



Multinational firms, global value chains and the organization of knowledge transfer

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ABSTRACT

This paper combines insights from different streams of literature to develop a more comprehensive framework for the analysis of knowledge transfer via value chain relationships. We integrate the existing literature in three ways. First, we consider value chain relationships as a multi-facet process of interaction between buyers and suppliers, involving different modes of knowledge transmission and development. Second, we assess whether and to what extent value chain relationships are associated with the presence of multinationals and with their embeddedness in the host economy. Third, we take into account the capabilities of local firms to handle the technology as a factor influencing knowledge transfer through value chain relationships. Using data on 1385 firms active in Thailand in 2001–2003, we apply a multinomial logit model to test how the nature and intensity of multinational presence and the competencies of local firms affect the organization of international knowledge transfer. We find that knowledge intensive relationships, which are characterized by a significant transmission of technical and organizational competencies along the value chains, are positively associated with the presence of global buyers in the local market, with the efforts of MNCs to adapt technology to local contexts, and with the technical capabilities of domestic firms. By contrast, the age of subsidiaries and the share of inputs purchased locally appear to increase the likelihood of value chain relationships with a lower technological profile.

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1. Introduction

Multinational firms are widely considered as crucial actors in knowledge transfer to local firms, especially when Less Developed Countries are considered as recipient economies. Relationships with suppliers are key channels in this perspective. Using a jargon increasingly adopted in the literature, we shall identify these vertical relationships with the term “value chain relationships” (or “Value chain governance modes”), through which production processes are organized on a global scale (Sturgeon, 2001). The development of such organizational arrangements goes hand in hand with significant knowledge flows. Some knowledge transfer occurs involuntarily through human capital mobility and through the imitation of the technological and managerial practices of global buyers. Important knowledge assets are also transferred voluntarily by multinationals in their efforts to increase the efficiency of their local suppliers (and to obtain access to local competencies on a reciprocity basis). However, not all value chain relationships are equally conducive to knowledge transfer. In this paper we analyze

under which circumstances local firms get involved in knowledge intensive value chain relationships.

Different streams of literature provide complementary insights on factors enhancing knowledge transfer through global value chain relationships. Among other strands of contributions, international production literature has emphasized a number of characteristics of both foreign and domestic firms which may favor vertical linkages, knowledge transfer and productivity spillovers. On the one hand, several features of foreign firms have been highlighted, including the intensity of their presence in a given market and their degree of embeddedness in local contexts. On the other hand, local skill endowment and ability to handle knowledge is also stressed as a fundamental condition making it advantageous for foreign firms to engage in knowledge transfer, and for domestic firms to gain access to foreign knowledge. While this stream of literature highlights the importance of linkage creation in the transfer of knowledge, the main focus remains on the international organization of production taking place within the boundaries of multinational firms. As a result, most of these contributions largely disregard the extreme variety of value chain relationships in which multinationals are involved.

From a different perspective and with a lesser focus on multinational enterprises, recent developments in the “Global value chain” literature have drawn attention to the variety of value chain rela-

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tionships wherein global buyers interact with local suppliers in different countries. Alternative relationships (governance modes) will emerge in the presence of different degrees of standardization of products and processes, and of different competencies of suppliers. As we shall highlight in reviewing this literature, the mode of governance is essential for understanding whether and how firms in developing countries can gain access to global markets, and benefit from them. However, this line of research places no particular emphasis on the characteristics of buyers, apart from their being global in nature. As opposed to works on the economics of international production, and quite symmetrically, global value chain literature has the merit of exploring the heterogeneity of governance modes but it neglects structural and behavioral differences across global buyers.

Combining insights from these two streams of literature, we develop a more comprehensive analytical framework to evaluate the choice of alternative modes of organizing knowledge transfer and exchange involving global buyers and local firms. The focus will be on vertical relationships between subsidiaries of multinational companies in a given host economy, and local suppliers active in the same economy. We shall follow five steps. First, we shall identify a wider range of value chain agreements than is usually the case in contributions on multinational firms and international production. Second, we shall allow for a greater heterogeneity of global buyers than is commonly done in the global value chain literature. Third, we shall take account of competencies of local firms as emphasized by both streams of research. Fourth, we shall argue that the characteristics of both foreign and domestic firms affect the choice of value chain governance modes. Fifth, and finally, we shall apply this more comprehensive analytical framework to the case of value chain arrangements between affiliates of multinationals and local firms active in Thailand, using data from the “Productivity and the Investment Climate Private Enterprise Survey” (PICS), conducted by the World Bank on a representative (stratified) sample of 1385 Thai firms from 2001 to 2003.

The paper is structured as follows. Section 2 overviews the background literature. Section 3 develops an integrated approach to the analysis of global value chain relationships and presents the main hypotheses. Section 4 illustrates the data and measures used for our empirical tests. Section 5 presents the empirical model and discusses the results of our econometric exercises. Section 6 concludes.

2. Previous literature

A plethora of contributions have focused on vertical relationships as a channel through which multinational firms, or more generally “global actors”, transfer knowledge¹ to local companies. For the purpose of the present paper, it is worth recalling some, largely complementary, developments which have emerged from two main streams of literature whose convergence would in our view generate useful synergies. On the one hand, important insights stem from a rather consolidated, albeit variegated, strand of contributions focusing on the economics and manage-

¹ We shall preferably use the term “knowledge” as it is more comprehensive than “technology”. In fact the former can be either embodied in machinery, final goods and services or take the form of skills, competencies and routines incorporated in workforce, institutions and organizations; it can have both codified and tacit aspects; some of it can be general and abstract from the contexts of use and hence cannot be identified directly with specific products or processes, while other knowledge bits can only be defined in connection with a given problem to solve or with a circumscribed field of application (See Arora and Gambardella, 1994 for a similar conceptualization of knowledge). Although the distinction might sound too simplistic and naive, we shall instead use the term “technology” only to identify the tools and procedures that are necessary to transform (material and immaterial) inputs into goods and services.

ment of the multinational corporation (MNC) and its key role in the international organization of production. We shall refer to this as International Production literature (see [letto-Gillies, 1992](#); [Cantwell, 2000](#) for extensive reviews of the different schools of thought which can be made fall under this heading). On the other hand, recent developments in the Global Value Chain literature have focused on more specific types of linkages, namely relationships through which global buyers organize their transactions along the value chains on a global scale (See [Kaplinsky and Morris, 2001](#) for a review) and on the importance of these linkages for local suppliers’ performance.

With no pretension of an exhaustive survey of the views on linkage creation and knowledge transfer in the very broad international production literature, one can easily single out three main approaches which are directly relevant to the scope of this paper.

First, the issue has been tackled in the rather extensive literature on the changing nature of *multinationals enterprises and their growing involvement in international collaborative ventures*. While empirical studies on international joint venturing have been proliferating since the mid-1980s (see [Mowery, 1988](#) for a comprehensive overview of the phenomenon in different industries), one may consider the works by [Cantwell \(1989\)](#) and [Dunning \(1993, 1995\)](#) as some of the earliest and most path-breaking in this respect. From a historical perspective [Dunning \(1995\)](#) theorized the emergence of what he called “Alliance capitalism”, as a result of the globalization of markets and of the changing nature of technology in a number of sectors. These forces are considered as fundamental pressures leading to a changing organization of MNCs, which increasingly have to resort to linkages with foreign counterparts endowed with complementary competencies. Building on these insights and earlier empirical work, several studies have explored different aspects of this changing nature of multinationals. These aspects range from the role of international alliances in the process of technological diversification and asset seeking strategies of multinational enterprises ([Granstrand et al., 1993](#); [Cantwell and Piscitello, 2000](#); [Narula, 2003](#)); to the complementarities between internal networks of subsidiaries and external networks of cooperation with local firms and institutions ([Zanfei, 2000](#); [Castellani and Zanfei, 2004](#)); to the choice of alternative market entry strategies, including joint ventures and contractual agreements with local counterparts ([Gomes-Casseres, 1989](#); [Hennart and Larimo, 1998](#); [Nisbet et al., 2003](#)); to the use of international networks to increase bargaining power of multinationals *vis à vis* national governments, labor forces and other stakeholders ([Cowling and Sugden, 1987](#); [letto-Gillies, 2002](#)). Although with different emphasis on knowledge transfer issues, these strands of research share the concern about the fact that the boundaries of MNCs are changing and getting fuzzier, and this can give rise to increasing voluntary and involuntary knowledge flows across countries.

Second, the issue of linkages and knowledge transfer has been at center stage in the rather extensive literature on the *embeddedness of MNCs*. Even though there is a variety of ways in which this notion has been conceptualized in the literature ([Dacin et al., 1999](#)), there seems to be some convergence on the idea that at least three aspects are topical:

- Embeddedness is the result of a process that requires time to take place, hence it is correlated to the length of establishment of multinationals in local contexts. A lengthy experience of local contexts is expected to favor acquaintance with local norms and codes of conduct, something which may help create mutual trust and make transactions more effective ([Vaccà, 1996](#); [Burchell and Wilkinson, 1997](#)).
- Embeddedness requires the creation of extensive webs of transactions with local firms and institutions. Through these interactions, multinationals will increase their access to local

competencies and eventually develop “thicker” relationships involving knowledge exchanges (Turok, 1993; Vaccà and Zanfei, 1995; Andersson and Forsgren, 1996).

- (c) Embeddedness implies mutual adaptation between the parties involved. By adapting to local practices, e.g., in the area of human resource management, and by modifying products and processes to local requirements, MNCs are able to achieve better performances at the plant level and to increase local market penetration (Rosenzweig and Nohria, 1994; Andersson et al., 2005). Adaptive efforts require knowledge of local contexts, and this is likely to be attained by means of (technical) linkages with local firms and institutions.

Third, linkages with local firms are one of the key channels through which MNCs may generate knowledge (and pecuniary) spillovers to the host economy. This issue has a long tradition of contributions particularly in development studies literature dating back to Hirschman (1958) and Lall (1978) and recently revived by Rodriguez-Clare (1996), Markusen and Venables (1999) and Javorcik-Smarzynska (2004). Multinational firms may enter a foreign country by setting up plants in upstream industries, where intermediate inputs are produced, or in downstream industries, mainly producing final goods. In both cases they tend to crowd out domestic competitors, but they are also likely to induce forward (in the former case) and backward (in the latter case) linkages, with positive effects on local firms. These effects may hinge upon the expansion of demand for local inputs, inducing higher efficiency; and on voluntary and involuntary knowledge transfer from multinationals to local suppliers and customers (see Barba Navaretti and Venables (2004), Narula and Zanfei (2005), Castellani and Zanfei, 2006 for recent reviews of the theoretical and empirical literature on this issue). While an improvement of supplier performances has been observed in many developing countries as a result of linkage creation processes (Unctad, 2001; Alfaro and Rodriguez-Clare, 2004), recent studies report some evidence that there can be positive effects for local firms also when multinationals source their inputs in advanced countries (Potter et al., 2003; Crone and Roper, 2001; Veugelers and Cassiman, 2004). Some works have stressed the importance of local firms' competencies and absorptive capacity as a necessary condition for spillovers to accrue to the host economies (Cantwell, 1989; Kokko, 1994). Other studies have emphasized that positive spillovers are more likely to occur when high local competencies combine with the presence of foreign firms that are as close as possible to the technological frontier (Castellani and Zanfei, 2006). More generally, the generation of spillovers, far from being the automatic result of multinational presence, requires the existence of a wide range of conditions concerning the characteristics of firms and of (national and supranational) institutions involved (Zanfei, 2004).

From a different perspective, other contributions have integrated lines of arguments emerged in innovation systems literature with issues concerning linkage creation, knowledge externalities and the development of national capabilities. This stream of research has long emphasized the role of interactions among different actors involved in technical change and has stressed that the quality of such interactions helps explain differences in national and sectoral patterns of innovation (Freeman, 1987; Lundvall, 1993; Malerba, 2005). Recent developments in this literature have also highlighted how changes and inertia of innovation systems may be responsible of the way innovative activities are organized across national borders. On the one hand, several studies have argued that institutional characteristics and localized learning processes have consolidated national differences in technological accumulation processes (Carlsson, 2003). On the other hand, some works have shown that internationalization of R&D and international linkage creation is often the result of a combination of pull and push factors

which will eventually determine a variety of creative responses of multinational firms to challenges and opportunities posed by the national systems (Narula, 2003).

As anticipated earlier in this section, a number of scholars have recently considered the issue of linkage creation and international transmission of knowledge from the “Global value chain” (GVC) perspective. The focus in these studies is on how firms active in international markets organize the transfer and coordination of complex and strategic information along the value chains (Baldwin and Clark, 2000; Sturgeon, 2000, 2002; Fujimoto et al., 2001; Langlois, 2003; Sturgeon and Lee, 2001).

With a lesser focus on MNCs, GVC approach analyzes mainly the strategic role of the relationships between global buyers and local suppliers, and their implications for development.

Drawing from the transaction cost literature, Gereffi and Wyman (1990) developed a pioneer framework that tied the concept of the value-added chain directly to the global organization of industries. He thereafter introduced the notion of “governance” of the Value Chains, defined as “authority and power relationships that determine how financial, material, and human resources are allocated and flow within a chain” (Gereffi, 1994). This concept is now central in the literature. However, recent developments have placed much more emphasis than original contributions on non-hierarchical governance modes. Among others, Gereffi et al. (2005) have stressed the role of inter-firm relationships and of institutional mechanisms through which non-market co-ordination of activities in the chain is achieved.

A set of strategic parameters can be highlighted as characterizing governance modes: what is to be produced, how it is to be produced, when it is to be produced and how much is to be produced. By focusing explicitly on the governance of disintegrated chains, the Global Value Chains approach drew attention to the first two critical parameters for value chain governance: what is to be produced, and how it is to be produced.²

Global Buyers most often play as “lead firms”, setting these governance parameters in quasi-hierarchic relationships, especially when they source inputs from developing countries. The form and the level of detail at which the buyers specify the parameters may vary substantially across countries and sectors. As an example, buyers can provide suppliers with a particular design for the producer to work on, they can get involved in their suppliers' quality systems, or even transfer technical personnel and help them introduce particular production processes, effective routines, or monitoring procedures.

Referring to this phenomenon, Gereffi earlier introduced a distinction between producer-driven and buyer-driven global value chains (Gereffi, 1994). In the former, the parameter setting is undertaken by the producers which control key product and process technologies; while in the latter the key parameters are set by retailers and brand-name firms which do not necessarily involve in production facilities. More recently Gereffi (1999b) has also pointed out that each of these different types of value chain is associated with different types of production systems. However the idea that there may be *heterogeneity in the behaviors of actors involved in global value chains*, implying different governance modes, has not been fully developed in subsequent literature, particularly when the role of buyers is at stake.³ Much greater attention is given to

² Humphrey and Schmitz (2000) distinguish two types of governance according to these parameters. On the one hand, they identify with the term “network” those relationships that bring together firms with complementary competences and which will jointly set the key parameters. On the other hand, they use the term “quasi-hierarchy” to identify relationships wherein the lead firm specifies what is to be produced, how it is to be produced and how the performance of subordinate firms in the chain is to be monitored.

³ We shall reconsider this insight in Section 3 of this paper.

other aspects affecting the choice of governance modes, including the nature of knowledge and the competencies of suppliers.

The *nature of knowledge* is at centre stage in several GVC studies on the electronics sector. Focusing on Value Chains and Production Networks, Sturgeon (2002) and Sturgeon and Lee (2001) emphasize the complexity of information exchanged between firms and the degree of asset specificity in production equipment. They highlight three types of value chain relationships, based on the degree of standardization of products and processes: (1) the “commodity supplier” that provides standard products through arm’s length market relationships, (2) the “captive supplier” that makes non-standard products using machinery dedicated to the buyer’s needs, and (3) the “turn-key supplier” that produces customized products for buyers, and uses flexible machinery to pool capacity for different customers. Hence technical change, affecting the nature and the degree of standardization of products and processes, has a significant impact on, and is influenced by, the evolution of governance modes in time.⁴

Gereffi et al. (2005) go deeper into the analysis of factors affecting alternative governance modes. They put forward the idea that there are three key determinants of value chain relationships: the complexity of information and knowledge transfer required to sustain a particular transaction, especially with respect to product and process specifications; the extent to which this information and knowledge can be codified and, therefore, transmitted efficiently and without transaction-specific investment between the parties involved in the transaction; the capabilities of actual and potential suppliers in relation to the requirements of the transaction.

The *competencies of suppliers* play a key role in the development of governance modes as they affect both the ability of local firms to contribute to technical change, and their bargaining power *vis à vis* global buyers. However, the causal relation also goes the other way around, from governance modes to firms’ competencies. There is consensus among GVC scholars that the governance of the value chain importantly affects the generation, transfer and diffusion of knowledge (Humphrey and Schmitz, 2000). The link between enterprise upgrading and GVC governance has also been made more explicit recently: in a GVC context, upgrading is defined as innovating to increase value-added (Giuliani et al., 2005; Pietrobelli and Rabelotti, 2006).

The GVC perspective is useful for various reasons. First, because the focus moves from manufacturing only to the other activities involved in the value chains of goods and services, including distribution and marketing. These activities account for increasing shares of GDP worldwide. Second, GVC emphasizes the nature of the relationships among the various actors involved in the chain, and their implications for development. Moving beyond firm-specific analysis and concentrating on inter-firm linkages, it allows to better capture dynamic flows of economic and organizational activities between producers within different sectors even on a global scale.⁵

Finally, for the purposes of the present paper, it is important to stress a further advantage of adopting this perspective. GVC studies

⁴ The concept of governance in the GVC literature is by and large dynamic. Humphrey and Schmitz (2002b) underline three factors which may affect the stability and evolution of governance mode: (a) power relationships may evolve when existing producers, or their spin-offs, acquire new capabilities; (b) establishing and maintaining quasi-hierarchical governance is costly for the lead firm and induces organizational rigidity because of transaction-specific investments and (c) firms and clusters often do not operate only in one chain but rather simultaneously in several types of chains, therefore they may apply competencies learned in one chain to value other chains.

⁵ For example, scrap metal collectors in South Africa are inextricably linked to a global export trade. They bring scrap metal in old trolleys directly to shipping agents who pay them London spot prices and transfer the scrap immediately to ships for export to iron and steel furnaces across the globe (Kaplinsky and Morris, 2001; Kaplinsky, 2000, 2001).

identify distinct types of relationships characterized by a different level of involvement of suppliers in knowledge intensive activities. This helps capture the essential features of knowledge dissemination and absorption, which are likely to enhance the development of local suppliers. GVC thus provides a perspective that is quite complementary to the view of international knowledge transfer emerged from international production literature, as recalled earlier in this section.

3. An integrated framework for the analysis of value chains and knowledge transfer

In this section we integrate and build on the existing literature in three ways. First, we consider value chain relationships as a multi-facet process of interaction between buyers and suppliers, involving different forms of knowledge transmission and development. Second, we assess whether and to what extent value chain governance is affected by the presence of multinationals and by their embeddedness in the host economy. Third, we take into account the capabilities of suppliers to handle the technology as a factor influencing knowledge transfer through value chain relationships.

As regards the first analytical step, we assume that value chain relationships can be classified according to the way suppliers are involved in the adoption, use and co-development of technology. On the one hand, this involvement will vary with the nature of technologies and with the capabilities of actors (Rosenberg, 1982; Von Hippel, 1988; Langlois and Robertson, 1995). On the other hand, the role of suppliers in knowledge development reflects strategic decisions (the so called “parameter setting”) concerning what is to be produced and on how it is to be produced (Gereffi, 1994; Humphrey and Schmitz, 2000, 2001).

While all value chain relationships do imply some transmission of information between the parties, the extent to which knowledge is actually created, transferred and adopted along the value chains varies dramatically. From this perspective, one can characterize at least three different types of value chain agreements. The first, which we shall name GOV1, is characterized by the transfer of a product specification from the purchasing firm to the supplier, and implies that the latter will carry out a number of tasks on her own which will eventually lead to the provision of the required good (or service), following the directions given by the buyer. Under this circumstance, knowledge transferred is kept to a minimum, will be mostly codified, and it will flow in one direction only (from the buyer to the supplier). A second mode of governance, which we shall dub GOV2, takes place when the buyer provides product design and quality standards to be followed in the production process. Knowledge transfer is uni-directional here too, but it may well be partly tacit and it is more detailed than in the former case. Under this circumstance, the supplier is given strict and mandatory instructions, and is thus granted very little degrees of freedom when executing his/her tasks. A third typology of value chain relationship, GOV3, can be observed when the buyer disseminates specialized competencies, and involves the supplier in R&D and knowledge development. One should notice it is not only a matter of “quantity” of knowledge flowing between firms: a substantial part of the transfer takes place through the mobility of personnel. The knowledge involved is thus largely tacit in nature, and flows in both directions, although not necessarily in a balanced way.

These typologies of value chain relationships thus correspond to different modes of organizing (international) knowledge transfer and diffusion. In fact they differ in terms of nature and quantity of knowledge being transferred, in terms of directions in which it flows, and in terms of the autonomous contribution of both the buyer and the supplier to knowledge development. Hence, no

simple hierarchy exists between them. However, it remains that knowledge plays a strategic role particularly in the case of GOV3, hence we shall refer to these as “knowledge intensive relationships”. Moreover, we may suggest that this governance mode is most likely to be a key vehicle for knowledge transfer from global buyers towards local firms, especially when LDCs are considered as recipient countries.⁶

The second analytical step anticipated earlier in this section consists in singling out the characteristics of global buyers which can be associated with the choice of value chain relationships. As argued earlier in this paper, this aspect has been largely disregarded in GVC literature. The only feature of buyers considered in these studies is their “global” nature as this implies a greater ability to switch to alternative suppliers in different countries and hence accumulate a greater bargaining power. We here argue that other characteristics of global buyers do matter, particularly whether and to what extent they are present in the market where suppliers are active; and how embedded they are in local contexts. Let us briefly discuss both of these factors.

As far as *multinational presence* is concerned, we expect that global buyers with an extensive web of subsidiaries in a given country and sector will have a higher propensity to set up knowledge intensive value chain agreements in that country and sector. Hence linkages of the third type described earlier will be more likely. In fact, acquaintance with the technical jargon, local norms and codes of conduct that are used in a specific context will reduce the uncertainty concerning the behavior of potential partners engaged in a given transaction. This will eventually pave the way for a greater involvement of local counterparts in collaborative activities.⁷ Moreover, the availability of extensive webs of subsidiaries located in a given market is likely to enable MNCs to better monitor alternative suppliers that are active locally. On the one hand, this will increase the outside options available to the MNC locally, hence reducing the risk that their counterparts behave opportunistically. On the other hand, there will be a greater possibility of selecting effective and reliable partners, thus increasing the expected payoff from knowledge transfer. This line of argument can be summarized in the following hypothesis.

H1. Global buyers with a significant presence in the local market are more likely to set up knowledge intensive value chain arrangements (positive impact on GOV3).

However, by emphasizing the importance of an extensive multinational presence we can capture only part of the story. The quality of multinational presence also matters. An important qualitative aspect of multinational presence is the degree of *embeddedness* of affiliates. As recalled in Section 2, there is still some variety in the

way the notion of embeddedness is being conceptualized and operationalized in the literature (Dacin et al., 1999). Nevertheless, most writings recognize that at least three aspects are involved. The first aspect to be considered is that taking roots in the host economy is by and large a function of time. This aspect was clearly illustrated by Dunning (1958) in his seminal study on US multinational penetration in the UK after WWII. From this perspective, the age of subsidiaries since establishment is a good predictor of acquaintance with local contexts, and may be expected to further reduce the behavioral uncertainty we have already referred to when talking about mere multinational presence. This would thus lead us to conclude that the longer the time since establishment, the greater will be a subsidiary's propensity to get involved in knowledge intensive relationships:

H2. The age of subsidiaries since their establishment is associated with the likelihood of knowledge intensive value chain agreements (positive impact on GOV3).

The second aspect characterizing the concept of embeddedness is the intensity of local sourcing of inputs for production. MNCs buying their inputs locally are likely to do so as part of more comprehensive value chain agreements with indigenous firms (Andersson and Forsgren, 1996). However, one needs to integrate this micro-level argument with a consideration of the more general technological environment at the host country level. In fact, the growing literature on national technological capabilities has emphasized that the potential level of inputs produced locally ultimately reflects the level of industrial development of the host country (See Narula, 2003 for a review). This implies that, when inputs are sourced in LDCs, a high share of purchases carried out locally may signal that MNCs are more concerned with cost saving than with quality and knowledge content. Under these circumstances we thus expect that high shares of inputs bought locally be associated with little or no knowledge transfer:

H3. A high share of inputs bought in a context characterized by low level of industrial development is likely to imply purchases of low cost goods, and with little or no transfer of knowledge (positive impact on GOV1).

The third feature of embeddedness is adaptation of MNCs to local practices and demand conditions (Lane and Lubatkin, 1998). Foreign firms may increase their local embeddedness by adapting to local procedures, norms of conduct and habits, especially in the field of human resource management (Rosenzweig and Nohria, 1994). They can also adapt a wider range of practices, including their product and process technology and their standard operating procedures, as illustrated by Andersson et al. (2005) with reference to about 160 subsidiaries of US and European multinationals. To the extent that subsidiaries pursue strategies of technology adaptation to local demands, one may expect they will set up comprehensive value chain arrangements through which they will exchange substantial amounts of knowledge.⁸ That is, subsidiaries will be ready to transfer knowledge in order to have access to adaptation and application abilities on a reciprocity basis. Hence our fourth hypothesis:

⁶ The contractual arrangements adopted in the relationship between global buyers and local suppliers also matter. For instance, it is widely acknowledged in a well-established literature (Mowery, 1988; Teece, 1992) that joint ventures are more effective contractual modes than arms length transactions when knowledge assets are transferred especially in the pre-paradigmatic phases of technology development and when appropriability regimes are weak. By adopting the analytical framework developed in this paper we mean to suggest that other characteristics of vertical relationships should be considered which are at least partially complementary to the contractual form adopted, and might depend on the characteristics of both local suppliers and global buyers.

⁷ One may observe that multinational presence will also reduce the “external uncertainty” concerning factors that are at least partially beyond the control of individual companies, such as the characteristics of local demand, institutions and business environment. As foreign firms increase their presence in a host economy and gather more information on these factors (hence reducing their uncertainty) they can be expected to be more prone to commit directly to local activities, possibly substituting for local suppliers. While this argument certainly applies when (static) transaction cost minimization is at stake, it seems to be much less the case of knowledge transfer operations, wherein dynamic efficiency considerations are at centre stage. See Castellani and Zanfei (2004) for a discussion of this issue.

⁸ The argument seems to be in line with the integration–responsiveness (IR) framework. Used in the international business literature, the IR framework focuses on the strategy and structure of MNCs in response to the global and local environmental pressure faced by the firm (Prahalad and Doz (1987)). In particular, although with no emphasis on knowledge transfer to local suppliers issues, earlier research by Bartlett and Ghoshal (1989), Taggart (1997) and Birkinshaw et al. (1998) has focused on the use of MNCs of their subsidiaries as sources of innovations in response to the local business environment and as a factor that the MNCs can leverage on a global basis.

H4. The higher the efforts to adapt products and processes, the higher the recourse to knowledge intensive value chain relationships (positive impact on GOV3).

A final step in our analytical framework concerns the competencies of local suppliers and how these can be associated with different governance modes. This aspect is emphasized in different streams of literature, including the GVC approach. Here we shall follow more closely the technological accumulation tradition within the international production literature (Cantwell, 1989; Kogut and Zander, 1993) wherein the importance of absorptive capacity is stressed as a key condition favoring interaction between MNCs and local contexts. This line of argument is largely complementary to the one developed to support hypothesis H3 above. Following Cohen and Levinthal (1989), the idea is that domestic firms will need some competencies not only to handle the knowledge they are already endowed with, but also as a means to gain access to external sources of knowledge (including foreign multinationals). From this perspective, the greater the technical competencies of local suppliers the more value chain agreements are likely to be an effective vehicle of knowledge transfer and adoption. This for at least two sets of reasons. First, MNCs themselves are more likely to be willing to transfer knowledge to partners that are able to use it effectively within the value chain arrangements, especially when appropriability regimes are well defined (Teece, 1992) and/or technology is modular enough to allow an effective division of labor along the value chains (Gereffi et al., 2005).⁹ Moreover, dealing with skilled suppliers reduces the risk that “residual incompatibilities” arise between the overall product design and the components manufactured by local suppliers (Puga and Trefler, 2005). Second, suppliers endowed with some technical skills are more likely to be interested in entering knowledge intensive value chain agreements, because the payoff they can expect to obtain from access to external sources of knowledge will be higher (Cohen and Levinthal, 1989).¹⁰ To summarize:

H5. The higher the technical capabilities of local suppliers the greater the likelihood that value chain arrangements are knowledge intensive (positive impact on GOV3).

However, suppliers with strong technical competencies are also likely to enter vertical relationships in which they are allowed a high level of autonomy. On the one hand, MNCs can be expected to be unable to exert a strong ex ante control on competent suppliers, due to information asymmetries. Such a view is consistent with agency theory, in which a global buyer (principal) is assumed to be interested in securing that the supplier (agent) behaves in accordance to the former's goals. Within this framework, information asymmetries in favour of a competent supplier will entail a shift from direct control of ongoing operations to output control: the principal (buyer) will more effectively evaluate the final performances of agents (suppliers), allowing them a greater discretionary power in the process leading to a given output (O'Donnell, 2000). In addition, the more suppliers are competent, the greater are their outside options, hence the higher their possibility to obtain some discretionary power, especially when taking decisions in relevant technical domains (Mudambi and Navarra, 2004). On the other hand, autonomy creates incentives for suppliers to increase their efficiency and to accumulate technical competencies. Contractual agreements wherein suppliers are allowed some degree of auton-

omy in such key areas as the choice of markets and technologies, are likely to make it possible for them to expand their sales and to exploit static and dynamic economies of scales. Moreover, a higher level of autonomy will also stimulate suppliers to invest in creative activities and to experience a wider range of learning paths (Andersson et al., 2005). Hence our final hypothesis:

H6. Competent suppliers are likely to be involved in global value chain relationships in which they are allowed a high level of autonomy, hence they meet low constraints in their technical choices (positive impact on GOV1 and negative impact on GOV2).¹¹

4. Data and variable specification

4.1. Sample and sources

This paper uses new firm level data from Thailand to test the six hypotheses presented above. The data come from the “Productivity and the Investment Climate Survey” (PICS), conducted by the World Bank and the Thailand Government on a sample of 1385 Thai firms in 2004. Surveyed firms are active in the following industries: Food Processing, Textile and Clothing, Wooden Furniture and Products, Auto parts, Electronics, Rubber and Plastic, Machinery and Equipment. These industries account together for more than half of the entire manufacturing value-added and of manufacturing exports. The regions covered are six: North, North East, Central, Bangkok and Vicinity, East and South.

The Enterprise Surveys sample the universe of registered businesses and follow a stratified random sampling methodology.¹² The unit of analysis was the establishment and the enumerators personally gathered the information. The survey questionnaire called for a variety of qualitative and quantitative information. The qualitative section covered issues related to ownership structure, knowledge acquisition, views on the business environment, and relationships with banks and other financial institutions. The quantitative section included questions on production, financial accounts and human resources.

Only registered firms were included in the population frame. The latter has been assembled by the national statistical agency with technical assistance from the World Bank, and it was then used to randomly choose the sample of small, medium and large establishments to be interviewed.¹³

4.2. Why Thailand

There are several reasons why it is worth using data on Thailand to examine the role of multinationals, FDIs and global value chains.

First, throughout the past decades, Thailand has experienced a rapid growth in private investment, both by local firms and by foreign multinationals through FDIs. This country has been a major FDI recipient in South-East Asia over the past two decades (Brimble and Sherman, 1999; Mephokee, 2002). As a matter of fact, in 2004, the Global Investment Prospects Assessment (GIPA) of UNCTAD (United Nations Conference on Trade and Development) designed to analyze “future patterns of FDI flows at global, regional, national, and industry levels”, has ranked Thailand as one of the four “top hot spots for FDI” in the world over the next four years, preceded only by China, India, and the United States. Thailand is ranked as the “Top

⁹ The reverse also applies: researchers have often highlighted that the lack of learning incentives and absorptive capacities may represent the reasons for the failure of knowledge transfer on the part of the transferor (Martin and Salomon, 2003).

¹⁰ In a similar vein, Szulanski (1996) finds that lack of absorptive capacities is a major barrier to internal knowledge transfer for eight large U.S. corporations.

¹¹ There is no contradiction between H3 and H6. In fact it is quite possible that global buyers use GOV1 both as an organizational device to source low cost inputs from local suppliers, and as a means to gain access to qualified suppliers which are competent enough to take care of specific production phases.

¹² For further information: <http://www.enterprisesurveys.org>.

¹³ We performed various tests to check missing values, zero sales, zero employment, and observations failing to satisfy other basic error checks.

3” most attractive country for FDI flows in two separate categories - “Asia” and “Developing Economies” - listed only behind only China and India (Unctad, 2005).

Second, until the late 1970s, FDI was dominant in import-substitution industries such as textiles, automobiles, and chemicals. From then on, an increasing share of FDI was directed to more export-oriented activities. Export-oriented FDI initially came to light in manufacturing industries such as clothing, textiles, footwear and toys. More recently, labor intensive assembly activities in electronics and electrical goods industries have been the main attraction to foreign investors. The shift in the composition of FDI from domestic-market oriented production to export-oriented production has closely mirrored the shift in the domestic trade policy regime and the very favorable approach of the Thai government towards FDI.

Third, Thailand has experienced impressively high rates of real GDP growth over most of the past 40 years. These positive achievements may partly be attributed to the successful transformation of the economic structure from agriculture to manufacturing. Manufacturing sector is now approaching two fifths of GDP, compared to one third of GDP before the Asian crisis and just over one fifth of GDP in the early 1980s. The growing importance of manufacturing in GDP has increased also in the investment slump phase that hit Asian economies in more recent years. In spite of this high growth of manufacturing activities, Thailand still exhibits a relatively low technological profile,¹⁴ which makes it particularly important for its firms to get involved in knowledge intensive relationships with foreign firms.

4.3. Variable description

As this paper focuses on the relationships occurring between the presence of multinationals and the local context via value chains, and taking into consideration the information available in the PICS data, in our empirical analysis we define foreign firms and local suppliers in the following way:

Foreign owned firms (FOR). We include in this category the firms located in Thailand that have a share of subscribed capital owned by foreign investors equal to at least 30%¹⁵ and the main shareholder is represented by a Multinational Company. About 24% of firms in the sample meets this definition.¹⁶ FOR firms buy most of their inputs in the local market (about 80%) and sell most of their production abroad (about 70%). It is through these firms (which can be defined as local subsidiaries of foreign multinationals) that global buyers organize their value chain relationships with Thai suppliers.

Domestic firms (DOM). We define domestic firms as those which are national owned and do not export more than 50% of their

output.¹⁷ About 50% of firms in the sample meets this definition (717 active firms).¹⁸ DOM firms sell more than 50% of their output in the domestic-market.

The distribution of firms is quite uneven across industries in our sample. The presence of FOR firms is concentrated in Electronics and Automotive parts, characterized by high levels of research and development, and a large share of professional and technical workers, and in Textile and Clothing. DOM firms are concentrated heavily in Textile and Clothing too and in Rubber and Plastics industry FOR firms are generally larger than domestic firms. See Appendix 1 for descriptive statistics on these categories of firms.

The next step is to build our measure of value chain governance which will represent the dependent variable in our econometric exercise. To this aim, we take into account the theoretical framework developed in Section 3, on the one hand, and peculiarities of the Thai production system, on the other hand. We define a measure of value chain governance based on the following variables:

- (a) percentage of sales made by suppliers exclusively to suit buyer's specification;
- (b) whether the buyer provided information on Design/Quality (i.e., product characteristics) and imposed product quality standards;
- (c) whether the buyer engaged the supplier in process or product R&D activities;
- (d) whether the buyer sent employees to (or organized personnel exchanges with) suppliers as a means to disseminate and diffuse new technologies into the local firms' production facilities.

Consistent with our discussion in Section 3, we identify three basic types of value chain governance characterized by different combinations of the key variables above (Table 1). GOV1 reflects a situation where less than 30% of total sales are made to meet the client's unique specification, and suppliers do not receive further inputs from the buyers; GOV2 type reflects a situation where the buyer is responsible for more than 30% of the supplier's total sales, and the client not only transfers a product specification but also provides details on the product design and intervenes to ensure that quality standards are met; finally GOV3 occurs when captive sales are higher than 30% and together with product specification, design and quality standards, the buyer disseminates knowledge and R&D activities.

Hence, our dependent variable GOV_{ij} takes value equal to 1 (GOV1) if captive sales of local firm i active in sector j represent a relatively low share of its total sales, no transfer of information occurs concerning design and quality standards, and there is no involvement in R&D activities; equal to 2 (GOV2) if there is a high share of captive sales, a transfer of precise requirements in terms of design and quality standards (hence a low discretionary power of suppliers), and no involvement in knowledge management and R&D; and equal to 3 (GOV3) if there is a high share of captive sales, a transfer of design and quality standards, and a direct involvement in

¹⁴ Thai firms' USPTO patenting has been almost null between 1980 and 1996 and has thereafter grown very gradually to reach an average level of approximately 20 patents per year in the subsequent decade. In the same period China and India have experienced a gradual growth of inventive activity until the mid-1990s and thereafter the number of patents with at least one inventor resident in one of the two countries has accelerated dramatically and exhibited an average increase of up to 75% per year (Puga and Treffer, 2005).

¹⁵ OECD and UNCTAD use a benchmark of 10% as threshold level. Other benchmarks taken by other researches include Sjöholm (1997) who considers a 15% threshold of equity owned by foreigners, Haddad and Harrison (1993) considered foreign firms as those with at least 5% equity owned by foreigners, Djankov and Hoekman (1998) had a benchmark of 20%, while Castellani and Zanfei (2006) considered foreign firms as those with at least 50% equity owned by foreigners.

¹⁶ The data used in our empirical analysis do not allow to identify the linkages among FOR nor whether they are part of the same multinational firm.

¹⁷ Using information about firms' ownership, whether firms have affiliates and/or separate operating facilities outside Thailand, and whether they have holdings or operations in other countries, we conclude that the sample of domestic firms (DOM) does not contain any Thai (domestic owned) multinationals, and that the only presence of Multinationals is to be found in the FOR firms category.

¹⁸ To avoid ambiguity in the analysis, we do not consider firms which are national owned and export more than 50% of their output. These firms represent about 26 percent of firms in the sample. By using this definition, we intend to focus on firms which concentrate most of their sales in the local market. Although our data do not allow to distinguish to what types of buyers DOM firms sell their goods, domestic firms belonging to this category represent the closest proxy of local suppliers which are involved in transactions with subsidiaries of foreign multinationals (FOR) active in the Thai market.

Table 1
Classification of value chain governance.

Types of Value Chain Governance	% of sales made according to buyers' unique specification	Design/quality and product quality standards	Knowledge dissemination and process and product R&D
GOV1	Less than 30%	No	No
GOV2	More than 30%	Yes	No
GOV3	More than 30%	Yes	Yes

knowledge management and R&D activities. It is worth noting that the three governance types are characterized inter alia by a different involvement of suppliers in knowledge development, and by distinct degrees of knowledge transfer from multinationals to local firms. We shall accordingly refer to GOV3 as “knowledge intensive” value chain relationships to emphasize this aspect. See Appendix 1 for descriptive statistics on the distribution of these governance types across industries and firms.

We focus on a set of sector and firm-specific characteristics which can be expected to be associated with these governance types. GOV_{ij} will be regressed on different measures of multinational presence, of the degree of embeddedness of foreign buyers in the host economy (Thailand), and (firm level) measures of the competencies of local suppliers. We shall run regressions on the sub-sample of 717 domestic owned companies active in Thailand. A vector Z of controls for firm size, year, and region is also included in all regressions. In order to control for industry specificities we also included four macro-sectors in the vector of controls.¹⁹

The equation to be estimated will thus be of the following type:

$$GOV_{ij} = f(SUB_j, AGE_j, LSUP_j, ADAPT_j, DOMTECH_{ij}, DOPAT_{ij}, Z_{ij})$$

The functional form used for the empirical test will be discussed in Section 5 below. Independent variables are defined as follows:

- *Multinational presence*

We computed two measures of the presence of multinationals. The foreign presence ratio (SUB_j) as the share of foreign subsidiaries out of the total number of firms located in Thailand and active in sector j ; the *subsidiary-workers ratio* ($SUBwks_j$) as the share of workers employed in foreign subsidiaries located in Thailand out of the total number of workers in sector j .²⁰ As discussed in Section 3, we expect the extent of foreign presence in the mar-

¹⁹ According to World Bank's ICA (Investment Climate Assessment) criteria based on OECD classification by technological intensity, we aggregated seven industries into four macro-sectors: High tech: electronics; Medium high tech: machinery; automotive parts; Medium low tech: rubber and plastics; Low tech: textile and clothing; food processing, wood.

²⁰ Our data do not allow to measure the number of subsidiaries of the specific multinational with which the individual supplier has a relationship. However the indicators we use allow to capture the intensity of multinational presence in the sector in which the vertical relationship takes place. These indicators are most likely to be sector specific, as it is well known that multinationals tend to concentrate in some industries more than others (high technology, scale intensive sectors characterized by high endogenous costs). We partially control for this effect by introducing macro-sector dummies as specified in the text and in footnote 19.

ket to reduce behavioral uncertainty of MNCs and to increase the likelihood that effective suppliers are eventually selected, hence facilitating the recourse to GOV3. (see H1 in Section 3).

- *Multinational embeddedness*

As discussed in Section 3, multinational embeddedness is a multi-facet concept which can be captured by different variables. We use the following proxies.

AGE_j : this is calculated as a weighted sum of subsidiaries, where the weights are given by the years that each subsidiary has been active in sector j in Thailand. A similar measure has been used also in Padmanabhan and Cho (1999) and Castellani and Zanfei (2004), and takes into account the length of time that foreign firms has been operating in a given market. This is expected to reinforce the impact of multinational presence and to affect positively the choice of GOV3 (see H2 in Section 3).

$LSUP_j$: this indicates the log of the amount of inputs bought locally by multinational subsidiaries in sector j . $LSUP$ captures how extensive are the market relationships of MNCs subsidiaries with local firms, as an indicator of embeddedness. The existing literature emphasizes that MNCs can obtain significant performance advantages from an extension of their relationships with local firms (Andersson et al., 2005). For the purposes of the present analysis we suggest that, especially in the case of relationships with suppliers in LDCs, a mere increase in the share of inputs purchased locally is likely to indicate mainly an effort to obtain cost savings through value relationships. We thus expect this measure to impact positively on GOV1 and negatively on GOV3 (see H3 in Section 3).

$ADAPT_j$: this measure identifies whether product and process technology are adapted by MNCs active in sector j to local requirements. For this purpose, we use a dummy variable which takes value one when foreign firms adapt their technology to suit local conditions, and zero otherwise. As discussed in Section 3, we expect this indicator to be associated with intensive exchanges of knowledge between MNCs, which value design, R&D and skills, and suppliers which co-develop the knowledge helping to adapt it to the local context. Hence we expect this variable to impact positively on GOV3 (see H4 in Section 3).

- *Domestic firms' capacity "to handle the technology"*

This capacity is proxied by two variables referred to domestic (Thai) firms only. $DOPAT_{ij}$ is a dummy variables which takes value 1 if the domestic supplier i active in sector j has filed a patent in the last 3 years and 0 otherwise; while $DOMTECH_{ij}$ takes value 1 if domestic firm i active in sector j develops the technology within the establishment locally and 0 otherwise. These measures capture domestic firms' absorptive capacity and can be expected to

be positively correlated to GOV3 (see H5 in Section 3). Moreover, we expect domestic capabilities to be associated with governance modes that allow a high degree of autonomy of local suppliers (see H6 in Section 3). Hence these variables should be positively correlated also with GOV1, which implies the lowest dependence of local suppliers from global buyers; and negatively correlated to GOV2, which is characterized by strict requirements in terms of design and quality standards.

5. Empirical analysis

5.1. Empirical model

We use a multinomial logit model approach to investigate the correlation between value chain governance modes and the characteristics of firms and sectors in Thailand. Since GOV1, GOV2 and GOV3 represent qualitatively different modes of organizing knowledge transfer, which may each be influenced by different combinations of explanatory variables, a multinomial logit model is the most suitable for this analysis. We estimated the multinomial logit model by maximum likelihood method.

We consider a vector of explanatory variables to examine the relationship between these variables and the y -th alternative in terms of governance levels. The vector contains the set of independent variables defined in Section 4 above: the ratio of foreign subsidiaries of MNCs to total firms active in sector j (SUB_j),²¹ the average age of subsidiaries in sector j (AGE_j), the share of inputs they buy locally ($LSUP_j$), whether they adapt the technology to suit local conditions ($ADAPT_j$); and the technological capabilities of domestic firms involved in the relationship ($DOMTECH_{ij}$ and $DOMPAT_{ij}$).²² As mentioned earlier, controls for year, industry, region and size are also included in this vector.

Following Greene (1997), we define a multi-category variable (y) as dependent variable. Let x be the vector of explanatory variables, the multinomial logit model response probability takes the following form:

$$P_r(y_n = k) = \frac{P_{nk} = \exp(x\beta_k)}{1 + \sum_{k=0}^K \exp(x\beta_k)} \quad \text{for } k = 0, 1, \dots, K \quad (1.1)$$

where P_{nk} is the probability that the dependent variable (Y_n) takes value k at n th observation, with k ranging from 0 to K . In our case k will take values 0, 1 or 2 to identify three different governance modes: GOV1 ($k=0$), GOV2 ($k=1$) and GOV3 ($k=2$).

It should be mentioned that the point estimates of a multinomial logit tell us, for each choice k , the change in probability of the outcome k , relative to the baseline outcome ($k=0$), induced by a unit change in the explanatory variables. In a multinomial framework, this does not assure that the absolute probability of outcome k will increase or decrease, but that k will be more or less likely relative to baseline outcome. As we are interested in the change in absolute probability of the outcome k induced by the regressors, we shall

²¹ We show only the results with foreign presence ratio expressed in terms of the number of foreign firms as a share of the total number of firms in sector j . We also tested the alternative measure expressed in terms of the number of workers, both separately and jointly with the other explanatory variables, with no significant diversities in results. The outcomes of regressions using alternative specifications are available from the authors upon request.

²² We use interaction terms to econometrically capture the additional effect of the variables considered when referred to domestic firms. Moreover, we test for multicollinearity and we run separated regression for each of the variables in the vector.

Table 2
Firms' characteristics and value chain governance.

Multinomial logit regression	GOV = 1 dy/dx	GOV = 2 dy/dx	GOV = 3 dy/dx
SUB	-0.17 (-4.58)	-0.28 (-2.29)	0.39 (3.79)
AGE	0.00 (2.19)	0.00 (-1.46)	0.00 (0.076)
LSUP	0.04 (2.39)	0.04 (1.24)	-0.08 (-2.48)
ADAPT	-0.14 (-1.64)	0.03 (3.15)	0.29 (3.15)
dompat*	0.06 (2.56)	-0.12 (-4.89)	0.09 (2.38)
domtech*	0.05 (2.87)	-0.12 (-4.27)	0.05 (2.97)
Industries	Included	Included	Included
Regions dummies	Included	Included	Included
Size	Included	Included	Included
Observations	717	717	717

Source PICS, authors' own computation.

calculate the marginal effect:

$$\delta_k \frac{\partial P_{nk}}{\partial x_n} \quad (1.2)$$

Estimation of the multinomial logit model is based on the assumption that probabilities of the alternative choices are independent of each other. This property is called the independence from irrelevant alternatives (IIA). The validity of this assumption is checked using the test introduced by Small and Hsiao (1985) (see Appendix 2).

Outcomes are presented in terms of marginal effects (Table 2). Small and Hsiao test results (Appendix 2) support the IIA assumption.

5.2. Discussion of results

5.2.1. Multinational presence (SUB)

As foreshadowed by the marginal effect reported in Table 2, the estimated coefficients on the variables used to identify Multinational presence suggest that a greater presence of SUB in the market increases the likelihood of observing types of governance featured by suppliers' involvement in knowledge management and R&D activities (GOV3). The evidence is thus broadly consistent with the hypothesis H1 (Section 3) that the extent of the presence of global buyers in the local market reduces behavioral uncertainty and increases the likelihood of success in the selection of partners, both conditions favoring the development of knowledge intensive value chain agreements.

5.2.2. Multinational embeddedness

The three measures of embeddedness used in this paper appear to have a different impact on the governance of value chain relationships.

As far as the length of time (AGE) is concerned, our findings reveal that an extensive and long lasting presence in the country is not significant for the three aspects of value chain governance considered in the analysis (Table 2). These results do not appear to be in line with hypothesis H2, according to which the age of subsidiaries increases the likelihood of knowledge intensive value chain agreements. This outcome might have to do with important firm-specific factors which we cannot control for, due to data limitations. For instance, some subsidiaries may be there as mere bridge-heads in the international organization of production and serve to develop outsourcing relationships with local Thai firms.²³ The bridgehead may then be used to explore the actual capabilities of local firms, and to the extent that these are found to be low profile, vertical relationships may well have a low knowledge content. This is broadly consistent with the evidence briefly recalled above (Section 4) and produced *inter alia* by Puga and Trefler (2005), who show that Thai

²³ We are grateful to one of the referees for suggesting this line of argument.

firms exhibited a very limited increase of the patents filed to the USPTO in 1980–2004, as opposed to other Asian countries characterized by much higher growth of inventive activity, such as China and India. Over time, MNCs active in Thailand may thus have experienced lower innovative performances than expected and this might have a negative impact on the decision to get involved in joint development of technology with local suppliers.

When we turn to another measure of embeddedness, namely the share of inputs bought locally (LSUP), we find a positive correlation with GOV1 and a negative correlation with GOV3 (Table 2). In other words, the more MNCs buy inputs locally the higher the likelihood of value chain relationships characterized by a very limited transfer of knowledge. These findings seem to support the hypothesis H3 (Section 3): it is most likely that MNCs purchasing a high share of their inputs in Thailand will do so above all to obtain significant cost savings. This priority is exactly opposite to the one that is normally pursued when value chain relationships are used to co-develop technology with local firms. While using local purchases to reduce costs seems to be a rather general rule when MNCs source their inputs in LDCs, this could be particularly the case of Thailand, as local input manufacturers might well be less dynamic than in other Asian countries.

Finally, the efforts of MNCs to adapt products and processes (ADAPT) appear to impact positively on GOV3. In other words, when MNCs are so “embedded” in local contexts that they invest in the adaptation of products and processes, value chain relationships are more likely to be knowledge intensive.²⁴ Under these circumstances, the arrangements with local suppliers will not only imply high shares of captive sales, but also significant transfers of knowledge concerning product specification, design and quality standards, and a substantial dissemination of knowledge and R&D activities (Table 2). These results are thus consistent with hypothesis H4 as discussed in Section 3.

5.2.3. Domestic firms' capacity “to handle the technology”

It is apparent from Table 2 that when suppliers have the capacity “to handle the technology”, value chain relationships are more likely to be characterized by transfer of design, quality standards and technology (GOV3). This result is robust to changes in the measure used to capture domestic firms' technical competencies, that is both dummies used for this purpose (whether domestic firms have filed patents, DOMPAT, or develop knowledge intra-muros, DOMTECH) have a positive impact on GOV3. Even more important, these variables remain significant also when controlling for the presence of multinational firms (SUB), suggesting that domestic competencies have a positive impact on knowledge intensive value chain relationships for any given level of foreign presence. Consistently with hypothesis H5, it thus appears that if local suppliers have the capacity to develop the technology within their establishments, value chain arrangement will likely be knowledge intensive. This result mirrors the correlation we found between GOV3 and ADAPT. The positive impact of ADAPT on GOV3 can be interpreted as a signal that the effort of MNCs to adapt technology requires governance modes through which some knowledge exchange occurs, and hence applications abilities can be more easily supplied by local firms. Quite symmetrically, the positive impact of DOMTECH (or DOMPAT) on GOV3 suggests that global buyers may be induced to set up knowledge intensive relationships with domestic suppliers when local competencies are high enough.

²⁴ It is worth noting that more than 60% of SUB firms in our sample adapt their technology to suit local conditions. This helps explain why the share of GOV2 is rather high as a whole. See Appendix 1, Table 2. However, the negative impact of AGE discussed in the text may signal that the share of GOV2 may be decreasing over time.

Consistently with H6, we also find that domestic competencies are positively associated with GOV1 and negatively correlated to GOV2. We suggest that this result might have to do with the different degree of autonomy that characterizes these two governance modes. GOV1 reflects the lowest dependence on global buyers: the latter represent a small share of total sales of suppliers and there is no requirement in terms of design or quality standard. It is quite possible that multinationals are available to set up relationships of this kind if suppliers have very high technical competencies, have a relatively high bargaining power and hence are allowed a significant degree of autonomy. GOV2 is quite opposite: high dependence from a single buyer, strict technical requirement but no involvement in cooperation with buyers. The negative coefficient of DOMPAT and DOMTECH when the dependent variable takes value GOV2 is thus consistent with the idea that these relationships are most likely to be carried out by suppliers with a relatively low technological profile.

6. Conclusion

In this paper we have attempted to combine insights from international production literature and from the recent “Global value chain” approach to develop a more comprehensive framework for the analysis of knowledge transfer via value chain relationships. It is suggested that the characteristics of both foreign and domestic firms affect the development of alternative modes of organizing value chain relationships between multinationals and local firms.

Our study has made an effort to integrate the existing literature in three ways. First, we have considered value chain relationships as a multi-facet process of interaction between buyers and suppliers, involving different degrees of knowledge transmission and development. Second, we have assessed whether and to what extent value chain governance is affected by the presence of multinationals and by their embeddedness in the host economy. Third, we have taken into account the capabilities of suppliers to handle the technology as a factor influencing knowledge transfer through value chain relationships.

Using data on a representative sample of 1385 Thai firms, we have applied a multinomial logit model to test whether and to what extent governance modes are influenced by multinational presence, by the degree of embeddedness of foreign buyers in the host economy (Thailand), and by the competencies of local suppliers. The available data allow us to carry out only a cross-section analysis which highlights simple correlations and no causal links between variables. Moreover, correlations are not always straightforward in the analysis. Nevertheless, knowledge intensive governance modes, that are characterized by a greater transmission of knowledge along the value chains, appear to be positively associated with the intensity of multinational presence in the local market, with the efforts of MNCs to adapt technology to local contexts, and with the competencies of domestic suppliers. These results are consistent with a view of knowledge transfer as a process that requires some proximity of MNCs to suppliers, and the local availability of technical capacities. Knowledge transfer is also facilitated when the degree of embeddedness of MNCs is high enough to induce affiliates to modify their products and processes to local demands. By contrast, the age of subsidiaries and the share of inputs purchased locally appears to be associated with value chain relationships with a lower technological profile. A high share of inputs purchased in a Less Developed Country may reflect a cost saving approach, in contrast with a strategy based on knowledge intensive value chain relationships. The negative impact of the age of subsidiaries may reflect that foreign buyers with a long experience of the Thai market have learned that local suppliers are not competent enough to make knowledge transfer worthwhile.

A deeper interpretation of these results calls for further research on the evolution of market structure in the Thai economy and on the actual behavior of MNCs active in that market, and possibly comparative works on different recipient economies. It remains that the empirical results obtained in this study induce some reflections on the role of embeddedness of MNCs as a factor conducive to knowledge transfer and local development. In fact, it appears that it is not enough that MNCs have an extensive and lasting presence in a country to favor the creation of knowledge intensive relationships with local firms; nor is it enough that foreign firms get involved in massive market transactions with local firms, if these concern low cost and low value-added goods. What seems crucial to make value chain relationships evolve and become fundamental vehicles for knowledge transfer is a combination of efforts by both domestic and foreign firms, aimed at increasing local competencies, on the one hand, and at adapting technology to host market conditions, on the other hand.

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Appendix A. Descriptive statistics on sample firms

A.1. Distribution of firms across industries (%)

	FOR	DOM
Textile and Clothing	17.8	26.1
Food Processing	9.1	5.4
Machinery	14.9	15.5
Electronics	30.1	7.7
Wood	3.7	10.7
Rubber and Plastics	9.0	23.1
Automotive Parts	17.1	11.6

A.2. Size distribution of firms in the sample (%)

	FOR	DOM
Small (less than 50 workers)	10.9	36.1
Medium (50 to 150 workers)	21.4	34.3
Large (more than 150 workers)	67.7	29.6
Total	100	100

Source: authors' own computation on PICS data.

A.3. Governance type distribution across industries (%)

	GOV 1	GOV 2	GOV 3	Total
Textile and Clothing	9.04	48.59	42.37	100
Food Processing	10.61	34.64	54.75	100
Machinery	11.3	40.11	48.02	100
Electronics	10.84	33.13	53.61	100
Wood	15.2	48.8	35.2	100
Rubber and Plastics	9.62	41.84	47.7	100
Automotive Parts	7.59	40.69	51.03	100
Pearson chi2 (6)=	16.2409	55.1731	54.8764	
Pr =	0.013	0.000	0.000	

Source: authors' own computation on PICS data.

A.4. Domestic firms Governance type distribution across industries (%)

	GOV 1	GOV 2	GOV 3	Total
Textile and clothing	13.9	47.8	38.5	100
Food processing	12.8	41.0	46.2	100
Machinery	12.6	41.4	45.9	100
Electronics	25.4	41.8	32.7	100
Wood	22.0	49.3	28.6	100
Rubber and plastics	13.3	38.8	47.7	100
Automotive parts	7.2	38.5	54.2	100
ALL INDUSTRIES	14.1	42.9	42.5	100

Source: authors' own computation.

Appendix B. Small–Hsiao test to assess the independence of irrelevant alternatives (IIA) assumption

The Small–Hsiao test is a modified version of the McFadden–Train–Tye likelihood ratio test. Following Small and Hsiao (1985), we can divide the sample randomly into two subsets of about equal size. The unrestricted model is estimated for both subsets where $\hat{\beta}_u^{S1}$ refers to estimates of the unrestricted model on the first subset, and $\hat{\beta}_u^{S2}$ is its counterpart for the second subset. A weighted average of the coefficients is computed as follows:

$$\hat{\beta}_u^{S1S2} = \left(\frac{1}{\sqrt{2}}\right) \hat{\beta}_u^{S1} + \left[1 - \left(\frac{1}{\sqrt{2}}\right)\right] \hat{\beta}_u^{S2}$$

After this, a restricted sample is created using the second subsample by eliminating all outcomes with a chosen value of the dependent variable. The model is the estimated using the restricted sample with $\hat{\beta}_r^{S2}$ referring to the estimated coefficients and $L(\hat{\beta}_r^{S2})$ indicating the likelihood. Finally, the following test statistic is used which is asymptotically distributed with degrees of freedom equal to the number of independent variables plus one

$$SH = -2\{L(\hat{\beta}_u^{S1S2}) - L(\hat{\beta}_r^{S2})\}$$

(1) Small–Hsiao test results (I specification with SUBwksj)

Omitted	lnL(full)	lnL(omit)	chi ²	df	P > chi ²	Evidence
1	-1244.71	-1240.79	7.84	9	0.55	For Ho
2	-556.623	-553.439	6.367	9	0.703	For Ho
0	-545.925	-542.333	7.184	9	0.618	For Ho

(2) Small–Hsiao test results (II specification with SUBj)

Omitted	lnL(full)	lnL(omit)	chi ²	df	P > chi ²	Evidence
1	-1279.46	-1277.9	3.129	9	0.959	For Ho
2	-572.716	-571.29	2.853	9	0.97	For Ho
0	-557.163	-555.939	2.448	9	0.982	For Ho

(3) Small–Hsiao test results (III specification vector SUBj; AGEj; LSUPj; ADAPTj; DOMTECHj and DOMPATij)

Omitted	lnL(full)	lnL(omit)	chi ²	df	P > chi ²	Evidence
1	-524.465	-516.831	15.268	16	0.505	For Ho
2	-518.801	-512.755	12.093	16	0.738	For Ho
0	-1180.186	-1176.825	6.722	16	0.978	For Ho

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