integration in the export marketplace through direct trading of shoes with their own brands and designs.

Among this group of firms, there are several leading firms, such as Grendene, Alpargatas and Arezzo. Due to the relative decline of other firms, especially those in the first group, these leading companies now accounts for most of the value of Brazilian footwear exports, and are responsible for the increase in the average price of exports of Rio Grande do Sul footwear industry. As shown in Figure 2, their sales and exports are not decreasing but increasing even since the late 2000s. The following section gives a brief description of these three firms.

Founded in 1971, Grendene is one of the world's largest producers of footwear, with net revenue of approximately US$ 667 million in 2015.[7] The company has exclusive proprietary technologies in the production of footwear for the women's, men's and children's markets. Its strategy was mostly based on the development of design capabilities and own brands. It owns widely known brands, including Melissa, Ipanema, and Grendene Kids, among others. Grendene accounts for 11 footwear factories in six industrial locations. Concerning its brand Melissa, Grendene was able to open shops in New York, Milan, London and other cities in developed countries. Besides, it has its own mold-producing plant, a factory producing polymerizing vinyl chloride (PVC) for its footwear production, and distribution logistics serving both traditional and non-traditional distributors and retailers in the whole of Brazil, and in the export market. In this sense, this firm has a strategy based on vertical integration and the control of most of the production value chains in footwear production.

Alpargatas[8] was founded in 1907, as the *Sociedade Anonyma Fábrica Brazileira de Alpargatas e Calçados*. During the 1960s the company launched the Havaianas, a Brazilian brand of flip-flop sandals that became one of the most successful brands in the Brazilian and global market, with

---

[5] Available at http://static.grendene.mediagroup.com.br/apresentacoes/1203_2016-11-17%20-%20Grendene%20-%20APIMEC%20meeting.pdf

[6] Available at https://www.google.com.br/?gws_rd=ssl#q=Institutional+Presentation+1Q16+Arezzo

[7] The information about Grendene is available at institutional and administrative reports at http://static.grendene.mediagroup.com.br/apresentacoes/1203_2016-11-17%20-%20Grendene%20-%20APIMEC%20meeting.pdf and http://static.grendene.mediagroup.com.br/relatorio/1111_Grendene%20-%20RA%20e%20Anexos%20-%20BR.pdf

[8] The information about Alpargatas is available at institutional and administrative reports at http://ri.alpargatas.com.br/arquivos/informacoes_financeiras/Resultados_Trimestrais/2015/PRESS_RELEASE_4T15_2015.pdf and http://ri.alpargatas.com.br/ingles/arquivos/informacoes_financeiras/Resultados_Trimestrais/2015/PRESS_RELEASE_2014.pdf

150 million pairs being made every year. This made Alpargatas one of the world's largest producers of footwear, with net revenue of approximately US$ 1.2 billion in 2015. It is important to note that the relatively high level of revenue of Alpargatas is owing to its international operations, accounting for more than 40% of its revenue in 2015.

Established in 1972, Arezzo & Co[9] started in Belo Horizonte in the state of Minas Gerais. In 1990s Arezzo has moved its main operations to Sinos Valley, where it has its R&D and production outsourcing activities. In the same decade, the Arezzo & Co also opened its first flagship store in Oscar Freire Street, a commercial center in São Paulo with national and international design brand names. In the succeeding years, this company also opened more stores in strategic consumption centers in other countries. In addition, investments were increased and research on innovative strategies in sales and operations in the franchise network were introduced, allowing Arezzo & Co to expand countrywide. The next step in Arezzo's strategy implemented in the 2000s was to develop specific brands for each segment and the expansion of the distribution channels. Currently, the company is considered as a leading Brazilian brand of women's footwear, selling more than 10 million pairs of shoes per year, in addition to handbags and accessories. In 2015, Arezzos' net revenue was approximately US$ 340 million, with the company owning portfolios of other renowned brands such as Arezzo, Schutz, Anacapri and Alexandre Birman. Arezzo also hosts fifteen to eighteen collections per year, and holds a strong local and global distribution network comprised of franchises and multi-brand stores.

In sum, the three mentioned firms have the common strategies of developing their own design capabilities and brands, while controlling the key value chains in both marketing and production. As a result, they were able to get out of the foreign firm dominated GVC, created their own value chain, and became independent from the major international shoe dealers from US and Europe. Owing to the emergence of these high-end segment firms, the footwear sector of the state of Rio Grande do Sul has recorded the highest average export price among the export regions of Brazil, as emphasized by Szapiro et al. (2015).

[figure 2]

It is also worth mentioning about the role of the industrial policy targeted at the development of a dynamic and innovative environment in the Sinos Valley (Szapiro et al., 2015). During the

---

[9] The information about Arezzo is available at institutional and administrative reports at
http://arezzoco.com.br/ShowApresentacao.aspx?IdTeleconferencia=WTzrnhdU7KOA/XcE9pvpQA==&IdCanal=lHwid1V32Tok0IgdNqvLQw==&linguagem=en and
https://www.google.com.br/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwjy28GP1_LRAhVEhpAKHdZlBfwQFggaMAA&url=http%3A%2F%2Fwww.arezzoco.com.br%2FDownload.aspx%3FArquivo%3DBWnfXWKH%2B%2BP16ZNl6oDRgA%3D%3D&usg=AFQjCNGAnX7Gvi1W0ZNb_6N1MPI_x5ZpnQ&cad=rja

internationalization phase of the sector (which begun in the 1970s), the main focus was the implementation of measures to encourage exports through the concession of taxes, privileged credits, and stimulus exchange rate policy (undervaluation). Since the 2000s, the policy that aimed at supporting the footwear sector, both at federal and state levels, focused on the technological development and innovation (Vargas, 2002; Calandro and Campos, 2013). However, given that the same policies were given to the all firms in the regions, the question of why only a small number of the firms survived the crisis and have kept expansion remain to be answered. Again, the firm-level decision-making and will to take the road of hard independence seems to be an important factor, as has been the case in plush toy sector in Korea.

4. Creating the Local Value Chains and Knowledge: Estimates and its Determinants

Foreign value-added share of gross exports (FVA) indicates which part of a country's gross exports consist of inputs that have been produced in, and thus imported from, other countries. It can be an important index to represent the degree of an economy's participation in the GVC. This section presents the trend of the FVA in selected economies in the world to have a tentative verification of the hypothesis proposed in section two.

The hypothesis comes from a dynamic perspective on the possibility of upgrading within the GVC. We proposed a non-linearity, such that while at the initial stage of upgrading, more participation in the GVC is desirable to promote learning, upgrading at later stages requires some effort to build local value chains which often necessitates a separation from the existing foreign-dominated GVC. This upgrade is necessary, although they might have to seek again for an opening to integrate once more into the GVC, after building up their own value-chains. This dynamic sequence of "first In, then Out and then In again" is consistent with the stories of the successful upgrading and catch-up by firms in Korea, India and Brazil discussed in the preceding section. In other words, the degree of participation with GVC will be measured by the FVA, such that higher (lower) values of FVA means more (or less) integration with the global economy through GVC.

Such values of FVA are already available at the OECD for selected years (1995, 2000, 2005, 2008 and more recent years) for selected economies. However, so that we may have estimates of longer time series with more frequencies, we have used the Input-Output tables of Korea, Taiwan, China and other countries, whenever necessary.[10] The estimation method of FVA follows Hummels, Ishil and Yi (2001). The FVA, namely foreign value added share of gross export, of an economy can be measured as follows.

---

[10] Input-Output Table data source: The Bank of Korea; National Statistics Office of Republic of China (Taiwan).

$$FVA = \mu A^M (I - A^D)^{-1} E / E_T$$

where $A^D = [a_{ij}^D]$ is an n×n matrix of direct input coefficients of domestic products, $A^M = [a_{ij}^M]$ is an n×n matrix of direct input coefficients of imported products, n is the number of sectors, E is a n×1 vector of export coefficients; E_T is the total exports of a country across the n sectors, and μ is a 1×n unit vector. Thus, $(I - A^D)^{-1}$ is the well-known Leontief Inverse, namely, the matrix of coefficients for the domestic intermediate product requirement.

[figures, 3 and 4]

Figure 3 shows the results of the FVA estimations for Korea and Taiwan. It shows that FVA in Korea had kept increasing since the economy opened up to join the GVC through OEM-based exports starting from labor-intensive goods until the early 1980s when it peaked, but soon started to decline until the mid-90s, and rose again since Korea joined OECD. FVA in Korea peaked over 36% in 1980 and fell down to 28% in 1993, the year Korea became an OECD member. It is interesting to note that this period of the mid-1980 to mid-1990s is the period of rapid catch-up in Korea according to Lee (2013), and the early to mid-1980 is the period when Korea was in the situation of the middle-income trap due to the rising wage rates but with still low value-added export structure. This pattern is consistent with the interpretation that Korea got out of the trap by increasing the share of local-value-added in its exports, and also is very close to our hypothesis of the N-shaped curve or the In-out-In again relationship.

The trend of FVA in Taiwan in Figure 3 is similar to that in Korea, although we do not have the data for a longer period. It shows that a similar decreasing trend also happened in Taiwan. FVA of Taiwan hit the bottom in the late 1980s at the value of 32%. This pattern of Taiwan hitting the bottom at earlier year than Korea makes sense because Taiwan had an early start in the 1950s—without a civil war like in Korea—and have always been leading Korea in every aspect including per capita GDP until the mid-2000s.

Figure4 depicts the relationship between the FVA and GDP per capita for these two economies. In this simplified figure, both Korea and Taiwan have the U-shaped path of GVC as the economy grows. It suggests that during the stage of the upper-middle economy with per capita GDP or roughly around the range between 3,000 and 10,000 dollars. According to Lee and Mathews (2012) and Lee (2013), this period is when the economies of Korea and Taiwan have experienced both inter-sectoral and intra-sectoral diversification and upgrading; Intra-sectoral upgrading is moving into high-valued segments in a given industry, and inter-sectoral upgrading is getting into new higher value-added industries. The decreasing trend of the FVA indicates that this process of double-upgrading coincided with the process of increasing local value-added.

[Figure5: China, Figure 6 for Latin America]

Figure 5 shows the case of China since 1995. It is shown that the FVA in China peaked at 37% in early 2000s and then also declined to the level of 31% in late 2000s. This implies that as another successful catching-up economy, China is replicating the similar pattern with some lags (about 15 to 20 years) after Korea or Taiwan.

Reading from the similar experiences of the FVA declines in the cases of successful catching-up economies, a common pattern seems to be the fact they all had a decade (roughly 10 year period) of the decline of more than 5% point of FVA, like from about 35% to about 30% or lower. In considering if a similar pattern has occurred in other economies in Southeast Asia or Latin America, the results show that there are a few economies which show a similar pattern, with a possible exception of Malaysia with a decline from higher than 45% FAV in 2000, to less than 40% FVA in 2009 (figure available upon request). That may explain why Malaysia is now most recently showing some sign of overcoming the middle-income trap, having reached more than 47% level of the US per capita GDP in 2015.

Figure 6 shows the cases of economies in Latin America, and there is no country which had experienced a decline of FVA over the 10-year period. Mexico, with the NAFTA, shows the highest degree of integration with the GVC, but no period of decline of FVA to create local value chains. In comparison, the two economies of Brazil and Argentina show very low level of the GVC participation, possibly reflecting the resource endowment with orientation to agriculture (Argentina) or mineral exports (Brazil). Chile shows the pattern of short-term ups and downs but no clear period of downward FVA trend over a considerably long period. This pattern of FVA seems to suggest that the degree of FVA depends not only on the degree of international integration but also the industrial structure, such that a country with heavy dependence on the primary sectors would have a low degree of FVA. The regressions in the next sub-section will try to confirm this reasoning.

Determinants of FVA

On the issue of the determinants of the degree of FVA in gross exports, it is very interesting to note that this period of increasing local value-added (or decreasing FVA in Figure 3) in Korea and Taiwan correspond to the period from the mid-1980s to the mid-1990s when these economies had increased rapidly the degree of knowledge localization shown in Figure 7. This variable represents the degree of knowledge creation and diffusion in a national economy, and is measured by the national-level self-citation of a country, defined as the share of a country-owned patents in the total citations made by all the patents owned by a country.[11] This values of this degree of knowledge creation and

---

[11]. Following the idea of Jaffe et al. (1993), Lee (2013: 49) measures this variables as the gap between the probability (A) of one country' patents citing its own patents and the probability (B) of the rest of

diffusion of Korea and Taiwan was about 5% in the mid 1980s, similar to the average middle income countries but increased to more than 1% (the average of high income countries) by the late 1990s. This variable of knowledge localization is one of the key national innovation system variables, and is related to the source in the acquisition of knowledge and is to reflect the degree that knowledge being created relies on domestic knowledge bases. In other words, it measures how much knowledge is created domestically in terms of citing the patents owned by inventors of the same nationality. The correspondence between this variable and the decreasing (increasing) FVA (DVA) implies that increasing local value-added has been supported by or has been made possible by the increasing degree of creating and diffusion more knowledge locally by indigenous actors. In contrast, is other middle income countries, including Brazil and Argentina, this variable of knowledge creation and diffusion had remained below 5% throughout the whole period.

Now to show this linkage from local knowledge creation to the FVA, we have tried simple regressions to explain the degree of FVA as a function of knowledge localization, per capita income, the size of an economy (measured by population) and the industry structure (measured by the share of manufacturing in GDP). The regressions use the FVA data from the OECD sources available for selected years, and knowledge localization available from the dataset used in Lee (2013) and available at (www.keunlee.com). The results presented in Table 1 confirms that the degree of local creation and diffusion of knowledge is negatively (positively) related to the FVA (DVA), both in the results of pooled OLS and the panel random effect models based on the Hausman tests. While the relationship may be only correlations, it is interesting to note that the correlations imply the linkage between the innovation system variables (knowledge localization) to the GVC variable of the FVA.

Our results can be compared with that of Mehta (2016) which tried regression analysis to find out the determinants of the domestic value added (DVA = 1- FVA), and finds that the share of medium skill workers is positively related to the DVA in EU and developing economies, whereas the share of low-skilled workers is negatively related. Given that Lee (2013; Chapter 3) has already proved that a higher degree of the knowledge localization is positively related to faster economic growth (per capita income), the intermediate links between knowledge localization and economic growth is found to be this process of increasing domestic value-creation (reducing relying on foreign value-added) by this

---

the world's patents citing that country's patents. Formally, (A) is calculated as the share of a country (X) among the total citations made by country X's patents, and (B) is the share of a country (X) in the all the citations made by the whole world except that country (X). The B part serves as a control group for the purpose of normalization because a country with just a large number of patents, like the US, would have naturally a high degree of (A). However, it turns out that except an exceptional country like US, this normalization does not matter, given the very high correlations between this normalized measurement and the non-normalized measure (A). Furthermore, sometimes the substaction makes the values often negative. Thus, this paper uses the simple measure (A) in the graph and the regressions. Actually, the graph of this variable in Figure 8 is quite similar to the normalized version in Lee (2013: 3.1).

study. These results are partially complementary to the finding by Fagerberg et al. (2016) that more FVA is negatively related to economic growth (per capita income growth).

The results also confirm our earlier reasoning that a country with heavy dependence on resources or agriculture (or on manufacturing) would show low (or high) degree of FVA. In other words, the results showing a positive coefficient of the manufacturing share in GDP suggest that manufacturing tend to be more internationally integrated than primary sectors and thus a country with a higher share of manufacturing would have higher values of FVA than otherwise.

The regression result also shows a U-shaped relationship between per capita income levels and the FVA, with the square term of per capita GDP is negative and significant. Given that the sample of countries used in regressions are all middle or high income countries, we cannot generate the whole non-linear N-shaped curve, but the curve except the first part corresponding to low income countries. This U-shaped curve (or positive relationship) for the middle and high income countries is consistent with our hypothesis because it implies that the degree of FVA decreases with the rising income levels during the middle income stage up to a certain high level, and, after that level, it increases again as economies get highly integrated internationally at high income levels.

[table 1]

Then, an emerging question is how to increase the degree of knowledge creation, so that we may promote more creation of local value-added instead of foreign value-added in exports. Again, we look for answer by looking at the experience of Korea and Taiwan. It is well known that these economies have rapidly increased the R&D/GDP ratio over the catch-up period, compared to Latin America (Kim and Lee, 2015), and also rapidly increased their college enrollment ratio (Lee and Kim, 2009). Beside this simple answer, we can also take note of the fact that the period of increasing degree of knowledge localization since the mid-1980s coincided exactly with the period of increasing specialization in short cycle-based technologies since the mid-1980s. As noted in Lee (2013), there exists a link between short-cycle technologies and knowledge localization, because short cycle technologies mean less reliance on the existing or old knowledge stock and thus specialization into short cycle technologies means a higher chance for quickly increasing the degree of knowledge localization. In sum, this implies that getting more into short-cycle technology-based sectors had led to increasing the degree of locally value-added in industry, as well as that of local creation of knowledge.

[figure 7]

5. Summary and Concluding Remarks.

This paper has forwarded the N-shaped curve hypothesis that while at the initial stage of growth more GVC is desirable for learning from outside, functional upgrading requires some effort or stage of seeking separation and independence from the existing foreign-dominated GVC, and that the latecomer firms and economies might have to seek again for an opening to integrate back into the GVC after building up their own local value chains. This dynamic sequence of "first In, then Out and then In again" would generate an N-shaped curve in terms of the degree of the participation in the GVC measured by the FVA (share of foreign value-added in gross exports of an economy). So, we hypothesize that the trend of the FVA would be increasing initially (during the low income and lower middle income stage), then decline at the upper middle income stage when they try to create more local value-added, relying less on GVC, and finally increase again at high income stage with now enhanced innovation capabilities and reintegration into the GVC.

This paper has tried to illustrate this 'N-shaped, In-Out-In again' hypothesis first by looking into cases of 'upgrading and independence' in Korea and Brazil, and second by checking the national level data of FVA and the determinants of the FVA. The successful case of the rise of the latecomer firms in Korea, Brazil and India have tend to start from the participation in and learning from the GVC at the earlier stage, and to switch to achieve independence not only in production but also marketing and branding, although the process of independence is difficult and risky. The key to overcoming these difficulties is to command a certain level of in-house capabilities in both marketing and technological innovation. Not taking the road toward independence might be a short-term option but cannot be a long-term option because the leading MNCs in the existing GVC is always looking for cheaper wage sites and contract firms, as shown by cases of firms in the footwear sector in Brazil.

The paper has then tried to verify the hypothesis by using the aggregate, national level data and presenting the trend of the share of foreign-value-added (FVA) in selected economies. It is shown that the trends of FVA in successful catching-up economies, like Korea, Taiwan, and recently China, is consistent with this N-shaped or In-Out-In again pattern, with the increasing values of FVA at the earlier period (at low income stage) or before 1980s, and then declining and increasing again in the most recent period. This finding is different from the view of Fagerberg et al. (2016) that participation at the GVC does not help even at low-income stage. Our view is that low income groups of economies should be engaged in the GVC to absorb and learn foreign knowledge, such as learning by exporting in the OEM mode which had been common in the early stage of growth in east Asia.

The paper has also presented some regression results that confirms some correlations between the degree of local creation and diffusion of knowledge and the values of FVA. This can be regarded as an important contribution because it illustrates the linkage between the innovation system variables (knowledge localization) to the GVC variable of the FVA. Given that Lee (2013; Chapter 3) has already proven that a higher degree of this knowledge localization is positively related to faster

economic growth, this study reveals the intermediate links is this process of increasing domestic value-creation: specifically, from increase in local knowledge to creation of local value-added and then to economic growth. This finding implies that building local innovation systems is the key to make upgrading and local value creation possible while being integrated in the GVC.

This study is in a sense a call for seeing both the perils and potentials of the GVC. The peril side emerges because the GVC may be just a global profit maximization led by MNCs, driven by the waves of global financialization which squeezes the profits from the lower tier of GVCs, without concerns for local value-added or descent job creation. The potential side is that GVC may offer initial learning channels, but eventual separation or independence included in the strategy; otherwise, the economy may lose in a competition against other sites and firms in other lower-wage economies. As such, the eventual goal should be making a transition from participation in the GVC to the creation of local value chains and innovation systems. If we conjecture from the experience of the Korean plush toy, Brazil footwear, and Indian IT-service sectors, the necessary requirements to make such a transition happen seems to include a 'decision and will' to try to be independent eventually' based on the indigenous ownership of the firms. Industrial policy cannot do the whole magic but may render some help in terms of promoting and building sector and national level innovation systems beyond the firm boundaries, as argued in the catch-up cycle perspective of Lee and Malerba (2017) which takes the industrial policy as another possible window of opportunity.

References

Amsden, A., and Chu W. (2003). Beyond Late Development: Taiwan's Upgrading Policies. MIT Press: Cambridge, MA.

Ernst, D., and Kim L. (2002). Introduction: Global Production Networks, Information Technology and Knowledge Diffusion. Industry and Innovation, 9(3): 147-153.

Fagerberg, J., B. Lundvall, and M. Srholec (2016). National innovation systems, global value chains and economic development. Paper at the 2016 Globelics conference held in Bandung.

Gereffi ,G. (2014). Global value chains in a post-Washington Consensus world. Review of International Political Economy, 21(1): 9-37.

Gereffi, G. (1999). International Trade and Industrial Upgrading in the Apparel Commodity Chain. Journal of International Economics, 48(1): 37-70.

Gereffi, G., Humphrey, G.J., and Sturgeon, T. (2005). The governance of global value chains. Review of International Political Economy, 12(1): 78-104.

Giuliani, E., Pietrobelli, C., and Rabellotti, R. (2005). Upgrading in global value chains: Lessons from Latin American clusters. World Development, 33(4): 549-573.

Hobday, M. (2003). Innovation in Asian industrialization: A Gerschenkronian perspective. Oxford Development Studies, 31(3): 293-314.

Hobday, M. (1994). Export-led Technology Development in the Four Dragons: The Case of Electronics. Development and Change, 25(2): 333–361.

Humphrey, J., and Schmitz. H. (2002). How does insertion in global value chains affect upgrading in industrial clusters?. Regional studies, 36(9): 1017-1027.

Jaffe, Adam B., M. Trajtenberg, and R. Henderson (1993). Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations. Quarterly Journal of Economics, 108(3): 577–98.

Kim, L. (1998). Crisis Construction and Organizational Learning: Capability Building in Catching-up at Hyundai Motor. Organization Science, 9(4): 506-521.

Kim, Y.K., and Lee, K. (2015). Different impacts of scientific and technological knowledge on economic growth: Contrasting science and technology policy in East Asia and Latin America. Asian Economic Policy Review, 10 (1): 43-66.

Lee, Keun, Kim, B.Y., Park, Y.Y., and Sanidas, E. (2013). Big businesses and economic growth Identifying a binding constraint for growth with country panel analysis. Journal of Comparative Economics, 41 (2): 561-82

Lee, K. (2005). Making a Technological Catch-up: Barriers and Opportunities. Asian Journal of Technology Innovation, 13(2): 97–131.

Lee, K., and Lim C. (2001). Technological Regimes, Catching-up and Leapfrogging: Findings from the Korean Industries. Research Policy, 30(3): 459-483.

Lee, K., and Malerba, F. (2017). Catch-up cycles and changes in industrial leadership: Windows of

opportunity and responses of firms and countries in the evolution of sectoral systems. Research Policy, 46(2): 338-351.

Lee, Keun, and Byung-Yeon Kim (2009). Both institutions and policies matter but differently for different income groups of countries: Determinants of long-run economic growth revisited. World Development, 37 (3): 533-549.

Lee, Keun, and J. Mathews (2012). Firms in Korea and Taiwan. In J. Cantwell and Ed Amann (eds.), The Innovative Firms in the Emerging Market Economies, New York: Oxford University Press.

Lee, Keun, Jaeyong Song, and Jooyoung Kwak (2015). An Exploratory Study on the Transition from OEM to OBM: Case Studies of SMEs in Korea. Industry and Innovation, 22(5): 423-442.

Lee, Keun, Tae Young Park, and Rishikesha T Krishnan (2014). Catching-up or Leapfrogging in the Indian IT Service Sector. Development Policy Review, 32(4): 495-518

Lee, Keun (2013). Schumpeterian analysis of economic catch-up: Knowledge, path-creation, and the middle-income trap. Cambridge University Press.

Lundvall, Bengt-Åke (1992). National systems of innovation: Toward a theory of innovation and interactive learning. London: Frances Pinter.

Lundvall, Bengt-Åke (2015). On the origins of the national innovation system concept and on its usefulness in the era of the globalizing economy. Working paper.

Lundvall, Bengt-Åke (2016). Learning Economy and the Economics of Hope. Anthem Press.

Malerba, Franco (2005). Sectoral systems of innovation: a framework for linking innovation to the knowledge base, structure and dynamics of sectors. Economics of Innovation and New Technology, 14(1-2): 63-82.

Mehta, Swati (2016). Tilting Towards South: What Determines the Changing Pattern of Global Value Chains?. Paper presented at the 2016 Globelics Conference, Bandung, Indonesia.

Navas-Alemán, Lizbeth (2011). The impact of operating in Multiple Value Chains for Upgrading: The case of the Brazilian Furniture and Footwear Industries. World Development, 39(8): 1386-1397.

Pietrobelli C., and Rabellotti R. (2011). Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries?. World Development, 39(7): 1261-69.

Rasiah, Rajah (2006). Electronics in Malaysia: export expansion but slow technical change. In V. Chandra (ed.), Technology, Adaptation, and Exports: How Some Developing Countries Got it Right, World Bank, Washington DC: 127.

Sturgeon, T., and Lester R. (2004). The New Global Supply-base: New Challenges for Local Suppliers in East Asia. In S. Yusuf, M. Altaf, and K. Nabeshima (eds.), Global Production Networking and Technological Change in East Asia, World Bank Press: Washington DC.

Szapiro, M., Vargas, M., Brito, M., and Cassiolato, J. (2015). Global Value Chains and National Systems of Innovation: Policy implications for developing countries. 13th Conferência Globelics, La Havana, Cuba.

UNCTAD (2013). Global Value Chains: Investment and Trade for Development. World Investment Report 2013, New York & Geneva: United Nations, UNCTAD.

Van Dijk, M., and Bell, M. (2007). Rapid Growth with Limited Learning: Industrial Policy and Indonesia's Pulp and Paper Industry. Oxford Development Studies, 35(2): 149-169.

Vargas, M., and Alievi, R. (2003). Learning trajectories and upgrading strategies in the footwear productive system of Sinos Valley. In: Cassiolato, J., Lastres, H., and Maciel, M. (Ed.), Systems of innovation and development — evidence from Brazil, Cheltenham: Edward Elgar.

World Bank (2010). Exploring the Middle-Income-Trap. World Bank East Asia Pacific Economic Update: Robust Recovery, Rising Risks, vol. 2, Washington, DC: The World Bank.

Table 1: From Knowledge Localization to the Domestic Value-added: Pooled OLS and panel

	Pooled OLS		Random Effect	
	(1) FVA	(2) FVA	(3) FVA	(4) FVA
Knowledge (Self-citation)	-35.29***	-31.74***	-20.87*	-21.57*
	(-5.18)	(-4.83)	(-2.46)	(-2.57)
Per cap GDP	0.000619***	0.0000229	0.000624***	0.000395
	(8.08)	(0.12)	(6.52)	(1.85)
PC GDP2		1.08e-08***		3.90e-09
		(3.45)		(1.19)
Population	0.00464	-0.000148	0.00721	0.00519
	(1.38)	(-0.04)	(1.35)	(0.95)
Manuf_vadd	1.207***	1.232***	0.997***	1.015***
	(8.49)	(9.08)	(5.35)	(5.50)
Constant	-10.68**	-4.937	-8.237	-5.883
	(-2.88)	(-1.26)	(-1.72)	(-1.14)
N	114	114	114	114
R-sq	0.497	0.547	0.213	0.195

Notes: t statistics in parentheses; * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Knowledge is the nation-level self-citation expressing the degree of creation and diffusion of knowledge in a country (not normalized value); PC GDP2 is square of per capita GDP; Manuf_Vadd is the share of manufacturing value added as % of GDP

Figure 1: Shoes Exports by Brazil and Rio Grande do Sul Region: 1989 to 2013
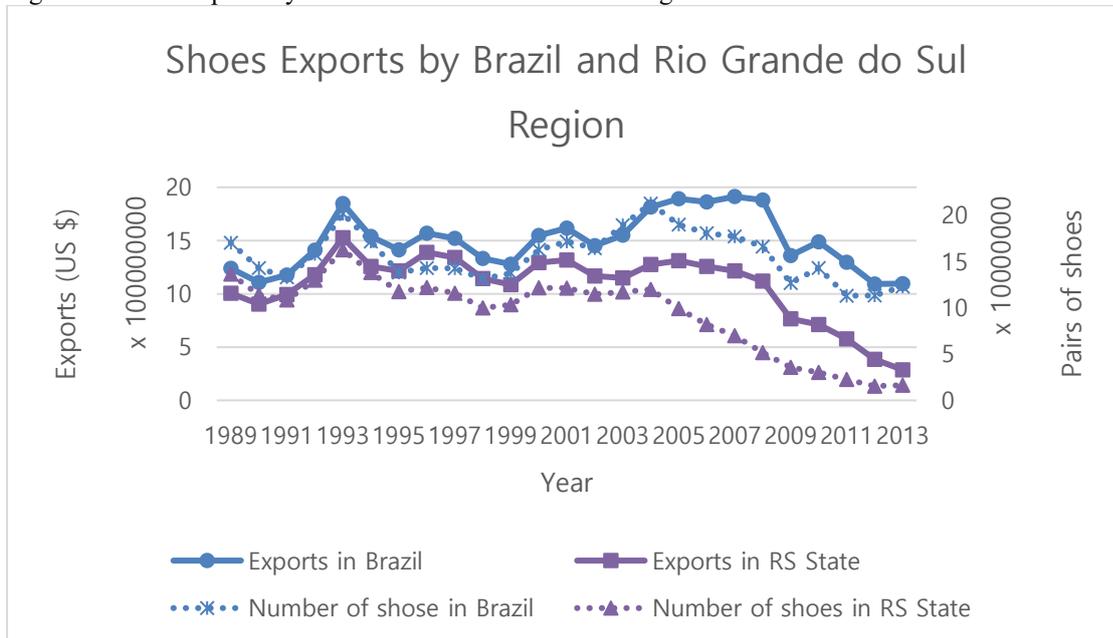
Source: Souza (2014)

Figure 2: After-Tax Sales (R$ million) of Leading firms
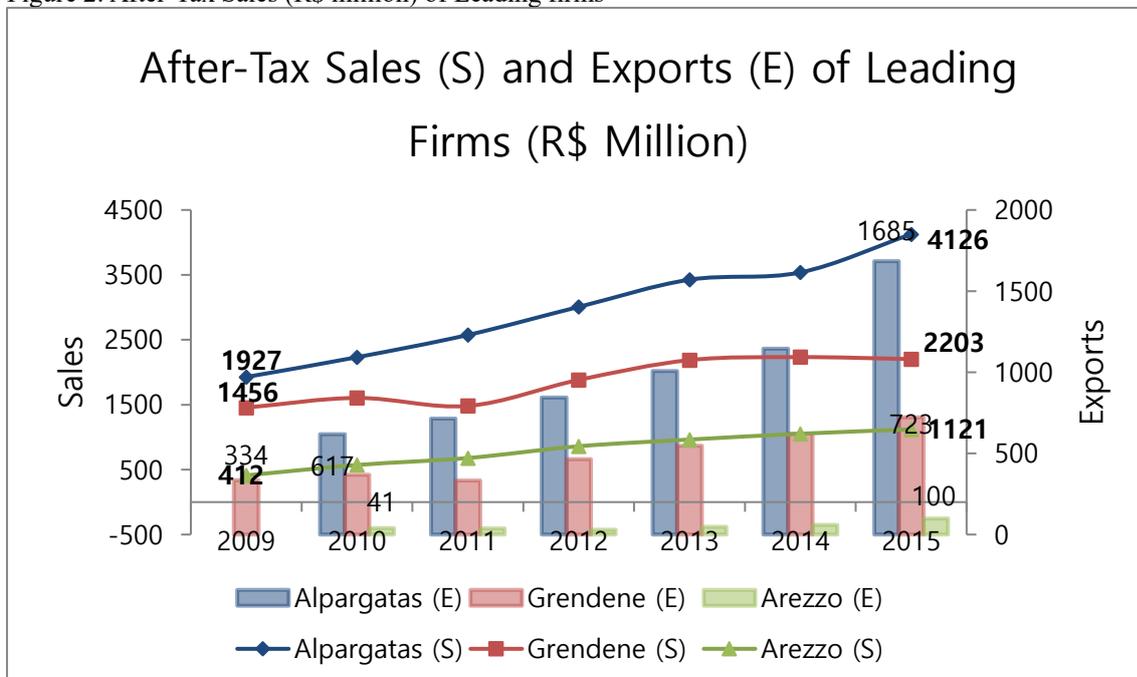
Note: The data of Alpargatas and Arezzo's exports for 2009 are not available. The data of Arezzo's exports was calculated based on the information of the share of exports of gross revenue. The same share was applied to the after –tax sales to provide the information about Arezzo's exports for the years 2010, 2011, 2012, 2013, 2014 and 2015.

Figure 3: Trend of FVA in Korea and Taiwan
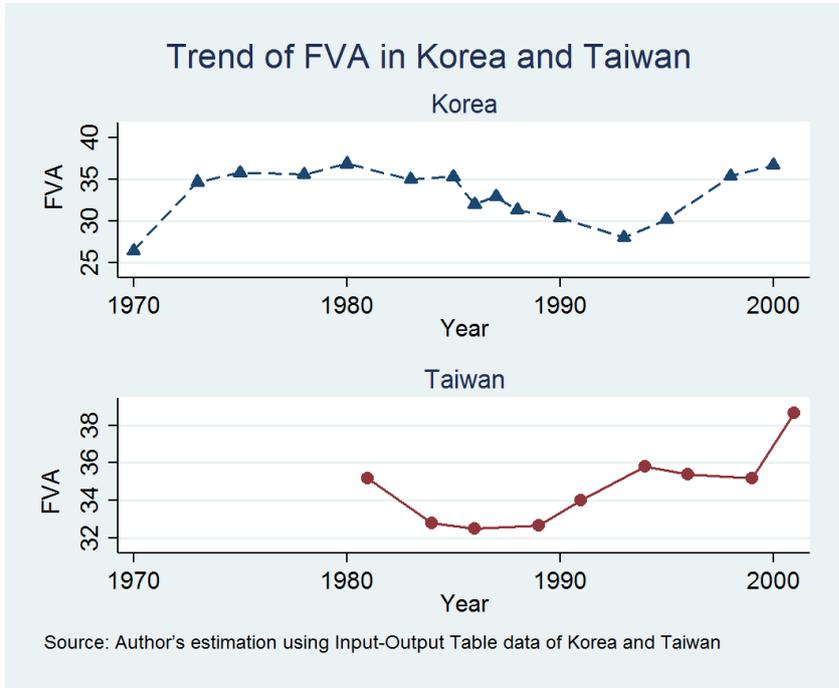
Note: FVA data are from author's estimation using Input-Output Table data of Korea and Taiwan.

Figure 4: Trend of the FVA and GDP per capita in Korea and Taiwan
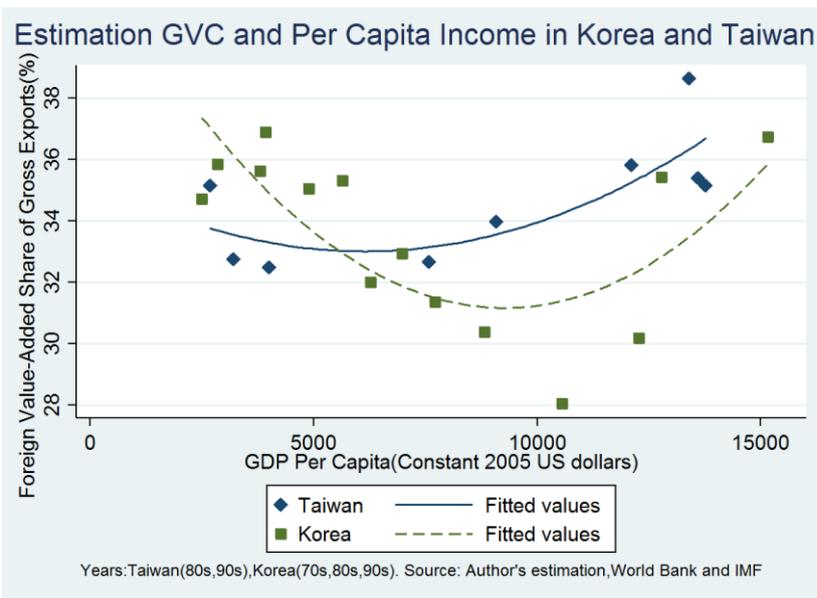
Notes: GDP Per Capita data of Korea are from World Bank and GDP Per Capita data of Korea are from IMF

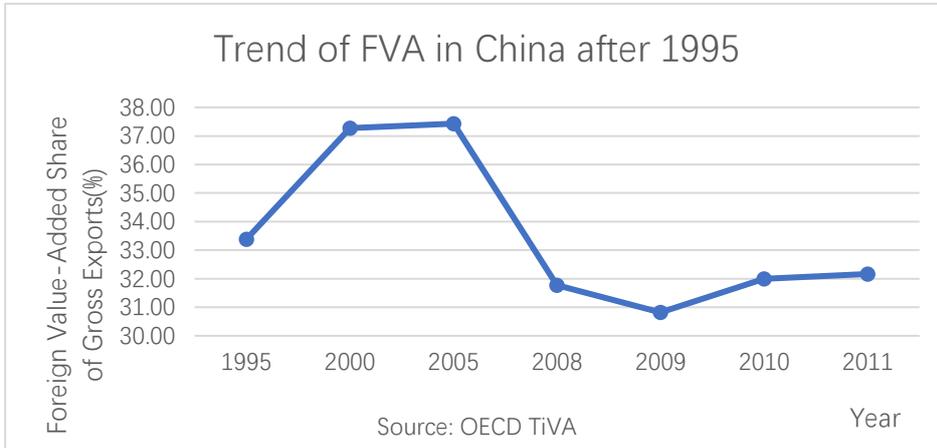Figure 5: Trend of FVA in China after 1995

Figure 6: Trend of FVA in four economies in Latin America after 1995
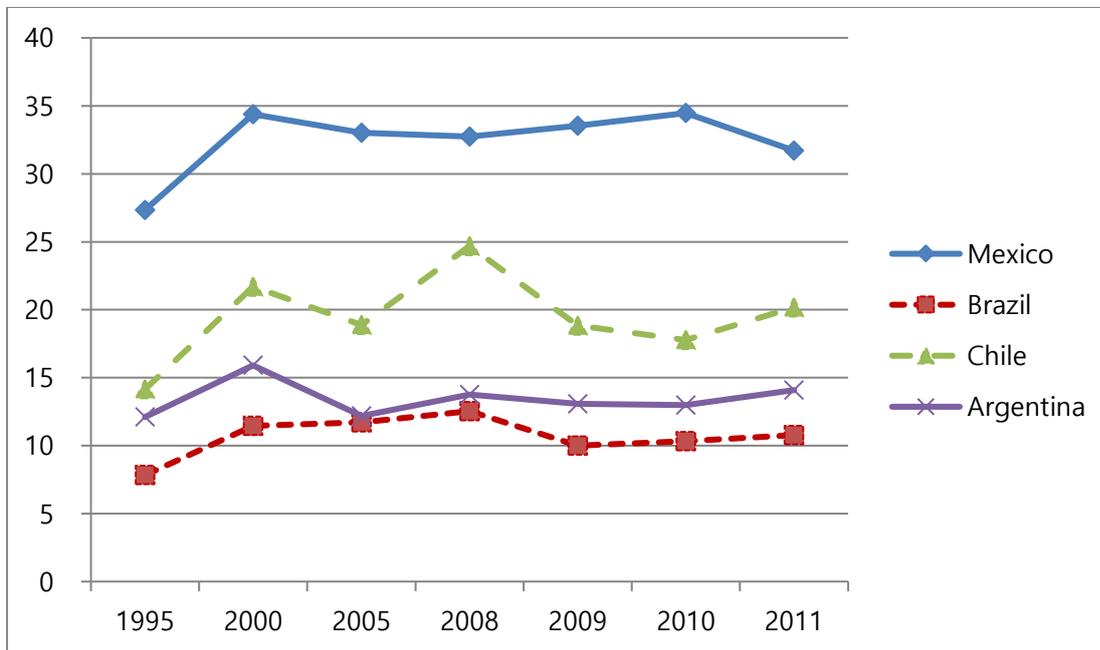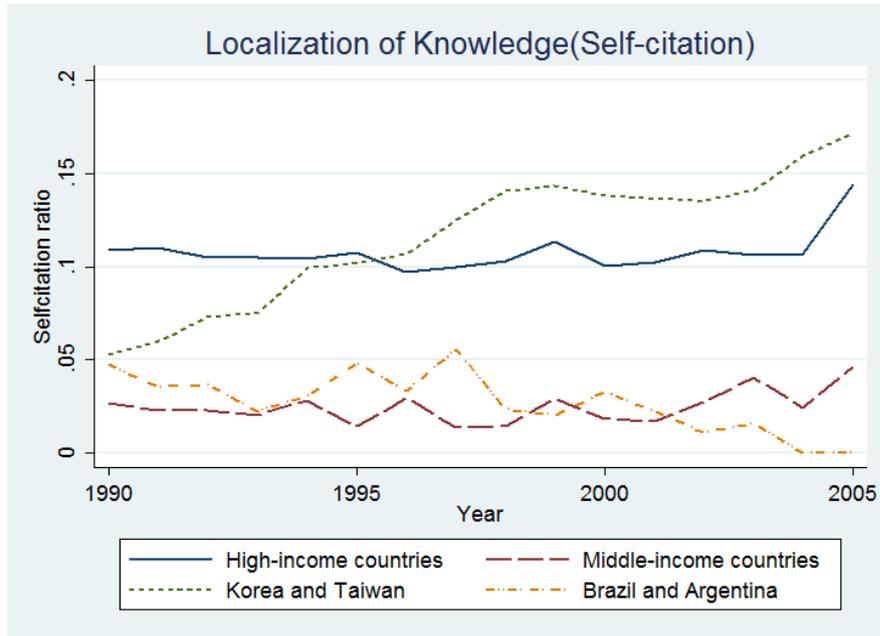

Source: OECD TiVA

Figure 7: localization of Knowledge creation & diffusion (1990-2005)

Source: Estimations using the NBER data available at (www.keunlee.com)

Appendix Table 1: Descriptive statistics and correlations

	No.Obs.	Means	Sd.	FVA	Self-citation	Per cap GDP	PC GDP2	Population	Manuf_vadd
FVA	141.00	23.64	10.73	1					
Self-citation	127.00	0.09	0.14	-0.18	1				
Per cap GDP	141.00	21459.80	12884.56	0.20	0.44	1			
PC GDP2	141.00	625000000.00	679000000.00	0.27	0.40	0.94	1		
Population	141.00	91.72	231.89	-0.06	0.05	-0.35	-0.22	1	
Manuf_vadd	127.00	19.16	5.85	0.41	-0.12	-0.40	-0.38	0.24	1