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Governance, Information Spillovers, and Productivity of Local firms: Toward an Integrated Approach to Foreign Direct Investment and Global Value Chains

Running Title: Governance, Spillovers, and Productivity

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Abstract

Information spillovers from multinational enterprises to local firms in developing countries are examined in the literature on global value chains and foreign direct investment. However, the both global value chain and foreign direct investment studies are carried out independently and separately. While global value chain studies describe an important mechanism that underlies the productivity improvements of local firms in developing countries, most foreign direct investment studies attempt to assess econometrically the impacts on the productivity of local firms. This literature review concludes that an integrated approach that incorporates the insightful perspective of global value chain studies into the empirical approach of foreign direct investment studies will likely reveal the channel through which information spillovers lead to the productivity improvements of local firms in developing countries.

JEL classification numbers: F21, F23, F63, O33

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

1. Introduction

Information or knowledge spillovers from 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) considers foreign direct investment (FDI) as an important element for job creation in developing countries through 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, a majority of developing countries have attempted to attract FDI by establishing investment promotion agencies (Harding & Javorcik, 2011); moreover, developing countries are beginning to attract and absorb more global FDI flows than developed countries.[1]

A common focus of both FDI and GVC studies is to examine the impact of MNEs' dispersed activities on the productivity improvements of local firms in developing countries, even though the latter has covered broader issues than the productivity impacts of foreign firms. One of the main interests of FDI studies is to econometrically elucidate

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

the impacts of knowledge spillovers from FDI on the productivity of domestic firms in host countries and identify factors that affect the strength of such spillover effects.[2] Robust findings of FDI studies are that backward spillovers (typically from foreign enterprises engaged in assembly to local parts suppliers) are significant and economically important, whereas horizontal spillovers (typically from foreign assemblers to local assemblers) are insignificant or even negative. GVC studies, which use the term "upgrading" (i.e., the capacity of a firm to innovate to increase the value added of its products and processes) (Giuliani, Pietrobelli, & Rabellotti, 2005) instead of productivity,[3] take for granted that the important relationship between foreign and local enterprises is vertical. They are largely conceptual and case study-based, mainly exploring why domestic firms have specific types of relationships with lead firms, termed as "GVC governance" (Gereffi, Humphrey, & Sturgeon, 2005), and whether certain types of GVC governance are associated with particular types of upgrading. Thus, this GVC

[2] For representative surveys of the empirical literature, see Saggi (2002), Görg and Greenaway (2004), Crespo and Fontoura (2007), Smeets (2008), Javorcik (2008, 2014), and Rojec and Knell (2018).

[3] Upgrading and productivity growth, however, are closely related according to Syverson (2011), who reviews several sources of firm productivity growth.

framework is useful to analyze the opportunities and barriers for local suppliers to participate in global supply chains and the distribution of value added within them (Gereffi & Lee, 2012).[4] GVC studies commonly find that high production capacity of local enterprises and difficulty in codifying the production system are the decisive factors affecting the choice of trust-based "relational" contracts with local producers rather than "captive" contracts. Furthermore, since local firms increasingly participating in GVCs now provide highly customized inputs rather than homogenous ones in lock-in relationships with their lead firms, the adoption of relational contracts has become rather common. This long-lasting nature of relational contracts offers favorable opportunities for technology transfer from lead firms (Antràs, 2019; the World Bank 2019).[5]

However, these studies are carried out independently and separately. For example, none of the representative empirical studies analyzing the impacts of FDI inflows on the productivity of domestic firms in developing countries, such as Aitken and

[4] Recently, a strand of GVC studies has conducted rigorous quantitative analysis of the international input-output structure of value chains using multi-country input-output tables. For a comprehensive overview of GVC studies, including this strand, see Inomata (2017).

[5] For empirical evidence that domestic firms improved their productivity through foreign technologies embodied in intermediate inputs, see Amiti and Konings (2007).

Harrison (1999), Javorcik (2004), Javorcik and Spatareanu (2008), and Lu, Tao, and Zhu (2017) refer to seminal GVC studies such as Humphrey and Schmitz (2002) and Gereffi, Humphrey, and Sturgeon (2005). In contrast, GVC studies focus on the role of global buyers rather than MNEs directly investing in developing countries, even though both global buyers and MNEs are potential sources of new useful knowledge. Nonetheless, 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) or outsourcing the production of goods and services to local suppliers or third-party providers by creating GVCs. Considering this, both GVC and FDI studies are bound to have common interests. Note that while a number of empirical studies, including Tomiura (2007), Nunn and Trefler (2008, 2013), Tomiura, Ito, and Wakasugi (2011), and Corcos et al. (2013) analyze MNEs' choice of an organizational form of GVCs (i.e., FDI versus foreign outsourcing) based on the theoretical models proposed by Antràs (2003) and Antràs and Helpman (2004, 2008), they do not analyze the productivity impacts of MNEs on local parts suppliers.

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. Specifically, while FDI studies are interested in the impact of the FDI presence on the productivity of local firms, particularly local parts suppliers, GVC studies are interested in the mechanism that changes the status of local parts suppliers from "captive" to "relational" because such a change is associated with increased technology transfer from foreign firms to local suppliers.[6] This change will be reflected in the growth of the total factor productivity (TFP) of local firms, which is the focus of FDI studies. Therefore, an integration of the two strands of studies, in which governance type is determined in the first stage, and TFP is determined by governance type and other covariates in the second stage, is expected to enrich empirical studies by revealing the mechanisms through which spillovers take place from foreign to local firms.

The rest of this paper is organized as follows. Section 2 reviews the major findings of existing studies of the channels of knowledge spillovers from FDI and their impacts on productivity, particularly in developing countries. Section 3 discusses the

[6] Keller (2004, 2010) provides a comprehensive survey of the literature on international technology transfer, including information spillovers from FDI. Keller (2012) further points out that technology transfer from foreign affiliates occurred even in those located in highly developed countries, such as the United States.

major contributions and limitations of GVC studies, comparing them with FDI studies. Section 4 offers suggestions for enriching FDI studies by incorporating the insightful perspective of GVC studies. The final section concludes by summarizing the contribution of this study and recommending new directions of FDI studies.

2. Research on knowledge spillovers from FDI

2-1. Channels of knowledge spillovers from FDI

In general, there are four major spillover effects: demonstration, labor turnover, competition (i.e., the effect of the entry of MNEs on market demand for products produced by competing local firms), and vertical linkage (that is, the externalities derived from the backward and forward linkages between MNEs and domestic firms). Review articles by Saggi (2002), Crespo and Fontoura (2007), Smeets (2008), and Rojec and Knell (2018) assume that the demonstration and imitation effects are identical. We wonder, however, if we should separate, at least conceptually, free copying, which corresponds to the demonstration effect, from resource-using activities, which correspond to the imitation effect. The absorptive capacity of domestic firms is particularly relevant in the case of imitation. Further, although studies such as Saggi (2002), Görg and Strobl (2005), Crespo and Fontoura (2007), Smeets (2008), Javorcik (2014), and Demena and Murshed

(2018) consider the labor turnover effect in addition to the demonstration and imitation effects, we would like to argue that labor turnover from foreign to domestic firms is one way of imitation, as it must incur the cost of recruiting and employing new workers.

The major problem with the classifications in 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 transaction), we argue that we should treat these effects separately from pure externality effects. The vertical linkage effects could also occur through technological support, including training for workers in local firms by foreign affiliates (Ivarsson & Alvstam, 2005, 2011; Jordaan, 2011, 2017; Amendolagine et al., 2019). Additionally, the vertical linkage effects could 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 should be separated from the pecuniary externality effects (effects of competition effects and training) arising from market mechanisms (see Table 1).

The literature assumes that the effects of demonstration, imitation, and backward linkage on the productivity of domestic firms are positive (Crespo & 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 induces domestic firms to use existing resources more efficiently, it would improve their productivity (Crespo & Fontoura, 2007; Demena & Murshed, 2018). On the other hand, if this intensified competition causes domestic firms to lose their market share, it would decrease their productivity (Crespo & Fontoura, 2007; Javorcik, 2014; Demena & Murshed, 2018; Rojec & Knell, 2018).

[Table 1 here]

2-2. Empirical assessment of knowledge spillovers from FDI

As Smeets (2008) and Irsova and Havranek (2013) summarize, the literature commonly analyzes information spillover effects from FDI by estimating the following function:[7]

$$\begin{aligned}\ln Y_{ijt} &= \beta_0 + \beta_K \ln K_{ijt} + \beta_L \ln L_{ijt} + \beta_1 Horizontal_{jt} + \beta_2 Backward_{jt} + \beta_3 Forward_{jt} \\ &+ \mathbf{X}'_{ijt}\boldsymbol{\beta}_4 + \mathbf{Z}'_{jt}\boldsymbol{\beta}_5 + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}\end{aligned}, \quad (1)$$

where i indexes the firm; j indexes the industry; t indexes time; Y is the value added of a

[7] Keller (2004) provides a more general specification of the effect of a specific foreign firm's activity on increases in domestic firm productivity.

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 output, employment or capital, where a "foreign" firm is commonly defined by having more than a threshold level of foreign equity share in the given firm);[8] *Backward* is a measure of the presence of FDI in downstream industries to which industry j supplies inputs; *Forward* is a measure of the presence of FDI in upstream industries from which industry j purchases inputs; 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; and ε is an error term.

We usually measure *Backward* and *Forward* by using the following formulas, respectively:

[8] An alternative measurement of the presence of FDI is the absolute value of employment (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 seems plausible because we can treat the existence of FDI like that of public goods.

$$Backward_{jt} = \sum_{k \neq j} (a_{jkt} \cdot Horizontal_{kt}), \quad (2)$$

$$Forward_{jt} = \sum_{m \neq j} (\sigma_{jmt} \cdot Horizontal_{mt}), \quad (3)$$

where *a* is the proportion of the output of sector *j* supplied to industry *k*. In other words, *Backward* is greater if the FDI presence in industry *k* is larger and it purchases a larger amount of intermediate products from industry *j*. σ is the proportion of the input of sector *m* purchased by industry *j*.[9] In other words, *Forward* is greater if the FDI presence in industry *m* is larger, and it supplies a larger amount of intermediate products to industry *j*. Note that *Backward* or *Forward* is specific to the industry in this specification, implying that this variable captures the effect of inter-industry variations in backward or forward linkages but not the effect of firm-specific backward or forward linkages. In equation (1), it is assumed that β_1 captures the intra-industry (horizontal) effect, while β_2 and β_3 capture the inter-industry (vertical) effects.

[9] Note that since only intermediate products that foreign firms supply in the domestic market are relevant for forward linkages shown in equation (3), exports are often excluded from output in industry *m* for the measure of the foreign firms' share in industry *m*, as in Javorcik (2004), Barrios, Görg, and Strobl (2011), Fatima (2016), and Lu, Tao, and Zhu (2017).

FDI studies commonly estimate equation (1) or its first-differences by using firm-level panel data in a variety of industries. The representative examples are Aitken and Harrison (1999), Castellani and Zanfei (2003), Javorcik (2004), Bwalya (2006), Haskel, Pereira, and Slaughter (2007), Blalock and Gertler (2008), Monastiriotis and Alegria (2011), Gorodnichenko, Svejnar, and Terrell (2014), and Kinuthia (2016), as presented in Table 2. Rather than or in addition to estimating equation (1) directly, some studies estimate TFP first[10] and regress it on FDI spillovers and other control variables in equation (1). Representative examples of this are Javorcik and Spatareanu (2008), Liu (2008), Blalock and Gertler (2009), Keller and Yeaple (2009), Barrios, Görg, and Strobl (2011), Javorcik and Spatareanu (2011), Fernandes and Paunov (2012), Merlevede, Schoors, and Spatareanu (2014), Newman et al. (2015), Fatima (2016), Hong, Sun, and Huang (2016), Thang, Pham, and Barnes (2016), Choi and Pyun (2017), Lu, Tao, and Zhu (2017), Ebghaei and Wigley (2018), and Njikam and Leudjou (2019), as presented in Table 3. Note that they employ either level or first-difference.

[10] Conceptually, this amounts to subtracting contributions of labor and capital from value added in equation (1). In order to address the potential endogeneity of factor inputs, these studies use the techniques of Olley and Pakes (1996), Levinsohn and Petrin (2003), Wooldridge (2009), or Ackerberg, Caves, and Frazer (2015) to estimate TFP in the first stage (see Table 3).

However, this frequently-used estimation implicitly adopts the following restrictive assumptions. First, this specification assumes that knowledge spillovers, which are flows, affect the level of productivity, which is determined by the accumulated stock of useful knowledge. Additionally, according to equation (1), FDI does not contribute to the domestic firm's productivity growth if the FDI share is constant, even though FDI presence in the absolute values increases due to the entry of new foreign firms (Todo & Miyamoto, 2006). Note, however, that Haddad and Harrison (1993), Sjöholm (1999), Chung, Mitchell, and Yeung (2003), Girma (2005), Todo and Miyamoto (2006), and Hamida and Gugler (2009) use estimation equations where the dependent variable is change so that knowledge spillovers affect productivity *changes* rather than *levels* (see Tables 2 and 3).

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 (Demena & Murshed, 2018). Third, the measurement of backward and forward linkages shown in equations (2) and (3) employs assumptions; for example, foreign affiliates, regardless of their nationality, have the same input-sourcing behavior as domestic firms, as Barrios, Görg, and Strobl (2011) point out. Indeed, Javorcik and Spatareanu (2011),

Monastiriotis and Alegria (2011), and Njikam and Leudjou (2019) find that spillovers from backward linkages substantially differ by FDI nationalities. Fourth, the spillover effects of FDI are identical across all industries; that is, β_1, β_2, and β_3 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. However, some studies, using the two-stage estimation method, such as Todo and Miyamoto (2006), Javorcik and Spatareanu (2008, 2011), Liu (2008), Blalock and Gertler (2009), Fernandes and Paunov (2012), Merlevede, Schoors, and Spatareanu (2014), Newman et al. (2015), Fatima (2016), Hong, Sun, and Huang (2016), Thang, Pham, and Barnes (2016), and Lu, Tao, and Zhu (2017) separately estimate the production function in each industry in the first stage (see Table 3). In summary, these restrictive assumptions are likely to lead to biased or imprecise estimations of the regression parameters.

In this regard, a specification of the estimation equation proposed by Griffith, Redding, and Van Reenen (2004) is highly relevant. The authors analyze the determinants of the industry-level productivity growth of 12 OECD countries from 1974 to 1994. Although their original units of analysis are country and industry, it is possible to change the units of analysis from country to industry and from industry to firm in our discussion.

The modified specification is as follows:

$$\Delta \ln(A_d)_{ijt} = \gamma_0 + \gamma_{1j}(\frac{R}{Y})_{ijt-1} + \gamma_{2j} \ln\frac{(A_F)_{jt-1}}{(A_d)_{ijt-1}} + \gamma_{3j}(\frac{R}{Y})_{ijt-1} * \ln\frac{(A_F)_{jt-1}}{(A_d)_{ijt-1}} + \mathbf{X}'_{ijt-1}\boldsymbol{\gamma}_{4j} + \mathbf{Z}'_{jt-1}\boldsymbol{\gamma}_5 + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}, \quad (4)$$

where R is firm i's expenditure on R&D; 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 from γ_{1j} to γ_{3j} can differ by industry.

Their specification has several advantages. First, Griffith, Redding, and Van Reenen (2004) assume that knowledge spillovers affect *changes* in productivity, but not the productivity *level*. Second, their specification predicts that the share of R&D expenditure in the firm, the technological distance of this firm from the frontier firm in the same industry, and the interaction term between the two affect productivity growth. 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 (i.e., the demonstration effect, γ_{2j}) from the spillover effect derived from the resource-using activities, measured by R&D expenditure (i.e., the

imitation effect, γ_{3j}). 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, the authors use the superlative index number approach of Caves, Christensen, and Diewert (1982), which allows us to estimate TFP by using flexible production function parameters.[11] Although the specification proposed by Griffith, Redding, and Van Reenen (2004) is relevant for FDI research, they focus on the spillover channels between firms in the same industry without considering any spillovers between firms in different industries (i.e., the backward and forward linkage effects). To address such problems, we must revise and extend the specification of their equation.

2-3. Horizontal (intra-industry) spillovers

Based on the meta-analysis, Wooster and Diebel (2010), Havranek and Irsova (2011), and Irsova and Havranek (2013) conclude that horizontal spillovers are insignificant and the occurrence of the positive effects may be derived from model misspecification or depends on specific characteristics of domestic economies and foreign investors. Indeed, a few

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

studies find robust positive intra-industry effects by mostly using data from Asian countries (Wooster & Diebel, 2010); for example, for MNEs in Korea (Choi & Pyun, 2017) and Turkey (Ebghaei & Wigley, 2018) and R&D-performing MNEs in Indonesia (Todo & Miyamoto, 2006) and Malaysia (Kinuthia, 2016) (see Tables 2 and 3).

In contrast, many studies that estimate equation (1) or its modified forms in developing countries find negative intra-industry spillover effects. The major examples are Aitken and Harrison (1999) for Venezuela, Bwalya (2006) for Zambia, Javorcik and Spatareanu (2008) for Romania, Fatima (2016) for Turkey, Hong, Sun, and Huang (2016) for China, Kinuthia (2016) for Kenya, and Lu, Tao, and Zhu (2017) for China (see Tables 2 and 3).

Additionally, Javorcik and Spatareanu (2008) found that the negative impacts are larger in wholly-owned foreign affiliates than in partially-owned foreign affiliates (joint ventures) because domestic firms are likely to have difficulties in accessing sophisticated technologies of wholly-owned foreign affiliates, or they are likely to protect their technological advantages. Based on a meta-analysis, Irsova and Havranek (2013) provide the same finding. Interestingly, Liu (2008) and Merlevede, Schoors, and Spatareanu (2014) find that horizontal spillovers are initially negative but end up positive in the longer term, thereby indicating that the spillover effect is likely to arise from imitation,

requiring resource-using and time-consuming R&D activities.

Therefore, the major 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 & Spatareanu, 2008; Javorcik, 2014).[12] 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.

Since the studies reviewed in this subsection typically apply equation (1) or its modified forms, 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 sort of average effects across them. Thus, it is possible that some industries have positive horizontal effects, while many others have negative horizontal effects.

[12] Although there are both foreign and domestic suppliers in some cases, the existing FDI studies do not incorporate the competition between them.

2-4. Vertical (inter-industry) spillovers

Since Javorcik's (2004) path-breaking study, many studies have found positive backward linkage effects based on equation (1) and its modified forms, including Bwalya (2006) for Zambia, Blalock and Gertler (2008) for Indonesia, Javorcik and Spatareanu (2008; 2011) for Romania, Gorodnichenko, Svejnar, and Terrell (2014) for 17 transition market economies, Merlevede, Schoors, and Spatareanu (2014) for Romania, Newman et al. (2015) for Vietnam, Fatima (2016) for Turkey, Thang, Pham, and Barnes (2016) for Vietnam, Lu, Tao, and Zhu (2017) for China, and Ebghaei and Wigley (2018) for Turkey (see Tables 2 and 3). Recent survey articles including Havranek and Irsova (2011), Javorcik (2014), and Rojec and Knell (2018) also conclude that inter-industry effects are clearer than intra-industry effects. Additionally, Javorcik (2004), Javorcik and Spatareanu (2008), and Newman et al. (2015) find that positive impacts are robust in the case of joint ventures, while there are no significant effects in the case of wholly-owned affiliates, because the former is more likely to engage in local sourcing, thereby creating greater scope for spillovers to local suppliers in upstream sectors.

Although some studies such as Javorcik (2004), Liu (2008), Barrios, Görg, and Strobl (2011), Merlevede, Schoors, and Spatareanu (2014), Gorodnichenko, Svejnar, and Terrell (2014), and Thang, Pham, and Barnes (2016) include the term capturing the effects

of forward linkages in addition to backward linkages as shown in equation (1), they find that there is no robust evidence of spillovers occurring through forward linkages (see Tables 2 and 3). This finding is attributable to the fact that local firms are typically engaged in upstream activities such as parts-supplying, whereas MNEs are mostly engaged in downstream activities. Only a few recent studies such as Fernandes and Paunov (2012) for Chile, Newman et al. (2015) for Vietnam, Fatima (2016) for Turkey, Lu, Tao, and Zhu (2017) for China, and Ebghaei and Wigley (2018) for Turkey find positive forward linkage effects (see Tables 2 and 3). Recent survey articles including Havranek and Irsova (2011) and Rojec and Knell (2018) conclude that forward spillovers are smaller or less likely to occur than backward spillovers.

The finding that the backward linkage effect is the major channel for 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 inter-firm governance issues, as will be discussed in the review of GVC studies. Indeed, several FDI studies analyze the determinants of local sourcing by foreign firms (Belderbos, Capannelli, & Fukao, 2001; Jordaan, 2011; Giroud, Jindra, & Marek, 2012; Amendolagine et al. 2013; Amendolagine et al. 2019) or the provision of

technology support from foreign firms to local suppliers (Jordaan 2011, 2017; Giroud, Jindra, & Marek, 2012; Amendolagine et al. 2019). However, they do not consider variables related to local suppliers' relational status with foreign firms; thus, we believe that we need to fill this gap between GVC and FDI studies.

[Table 2 here]

[Table 3 here]

3. Topics, contributions, and limitations of GVC studies

3-1. GVC governance and upgrading

GVCs are defined as "fragmented supply chains, with internationally dispersed tasks and activities coordinated by a lead firm" (UNCTAD, 2013: 125). Typically, GVC studies aim to explore 1) the types of local firms' relationships with lead firms (i.e., GVC governance), and 2) the relationships between GVC governance and the type of upgrading. Specifically, upgrading is defined as "making better products, making them more efficiently, or moving into more skilled activities" (Giuliani, Pietrobelli, & Rabellotti, 2005: 552).

Gereffi, Humphrey, and Sturgeon (2005) argue that GVC governance is determined by three factors: 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, codification of the production system is difficult, and local producers are incapable of production and management activities, the lead firm internalizes its production activities by setting up its own affiliates. That is, FDI is considered as one type of GVC governance. Gereffi, Humphrey, and Sturgeon (2005) label this governance type as "hierarchy" (see Table 4). However, transactions between foreign affiliates and local firms are not their main concern (Morris & Staritz, 2017). Thus, the arrows indicating the directions of order and information do not appear in the case of hierarchy in Figure 1. In contrast, information spillovers, especially through the supply of intermediate inputs to foreign firms (backward linkages), have been one of the key issues in FDI studies since Javorcik's (2004) path-breaking findings. In other words, FDI studies usually consider lead firms as foreign affiliates that are engaged in production activities using subcontracts with local parts suppliers in developing countries. Meanwhile, GVC studies, especially those interested in buyer-driven value chains, consider them as global buyers that are located in developed countries and control or coordinate the value chains without directly engaging in production activities or procuring any inputs from local firms (Morris &

Staritz, 2017).[13]

[Table 4 here]

[Figure 1 here]

If transaction costs are high and 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 to seek mutually dependent and beneficial relationships. The development of a good reputation, a higher trust created by repeated transactions, and family and ethnic ties between the lead firm and local producers enable such relationships to flourish. Gereffi, Humphrey, and Sturgeon (2005) label this governance type as "relational" (see Table 4). Conversely, if transaction costs are high and local producers are incapable, but codification of the production system is easy, the lead firm outsources its activities to local producers and monitors and controls them tightly. In this case, local firms passively receive materials and production instructions

[13] In contrast, in the case of producer-driven chains, which are observed in capital-intensive and technology-intensive industries, such as automobiles, lead firms are usually considered to engage in production activities, creating multi-layered production systems. Indeed, a few GVC studies analyzing the automotive industry, such as Ivarsson and Alvstam (2005) and Simona and Axèle (2012), focus on the knowledge transfer from foreign affiliates to local parts suppliers.

from the lead firm. Gereffi, Humphrey, and Sturgeon (2005) label this governance type as "captive" (see Table 4). Importantly, information flow is bidirectional in a relational value chain, whereas it is unidirectional in a captive value chain (see Figure 1). Gereffi, Humphrey, and Sturgeon (2005) also consider market-based relationships, which arise when transaction costs are low, codification of the production system is easy, and local producers are capable.[14] From the perspective of FDI studies, the distinction between captive and relational suppliers is important, because the scope for productivity improvements of local suppliers is clearly different between these two types.

In addition to the typology of the relationships between the lead firm and local firms, GVC studies discuss the relationships between the different types of GVC governance (e.g., captive or relational) and different types of upgrading. They usually define functional upgrading as a shift to higher value-added activities within a given value chain, such as design, marketing, and branding, while defining product upgrading as a shift to more sophisticated product lines with higher unit values, and process upgrading

[14] Additionally, Gereffi, Humphrey, and Sturgeon (2005) also consider modular relationships, in which local suppliers become "turn-key" suppliers, who mediate between the lead firm and other local suppliers. However, we do not discuss this governance type, because FDI studies usually consider only foreign and local enterprises and do not consider such intermediary firms.

as a more efficient transformation of inputs into outputs by reorganizing the production system or introducing superior technology within a given type of output (Humphrey & Schmitz, 2002; Giuliani, Pietrobelli, & Rabellotti, 2005; UNIDO, 2004) (see Figure 2). In contrast, FDI studies capture upgrading as productivity improvement, irrespective of the types of upgrading.

[Figure 2 here]

Integration into value chains in which local firms have symmetric relationships with the lead firm (i.e., relational value chains) offers favorable opportunities for functional upgrading because local producers that are capable of management activities and have relatively strong bargaining powers vis-à-vis the lead firm can negotiate their assigned tasks in the value chains (Humphrey & Schmitz, 2002; Giuliani, Pietrobelli, & Rabellotti, 2005; Morrison, Pietrobelli, & Rabellotti, 2008; Pietrobelli & Rabellotti, 2011). In fact, many case studies find that large-sized, first-tier, or foreign-owned relational suppliers have succeeded in extending their tasks toward pre-assembly and post-assembly stages, including some management activities in developing countries, including Bair and Gereffi (2001) for the apparel industry in Mexico; Dolan and Humphrey (2004) for the fresh vegetable industry in Kenya and Zimbabwe; Poon (2004) for the information

technology (IT) industry in Taiwan; Ponte et al. (2014) for the aquaculture industry in Thailand; and Morris and Staritz (2017) for the apparel industry in Lesotho (see Table 5).

In contrast, integration into value chains in which local firms are in captive relationships with lead firms offers unfavorable conditions for such functional upgrading (Humphrey & Schmitz, 2002; Giuliani, Pietrobelli, & Rabellotti, 2005; Schmitz, 2006; Pietrobelli & Rabellotti, 2011). This case confines local producers to simple tasks and discourages them from engaging in value-added activities, such as product design and marketing, because of their low-level management abilities. In fact, many case studies find limited possibilities of functional upgrading of small-sized, lower-tier, or domestically-owned captive suppliers in developing countries, including Dolan and Humphrey (2000, 2004) for the fresh vegetable industry in Kenya and Zimbabwe; Schmitz and Knorringa (2000) for the footwear industry in Brazil, China, and India; Bair and Gereffi (2001) for the apparel industry in Mexico; Navas-Alemán (2011) for the footwear and furniture industries in Brazil; and Ponte et al. (2014) for the aquaculture industry in Bangladesh, China, Thailand, and Vietnam (see Table 5).

Both relational and captive suppliers are interested in upgrading the quality of their products and production processes by learning from their production experience (Humphrey & Schmitz, 2002; Pietrobelli & Rabellotti, 2011). However, captive suppliers

have particularly favorable opportunities to learn process and product upgrading from lead firms because they have incentives to instruct local firms to produce high-quality inputs (Humphrey & Schmitz, 2002; Giuliani, Pietrobelli, & Rabellotti, 2005; Schmitz, 2006; Altenburg, Schmitz, & Stamm, 2008; Pietrobelli and Rabellotti, 2011). In fact, some case studies find that captive suppliers are likely to achieve process and (or) product upgrading in developing countries, including Schmitz and Knorringa (2000) for the footwear industry in Brazil and China; Ivarsson and Alvstam (2011) for the furniture industry in China, Indonesia, Thailand, and Vietnam; Navas-Alemán (2011) for the footwear and furniture industries in Brazil; and Ponte et al. (2014) for the aquaculture industry in China and Thailand (see Table 5).

3-2. Contributions of GVC studies

Lead firms usually discourage local firms from participating in value-added pre-production and post-production activities because they consider such activities as their core competencies and the major source of their profit (Schmitz & Knorringa, 2000; Bair & Gereffi, 2001; Humphrey & Schmitz, 2002; Schmitz, 2006; Altenburg, Schmitz, & Stamm, 2008; Morrison, Pietrobelli, & Rabellotti, 2008; Schmitz & Strambach, 2009). Indeed, many case studies find that local suppliers in developing countries often achieve

process and product upgrading but face difficulties in functional upgrading (Schmitz & Knorringa, 2000; Navas-Alemán, 2011; Rossi, 2013; Ponte et al., 2014). Moreover, functional upgrading requires local suppliers to have advanced technological capabilities that most of them do not have (Martinez-Covarrubias, Lenihan, & Hart, 2017). However, a recent survey of GVC case studies by Choksy, Sinkovics, and Sinkovics (2017) concludes that functional upgrading is a key determinant of increased profit margins for suppliers in developing countries.

Sato and Fujita (2009) argue that once local firms obtain higher capabilities as suppliers of parts to MNEs, they try to 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-production and post-production activities. In fact, such evolutionary processes indeed occur in developing countries, as reported by Poon (2004) for the IT industry in Taiwan, Ivarsson and Alvstam (2011) for the furniture industry in China, Indonesia, Thailand, and Vietnam, and Contreras, Carrillo, and Alonso (2012) for the automotive industry in Mexico. Importantly, local suppliers' productivity and the governance type choice analyzed by GVC studies are endogenous and mutually dependent. In contrast, FDI studies basically consider that FDI presence is exogenously determined, as discussed in the review of FDI studies.

The distinction between captive and relational contracts is similar to the distinction between contracts with “drawings supplied” and “drawings approved” by core firms in the automobile industry in Japan. According to Asanuma (1989) and Sturgeon, Van Biesebroeck, and Gereffi (2008), “drawings approved” have become more common over time, replacing “drawings supplied.” Thus, 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, Karlan, & Schoar, 2010; Bloom et al., 2013; Sonobe & Otsuka, 2014). In a study on 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.

Figure 3 shows how total value added is distributed to the local parts supplier and the MNE to illustrate the distinction between captive and relational suppliers. We assume that total value added consists of payments to labor and capital (designated by areas KL) and profit (π) accrued to management activities, including technology choice, product design, and marketing. In this framework, when the management improves

without changing the employment of capital and labor, π as well as total value added will increase, which will be reflected in increases in the TFP.

[Figure 3 here]

In 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 MNE discourages them from engaging in value-added activities. In contrast, if the local firm is highly capable of management activities and is independent, it receives the major part or even the whole area of π. This situation is consistent with the view of Dedrick, Kraemer, and Linden (2010), who point out that functional upgrading of parts suppliers increases the share of profit accrued to these suppliers. 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 a technological improvement.

Additionally, if we consider revenue-based TFP, which is widely used in FDI literature, instead of the quantity-based TFP, the productivity difference between captive and relational suppliers can further increase. This is because the revenue-based TFP is

positively correlated with prices (Foster, Haltiwanger, & Syverson, 2008), while relational suppliers are likely to receive higher prices from MNEs than captive suppliers due to their relatively strong bargaining power (Antràs, 2019; Cajal-Grossi, Macciavello, & Noguera, 2019).

Further, it is necessary to point out that GVC studies made useful observations on FDI, which are not recognized in FDI studies. First, Hobday and Rush (2007) observe that foreign subsidiaries also improve productivities over time through learning and adaptation. Thus, the productivity of foreign firms may not be wholly exogenous. Second, Sturgeon, Van Biesebroeck, and Gereffi (2008) point out that in the automobile industries, first-tier suppliers in advanced countries initiate production in developing countries after automobile companies relocate their production bases. This situation indicates that vertical linkages between foreign firms and their first-tier suppliers are not created in developing countries but, are to some extent, transferred from advanced to developing countries. Third, Bair and Gereffi (2001) and Dolan and Humphrey (2004) find that small-sized lower-tier suppliers are especially inactive in functional upgrading because first-tier local suppliers and foreign firms exert tight control on their incapable subcontractors, thereby confining them to simple assembly tasks.

3-3. Limitations of GVC studies

The mechanism underlying the productivity improvements of local firms that GVC studies suggest closely relates to the inter-industry spillover effects of FDI through the supply of parts and components to MNEs (backward linkages), which have been empirically analyzed by a number of FDI studies, such as Javorcik (2004) and Javorcik and Spatareanu (2008). However, although despite some exceptions, such as Ivarsson and Alvstam (2005) and Simona and Axèle (2012), in general, a detailed analysis of the dynamic mechanism behind the productivity improvements of local parts suppliers is not the primary concern of seminal GVC studies. Indeed, Schmitz and Knorringa (2000), Dolan and Humphrey (2000, 2004), Bair and Gereffi (2001), Navas-Alemán (2011), and Rossi (2013) consider foreign firms to be global buyers, such as branded marketers, retailers, and branded manufactures located in developed countries, while they consider local suppliers to be exporters located in developing countries.

It is worth noting that recent GVC studies such as Morrison, Pietrobelli, and Rabellotti (2008), Sato and Fujita (2009), Kawakami and Sturgeon (2011), and Lema, Quadros, and Schmitz (2015) have pointed out that local suppliers' capabilities are not exogenous. Thus, new GVC studies have developed their own analytical frameworks to analyze the evolutionary process and mechanism of local suppliers' capability

development and innovation, such as the "capability matrix" (Sato & Fujita, 2009) and the "organizational decomposition of the innovation process" (Schmitz & Strambach, 2009; Lema, Quadros, & Schmitz, 2015).[15]

Several econometric studies are carried out on the relationship between the types of GVC governance and the productivity of local firms. For example, Pietrobelli and Saliola (2008) empirically analyzed the impacts of different types of GVC governance on the productivity of local firms in Thailand. Similarly, Simona and Axèle (2012) empirically analyzed the impacts of different types of GVC governance on the knowledge transfer from foreign firms to local suppliers in the Polish automotive industry and found that long-term trust-based relationships promote knowledge transfer. Martinez-Covarrubias, Lenihan, and Hart (2017) also found that relational suppliers with higher technological capabilities were more likely to achieve functional upgrading in Mexico.

Although those econometric studies consider the GVC governance types as exogenously given regardless of the productivity, the literature on the firm's organizational choice reveals that the productivity is its decisive factor; that is, more

[15] For that purpose, Kawakami and Sturgeon (2011) incorporate several theoretical frameworks, including the technological capability approach (Lall, 1992) and the dynamic capability approach (Teece, 2009), into the GVC framework.

productive MNEs prefer vertical integration (Antràs & Helpman, 2004, 2008; Tomiura, 2007; Nunn & Trefler, 2008, 2013; Corcos et al., 2013). Moreover, although those studies consider relational suppliers as one type of GVC governance, the literature, which incorporates the theory of incomplete contracts, reveals that the choice of relational contracts in itself affects the organizational choice. Since highly customized inputs are more likely to be exchanged in long-term trust-based relationships, investments required under such relationships have no or little value outside of the specific buyer-supplier relationship and hence, cause the standard hold-up problem. Thus, the relational contracts matter for the organizational choice (i.e., vertical integration versus foreign outsourcing) depending on the relative importance of such investments of MNEs and suppliers (Antràs, 2003; Antràs & Helpman, 2004, 2008; Nunn & Trefler, 2008, 2013; Corcos et al., 2013). Therefore, the literature indicates that the choice of GVC governance types and the productivity of local firms are endogenous and mutually dependent. We discuss how to deal with this endogeneity issue in Section 4.

[Table 5 here]

4. Toward an integration of FDI and GVC studies: Incorporating the view of GVC into estimation of information spillovers

4-1. Incorporation of governance types

In this section, we suggest ways in which to incorporate the perspectives of GVC studies into the framework of FDI studies. From the perspective of the development of local firms and industries, analyzing how and under what conditions captive suppliers transform into relational suppliers is crucial. The important issue is to identify the determinants of the shift from captive to relational suppliers. Estimating a multinomial logit function to identify the determinants of the governance types, Saliola and Zanfei (2009) found that technological competence of local firms relates positively to the choice of knowledge-intensive value chains. A recent survey of GVC case studies by Choksy, Sinkovics, and Sinkovics (2017) also suggests that functional upgrading is more likely to occur in the case of privileged suppliers, which are larger, possess more resources, and have a stronger industrial position than non-privileged suppliers.

Since the governance types of the contract between foreign and local firms affect the division of the value added between foreign and local firms, as illustrated in Figure 3, measured TFP is supposedly affected by the governance types. Thus, we propose the inclusion of the governance type as an explanatory variable in equation (4), as indicated by equation (5):

$$\Delta \ln(A_d)_{ijt} = \gamma_0 + \gamma_{1j}(\frac{R}{Y})_{ijt-1} + \gamma_{2j} \ln \frac{(A_F)_{jt-1}}{(A_d)_{ijt-1}} + \gamma_{3j}(\frac{R}{Y})_{ijt-1} * \ln \frac{(A_F)_{jt-1}}{(A_d)_{ijt-1}}, \quad (5)$$
$$+ \gamma_{4j}\text{Relational}_{ijt-1} + \mathbf{X}'_{ijt-1}\boldsymbol{\gamma}_{5j} + \mathbf{Z}'_{jt-1}\boldsymbol{\gamma}_6 + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}$$

where *Relational* is an indicator of the relational contract, and the other variables are the same as in equation (4).

We note that the proposal of this study coincides with recent literature on the empirical analysis of relational contracts. In addition to the impacts of relational contracts on the MNE's organizational choice, some studies have analyzed the impacts of relational contracts on the performance of local suppliers.[16] For example, Cajal-Grossi, Macciavello. and Noguera (2019) found that suppliers having relational contracts received higher markups and prices from their buyers in the garment industry in Bangladesh. However, the challenge of this new estimation is to find out appropriate instruments because the measurement of the governance types is notoriously difficult, while it is intrinsically related to the determinants of productivity of the local suppliers, as pointed out by Antràs (2019).

[16] Macchiavello (2018) provides a survey of recent empirical studies on relational contracts.

4-2. Choice of proxies for relational contracts

While we cannot determine the best proxy variable for relational contracts a priori, we can suggest several possibilities. The first group of variables refers to the suppliers' position in a given value chain. First-tier suppliers are likely to have relational contracts with foreign firms, as suggested by Bair and Gereffi (2001), Dolan and Humphrey (2004), and Blažek (2016). 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, as suggested by Dolan and Humphrey (2004) and Schmitz (2006). This is because the diversification of customers and markets suggests the symmetric and independent relationships that local suppliers have with foreign firms, indicating relational contractual relationships (Dolan & Humphrey, 2004). Schmitz (2006) also concludes that the diversification of markets and customers facilitates the functional upgrading of local suppliers. The third group of variables may relate to the nature of the contract between the supplier and foreign firms, such as the length and extent of division of the labor in preparing drawings or blueprints. A long-term contract with significant involvement of the supplier in the preparation of drawings would imply closer relational contracting, as suggested by Asanuma (1989), Sturgeon, Van Biesebroeck, and Gereffi (2008), and Simona and Axèle (2012). Similarly,

Martin, Méjean, and Parenti (2018) measured the relational contract as the duration of supplier-buyer relationships. The fourth group refers to the composition of workers, including non-production workers engaged in pre-production and post-production activities, as suggested by Gereffi (1999) and Sato and Fujita (2009).

4-3. Choice of instrumental variables

Since the choice of relational contracts is endogenous, we need instruments in the new estimation. According to the original ideas of the GVC study by Gereffi, Humphrey, and Sturgeon (2005), the variables that represent transaction costs of contracts, codification of production systems, and innate capability of local suppliers are those affecting the choice between captive and relational contracts. Transaction costs are often measured by asset specificity, and many studies have analyzed the impacts of asset specificity on buyer-supplier relationships (David & Han, 2004; De Vita, Tekaya, & Wang, 2011). However, since Gereffi, Humphrey, and Sturgeon (2005) consider that transaction costs are high in both relational and captive contracts, we cannot use this variable for the identification of the contract choice. Since the capability of local suppliers is directly correlated with TFP, we cannot use it for the instrumental variable, either. Thus, the codification of production systems is the only possible variable that potentially serves as

the instrument. That is, local suppliers are likely to have relational contracts if codification of the production system is difficult. The codifiability is likely to be related to the nature of transacted parts and components. If transacted parts are standard ones (e.g., steel plates), the codifiability will be high. In contrast, if parts are nonstandard and specific to the contractual transaction, the codifiability is likely to be low. Captive contracts will be chosen in the former case, whereas relational contracts will be chosen in the latter case.

We argue that although it is difficult to identify the nature of transacted parts, some variables representing the nature of transactions are closely related. For example, Dyer (1996a, 1996b) and Artz (1999) use delivery frequency as the operational indicators for nonstandard parts because they are difficult to obtain from arm's length transactions and, hence, are more likely to be required just-in-time. Recently, Antràs (2019) and the World Bank (2019) also have pointed out that customized products particularly require just-in-time delivery.

Additionally, based on the classification of Rauch (1999), the share of inputs not sold at organized exchanges or reference prices have been widely used as the variable indicating the nonstandard or differentiated products (Nunn, 2007; Nunn & Trefler, 2008; Antràs & Chor, 2013; Corcos et al., 2013). Note that although this stream of research analyzes global buyers' international sourcing strategy (i.e., imports from their own

affiliates or independent foreign suppliers), we are concerned with the choice of contracts between foreign affiliates and local suppliers located in the same country. We consider that the idea developed for international sourcing can be applied to the analysis of the contract choice of local suppliers.[17] For example, Linarello (2018) uses the number of inputs not sold at organized exchanges as the measure of product specificity of intermediate inputs transacted between buyers and suppliers in the same country.

We argue that the suggested instruments (i.e., delivery frequency of inputs and the share of inputs not sold at organized exchanges or reference prices) are considered to satisfy exclusion restrictions. First, the instruments are undoubtedly correlated with the choice of relational contracts. For example, Martin, Méjean, and Parenti (2018) empirically show that the relational contract, measured by the duration of supplier-buyer relationships, is closely related to the product specificity measure based on the classification of Rauch (1999). Further, the suggested instruments are not necessarily correlated with the suppliers' productivity. In any case, we must further consider the

[17] To our best knowledge, it is beyond the purview of existing FDI studies, as well as this study, to consider the impacts of quality or oligopolistic competition among a few foreign firms in downstream sectors on the productivity growth of local suppliers in upstream sectors.

careful selection of appropriate variables for the instruments.[18]

Furthermore, the incorporation of the GVC governance types may help researchers of FDI studies to estimate more precise effects of FDI on the productivity change of local suppliers. For example, since the measure on the FDI presence and its measurement error may be correlated with the GVC governance types, the inclusion can reduce the potential omitted variable and measurement error bias. Further, since the effects of FDI presence may be different between captive and relational suppliers, the incorporation allows for estimating the subgroup treatment effects defined by the contract-type groups, thereby helping to deal with the treatment effect heterogeneity. We believe that by integrating the analysis of productivity-focused FDI studies with the analysis of contract-focused GVC studies, our understanding of the role of FDI in improving the efficiency of local firms will be deepened further.

5. Conclusions

Given the rapid increase in the volume of FDI flows over the past several decades coupled with its potential role in transferring advanced technology and management practices

[18] Ideally, we would like to undertake an empirical exercise employing the suggested model and variables.

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 FDI and GVCs, both of which are interested in the transfer of useful knowledge for the development of local firms in developing nations. Nonetheless, cross-references between FDI and GVCs studies on the productivity impacts on local firms are severely lacking.

We first found that FDI studies have made several significant findings, particularly 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. However, we revealed that the specification of the estimation functions in FDI research suffers from several restrictive assumptions, such as the common assumption of 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. For this reason, we visited the literature on GVCs and found that it provides useful insights into the relationships between foreign and local firms, which depend on transaction costs, codifiability of production systems, and production and

managerial capability of local firms, as well as how functions, products, and production processes are upgraded. Although GVC studies remain largely conceptual and case study-based, they explore an important mechanism underlying the productivity improvements of local firms, which undoubtedly help enrich FDI studies. Particularly, we incorporated the essence of GVC studies, where governance types affect the productivity change of local firms, into the estimation of information spillovers from FDI. This exploration, in turn, deepens the analysis of GVC studies.

To overcome the limitations of existing studies, this study has made several recommendations. First, it has suggested a possible way to avoid the limitations of the estimation methods of the impact of FDI by extending the model of productivity improvement, originally developed by Griffith, Redding, and Van Reenen (2004) to examine the effect of the technology gap between the frontier firm and other firms. Second, given that both GVC and FDI research are interested in knowledge transfer, this study has suggested several ways to enrich the latter by incorporating the insights of GVC research. In particular, we proposed the integrated approach, in which the choice of relational contracts is determined in the first stage and the changes in local firm's productivity are affected by this choice in the second stage. We provided some suggestions on how to address the endogeneity issue in this new estimation strategy. We

call for further elaboration of estimation methods to deepen our understanding of the impact of FDI on the development of local enterprises and industries.

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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 elaboration.

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

Table 2

Findings of productivity impacts of FDI based on the one-stage estimation method

Author	Year	Industry/country	Research periods	Data/technique	Productivity measure/Foreign presence measure/IV (if used)	Effect on productivity
Haddad and Harrison	1993	Manufacturing industries/ Morocco	1985-1989	Panel	TFP (change)/capital share (level)	Horizontal: ?
Aitken and Harrison	1999	Manufacturing industries/ Venezuela	1976-1989	Panel	Output (level and change)/employment share (level and change)	Horizontal: −
Sjöholm	1999	Manufacturing industries/ Indonesia	1980-1991	Cross-sectional	Output (growth)/output share (level)	Horizontal: +
Castellani and Zanfei	2003	Manufacturing industries/ France, Italy, and Spain	1992-1997	Panel	Output (change)/absolute value of employment (change)	Horizontal (Italy): + Horizontal (Spain): − Horizontal (France): ?
Javorcik	2004	Manufacturing industries/ Lithuania	1996-2000	Panel/OP	Output (level and change)/output share (level and change)	Horizontal: ? Backward (joint venture): + Forward: ?
Bwalya	2006	Manufacturing industries/ Zambia	1993-1995	Panel/GMM	Output (change)/employment share (change)	Horizontal: − Backward: +
Haskel, Pereira, and Slaughter	2007	Manufacturing industries/the United Kingdom	1973-1992	Panel/IV, GMM	Output (level and change)/employment share (level and change)/FDI initial levels, inward FDI to the United States	Horizontal: +
Blalock and Gertler	2008	Manufacturing industries/ Indonesia	1988-1996	Panel/OP, translog	Output (level)/output share (level)	Horizontal: ? Backward: +
Hamida and Gugler	2009	Manufacturing, service and construction sectors/ Switzerland	1998-2001	Panel	Output (change)/sales share (level)	Horizontal: ? Horizontal (sub-sample of firms with mid-technological gaps): +
Monastiriotis and Alegria	2011	Manufacturing and non-manufacturing sectors/ Bulgaria	2002-2005	Panel/ IV	Output (level)/employment share (level)/past values of foreign ownership shares, sectoral employment shares of foreign-owned firms in Romania	Horizontal: ? Horizontal (Greek joint ventures): +
Gorodnichenko, Svejnar, and Terrell	2014	Manufacturing and service sectors/17 transition market economies	2002-2005	Panel	Output (change)/output share (change)	Horizontal: ? Backward: + Forward: ?
Kinuthia	2016	Manufacturing industries/ Kenya and Malaysia	2000-2005	Panel/translog	Value added (level)/employment share (level)	Horizontal (Kenya): − Horizontal (R&D-performing foreign firms in Malaysia): + Backward (Malaysia): −

Source: Authors' own elaboration.

Note: OP indicates that the technique of Olley and Pakes (1996) is used for the productivity estimation. IV and GMM indicate that the instrumental variables method and the generalized method of moments are used for the estimation, respectively. Translog indicates that the translog production function is used. Moreover, + and － indicate statistically significant positive and negative effects, respectively, while ? indicates mixed or statistically insignificant effects.

Table 3

Findings of productivity impacts of FDI based on the two-stage estimation method

Author	Year	Industry/country	Research periods	Data/technique	Productivity measure/Foreign presence measure/IV (if used)	Effect on productivity
Chung, Mitchell, and Yeung	2003	Auto-component industries/the United States	1979-1991	Cross-sectional	TFP (growth)/whether local suppliers provided components to Japanese assemblers	Backward: ?
Girma	2005	Manufacturing industries/the United Kingdom	1989-1999	Panel/separate estimation of each industry in the first stage	TFP (growth)/employment share (level)	Horizontal: ?
Todo and Miyamoto	2006	Manufacturing industries/Indonesia	1994-1997	Panel/separate estimation of each industry in the first stage, OP, GMM	TFP (change)/employment share (level)	Horizontal (R&D-performing foreign firms): +
Javorcik and Spatareanu	2008	Manufacturing industries/Romania	1998-2003	Panel/separate estimation of each industry in the first stage, LP, translog	TFP (change)/output share (change)	Horizontal: － Backward (joint venture): +
Liu	2008	Manufacturing industries/China	1995-1999	Panel/separate estimation of each industry in the first stage, OP	TFP (level)/output share (level)	Horizontal (short term): － Horizontal (long term): + Backward (short term): － Backward (long term): + Forward (short term): ? Forward (long term): ?
Blalock and Gertler	2009	Manufacturing industries/Indonesia	1988-1996	Panel/separate estimation of each industry in the first stage, ACF, LP	TFP (level)/output share (level)	Horizontal: ? Horizontal (interacted with absorptive capacity): +
Keller and Yeaple	2009	Manufacturing industries/the United States	1987-1996	Panel/OP, IV	TFP (change)/employment share (change)/industry-level changes in shipping costs and tariffs	Horizontal: +
Barrios, Görg, and Strobl †	2011	Manufacturing industries/Ireland	1983-1998	Panel/LP, IV, GMM	TFP (level)/output share (level)/level of government grants given to foreign firms	Horizontal: ? Backward: + Forward: ?
Javorcik and Spatareanu	2011	Manufacturing industries/Romania	1998-2003	Panel/separate estimation of each industry in the first stage, ACF	TFP (level)/output share (level)	Backward (American affiliates): + Backward (European affiliates): ?
Fernandes and Paunov	2012	Manufacturing industries/Chile	1992-2004	Panel/separate estimation of each industry in the first stage, ACF, LP, OP, IV	TFP (level)/output share (level)/values of the outward FDI stocks in service sectors of the US and Spain	Forward (with service sectors): +
Merlevede, Schoors, and Spatareanu	2014	Manufacturing industries/Romania	1996-2005	Panel/separate estimation of each industry in the first stage, ACF, LP, OP, index number, translog	TFP (change)/output share (change)	Horizontal (short term): － Horizontal (long term): + Backward (short term): + Backward (long term): ? Forward: ?
Newman et al.	2015	Manufacturing industries/Vietnam	2009-2012	Panel/separate estimation of each industry in the first stage, OP, Wooldridge	TFP (change)/revenue share (change)	Horizontal: ? Backward (joint venture): + Forward (indirect linkages): － Forward (direct linkages): +
Fatima	2016	Manufacturing and service sectors/Turkey	2003-2010	Panel/separate estimation of each industry in the first stage, LP	TFP (level)/output share (level)	Horizontal: － Backward: + Forward: +
Hong, Sun, and Huang	2016	Manufacturing industries/China	1998-2007	Panel/separate estimation of each industry in the first stage, LP	TFP (level)/employment share (level)	Horizontal: －
Thang, Pham, and Barnes	2016	Manufacturing industries/Vietnam	2000-2005	Panel/separate estimation of each industry in the first stage, LP	TFP (level)/employment share (level)	Horizontal: ? Backward: + Forward: ?
Choi and Pyun	2017	Manufacturing industries/Korea	1990-2007	Panel/LP	Standardized TFP (level)/output share (level)	Horizontal (industries with low concentration and low capital intensity): + Horizontal (industries with high concentration and high capital intensity): －
Lu, Tao, and Zhu	2017	Manufacturing industries/China	1998-2007	Panel/separate estimation of each industry in the first stage, ACF, LP, OP, IV	TFP (level)/output share (level)/variations across industries in the changes in FDI regulations on China's WTO accession	Horizontal: － Backward: + Forward: +
Ebghaei and Wigley †	2018	Manufacturing industries/Turkey	2003-2011	Panel/LP, OP	TFP (level)/output share (level)	Horizontal: + Backward: + Forward: +
Njikam and Leudjou	2019	Manufacturing industries/Cameroon	1993-2005	Panel/LP, GMM	TFP (change)/output share (change)	Backward (Asian affiliates): + Backward (American and European affiliates): －

Source: Authors' own elaboration.

Note: † indicates that the one-stage estimation method is also used. ACF, LP, OP, Wooldridge, and index number indicate that the techniques of Ackerberg, Caves, and Frazer (2015), Levinsohn and Petrin (2003), Olley and Pakes (1996), Wooldridge (2009), and the index number approach are used for the productivity estimation, respectively. IV and GMM indicate that the instrumental variables method and the generalized method of moments are used for the estimation, respectively. Translog indicates that the translog production function is used. Moreover, + and − indicate statistically significant positive and negative effects, respectively, while ? indicates mixed or statistically insignificant effects.

Table 4

Three determinants of GVC governance

Governance type	Complexity of transactions	Ability to codify transactions	Supply base capabilities
Market	Low	High	High
Relational	High	Low	High
Captive	High	High	Low
Hierarchy	High	Low	Low

Source: Table 1 in Gereffi, Humphrey, and Sturgeon (2005: 87) with authors' own modifications.

Table 5

Findings of GVC case studies in developing countries

Author	Year	Industry/country	Main variables examined	Governance types	Results on productivity (or firm performance)
Dolan and Humphrey	2000	Fresh vegetable industry/Kenya and Zimbabwe	Relationships between GVC governance types and upgrading types	Small-sized exporters	Functional upgrading: −
Schmitz and Knorringa	2000	Footwear industry/Brazil, China, and India	Global buyers' assessment of suppliers' performance/ buyers' role in suppliers' upgrading	Captive suppliers in Brazil Captive suppliers in China Captive suppliers in the three countries	Product and process upgrading: + Product upgrading: + Functional upgrading: −
Bair and Gereffi	2001	Apparel industry/Mexico	Relationships between GVC governance types and upgrading trajectories	Large-sized first-tier suppliers Small-sized second- and third-tier suppliers	Functional upgrading: + Functional upgrading: −
Dolan and Humphrey	2004	Fresh vegetable industry/Kenya and Zimbabwe	Relationships between GVC governance types and upgrading trajectories	Captive suppliers Relational suppliers	Functional upgrading: − Functional upgrading: +
Poon	2004	Information technology (IT) industry/Taiwan	Contribution of global production networks to suppliers upgrading	Large-sized first-tier suppliers	Functional upgrading: +
Pietrobelli and Saliola	2008	Manufacturing industries/Thailand	Relationships between GVC governance types and TFP	Local suppliers with more intense involvement from buyers	TFP: +
Ivarsson and Alvstam	2011	Furniture industry/China, Indonesia, Thailand, and Vietnam	Relationships between GVC governance types and upgrading trajectories	Captive suppliers From captive to relational suppliers	Product and process upgrading: + Functional upgrading: +
Navas-Alemán	2011	Footwear and furniture industries/Brazil	Relationships between GVC governance types and upgrading types	Captive suppliers Captive suppliers Market-based suppliers	Functional upgrading: − Product and process upgrading: + Functional upgrading: +
Contreras, Carrillo, and Alonso	2012	Automotive industry/Mexico	Impacts of spin-offs from MNEs to upgrading trajectories of local suppliers	Spin-offs from MNEs	Functional upgrading: +
Simona and Axèle	2012	Automotive industry/Poland	Determinants of knowledge transfer from foreign firms	Relational suppliers	Knowledge transfer: +
Rossi	2013	Garment industry/Morocco	Relationships between GVC governance types and upgrading types/social upgrading	Continuous suppliers Fast fashion suppliers	Process upgrading: + Process upgrading: +
Ponte et al.	2014	Aquaculture industry/Bangladesh, China, Thailand, and Vietnam	Relationships between GVC governance types and upgrading types/upgrading trajectories	Captive suppliers in China and Thailand Captive suppliers in the four countries Relational suppliers in Thailand	Product and process upgrading: + Functional upgrading: − Functional upgrading: +
Morris and Staritz	2017	Apparel industry/Lesotho	Relationships between investors' origins and upgrading types	South African affiliates Taiwanese affiliates	Functional and process upgrading: + Functional, product, and process upgrading: −
Martinez-Covarrubias, Lenihan, and Hart	2017	Manufacturing industries/Mexico	Determinants of functional upgrading	Market-based/relational suppliers	Functional upgrading: +

Source: Authors' own elaboration.

Note: + and − indicate positive and negative effects, respectively.

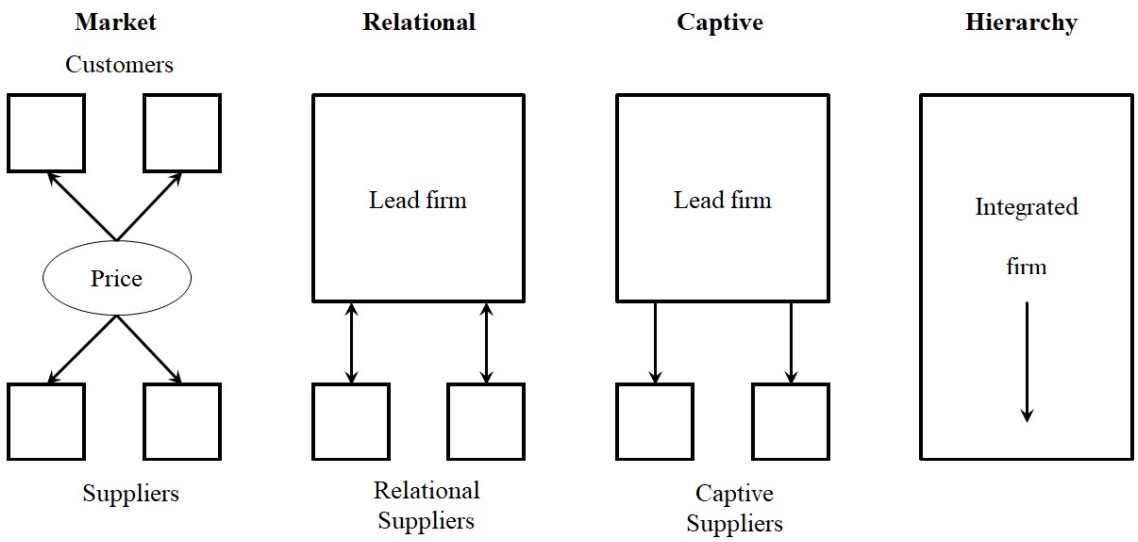

Figure 1. Four types of GVC governance.

Source: Authors' own drawing, based on Figure 1 in Gereffi, Humphrey, and Sturgeon (2005: 89).

Note: Arrows show the directions of order and information. Quadrangles show the boundaries of each organization.

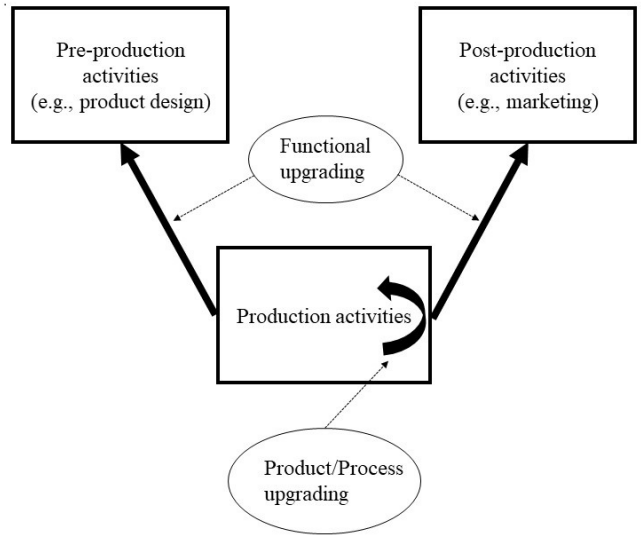

Figure 2. Types of upgrading.

Source: Authors' own drawing, based on Figure 3 in UNIDO (2004: 10).

Note: Arrows show the upgrading.

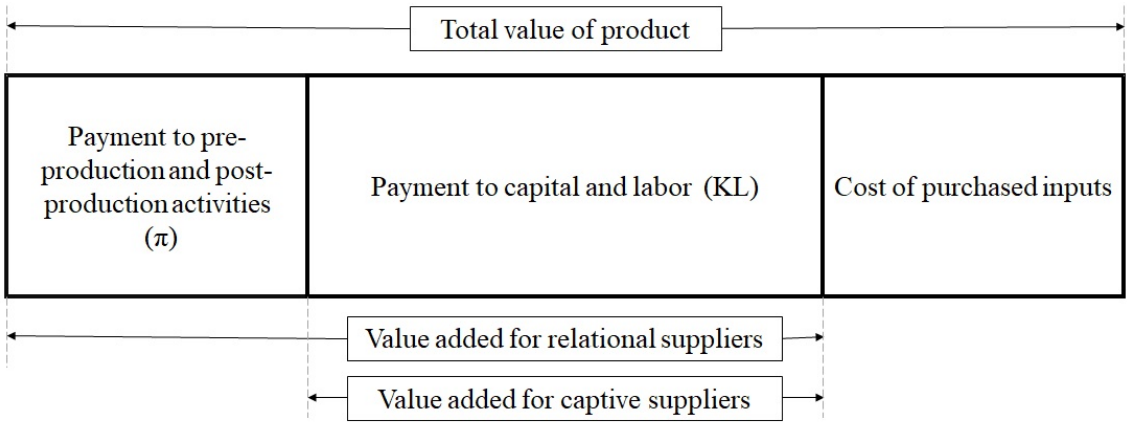

Figure 3. Components of the value added in captive and relational suppliers.

Source: Authors' own elaboration.