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

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Abstract

This paper puts forth a hypothesis that while at the initial stage of growth by a latecomer, more participation at the global value chains (GVC) is desired to learn foreign knowledge and production skills, functional upgrading requires effort to seek separation and independence from existing foreign-dominated GVC, and that latecomer firms and economies might have to re-seek an integration back into GVC after building up their own local value chains. This paper attempted to verify this "In-Out-In Again" hypothesis by looking into cases of "upgrading and independence" in Korea and Brazil, and by checking the national level data of the share of foreign value-added (FVA). Trends of FVA in successful catching-up economies, including China in recent years, are consistent with this In-Out-In Again pattern. Regression results also confirm correlations between the degree of local creation and diffusion of knowledge and FVA values. This finding can be viewed as an important contribution because the relationship illustrates the linkage between innovation system variables (knowledge localization) to the GVC variable of the FVA. This finding further implies that building local innovation systems is the key in making possible upgrading and local value creation while integrating in the GVC.

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

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1. Introduction

A rising trend has been observed in the international integration of the economies and globalization of production over the last decades, particularly since the rise of the World Trade Organization (WTO), which promotes open international trade. Thus, as supply chains became global in scope and more intermediate goods are traded across borders, the concept of global value chains (GVC) became more relevant in the understanding of emerging economic relations (UNCTAD, 2013). The concept helps in setting a framework to understand how international supply chains link economic activities at the global, regional, national, and local levels within particular industries (Gereffi, 2014). Value chain refers to the series of value-creating activities that transform raw or intermediate materials into finished products. The key issue identified in studying value chains is the question on whether the 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 pertains to the power relations among actors involved in the activities. Gereffi (2005) discusses five modes of governance, which range from the most power-asymmetric mode of hierarchy and captive modes to less asymmetric modes of relational and modular modes, and up to a 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, which include process, product, functional, and intersectoral. 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, while functional upgrading refers to acquiring new, superior functions in the chain, such as design or marketing, and 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 occurring to a certain extent, but functional and intersectoral upgrading are rare. More recently, Pietrobelli and Rabellotti (2011) observed that the GVC approach has focused less on how local, regional, or national institutions condition the upgrading opportunities of business activities, and pointed out potential supplementary role by Schumpeterian or innovation system perspectives.

Innovation systems (IS) refer to the elements and relationships that interact in the production, diffusion, and use of new and economically useful knowledge at the national, sectoral, and firm levels (Lundvall, 1992; Malerba, 2005). 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, consequently influencing the economic performance of countries and their firms. Compared to the GVC school of thought, the Schumpeterian school places more emphasis on the "within-nation" variables than international variables affecting economic growth.

A call to integrate the two approaches, GVC and IS has been emerging, with the recent initiatives by Lundvall (Lundvall, 2015, 2016). The current study can 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. If an economy decides to pursue a more independent path for industrialization (industrial policy), the economy should arrange access to learning (foreign knowledge), which in turn means a certain degree of openness to GVC (or global knowledge flow). However, merely 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 determine the "right and dynamic" mode and ways of engagement with GVC, with the long-term goal of building and upgrading own "local chains for value and knowledge creation," thereby leveraging a bigger piece of the pie from the global profit. The motivation of the current study is that while joining GVC appears to be necessary for learning, the risk in being stuck in low value-added activities without making a progress toward higher tier in the value chains exists, consequently causing the economy to fall 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 a battle for this position may occur among the key involved parties. Hence, the GVC perspective is limited in providing tips for winning in this battle because GVC tends to, at least implicitly, assume that leadership (or flagship company roles) in sectors continue to remain in the hands of the firms from the North. In this sense, GVC is still confined to the old product lifecycle theory perspective (the North is always the leader, with the South to inherit mature segments from the North). The static view (five governance modes) or linear view also continues without paying attention to the dynamic changes among the five governance modes, and without much attention to independent upgrading by Southern firms, and assume a view that more integration to GVC is always better.

An alternative theoretical framework is "catch-up cycle" theory (Lee and Malerba, 2017), which acknowledges the possibility and reality that latecomer firms and industries that 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 more integration to the GVC is desirable at the initial stage, upgrading requires that the latecomer firms and industries exert effort to enter a different stage where temporary separation occurs from the existing foreign-dominated GVC, although these firms might have to seek for more openings to integrate once more in the GVC after upgrading. This view is consistent with observation by Amsden and Chu (2003) that a form of national ownership is needed eventually to build local value chains. This dynamic sequence of "first In, then Out and then In Again" will be the focus and hypothesis of this paper.

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The rest of the paper is organized as follows. Section two is devoted to theoretical discussion, which centers on the possibility of functional upgrading in the three-stage model of the OEM-ODM and OBM in the manufacturing sector. In section three, the "In-Out-In Again" hypothesis is illustrated first by looking into the cases of "upgrading and independence" in Korea and Brazil.

Section four verifies 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 factors determine the share of foreign value-added, which is termed 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 FVA. This result can be regarded as an important contribution because a linkage is verified between innovation system variables (knowledge localization) to the GVC variable of the FVA. Summed together, these findings imply that building local innovation systems is the key in making possible the upgrading and local value creation after 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 have very rarely occurred. In contrast, Lee and Mathews (2012) and Lee (2013: 22-23) find 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. Those studies called the upgrading as "double upgrading" and consider both intra- and inter-sectoral dimensions. Their argument is that Korea and Taiwan achieved this double upgrading, thereby enhancing 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 GVC tends to cause wage rates to rise accordingly, new cheaper labor sites in "next-tier down" countries can emerge to replace a country's position in the GVCs. This condition forces firms to move up to higher value-added activities in the same industries or lose price competitiveness gradually and decline as the orders from the MNCs will move to other countries. The case of the footwear sector in Brazil is an example and will be discussed in next section.

In this debate on upgrading within GVC, particularly functional upgrading, the three stages of OEM-ODM-OBM have often been the key framework of understanding (Hobday, 2003). The OEM is the first step in catching-up among East Asian manufacturers. Own Design Manufacturing (ODM) is the second step of catch-up where manufacturers can depart from simple jobs, such as assembling, and begin involvement in production design. Own Brand Manufacturing (OBM) is the last step, and

refers to when these manufacturers perform independently all 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.[1]

However, the transition from one mode to the next is not easy, especially in the transition to OBM, because this step involves several risks, including counterattacks from flagship firms in existing GVC or 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 sectors in Brazil. Thus, this stage can be prolonged by a slowdown, which may even lead to decline in sales or market shares and, eventually to a possible crisis for firms attempting this functional upgrading. For instance, in the case of consumer goods, former vendor companies (brand owners) often stop giving OEM orders to destroy the company that has begun to sell their competing brands (Lee et al., 2015). In the case of capital goods, incumbent companies suddenly charge predatory prices in the market once they realize that latecomer firms have become successful in developing their products, which poses the threat of competition against products of the incumbent. In certain cases, the incumbent reacts by filing lawsuits against the latecomers, and claiming that the latter copied their products. In other cases, 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 firm. The aversion of former buyer firms toward their suppliers to becoming OBM has been documented in earlier studies on Latin America, such as Giuliani, Pietrobelli, and Rabellotti (2005), and Navas-Alemán (2011).

This possibility of interference by incumbent leading firms in the GVC implies that functional upgrading to OBM often requires a fight for independence against leading firms in the GVC. This recognition is in some degree in contrast with several studies in GVC literature that have tended to concentrate on collaborations between the flagship firms in the West and firms in the South (Ernst and Kim, 2002; Sturgeon and Lester, 2004). Latecomer firms from the South certainly have the option of no fight and no associated risk, but could choose 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 because it may lead to stable growth for a while. However, in the longer term, the strategy is often uncertain as new late entrant firms emerge from the next tier in catching up countries, and offer lower wages and costs (Lee and Mathews, 2009). The limitations of this dependent catch-up strategies are shown in the case of other countries reported in previous studies (Van Dijk and Bell, 2007; Rasiah, 2006).

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

In terms of ownership of value-created in the GVC, the process of upgrading from OEM to ODM and finally to OBM is the process of creating more value locally and obtaining a certain degree of independence from the flagship firms in the exiting GVC. Another critical matter is to identify as a final goal for the firms to eventually have a form of local ownership, otherwise, building independently would be difficult (Amsden and Chu, 2003). Although Taiwan has been more dependent on foreign MNCs than Korea, it also eventually created locally owned big businesses, thereby joining the status of high-income economies. Lee et al. (2013) confirm that both Korea and Taiwan have created a critical number of global big businesses relative to the size of their economy. By the early 2010s, Taiwan had 8 companies included in Fortune 500 class companies and Korea had 13 such companies.

The above discussion leads us to formulate the hypothesis that while at the initial stage, more integration to the GVC is desirable to learn from foreign sources of knowledge, functional and sectoral upgrading requires effort or a stage of seeking a separation and independence from the existing foreign-dominated GVC. Then, latecomer firms and economies might have to seek more opening or integration after building their own local value chains. This dynamic sequence of "First In, Then Out and Then In Again" would generate a non-linear curve in terms of the degree of participation in the GVC, as measured by FVA (share of foreign value-added in gross exports of an economy).

Lee (2005) and Chapter 7 of Lee (2013) illustrate that the first phase of participating in the GVC is to obtain operational knowledge or skills in the mode of 'learning by doing' participating in the arrangement of OEM or FDI. The intermediate stage of separation, which would require building capabilities in designing, R&D, and marketing, will be illustrated in the following sub-section will be illustrated in the following sub-section, relying on Lee et al (2015) and Lee (2005) which discuss learning at different stages in details. The last phase of re-increasing GVC participation tends to emerge when the firms would often become internationalized in production, facing rising domestic wages, and relocating their factories to lower wage sites, as exemplified in the next section by stories of Korean firms, which included SMEs and big businesses. Thus, we hypothesize that the trend of the FVA would increase initially (during the low and lower middle income stages), then decline at the upper middle income as they try to create more local value-added, relying less on GVC, and finally increase again at the 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. Case of Korean Firms attaining independence from the GVC

Works, such as Hobday (1994) and Kim (1997), have noted that the involvement of latecomer firms with the GVC in the form of 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), who called it the "OEM trap." For example, more than 500 OEM plush toymakers operated in the mid-1980s in Korea. Currently, the number is almost zero because most of them either went bankrupt due to the rise in domestic wages and the entry 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 (*Aurora World*). The CEO (Mr. Roh) of this company explained that while he made a fortune in the 1980s via OEM, he 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. These circumstances forced Mr. Roh to take the risk of trying to become an OBM. The limitation of the OEM-based catch-up strategies are 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 to the ODM or OBM mode is not easy and involves risks and challenges. The first challenge is 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, several firms started out in emerging markets and entered developed countries later. The emergence of new and less costly marketing channels served as a window of opportunity for several latecomers.

Other risks involve interfering behavior or even direct attacks from incumbent firms. Counterattacks from incumbent firms presented several forms of significant risks, including sudden disconnection in supplier relationship, litigation over IPRs, and price wars or dumping. The most common is the deterring action 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, incumbent vendors cancelled and stopped their OEM/ODM orders to prevent the company from rising as a new brand owner. The sales of the company declined from 1991 when the firm took the road to being an OBM, and stagnated for five 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). An interesting note is that the shape of the sales of this company is similar to the hypothesized in-out-in shape itself (rising-decline

and rising again). The FVA rose again eventually because these firms all become internationalized. For instance, Aurora World, although an SME, had all relocated its factories to Southeast Asia or China, with only R&D and headquarter functions remaining in Korea.

Lee et al. (2015) illustrates the cases of risky but successful transition toward OBM, such as Aurora World, Shimro Musical Instruments, and HJC Helmets, which produce toys, musical strings, and helmets, as their main competitive items, respectively. These firms 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.

While the above are examples from SMEs, the Korean success in overall industrial upgrading beyond the middle income trap was possible because many big businesses went through the similar process of functional upgrading from OEM to OBM. A notable example is Hyundai Motors, which started as an OEM that assembled parts for Ford (Lee, 2005). During its establishment in 1968, Hyundai Motor had an assembler agreement with Ford for 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 become 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 a Mitsubishi engine (Lee and Lim, 2001). Then, when Hyundai wanted to develop and produce its own engines and transmissions, Mitsubishi refused to help or teach Hyundai about engine technologies. Hence, Hyundai had to take another risky road for independence of developing its own engines. This eventual separation is expected in the long-term journey of upgrading within the GVC.

Participation in the GVC is helpful as long as the forerunner firms provide product or process designs for latecomer firms. However, as technological capabilities of latecomer firms grew, the firms felt the increasing difficulty of buying or obtaining licenses 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 be considered a "crisis" for the catching-up firm (L Kim, 1998). The crisis means that products are available for the latecomers to imitate, but no design is available from the incumbent producers who are reluctant to transfer the design technology. To overcome this crisis, latecomer firms have to acquire design technology, or to learn how to design existing products.

3.2. Case of the footwear sector in Brazil

Brazil is the world's third largest footwear producer, with approximately 7,700 producers. In 2015, this sector produced 944 million pairs of shoes and exported about 124 million pairs to more than 150 countries (Grendene, 2016).[2] Although many regions of Brazil produce footwear, the province of Rio

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

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 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 the growth phase, which was characterized by the increasing integration into the GVCs controlled by large international buyers. Figure 1 shows the rapid expansion of the sector's exports and the number of pairs of shoes. The figure also shows the decline since the mid 2000s, with the peak at of 2004. This pattern is true at the national level as well as for the region of Rio Grande do Sul. In the second phase, which began from the 2000s, shows the gradual decline because of increasing competition from China and the limitations associated with the subordination of local shoe companies to large GVC. Hence, this period is also a time to search for new sources and strategies for competitiveness. In this regard, we noted two groups of 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 GVCs, and remained to specialize 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 terms of 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 local technological and training infrastructure. Although this strategy of being integrated into GVC has allowed local producers to gain access to external markets, they are limited in the area of local knowledge creation and development of design, marketing, and own branding capabilities (Humphrey and Schmitz, 2002). Hence, 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 upgrades in terms of functional and intersectoral upgrading. Hence, a gradual and eventual decline occurred, as shown in the Figure 1 (Szapiro et al., 2015).[3]

The second group of shoe manufacturers has 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 most importantly, the

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3 According to our field research, which 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).

development of their own brand (Gredene Report[4] and Arezzo Report[5]). These firms are more dynamic in terms of innovation, which results from the implementation of local learning mechanisms involving either local or external sources of knowledge (Vargas and Alievi, 2003). Thus, 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, several leading firms are identified, including Grendene, Alpargatas, and Arezzo. In contrast to the decline of firms in the first group, these leading companies now account for most of the value of Brazilian footwear exports and are responsible for the increase in the average price of exports of the Rio Grande do Sul footwear industry. As shown in Figure 2, their sales and exports have kept increasing in the 2000s. A brief description of these three firms follows.

Founded in 1971, Grendene is one of the world's largest producers of footwear, with net revenue of approximately US$ 667 million in 2015.[6] The company has exclusive proprietary technologies in the production of footwear for the women, men, and children's markets. Its strategy focused on the development of design capabilities and own brands. The company owns widely known brands, including Melissa, Ipanema, and Grendene Kids, among others. Concerning its brand Melissa, Grendene was able to open shops in New York, Milan, London, and other cities in developed countries. Moreover, the brand has its own mold-producing plant (a factory that produces polymerizing vinyl chloride for its footwear production) and distribution logistics serving both traditional and non-traditional distributors and retailers in the entire Brazil and the export market. In this sense, this firm has a strategy based on vertical integration and control of most of the production value chains in footwear production.

Alpargatas[7] was founded in 1907 as the *Sociedade Anonyma Fábrica Brazileira de Alpargatas e Calçados*. In 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 150 million pairs being made every year. This rate of production made Alpargatas one of the world's largest

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

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

6 Information on Grendene is available through 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

7 Information about regarding 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

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producers of footwear, with net revenue of approximately US$ 1.2 billion in 2015. Notably, Alpargatas owes its relatively high level of revenue to its international operations, which accounts for over 40% of its revenue in 2015.

Established in 1972, Arezzo & Co[8] started in Belo Horizonte. In the 1990s, Arezzo moved its main operations to Sinos Valley, where it conducts its R&D and production outsourcing activities. In the same decade, Arezzo opened its first flagship store at Oscar Freire Street, a commercial center in São Paulo with national and international design brand names. Innovative strategies in sales and operations in the franchise network were also introduced, thereby allowing Arezzo 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 its distribution channels. Currently, the company is considered a leading Brazilian brand of women's footwear, selling over 10 million pairs of shoes per year, apart from handbags and accessories. In 2015, with the company owning portfolios of renowned brands, such as Arezzo, Schutz, Anacapri, and Alexandre Birman, Arezzo holds strong local and global distribution networks comprising franchises and multi-brand stores.

The three mentioned firms possess common strategies of developing their own design capabilities. This effort has been associated with the creation and strengthening of R&D departments and the hiring of professional designers to create new collections of footwear for the national market. This process has resulted in a significant increase in the formalization of R&D activities in the companies (Vargas and Alievi, 2003; Szapiro et al, 2015).[9] Figure 3 showing the cumulative number of the patents filed by these companies at the National Intellectual Property Institute, which confirms the trend of increasing technological capabilities.

Their own technological capabilities and brands have become their basis for leaving foreign firm-dominated GVC, subsequently creating their own value chain and gaining independence from the major international shoe dealers from the US and Europe. With 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 (Szapiro et al., 2015).

[Figures, 2 and 3]

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8 Information on 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

9 More information available at: http://www.abicalcados.com.br; https://www.grendene.com.br; https://www.arezzo.com.br; www.alpargatas.com.br.

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The role of the industrial policy targeted at the development of a dynamic and innovative environment in the Sinos Valley is worth mentioning (Szapiro et al., 2015). During the internationalization phase of the sector (which begun in the 1970s), the main focus was on 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) have focused on technological development and innovation (Vargas, 2002; Calandro and Campos, 2013). However, considering that the same policies were made available to all firms in the regions, the following question remains: what explains the small number of firms surviving the crisis and their continuing expansion? Firm-level decision making and the will to take the road of hard independence appear to be once again the important factors, as was case in the 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 consists of inputs produced and imported from other countries. In other words, the degree of participation with GVC will be measured by FVA, such that higher (lower) values of FVA means additional (or less) integration with the global economy through GVC. This index can be regarded as one of the measures representing 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 verify the hypothesis proposed in Section 2.

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

$$FVA = \mu AM(I-AD)^{-1}E/ET,$$

where $AD=[a_{ij}D]$ is an $n \times n$ matrix of direct input coefficients of domestic products, $AM=[a_{ij}M]$ is an $n \times n$ matrix of direct input coefficients of imported products, n is the number of sectors, E is a $n \times 1$ vector of export coefficients, ET is the total exports of a country across the n sectors, and μ is a $1 \times n$

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

unit vector. Thus, (I-AD)-1 is the well-known Leontief Inverse, namely, the matrix of coefficients for the domestic intermediate product requirement.

[Figures, 4 and 5]

Figure 4 shows the results of the FVA estimations for Korea and Taiwan, and illustrate 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 its peak in the early 1980s. Then, the FVA soon started to decline until the mid-1990s and rose again when Korea joined OECD. FVA in Korea peaked over 36% in 1980 and dropped to 28% in 1993, the year when Korea became an OECD member. Notably, this period between the mid-1980s to mid-1990s is the period of rapid catch-up in Korea according to Lee (2013). Moreover, the early to mid-1980s is the period when Korea was under 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 escaped from the trap by increasing the share of local-value-added in its exports and is also close to our hypothesis of the In-out-In again relationship.

The trend of FVA in Taiwan in Figure 4 is similar to that in Korea, although we have no data for a longer period. A similar decreasing trend was also be observed in Taiwan. The FVA of Taiwan hit the bottom in the late 1980s at the value of 32%. This pattern of Taiwan hitting the bottom at an earlier year than Korea makes sense because Taiwan had an early start in the 1950s (without a civil war as in Korea) and have constantly been leading Korea in every aspect, including per capita GDP until the mid-2000s.

Figure 5 depicts the relationship between the FVA and GDP per capita for these two economies. In this simplified figure, both Korea and Taiwan have a U-shaped path of GVC as the economy grows. This finding suggests that the curves hit the bottom during the stage of the upper-middle income stage with their per capita GDP 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 tried both inter-sectoral and intra-sectoral diversification and upgrading. Intra-sectoral upgrading refers to moving into high-valued segments in a given industry, and inter-sectoral upgrading refers to making entries 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.

[Figure 6, 7]

Figure 6 shows the case of China since 1995, indicating that FVA in China peaked at 37% in the early 2000s and then declined to the level of 31% in the late 2000s. This finding implies that as another successful catching-up economy, China is replicating a similar pattern with some lags (approximately 15 to 20 years) after Korea or Taiwan.

□

Reading from the similar experiences of FVA declines in these successful catching-up economies, a common pattern seems to be that the economies underwent a decade (roughly 10-year period) of the decline of over 5% point of FVA, from approximately 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 few existing economies show a similar pattern (with the 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). Such phenomenon may explain why only Malaysia is now showing some signs of overcoming the middle-income trap, having reached over 47% level of the US per capita GDP in 2015.

Figure 7 shows the cases of economies in Latin America. No existing country had experienced a decline of FVA over the 10-year period. With the NAFTA, Mexico shows the highest degree of integration with the GVC but with no period of decline of FVA to create local value chains. In comparison, the two economies of Brazil and Argentina show extremely low levels of GVC participation, possibly reflecting the resource endowment with orientation to agriculture (Argentina) or mineral exports (Brazil). Chile shows a pattern of short-term ups and downs but no clear period of downward FVA trend over a considerably long period. This pattern of FVA appears 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 attempt to confirm this reasoning.

Determinants of FVA

On the issue of the determinants of the degree of FVA in gross exports, this period of increasing local value-added (or decreasing FVA in Figure 3) in Korea and Taiwan corresponds 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 8. 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 a share of country-owned patents in the total citations made by all patents owned by a country.[11] These values of the degree of knowledge creation and diffusion of Korea and Taiwan were approximately 5% in the mid 1980s, similar to the average middle-income countries; however, these

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11 Following the idea of Jaffe et al. (1993), Lee (2013: 49) measures these variables as the gap between the probability (A) of one country' patents citing its own patents and the probability (B) of the rest of the world's patents citing that country's patents. Formally, (A) is calculated as the share of a country (X) among total citations made by country X's patents, and (B) is the share of a country (X) in all citations made by the entire world, except for country (X). The B part serves as a control group for the purpose of normalization because a country with a large number of patents, such as the US, would naturally have a high degree of (A). However, it turns out that except for an exceptional country like (e.g., US), this normalization effect is negligible, given the very high correlations between this normalized measurement and the non-normalized measure (A). Furthermore, sometimes the subtraction occasionally causes the values to become negative. Thus, this paper uses the simple measure (A) in the graph and the regressions. Actually, the graph of this variable in Figure 9 is quite similar to the normalized version in Lee (2013: Figure 3.1).

values increased to more than over 10% (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. The variable aims to reflect the degree that knowledge being created relies on domestic knowledge bases. In other words, the variable 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 foreign value-added (FVA) or increasing domestic value-added (DVA) implies that increasing local value-added has been supported by or made possible by the increasing degree of locally creation and diffusion of more local knowledge by indigenous actors. In contrast, in other middle income countries, including Brazil and Argentina, this variable of knowledge creation and diffusion remained below 5% throughout the entire period.

[Figure 8]

We show the linkage from local knowledge creation to the FVA by attempting simple regressions to explain the degree of FVA as a function of knowledge localization, per capita income, size of an economy (measured by population), and industry structure (measured by the share of manufacturing in GDP). The regressions use FVA data from 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 confirm that the degree of local creation and diffusion of knowledge is related negatively (positively) to the FVA (DVA), both in the results of pooled OLS and the panel random effect models based on the Hausman tests. Although the relationship may be limited to correlations, it is interesting to note that the correlations imply the linkage between innovation system variables (knowledge localization) to the GVC variable of the FVA.

Our results can be compared with that of Mehta (2016), who attempted to use regression analysis to determine the determinants of the domestic value added (DVA = 1- FVA). Subsequently, Mehta (2016) found that the share of medium skill workers is related positively to the DVA in EU and developing economies, whereas the share of low-skilled workers is related negatively. Given that Lee (2013; Chapter 3) had already proved that a higher degree of the knowledge localization is related positively to faster economic growth (per capita income), the intermediate links between knowledge localization and economic growth are found to be the process of increasing domestic value-creation (reducing relying on foreign value-added) by this study. These results are partially complementary to the finding by Fagerberg et al. (2016) that more FVAs are related negatively 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 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 tends to be more internationally integrated than the 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 being positive and significant. Sample countries used in regressions are mostly middle- or high-income countries, and thus, we cannot generate the entire non-linear curve, but the curve, except the first part corresponding to low-income countries. This U-shaped curve 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 then that level increases again as economies get become highly integrated internationally at high-income levels.

[Table 1]

The following emerging question can be raised: how can we increase the degree of knowledge creation to promote corresponding creations of local value-added instead of foreign value-added? Again, we are searching for answers by looking at the experience of Korea and Taiwan. These economies are widely known to have increased their R&D/GDP ratio rapidly over the catch-up period, compared to with Latin America (Kim and Lee, 2015). In addition they also rapidly increased their college enrollment ratio (Lee and Kim, 2009). Apart from 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), a link between short-cycle technologies and knowledge localization exists, because short- cycle technologies mean less reliance on the existing or old knowledge stock. Thus, specialization into short short-cycle technologies means a higher chance to increase quickly the increase in degree of knowledge localization. In sum, this finding implies that delving further into the short-cycle technology-based sectors would facilitate the increasing degree of locally value-added in industry, as well as that of the local creation of knowledge. Increasing specialization into short-cycle sectors can be considered as a feature of inter-sectoral diversification and upgrading into new sectors and new value segments. In this sense, these variables of knowledge localization (national self-citation) reflect both intra- and inter-sectoral upgrading, which explain the changes in FVA and DVA.

5. Summary and Concluding Remarks.

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This paper put forth the In-Out-In again hypothesis that while at the initial stage of growth, more participation at GVC is desirable to learn from the outside and that functional upgrading requires some effort or stages of seeking separation and independence from existing foreign-dominated GVCs. Latecomer firms and economies might have to seek 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 a non-linear curve in terms of the degree of participation in the GVC measured by FVA (share of foreign value-added in gross exports of an economy). Hence, we hypothesize that the trend of the FVA would increase initially (during the low low-income and lower middle middle-income stages), and then decline at the upper middle middle-income stage when they attempt to create more local value-added (relying less on GVC), and finally increase again at high-income stage with the now enhanced innovation capabilities and reintegration into the GVC.

This paper has attempted to illustrate this 'In-Out-In again' hypothesis initially by looking into cases of 'upgrading and independence' in Korea and Brazil, and then checking the national level data of FVA and the determinants of the FVA. The successful case of the rise of latecomer firms in Korea and Brazil have tended to start from the participation in and learning from GVC at the earlier stage, and then switching to achieve independence not only in production but also marketing and branding. However, 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. Avoiding the road toward independence might be a short-term option but such option cannot be sustained in the long run because the leading MNCs in the existing GVC are always looking for cheaper wage sites and contract firms, as shown by cases of firms in the footwear sector in Brazil.

The paper then attempted to verify the hypothesis by using aggregate, national level data and presenting the trend of the share of FVA in selected economies. The trends of FVA in successful catching-up economies, such as Korea, Taiwan, and China in recent years, are shown to be consistent with the In-Out-In again pattern, with the increasing values of FVA at the earlier period (at low income stage) or before the 1980s. The trend is shown to be declining and increasing again in the most recent period. This finding is different from the view of Fagerberg et al. (2016) that participation in GVC does contribute even at the low-income stage. Our view is that low-income groups of economies should be engaged in GVC to absorb and learn foreign knowledge, such as learning by exporting in the OEM mode, which was a common practice in the early stage of growth in East Asia.

The paper also presented regression results that confirm the correlations between the degree of local creation and diffusion of knowledge and the values of FVA. This finding 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 previously that a higher degree of this knowledge localization is related positively to faster economic growth, this study reveals that the intermediate links include this process of

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

In a sense, this study is a call to see both the perils and potentials of the GVC. The peril side emerges because the GVC may simply be a global profit maximization led by MNCs, driven by the waves of global financialization, which squeezes the profits from the lower tier of GVCs. Such attempt is 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 should also be considered; 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 the 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 appear to include a 'decision and will' to attempt at the eventual independence based on the indigenous ownership of the firms.

In terms of the role of the NIS in each stage, it can be said that while the role of the NIS at the first stage is to supply the workforce with primary and secondary education, as well as physical and social infrastructure to attract FDI, its role at the 'out-stage' would include the government helping domestic firm in their effort at seeking independence, including offering help in the case of IPR disputes with incumbent firms, especially patent trolls. As discussed in Lee et al. (2015), the Korean government has adopted several policy measures, such as selling commercial insurance against possible IPR lawsuits, service to conduct pre-marketing or exporting investigation of possible legal disputes, and package consulting for SMEs that have faced IPR lawsuits with foreign entities. In general, industrial policy cannot perform the whole magic but may render some help and assistance in terms of promoting and building the sector and national level innovation systems beyond the firm boundaries, as argued in the catch-up cycle perspective of Lee and Malerba (2017), which considers the industrial policy as another possible window of opportunity.

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

	Pooled OLS		Random Effect	
	(1)	(2)	(3)	(4)
	FVA	FVA	FVA	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 that expresses the degree of creation and diffusion of knowledge in a country; PC GDP2 is the 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
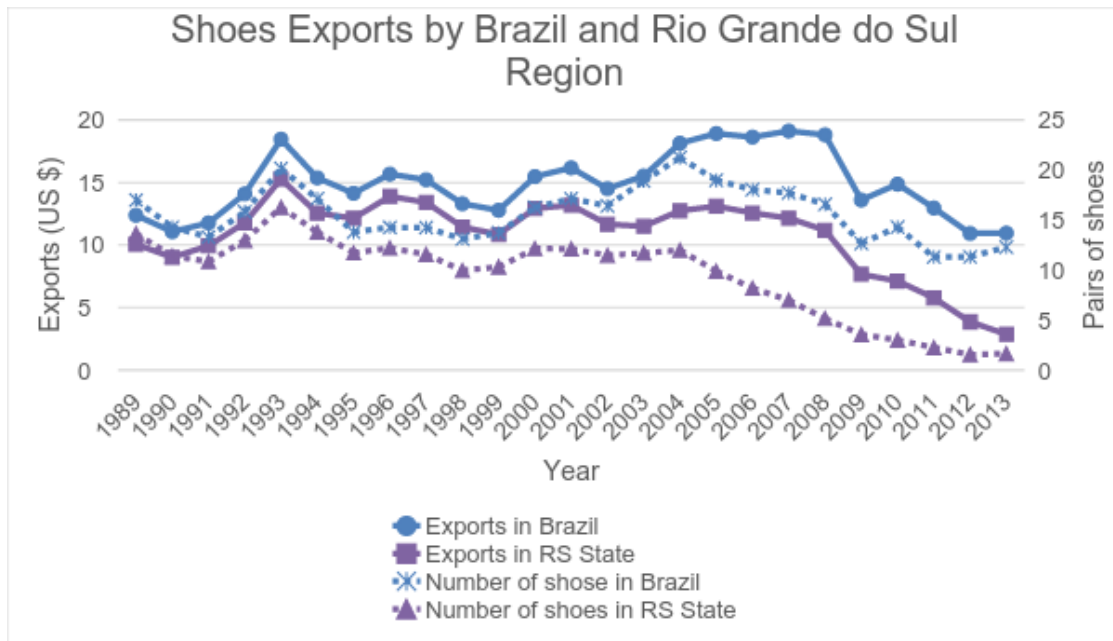
Source: Souza (2014)

Figure 2: After-Tax Sales (R$ million) of leading firms
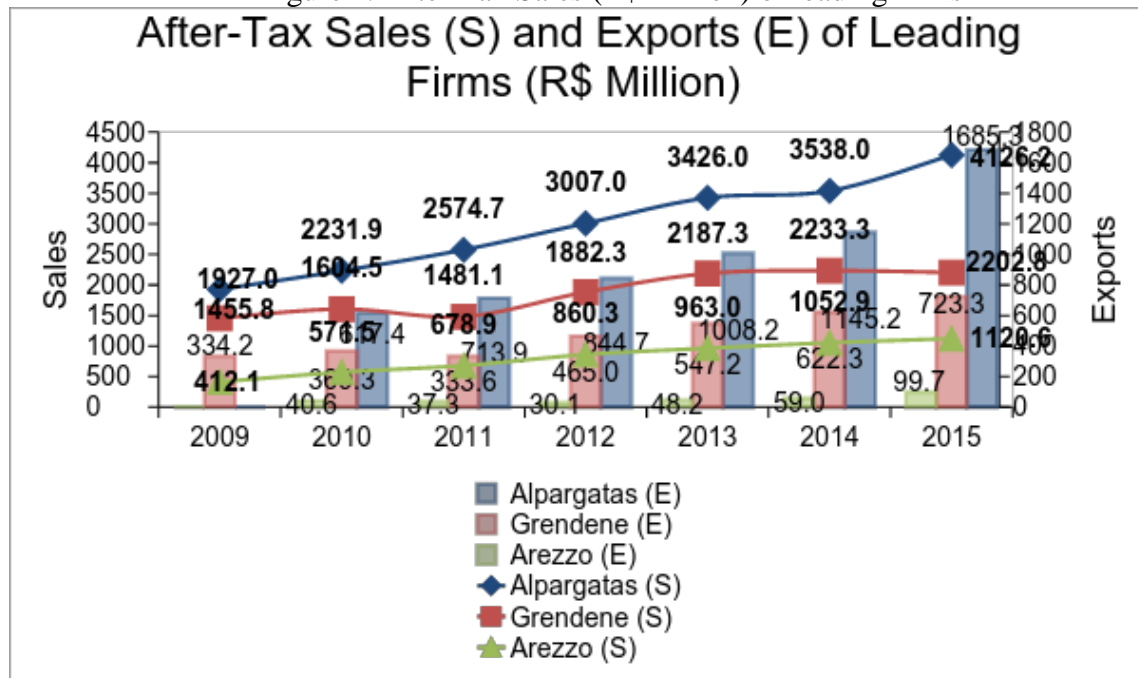
Note: Data on Alpargatas and Arezzo's exports for 2009 are not unavailable. Data on Arezzo's exports were calculated based on the information of the share of exports of gross revenue. The same share was applied to the after-tax sales to provide the information on Arezzo's exports for the years 2010–2015.

Figure 3: Cumulative number of patents of Grendene and Alpargatas
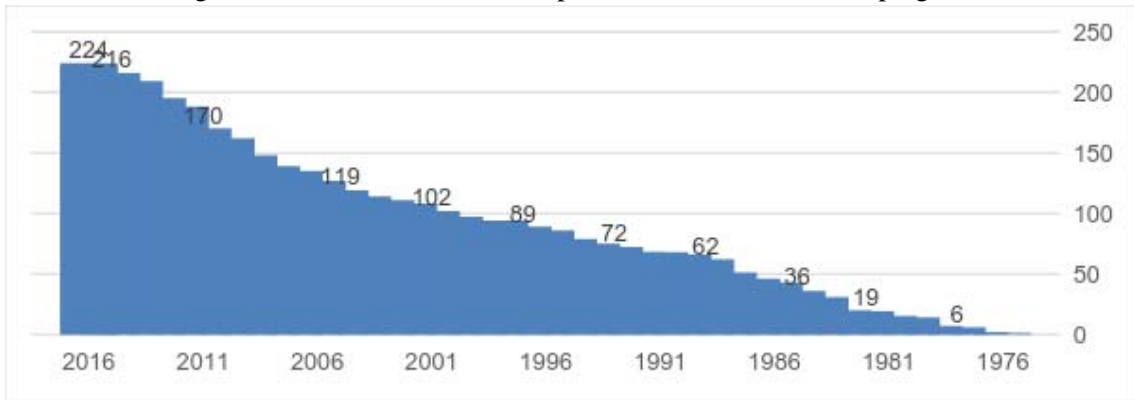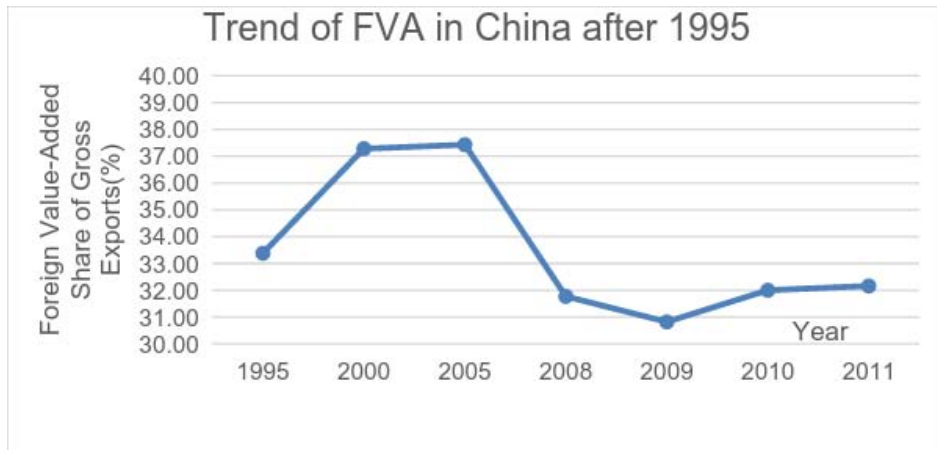
Figure 4: Trend of FVA in Korea and Taiwan
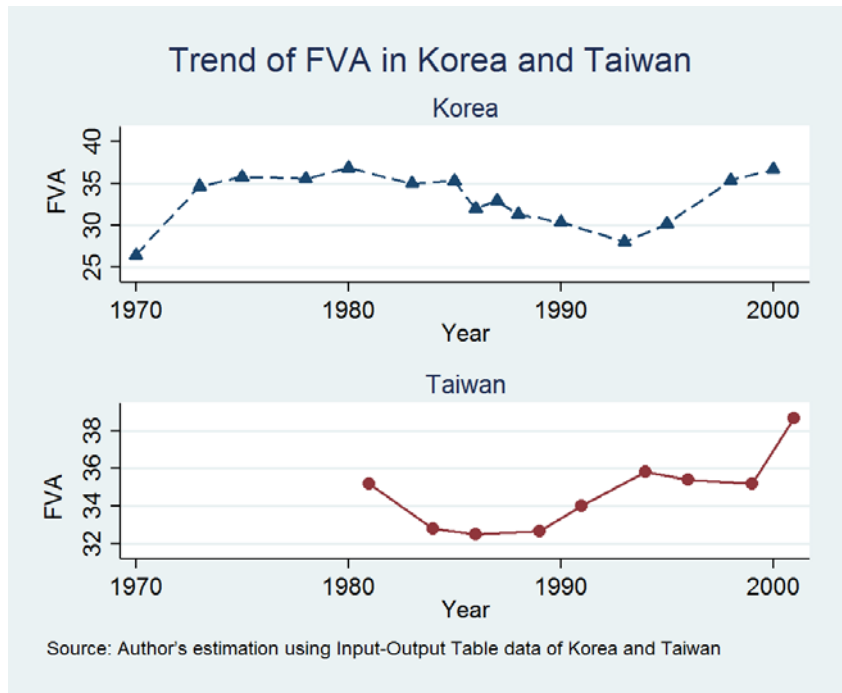
Note: FVA data are from author's estimation using the Input-Output Table data of Korea and Taiwan.

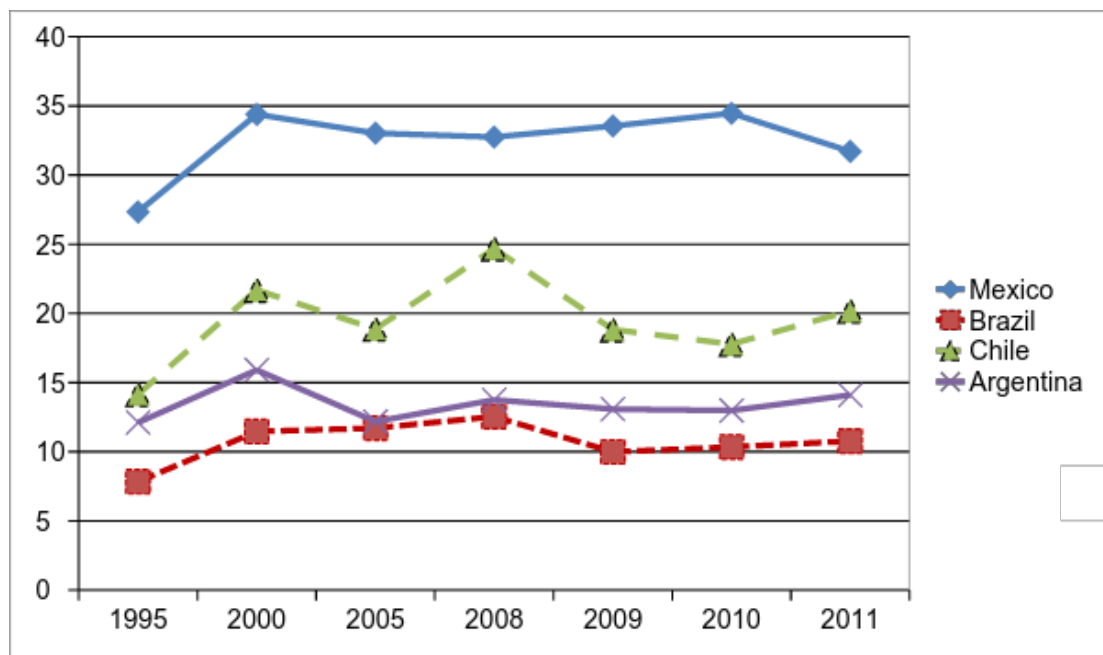Figure 5: Trend of FVA and GDP per capita in Korea and Taiwan
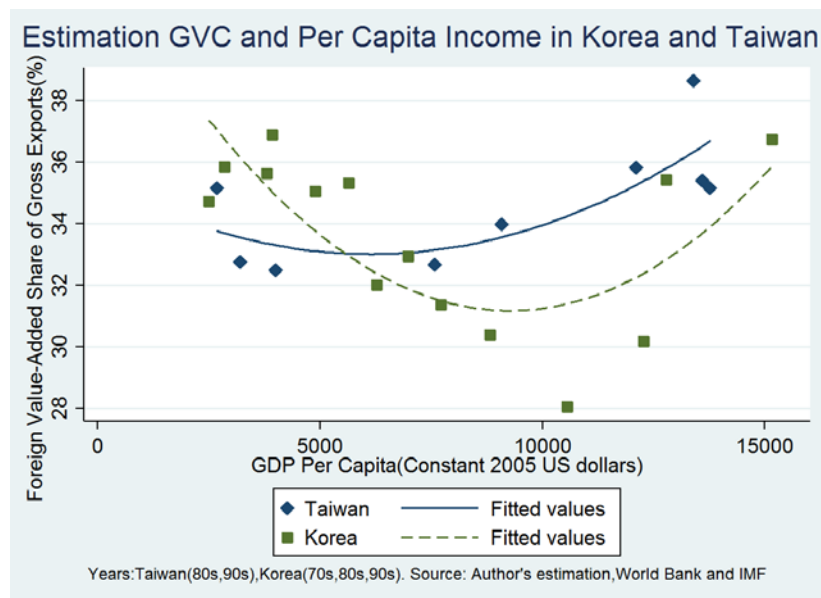
Notes: GDP per capita data of Korea are from the World Bank, and GDP per capita data of Korea are from IMF.

□

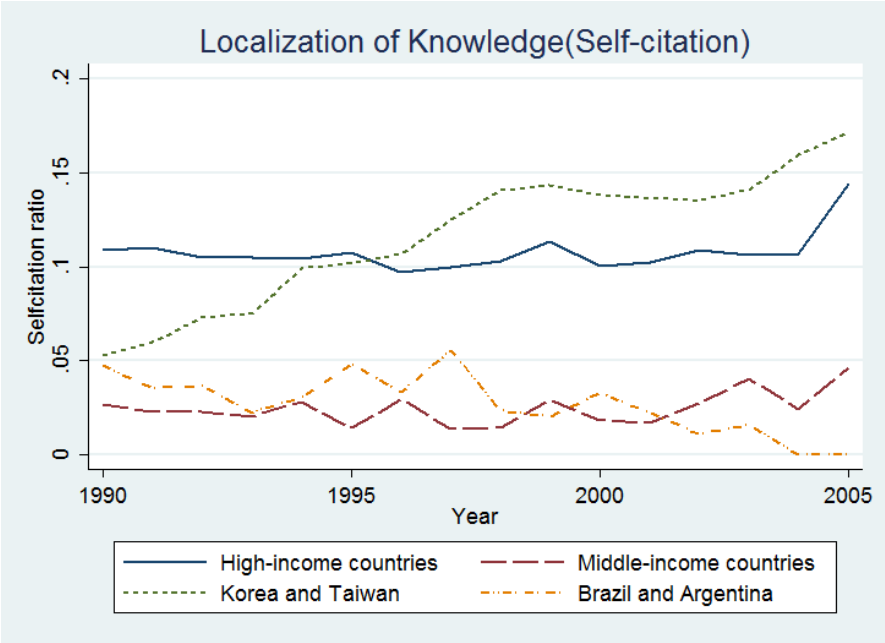Figure 6: Trend of FVA in China after 1995

Source: OECD TiVA

Figure 7: Trend of FVA in four economies in Latin America after 1995

Source: OECD TiVA

Figure 8: Localization of knowledge creation and diffusion (1990–2005)

Source: Estimations using 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