A Review of the Literature on Productivity Impacts of Global Value Chains and Foreign Direct Investment: Towards an Integrated Approach

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Abstract

Although information spillovers from multinational enterprises to local firms in developing countries are examined in the literature on global value chains (GVCs) and foreign direct investment (FDI), GVC and FDI studies are carried out independently and separately. On the one hand, GVC studies are insightful but largely descriptive and conceptual, without undertaking rigorous hypothesis testing. On the other hand, FDI studies are quantitative, with a focus on the impacts on the productivity of local enterprises in developing countries; however, their frequently used estimation functions suffer from several restrictive assumptions. The presented review of previous GVC and FDI studies shows that these two strands of the literature are both interested in information spillovers as well as the absorptive capacity of domestic enterprises and the

backward linkages between foreign and domestic enterprises, even though their theoretical perspectives differ substantively. This literature review concludes that an integrated approach that incorporates the insightful perspective of GVC studies into the empirical specification of FDI studies would likely lead to more meaningful empirical findings that may reveal the mechanisms behind the productivity improvements of local enterprises in developing countries in greater depth.

Keywords: foreign direct investment, global value chains, information spillovers, absorptive capacity, backward linkages, integrated approach

JEL codes: F21, F23, F63, O33

1. Introduction

Information or knowledge spillovers from the internationally dispersed activities of multinational enterprises (MNEs) to domestic enterprises are an important source of technological progress in developing countries. For example, the World Bank (2012) points out the importance of foreign direct investment (FDI) for job creation in developing countries through the effect of information spillovers on productivity improvements. UNCTAD (2013) discusses the extent to which local enterprises in developing countries

benefit from participating in global value chains (GVCs) in terms of increases in value-added, employment, income, and exports. Indeed, the majority of developing countries have attempted to attract FDI by setting up investment promotion agencies (Harding and Javorcik 2011), and developing countries have recently began to absorb more FDI than developed countries have.[1]

The impact of such internationally dispersed activities of MNEs on productivity improvement of local firms in developing countries is the main subject of both FDI and GVC studies. The main interests of FDI studies lie in the empirical elucidation of the impacts of knowledge spillovers from FDI on domestic firms' productivity in host countries and the identification of factors that affect the strength of such spillover effects, with many statistical analyses on this topic.[2] In contrast, GVC studies on the productivity impacts are largely descriptive and conceptual; their main interests are exploring why domestic firms have specific types of relationships with lead firms in developed countries, termed "GVC governance" in the literature (Gereffi et al. 2005).[3]

However, these studies are carried out independently or separately. For example, none of the representative empirical studies of the impacts of FDI inflows on the productivity of domestic firms in developing countries, such as Aitken and Harrison (1999), Javorcik (2004), and Javorcik and Spatareanu (2008), refers to seminal GVC

studies such as Humphrey and Schmitz (2002) and Gereffi et al. (2005). On the contrary, GVC studies focus on the role of global buyers rather than MNEs, even though both global buyers and MNEs are potential sources of new useful knowledge. Only a few studies (e.g., Murakami and Hernández 2016) analyze the spillover effects of FDI on the upgrading of production activities in developing countries, while applying the analytical concepts and tools of both FDI and GVC studies. Nonetheless, considering that shifting production bases from developed to developing countries can be achieved by either relocating a production base from a parent company to its foreign affiliates (i.e., FDI), which, in turn, use local suppliers, or by outsourcing the production of goods and services to local suppliers or third-party providers by creating GVCs, both GVC and FDI studies are bound to have common interests. Note that although after path-breaking study of Antràs and Helpman (2004), a number of empirical studies analyze MNEs' organizational choice of GVCs (i.e., FDI versus foreign outsourcing),they do not analyze the productivity impacts of MNEs on local part-suppliers.[4] These studies, therefore, are outside of the scope of the present literature review.

Based on a review of the literature on the productivity impact of GVCs and FDI, this study finds that these two strands of research are commonly interested not only in technological and managerial information spillovers but also in the absorptive capacity

of domestic firms and the backward linkages between foreign and domestic firms. In addition, this study demonstrates the significant scope for empirical research to make new contributions to the literature on the impacts of FDI on industrial development in developing countries by incorporating the insightful perspective of the GVC approach into empirically rigorous FDI studies.

The rest of this paper is organized as follows. The second section discusses the major contributions and shortcomings of GVC studies from the comparative viewpoint of FDI studies. The third section reviews the major findings of existing studies of the channels of knowledge spillovers from FDI and their impacts on productivity as well as the determinants of FDI spillovers in developing countries. Based on this review, this section also presents an integrated econometric approach to FDI studies. The fourth section makes further suggestions for enriching FDI studies by incorporating the insightful perspective of GVC studies. The final section concludes and suggests new areas of research useful for industrial development policies in developing countries.

2. Research on GVCs

2-1. Topics of GVC studies

GVCs are defined as “fragmented supply chains, with internationally dispersed tasks and

activities coordinated by a lead firm" (UNCTAD 2013, 125). GVC studies typically aim to explore 1) the typology of local firms' relationships with lead firms (i.e., GVC governance) and 2) the relationships between GVC governance and the type of upgrading (i.e., increase in value-adding activities; Humphrey and Schmitz 2002; Giuliani et al. 2005). Specifically, upgrading is defined as "the capacity of a firm to innovate to increase the value added of its products and processes" (Giuliani et al. 2005, 550).

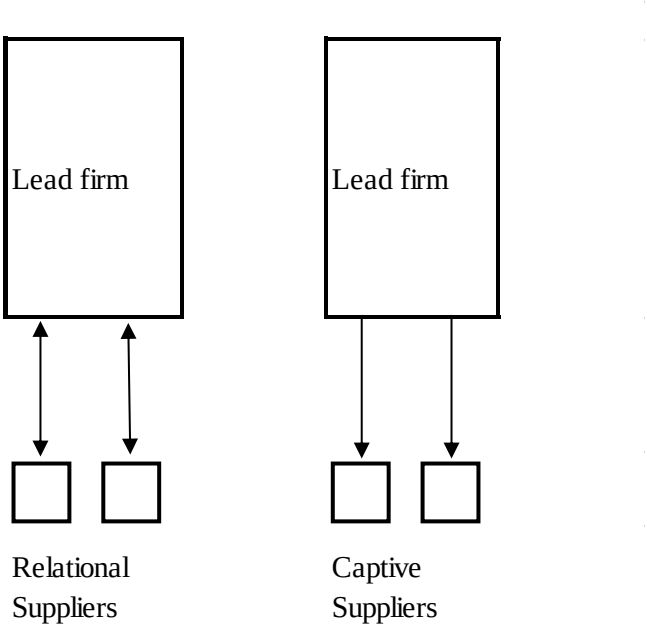
Gereffi et al. (2005) argue that GVC governance is determined by three factors: the complexity of transactions, ability to codify transactions, and supply base capabilities. We assume that the complexity of transactions is closely associated with transaction costs, the ability to codify transactions refers primarily to the ability to codify production systems, and supply base capabilities encompass those of production and management. Thus, if transaction costs are high, the codification of the production system is difficult, and local producers are incapable, the lead firm internalizes its production activities by setting up its own affiliates (i.e., FDI). Gereffi et al. (2005) label this governance type "hierarchy." However, they do not discuss transactions between foreign affiliates and local firms, which is one of the key issues in FDI studies. On the contrary, if transaction costs are high and the codification of the production system is difficult, but local producers are capable of production and management activities, the lead firm outsources

its activities to local producers, with the aim to seek mutually dependent and beneficial relationships. The development of a good reputation, higher trust created by repeated transactions, and family and ethnic ties between the lead firm and local producers can allow such relationships to flourish. Gereffi et al. (2005) label this governance type "relational." Conversely, if transaction costs are high and local producers are incapable, but the codification of the production system is easy, the lead firm outsources its activities to local producers and tightly monitors and controls them. In this case, local firms passively receive materials and production instructions from the lead firm. Gereffi et al. (2005) label this governance type "captive." As Figure 1 demonstrates, information flows in two directions in a relational value chain compared with only one direction in a captive value chain.

In addition to the typology of the relationship between the lead firm and local firms, Humphrey and Schmitz (2002) and Pietrobelli and Rabellotti (2011) discuss the relationships between the types of GVC governance and the types of upgrading. These studies define functional upgrading as a shift to higher value-adding activities within a given value chain, product upgrading as a shift to more sophisticated product lines with higher unit values, and process upgrading as the transformation of inputs into outputs more efficiently by reorganizing the production system or introducing superior

technology within a given type of output (Humphrey and Schmitz 2002; Giuliani et al. 2005).[5] For example, integration into those value chains in which local firms have symmetric relationships with the lead firm (e.g., relational value chains) offers favorable opportunities for functional upgrading, because local producers, which are capable of management activities and have relatively strong bargaining power vis-à-vis the lead firm, can negotiate their assigned tasks in the value chains. On the contrary, integration into value chains in which local firms are under captive relationships with lead firms offer no favorable conditions for such functional upgrading. This case confines local producers to simple tasks and discourages them from engaging in value-adding activities such as production design and marketing because of their low-level management abilities. However, both relational and captive suppliers are interested in upgrading the quality of their products and production processes by learning from their production experience (Humphrey and Schmitz 2002; Pietrobelli and Rabellotti 2011). It is thus likely that relational suppliers would be more successful at upgrading than captive suppliers because of their superior entrepreneurial abilities.

Figure 1. Two types of GVC governance: captive and relational value chains



Source: Authors' own, based on Figure 1 of Gereffi et al. (2005, 89).

Note: The arrows show the directions of order and information.

2-2. Contributions of GVC studies

Based on the conceptual framework of GVC studies, Sato and Fujita (2009) consider functional upgrading to be the action of widening capabilities from production to pre- and post-production management. One example might be the more active participation of local firms in pre-production activities (e.g., marketing research, technology choice and development, and production design) as well as post-production activities (e.g., advertising and marketing). Lead firms usually discourage local firms from participating in value-adding pre- and post-production activities, which are considered to be the core

competencies of lead firms and a major source of their profit (Humphrey and Schmitz 2002). In addition, the debate about the "smile curve" highlights that tasks in pre- and post-production activities tend to generate higher value-added than those in production activities per se, such as manufacturing and assembling (Mudambi 2008; Shin et al. 2012). Thus, the insight of Sato and Fujita (2009) provides an important mechanism behind the productivity improvements of local firms: once local firms obtain higher capabilities as suppliers to MNEs, they participate in relational value chains, instead of captive value chains. This evolution of local firms' relationships with MNEs extends their functions toward high-value-generating tasks related to pre- and post-production activities.

The distinction between captive and relational contracts is similar to the distinction between contracts with "drawings supplied" and "drawings approved" in the automobile industry in Japan (Asanuma 1989). In the former case, suppliers manufacture parts according to the drawings or blueprints that core firms supply, whereas in the latter case, suppliers manufacture parts according to drawings that suppliers provide and that the core firm approves. According to Asanuma (1989), "drawings approved" have become more common over time, replacing "drawings supplied." We consider that this process corresponds to the evolution from captive to relational contracts. How local producers transform themselves from captive to relational suppliers is a major

development issue.

This argument is consistent with the recent findings in the field of development economics that emphasize the role of management practices and managerial human capital in improving the performances of manufacturing firms in developing countries (Bruhn at al. 2010; Bloom et al. 2013; Sonobe and Otsuka 2014; Bloom et al. 2016). In a study of the productivity improvements of acquired plants in Indonesia from 1983 to 2001, Arnold and Javorcik (2009) suggest that foreign firms employ organizational and managerial systems that make the production process more efficient.

2-3. Shortcomings of GVC research

Although this discussion of GVCs closely relates to the inter-industry spillover effects of FDI through the supply of parts and components to MNEs (backward linkages), the analysis of the dynamic mechanism behind the productivity improvements of local parts-supplying firms is not the main concern of GVC studies. Indeed, seminal GVC studies such as Humphrey and Schmitz (2002), Gereffi et al. (2005), and Pietrobelli and Rabellotti (2011) focus on the static categorization of GVC governance and upgrading, rather than the evolution of enterprises from the captive type to the relational type.

Another important reason for the neglect of the evolutionary process of local

industry is that GVC studies, especially early studies such as Gereffi and Korzeniewicz (1994), consider lead firms to be global buyers located in developed countries (e.g., large supermarkets), whose main role is to control or coordinate the GVC without directly engaging in production activities. As mentioned in the second section, GVC studies assume that foreign affiliates engage in independent production without procuring any inputs from local firms. In addition, the empirical foundations for the arguments of these studies are weak: the original studies undertook only conceptual analyses regarding the choice of governance systems, but did not examine their quantitative impacts on the productivity of local firms, which is a major issue for FDI studies. Subsequently, researchers carried out empirical studies of local firms' productivity and the types of GVC governance; however, these studies lacked a rigorous econometric methodology. For example, Pietrobelli and Saliola (2008) empirically analyze the impacts of various types of GVC governance on local firms' productivity in Thailand from 2001 to 2003. However, to what extent their categorization is based on the original concepts of Gereffi et al. (2005) is uncertain. Moreover, although the types of GVC governance are endogenous with respect to firms' productivity, the authors do not deal with the endogeneity issue.

3. Research on FDI

3-1. Channels of knowledge spillovers from FDI

Although numerous studies discuss the channels of knowledge or information spillovers from FDI, there is inconsistency and confusion about their conceptual classification. In general, four major spillover effects are considered to exist: the demonstration effect, labor turnover effect, competition effect (i.e., the effect of the entry of MNEs on market demand for the products produced by competing local firms), and vertical linkage effect (i.e., the externalities derived from the backward linkages between MNEs and domestic firms). However, some review articles such as Saggi (2002), Crespo and Fontoura (2007), and Smeets (2008) assume that the demonstration effect and imitation effect are identical. We argue that we should separate, at least conceptually, free copying, which might correspond to the demonstration effect, from resource-using activities, which might correspond to the imitation effect. This is because we should analytically separate the case of freely appropriable knowledge or technologies of foreign firms from the case in which only domestic firms that expend conscious effort can acquire useful new knowledge. The absorptive capacity of domestic firms is particularly relevant in the latter case. Further, although studies such as Saggi (2002), Görg and Strobl (2005), Crespo and Fontoura (2007), Smeets (2008), and Javorcik (2014) consider the labor turnover effect in addition to the imitation effect, we argue that labor turnover from foreign to domestic

firms is a one way of imitation, as the latter must incur the cost of recruiting and employing new workers.

The major problem with the classifications of existing studies, except for Javorcik (2014), is that they do not differentiate between pure and pecuniary externality effects. Since competition and vertical linkage effects undoubtedly occur through market mechanisms (market competition and purchases as well as sales of inputs), we argue that we should treat these effects separately from pure externality effects. In addition, the vertical linkage effect might accompany pure externality effects if parts suppliers learn from foreign firms through demonstration and imitation. Therefore, we argue that demonstration, imitation, and some sort of vertical linkage are the pure externality effects of FDI, which we should separate from the pecuniary externality effects (i.e., competition effects and some sort of vertical linkage effect such as training) arising from market mechanisms (see Table 1). In the next step, we can classify these four channels of knowledge spillovers from FDI into either inter-industry or intra-industry effects. The competition effect is an intra-industry spillover effect, while the vertical linkage effect is an inter-industry effect. Moreover, since the demonstration and imitation effects might occur between firms in the same industry as well as between vertically related firms (e.g., with regard to management methods), they can be both inter-industry and intra-industry

effects.

The literature deems the demonstration, imitation, and backward linkage effects to improve the productivity of domestic firms (Crespo and Fontoura 2007). However, the competition effect can have both positive and negative impacts on productivity (see Table 1). On the one hand, if intensified competition with MNEs were to induce domestic firms to use existing resources and technologies more efficiently, it would improve their productivity (Görg and Greenaway 2004; Crespo and Fontoura 2007). On the other hand, if this intensified competition were to cause domestic firms to lose their market share, with a consequent increase in their average costs, it would decrease their productivity (Crespo and Fontoura 2007; Javorcik 2014).

Table 1. Impacts of the four channels of knowledge spillovers from FDI on local firms' productivity

	Pure externality	Pecuniary externality
Demonstration	+	
Imitation (Labor turnover)	+	
Competition		－or +
Vertical linkage	+	+

Source: Authors' own.

Notes: + and －indicate that the channel theoretically has positive and negative impacts, respectively, on domestic firms' productivity.

3-2. Empirical assessment of knowledge spillovers from FDI

As Smeets (2008) summarizes, the literature commonly analyzes information spillover effects from FDI by estimating the following function:

(1)

$$\ln Y_{ijt} = \beta_0 + \beta_K \ln K_{ijt} + \beta_L \ln L_{ijt} + \beta_1 Horizontal_{jt} + \beta_2 Backward_{jt} + \mathbf{X}'_{ijt}\boldsymbol{\beta}_3 + \mathbf{Z}'_{jt}\boldsymbol{\beta}_4 + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}$$

,

where *i* indexes the firm; *j* and *k* index the industry; *t* indexes time; *Y* is the value-added of a domestic firm; *K* is capital; *L* is labor; β_k and β_l are the production elasticities of capital and labor, respectively; *Horizontal* is a measure of the presence of FDI in industry *j*, which is usually measured by the foreign firms' share of total employment or output (a "foreign" firm is commonly defined by the share of the equity owned by foreign investors in the given firm);[6] *Backward* is a measure of the presence of FDI in downstream industries supplied by industry *j*; *X* is a vector of the firm-level control variables that are assumed to affect productivity, such as the ratio of R&D expenditure and the level of workers' human capital; *Z* is a vector of the industry-level control variables such as the degree of market concentration and export orientation; α_i is a time-invariant firm fixed effect; α_j is a time-invariant industry fixed effect; α_t is a time effect;[7] and ε is an error

term.

Some studies include a term capturing the forward linkage effect arising from parts-supplying MNEs (Liu 2008; Smeets 2008; Fatima 2016). However, local firms typically engage in parts-supplying upstream industries, whereas MNEs engage in downstream activities. Thus, we consider that the forward linkage effect is not empirically important and do not include its term in equation (1).

We usually measure *Backward* by using the following formula:

(2)

$$Backward_{jt} = \sum_{k \neq j} (a_{jkt} \cdot Horizontal_{kt}),$$

where *a* is the proportion of the output of sector *j* supplied to industry *k*. In other words, *Backward* is greater if the FDI in industry *k* purchases a larger amount of intermediate products from industry *j*. Note that *Backward* is specific to the industry in this specification, implying that this variable captures the effect of inter-industry variations in backward linkages, but not the effect of firm-specific backward linkages. In equation (1), we assume that β_1 and β_2 capture the intra-industry (horizontal) effect and the inter-industry (vertical) effect, respectively.

The literature often estimates equation (1) by using firm-level data in a variety

of industries. However, this frequently used estimation implicitly adopts the following restrictive assumptions. First, the literature assumes that knowledge spillovers, which are flow, affect the level of productivity, which is determined by the accumulated stock of useful knowledge. Second, the spillover effect captured by β_1 is only a demonstration effect, because this term captures the effects that arise without any conscious effort by local firms to learn, implying that it does not capture the spillover effects derived from imitation. Third, the measurement of backward linkages shown in equation (2) is industry-specific and employs highly restrictive assumptions; for example, foreign affiliates, regardless of their nationality, have the same input-sourcing behavior as domestic firms do, as Barrios et al. (2011) point out.[8] Fourth, the spillover effects of FDI are identical across all industries, that is, β_1 and β_2 are identical, which enables the use of firm-level data in different industries to identify the spillover effects. Fifth, different industries have the same production function parameters, that is, β_k and β_l are identical.[9] These restrictive assumptions are likely to lead to biased or imprecise estimations of the regression parameters.

In addition, what the backward linkage variable captures is unclear. If frequent transactions between foreign affiliates and local firms are associated with training of production for workers in local firms by foreign affiliates, its coefficient captures the

training effect. If frequent transactions relate to local firms recruiting workers in foreign firms, the coefficient would reflect the imitation effect. Further, it might not reflect the demonstration effect, since the products produced by foreign firms and local firms are different, even though local firms might copy improved management practices. Thus, the backward linkage coefficient would capture the mixed effects arising from the intimate transactional relationship between the two types of firms. Hence, although we assume that the backward linkage effects are identical among various inter-enterprise relationships, such effects are likely to differ for different inter-firm transactional relationships.

In this regard, the specification of the estimation equation proposed by Griffith et al. (2004) is highly relevant. These authors analyze the determinants of the industry-level productivity growth of 12 OECD countries from 1974 to 1994. Although their original unit of analysis is country and industry, we change the unit of analysis from country to industry and from industry to firm in our discussion. Their specification has several advantages. First, Griffith et al. (2004) assume that knowledge spillovers affect *changes* in productivity, but not the productivity *level*. Todo and Miyamoto (2006) also adopt the same assumption. Second, their specification predicts that the share of R&D expenditure in the *i*-th firm, the technological distance of the *i*-th firm from the frontier

firm in the same industry *j*, and the interaction term between the firm's share of R&D expenditure and the technological distance, affect productivity growth.[10] They also measure the technological distance by using the difference in TFP. In other words, this specification separates the spillover effect automatically derived from the technological distance from the spillover effect derived from the resource-using activities, measured by R&D expenditure. Thus, this specification separates the demonstration effect from the imitation effect. Third, the use of each firm's technological distance from the frontier firm within the same industry allows each industry to have different horizontal spillover effects. Fourth, they use the superlative-index-number approach of Caves et al. (1982), which allows us to estimate TFP by using flexible production function parameters.[11]

Although the specification of Griffith et al. (2004) is highly relevant for FDI research, some revisions are necessary. First, the interests of that study lie in the technological distance from the frontier firm, rather than foreign firms. Second, they focus on the spillover channels between firms in the same industry without considering any spillovers between firms in different industries (i.e., the vertical linkage effect). To address such problems, we revise their specification and discuss the advantages of the revised estimation function later in this section.

3-3. Horizontal (intra-industry) spillovers

Early studies using firm-level cross-sectional data, such as Kokko (1994) and Chuang and Lin (1999), find positive intra-industry spillover effects. However, once controlling for industry- or firm-specific fixed effects by using panel data, the observed positive effects disappear, as Aitken and Harrison (1999), Javorcik (2004), and Liu (2008) find. These findings indicate that the positive impacts observed in the early cross-sectional studies may be generated by the larger presence of foreign firms in more productive industries rather than the productivity improvements brought about by foreign firms (Smeets 2008; Javorcik 2014). Indeed, only a few studies carrying out firm-level panel data analysis find robust positive intra-industry effects, for example for MNEs in the United Kingdom (Haskel et al. 2007) and in the United States (Keller and Yeaple 2009) and for R&D-performing MNEs in Indonesia (Todo and Miyamoto 2006).

By contrast, many of the studies that estimate equation (1) by using firm-level panel data in developing countries find negative intra-industry spillover effects. The major examples are Aitken and Harrison (1999) for Venezuela from 1976 to 1989, Bwalya (2006) for Zambia from 1993 to 1995, Javorcik and Spatareanu (2008) for Romania from 1998 to 2003, Kee (2015) for Bangladesh from 1999 to 2003, Fatima (2016) for Turkey from 2003 to 2010, and Lu et al. (2017) for China from 1998 to 2007.

Furthermore, Javorcik and Spatareanu (2008) find that the negative impacts are smaller in partially owned foreign affiliates (joint ventures) than in wholly owned foreign affiliates, because the former are more likely to use less sophisticated technologies transferred from the headquarters than the latter; thus, domestic firms can more easily absorb such technologies from partially owned foreign affiliates through the demonstration or imitation effects. Interestingly, Liu (2008) finds negative impacts in the short term but positive impacts in the longer term, which might indicate that the spillover effect is likely to arise from imitation, requiring resource-using and time-consuming R&D activity. In addition, some studies find no significant intra-industry spillover effects, such as Haddad and Harrison (1993) for the case of Morocco from 1985 to 1989.

Therefore, the dominant findings in the literature indicate that the negative impacts of the competition effect dominate the positive knowledge spillover effects (demonstration and imitation) in the short term in most developing countries (Javorcik and Spatareanu 2008; Javorcik 2014). Thus, the presence of foreign firms in most developing countries does not unconditionally generate positive horizontal externality effects. In other words, what matters could be the imitation effect but not the demonstration effect, implying that the absorptive capacity of domestic firms is likely to play a role.

Because the studies reviewed in this subsection typically apply equation (1), the estimation results are likely to suffer from the misspecification of the functional relationships. Especially, since these studies assume identical horizontal spillover effects across all industries, they could estimate some kind of average effects across them. Thus, it is likely that some industries have positive horizontal effects, while many others have negative horizontal effects.

3-4. Vertical (inter-industry) spillovers

Before Javorcik's (2004) path-breaking study, the majority of empirical studies of FDI analyzed intra-industry effects.[12] Since the publication of Javorcik (2004), many studies have found positive backward linkage effects based on equation (1) by using firm-level panel data, including Bwalya (2006) for Zambia from 1993 to 1995, Blalock and Gertler (2008) for Indonesia from 1988 to 1996, Javorcik and Spatareanu (2008) for Romania from 1998 to 2003, Javorcik and Spatareanu (2011) for Romania from 1998 to 2003, Barrios et al. (2011) for Ireland from 1983 to 1998, Kee (2015) for Bangladesh from 1999 to 2003, Fatima (2016) for Turkey from 2003 to 2010, and Lu et al. (2017) for China from 1998 to 2007.[13] In her survey article, Javorcik (2014) concludes that inter-industry effects are clearer than intra-industry effects. Further, based on the meta-analysis presented by

Havranek and Irsova (2011, 237), "backward spillovers are economically important, … horizontal spillovers are not statistically different from zero."

The finding that the backward linkage effect is the major channel for the positive spillovers indicates that subcontracting relationships between local firms in upstream industries and MNEs in downstream industries are crucial for improving the productivity of local firms. Thus, the findings of FDI studies strongly relate to the argument of GVC research concerned with the inter-firm governance issues, as discussed in the second section.

3-5. Labor turnover, absorptive capacity, and agglomeration economies

Some studies pay special attention to the role of labor turnover, absorptive capacity, and agglomeration economies in disseminating FDI's useful knowledge to local firms. Both GVC and FDI studies are commonly interested in these issues.

Typically, the literature estimates the impacts of labor turnover by including the share of owners and workers who have previous work experience in or training experience by MNEs in the same industry in equation (1), instead of the horizontal linkages measured by the share of FDI.[14] For example, Görg and Strobl (2005), analyzing manufacturing firms in Ghana from 1991 to 1997, find that owners' previous work experience in MNEs

in the same industry has positive impacts on domestic firms' productivity. In addition, Balsvik (2011) finds that the share of workers with experience in MNEs has positive impacts on the productivity of domestic plants in Norway from 1990 to 2000. Fosfuri et al. (2001) provide some theoretical foundations for the impacts of labor turnover by showing that FDI technological spillovers due to workers' mobility occur if MNEs do not compete fiercely with domestic firms in the same product market and the absorptive capability of the local firm is sufficiently high.

Other studies focus on the impacts of labor turnover on individual workers' wages in domestic firms, instead of their productivity, although the estimation strategy is essentially the same as the studies estimating the impacts on productivity.[15] For example, Poole (2013) finds that the share of former MNE workers has positive impacts on the wages of remaining workers in domestic firms in Brazil from 1996 to 2001, after controlling for various individual- as well as firm-level characteristics. This finding could indicate that former MNE workers bring new useful knowledge for workers in local firms.[16]

However, some time-variant positive shocks in those domestic firms may correlate with both the new hiring of former MNE workers and the productivity or wage increase in those three studies (i.e., Görg and Strobl 2005; Balsvik 2011; Poole 2013).

Thus, we require empirical analyses using more explicit indicators of imitation through labor turnover. However, official data on such indicators are scarce and thus original firm-level surveys might needed to be carried out.

Typically, the literature estimates the impacts of absorptive capacity by including an additional interaction term between the measures of the presence of FDI and of absorptive capacity in equation (1).[17] In other words, such equations estimate whether the impacts of FDI presence in the given industry differ according to the firm's absorptive capacity. The literature often measures the absorptive capacity of domestic firms by their R&D expenditure (Cohen and Levinthal 1989; Griffith et al. 2004). Moreover, studies measure the technology gap by the ratio of the highest (frontier-level) productivity within the same industry to that in domestic firms (Griffith et al. 2004) or by the ratio of productivity in foreign firms to that in domestic firms (Castellani and Zanfei 2003; Jordaan 2008).

There are two contrasting views regarding the impacts of the technology gap on domestic firms' productivity (Castellani and Zanfei 2003; Smeets 2008; Imbriani et al. 2014). On the one hand, the "catching up" hypothesis argues that large technology gaps to MNEs can enhance the spillovers effects of FDI because of the greater potential for technological improvements (Findlay 1978; Wang and Blomstrom 1992). In this case, the

coefficient of the interaction term of FDI presence with the technology gap measure should be positive. On the other hand, the higher absorptive capacity of local firms can enhance the positive spillover effects of FDI, making the coefficient of the interaction term between the presence of FDI and absorptive capacity positive.

We summarize previous empirical findings as follows. Castellani and Zanfei (2003), analyzing firm-level panel data in France, Italy, and Spain from 1992 to 1997, find that the interaction term of FDI presence with the technology gap measure has a significantly positive coefficient, while the interaction term with the absorptive capacity measure has no significant coefficient. Jordaan (2008), analyzing the spillover effects of FDI in several Mexican regions in 1993, finds that the interaction term of FDI presence with the technology gap measure has a significantly positive coefficient. Thus, these findings support the catching up hypothesis. On the contrary, Fatima (2016), analyzing Turkey from 2003 to 2010, finds that the interaction term of FDI presence with the technology gap measure has a significantly negative coefficient. Blalock and Gertler (2009) find that the interaction term of FDI presence with the absorptive capacity measure (i.e., R&D expenditure) has a significantly positive coefficient in Indonesian manufacturing firms from 1988 to 1996.

Some researchers consider the relationship between the technology gap and

degree of productivity benefits from FDI to have an inverted U-shape: the productivity benefits are likely to be small for both low- and high-technology gaps, while they are high for intermediate technology gaps. Indeed, Girma (2005) finds the existence of an inverted U-shaped relationship between the technological gaps and productivity benefits from FDI in manufacturing firms in the United Kingdom from 1989 to 1999. In addition, Ben Hamida and Gugler (2009), analyzing firm-level panel data from both manufacturing and services/construction sectors in Switzerland from 1998 to 2001, find that intra-industry FDI presence has positive impacts on local firms' productivity only when local firms have intermediate technology gaps with foreign firms. By contrast, there are no significant impacts when local firms have small and large technology gaps.

Several studies find other mechanisms that attenuate the negative horizontal linkage effects of FDI. For example, Girma et al. (2015), using firm-level data from manufacturing industries in China from 2004 to 2006, find that the presence of foreign firms has positive impacts on domestic firms' productivity only when the foreign presence reaches a certain threshold (i.e., 40%) within a cluster. Furthermore, Lu et al. (2017) find that intra-industry FDI in the same city has positive impacts on domestic firms' productivity, while that in more distance areas has negative impacts. Such positive effects might arise from agglomeration economies, which facilitate information spillovers,

mobility of workers from foreign to domestic firms, and inter-firm transactions. This is likely to be important, as most manufacturing industries are clustered in developing countries (Sonobe and Otsuka 2006, 2011, 2014).

3-6. An integrated econometric approach to FDI impact

By modifying the specification of Griffith et al. (2004), we propose the following function for an integrated econometric approach to FDI studies:

(3)

$$\Delta \ln(A_d)_{ijt} = \gamma_0 + \gamma_{1j}(\frac{R}{Y})_{ijt-1} + \gamma_{2j} \ln \frac{(A_F)_{jt-1}}{(A_d)_{ijt-1}} + \gamma_{3j}(\frac{R}{Y})_{ijt-1} * \ln \frac{(A_F)_{jt-1}}{(A_d)_{ijt-1}} + \gamma_4 Backward_{jt-1} + \mathbf{X}'_{ijt-1}\boldsymbol{\gamma}_5 + \mathbf{Z}'_{jt-1}\boldsymbol{\gamma}_6 + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}$$

,

where *R* is firm *i*'s expenditure on R&D;[18] *A* is TFP ; $\Delta \ln A$ is the growth rate of TFP; A_F and A_d are the TFP of foreign firms and domestic firms, respectively; and the other variables are the same as in equation (1). Note that the coefficients γ_{1j} to γ_{3j} can differ by industry.

This specification has the following four main advantages. First, we expect knowledge spillovers to determine productivity *changes* rather than productivity *levels*. Second, we expect the term of the productivity gap between firm *i* and foreign firms

within the same industry *j* to capture the spillover effects due to the demonstration effect (i.e., γ_{2j}), while the term interacted with the ratio of the firm's R&D expenditure to value-added captures the spillover effects from the imitation effect (i.e., γ_{3j}). In this way, we separate the imitation effects from the demonstration effects in this specification. We expect that γ_{2j} and γ_{3j} are positive. Moreover, according to Crespo and Fontoura (2007), the ratio of the firm's R&D expenditure can be indicate the firm's absorptive capacity. Third, the use of each firm's TFP gap from foreign firms within the same industry allows each industry to have different demonstration and imitation effects. Fourth, the specification uses the superlative-index-number approach, which allows us to estimate TFP by using flexible production function parameters. Note that we include a term that is expected to capture the vertical linkage effects (i.e., γ_4), which are missing from the original specification of Griffith et al. (2004).

In summary, this specification avoids the four problems of estimating equation (1), namely the assumed effects of FDI's presence on the level of productivity, neglect of imitation effects, identical spillover effects across industries, and identical production function parameters across industries. Furthermore, this specification considers the effects of absorptive capacity. What remains for us to integrate are (1) the effect of labor turnover, which we might incorporate as an additional explanatory variable or as an

interaction term with the technology gap, and (2) identical backward linkage effects across industries. The second issue can be resolved only if we have access to firm-specific information representing the extent of the interaction between local and foreign firms.

4. Integration of Research on FDI and GVCs

In this section, we suggest ways in which to incorporate the perspectives of GVC studies into the framework of FDI studies. From the viewpoint of the development of local firms and industries, analyzing how and under what conditions captive suppliers transform into relational suppliers is crucial. The first question we ought to address is how existing FDI studies deal with the abovementioned transformation. For this purpose, we prepare Figure 2, which illustrates how total value added is distributed to the local parts supplier and the MNE. We assume that total value-added consists of the payments to labor and capital (designated by areas KL) and profit (π) accrued to management activities, including technology choice, production design, and marketing. In this framework, when management improves without changing the employment of capital and labor, π as well as value added increases, which will be reflected in increases in TFP.

Under a captive governance system, a local firm receives only area KL, whereas an MNE receives the whole of π. This is reasonable, because captive suppliers are

assigned simple tasks in production activities and the system discourages them from engaging in value-adding activities such as production design and marketing. On the contrary, if the local firm is highly capable of management activities and independent, the local supplier that engages in pre- and post-production management activities receives the major part or even the whole area of π. We believe that such a shift from being a captive supplier to a relational supplier is crucial to the industrial development process. However, the production function approach, which FDI studies use exclusively, simply captures this shift as technological improvement.

The above discussions infer that whether a supplier is captive or relational affects the measured productivity associated with backward linkages. Thus, we propose replacing industry-specific $Backward_{jt}$ in equation (3) with firm-specific $Relational_{ijt}$, which we define as the extent of the mutually beneficial relationship between the *i*-th supplier and foreign company. In other words, we propose the following simultaneous equations:

(4)

$$Relational_{ijt-1} = a_0 + a_1 Transaction_{ijt-1} + a_2 Codifiabil\,ity_{ijt-1} + a_3 Capacity_{ijt-1} + a_i + a_j + a_{t-1} + \eta_{ijt-1}$$

,

(5)

$$\Delta \ln(A_d)_{ijt} = \gamma_0 + \gamma_{1j}(\frac{R}{Y})_{ijt-1} + \gamma_{2j} \ln \frac{(A_F)_{jt-1}}{(A_d)_{ijt-1}} + \gamma_{3j}(\frac{R}{Y})_{ijt-1} * \ln \frac{(A_F)_{jt-1}}{(A_d)_{ijt-1}} + \gamma_4 Relational_{ijt-1} + \mathbf{X}'_{ijt-1}\boldsymbol{\gamma}_5 + \mathbf{Z}'_{jt-1}\boldsymbol{\gamma}_6 + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}$$

,

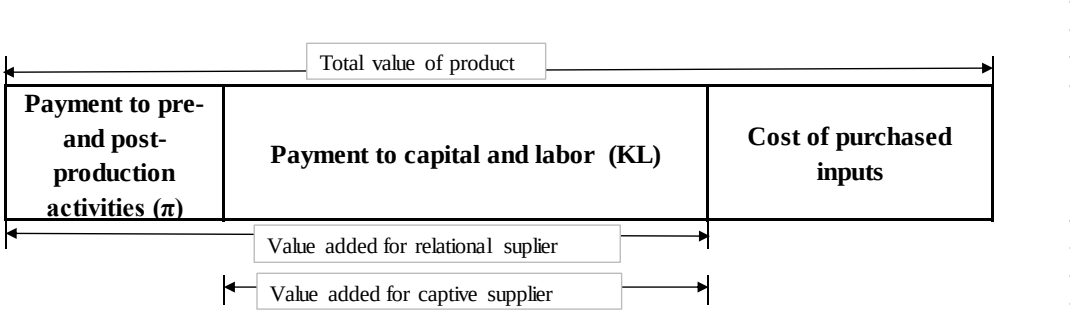
where *Relational* is an indicator of the relational contract; the three right-hand variables in equation (4) (*Transaction*, *Codifiability*, and *Capacity*) refer to the transaction costs of contracts, codifiability of production systems, and innate capacity of local suppliers, respectively; and the other variables are the same as in equation (3). For the specification of equation (4), we follow the original ideas of the GVC study of Gereffi et al. (2005). Note that the relational supplier is independent and not subordinate to any particular MNE.

There are two issues in estimating equations (4) and (5): measurement and endogeneity. While we cannot determine the best proxy variable for the relational contract a priori, we can suggest several possibilities. The first group of variables may be related with the nature of the contract between the supplier and foreign firm, such as its length and the extent of the division of labor in preparing drawings or blueprints. A longer contract with larger involvement by a supplier in the preparation of drawings implies closer relational contracting. The second group pertains to the independence of the decision-making authority of the supplier, such as the number of contracting foreign firms and the sales share of the dominant contracting foreign firm. The diversification of

contracts with foreign firms suggests the independence of the local supplier. The third group refers to the composition of workers, including the proportion with work experience in foreign firms, and non-production workers engaged in pre- and post-production activities.

As *Relational* is endogenous, we need instruments in the estimation of equation (4). For example, the geographical distance between local and foreign firms is a suggested proxy for the transaction costs of contractual relationships. The variables used for the measurement of relationship-specific inputs, such as the share of intermediate inputs ordered with technical specifications from MNEs discussed by Defever and Toubal 2013), can be a proxy for the difficulty of the codification of the production system. We should further consider the careful selection of appropriate measures for the instrumental variables.

Figure 2 Components of the value added in captive and relational suppliers



Source: Authors' own.

5. Concluding remarks

Given the rapidly rising amount of FDI over the past several decades and its potential role in transferring advanced technology and management practices from developed to developing countries, increasing scholarly attention has been paid to the productivity impacts of FDI on local firms in developing countries. This study reviewed the literature on the productivity impacts of GVCs and FDI, both of which are interested in the transfer of useful knowledge for the development of local firms in developing nations. Nonetheless, cross-references between GVC and FDI studies on the productivity impacts on local firms are severely lacking.

We first found that the literature on GVCs provides useful insights into the relationship between foreign and local firms, which depends on transaction costs, codifiability of production methods, and capability of local firms as well as the ways in which functions, products, and production processes are upgraded. This strand of the literature, however, remains largely descriptive and conceptual without undertaking rigorous hypothesis testing. Second, we found that FDI studies have made several significant findings, particularly regarding the importance of the backward linkages between foreign firms in downstream industries and domestic firms in upstream

industries rather than the horizontal linkages between firms in the same industry. Such a vertical relationship is the central issue addressed by GVC studies.

Further, we revealed that the specification of the estimation functions in FDI research suffers from several restrictive assumptions; for example, a common assumption is the existence of identical productivity effects of the presence of FDI across different industries. Furthermore, most FDI studies have failed to explore how useful knowledge is transferred from foreign to local enterprises in practice and, consequently, how the management behavior of local enterprises changes, although some studies have paid attention to the roles of the absorptive capacity of local enterprises and labor turnover from foreign to local enterprises in the knowledge transfer process.

To overcome the limitations of existing studies, this study made several suggestions. First, it suggested a possible way in which to avoid the shortcomings of the estimation methods of the impact of FDI by extending the model of productivity improvement originally developed by Griffith et al. (2004) to examine the effect of the technology gap between the frontier firm and other firms. Second, given that both GVC research and FDI research are interested in knowledge transfer, this study suggested several ways in which to enrich the latter by incorporating the insights of GVC research. In particular, we proposed incorporating the idea of the evolution of the contractual

relationship from captive to relational suppliers into the estimation framework of FDI research.

Finally, although policymakers in developing countries are interested in the impact of FDI on industrial development, the analysis of industrial development is outside the scope of both GVC research and FDI research for two reasons. First, these two strands of studies commonly concern productivity growth or the upgrading of functions, products, and processes in relatively short periods. Thus, neither strand analyzes the long-term dynamic process of industrial development. Second, analysis of the roles of entrepreneurs and "innovation" based on learning from FDI is lacking, even though the causes and consequences of entrepreneurial innovation are central to industrial development. For such an analysis, we must explicitly analyze what types of innovations are crucial in industrial development and the role played by entrepreneurial traits such as work experience in MNEs, the experience of receiving technology and management training, and schooling levels, based on the availability of detailed long-term data. Without such analysis, we will not be able to draw useful lessons for policymakers in developing countries, who are interested in promoting industrial development by attracting FDI.

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Notes

[1] The values of FDI inflows in developing countries surpassed those in developed countries in 2012 for the first time (UNCTAD 2013).

[2] For representative surveys of the empirical literature, see Saggi (2002), Görg and Greenaway (2004), Crespo and Fontoura (2007), Smeets (2008), and Javorcik (2014).

[3] Note that the GVC studies we are interested in must be distinguished from those which attempt to explore comprehensive and detailed picture of the dynamic network structure of global economy by using multicountry input-output tables, such as Dietzenbacher et al. (2005) and Johnson and Noguera (2012). Regarding the comprehensive overview on these GVC studies, see Dollar (2017) and Inomata (2017).

[4] The representative empirical studies on the MNEs' organizational choice between FDI and foreign outsourcing are Yeaple (2006) for the United States, Tomiura (2007) for Japan, Fernandes and Tang (2012) for China, Bernard et al. (2010) for the United states, Corcos et al. (2013) for France, Defever and Toubal (2013) for France, and Nunn and Trefler (2013) for the United States.

[5] See also Figure 3 of UNIDO (2004, 10).

[6] An alternative measurement of the presence of FDI is the absolute value (e.g., the number of workers employed by foreign firms), as suggested by Castellani and Zanfei (2003). If we assume that the demonstration effect is the main channel, the use of the absolute value is plausible because we can treat the existence of FDI like that of public goods.

[7] For simplicity, we show the fixed effects by α in the subsequent equations.

[8] See Barrios et al. (2011) for the other two restrictive assumptions regarding the measurement of backward linkages. Note that Javorcik and Spatareanu (2011), analyzing firm-level panel data in Romania from 1998 to 2003, find that the strength of the backward linkage effect depends on the nationality of the FDI.

[9] This is not necessarily true, and a few studies assume that β_K and β_L differ by industry. For example,

Chung et al. (2003) and Blalock and Gertler (2008) estimate the production function only for homogeneous industries with similar technologies, while Todo and Miyamoto (2006) and Fatima (2016) separately estimate the production function in each industry in the first stage and pool the estimated total factor productivity (TFP) in the second stage to analyze its determinants.

[10] Their specification originally assumes that the firm's growth of the R&D stock and other controls determine the productivity growth in a given firm. If the depreciation rate of the R&D stock is small, the growth of the R&D stock multiplied by the elasticity of output with respect to the R&D stock is reduced to the share of R&D expenditure in the value of output multiplied by the rate of return to R&D. For details, see equations (2) and (3) of Griffith et al. (2004, 884).

[11] See Aw et al. (2001) for an extension of the superlative-index-number approach to the case of combined cross-sectional and time-series data. Arnold and Javorcik (2009) use this approach to estimate TFP.

[12] However, a few studies analyzed vertical spillovers before Javorcik (2004). For example, Belderbos et al. (2001) analyze the determinants of the local content ratios of 272 Japanese electronics manufacturing affiliates in 24 countries in 1992.

[13] However, Liu (2008) finds negative inter-industry effects in the short term, as in the case of intra-industry effects. On the contrary, Chung et al. (2003) find that local suppliers providing components to Japanese assemblers (tie-in firms) do not receive significant vertical spillover effects, although such suppliers have a higher survival rate than other suppliers (non-tie-in firms) in the automobile industry in the United States from 1979 to 1991.

[14] See also equation (3) of Smeets (2008, 115).

[15] See, equation (4) of Smeets (2008, 115). In this equation, the dependent variable is individual workers' wages instead of firm-level productivity. However, the independent variables are the same, except for the additional inclusion of individual workers' characteristics such as age, educational level, and occupational category.

[16] Lipsey and Sjöholm (2004) find that foreign-owned firms pay higher wages for a given educational level than domestically owned ones, possibly because of the acquisition of improved knowledge by workers in foreign firms.

[17] See equation (5) of Smeets (2008, 118).

[18] If data on R&D expenditure are not available at the firm level, proxy variables such as the share of skilled workers in total employment can be used.

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