Determinants and Impacts of Inward FDI in Japan

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Thesis Summary

The thesis is concerned with determinants and impacts of inward foreign direct investment (FDI) in Japan. The research consists of three empirical studies. The first study examines how source country characteristics affect the aggregate FDI inflows in the Japanese economy during the period of 1989-2002. Our results demonstrate that the stable investment climate of the home country is an essential factor inducing FDI inflows to Japan. By contrast, the export performance of the source country is negatively correlated with FDI inflows, indicating that international trade and FDI are substitutes.

The second study identifies the determinants of foreign penetration across Japanese manufacturing sectors at the three-digit level during the period of 1997-2003. More importantly, this study examines the moderating effects of keiretsu affiliations on the relationship between various sectoral characteristics and foreign participation. The evidence of both horizontal and vertical keiretsu impacts on foreign penetration depends on not only different proxy measures used for inward FDI, but also on the level of technological sophistication in given sectors. In general, our results demonstrate that horizontally linked keiretsu are positively associated with foreign productions in knowledge-intensive sectors. By contrast, this effect becomes a significant entry barrier to foreign employment in low-tech sectors. The result from the quadratic specifications points to the presence of nonlinear threshold effects. Keiretsu affiliations may initially have pre-emptive effects on foreign entrants due to fierce competition. However, after reaching a certain threshold level, keiretsu networking becomes a facilitating device for foreign entry.

The final study evaluates the impacts of a foreign presence on the productivity of Japanese manufacturing firms over the period of 1997-2003. Our results suggest that spillover effects largely differ according to the level of absorptive capacity of indigenous firms. In general, the potential productivity spillovers are generated from forward linkages where Japanese firms purchase the intermediate inputs from foreign firms. There are greater efficiency gains in keiretsu-intensive sectors for domestic firms that possess sufficient absorptive capacity from a foreign presence in downstream and upstream sectors. By contrast, horizontal spillovers in sectors dominated by vertical keiretsu reduce the productivity level of local firms due to adverse competition and crowding-out effects.

Key Words: foreign direct investment, determinants, productivity, spillovers, keiretsu

To my parents

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Chapter One

1. Introduction

Foreign Direct Investment (FDI) has been playing an increasingly prominent role in the world economy in the last two decades. Extensive academic literature has attempted to explain the substantial growth of FDI at various countries. This thesis is concerned with determinants and impacts of inward FDI, which are the most important and topical themes in regards to theoretical and empirical research on FDI. The empirical focus of the present study is directed at Japan, as the case of Japan is particularly interesting in the context of international business research. One essential rationale for undertaking this research is that we have limited knowledge and little relevant empirical analysis on FDI in Japan. The method of approach in existing studies is often descriptive and the interpretation is mainly based on qualitative rather than econometric analysis. This study, therefore, pursues more specific testing with formal economic analysis of determinants and impacts of inward FDI with the particular emphasis on the dominant roles played by *keiretsu* using panel based

techniques. The thesis substantially increases our understanding of these issues by providing valuable theoretical and methodological advancements.

The introductory chapter begins by providing background information and motivation to the proposed research in order to get a broader picture of the major studies on FDI in Japan. Section 1.2 identifies the research gaps we need to fill, and formulates research problems based on the literature review. Section 1.3 briefly discusses the methodological issue. Section 1.4 presents key findings from our empirical studies and main contributions. The final section provides the structure of the thesis.

1.1. Research Setting

It has been widely recognised that Japan attracts disproportionately low level of inward FDI relative to other leading advanced nations[1] (Head and Ries 2005; Jones and Yoon 2006). During the period after the Second World War, the Japanese market had been heavily protected through various measures restricting capital inflows, see historical aspects and the regulatory environment of FDI in Japan (Mason 1992; Bailey et al. 1994). The only alternative available to foreign firms wishing to invest in Japan between 1952 and 1964 was so called 'Yen Companies', under the condition that their earnings be retained in Japan. Investing foreign firms were not allowed to

[1] During the period of 2000-2005, the average FDI inflows as a percentage of gross fixed capital formation are merely 0.7 percent for Japan, compared with 6.7 percent for the United States, 13.4 percent for Germany, and 24.5 percent for the UK (Paprzycki 2007). Similarly, the stock of inward FDI as a percentage of GDP in 2005 are 2.2 percent in Japan, compared with 13.0 percent in the United States, 18.0 percent in Germany, and 37.1 percent in Britain (ibid).

access to the foreign exchange needed for the repatriation of their capitals and profits. Whilst the Japanese yen became convertible in 1964, all incoming FDI required specific government screening and approval until 1973, when the final stage of liberalisation came in effect. Joint ventures with minority equity participation were therefore the most common form of FDI and the restrictions made foreign firms virtually impossible to acquire and control Japanese firms. Japan has since gradually eliminated most of the formal restrictions on inward direct investment since the 1970s. By the early 1980s, the capital controls were abolished and transactions on hostile takeovers became principally possible without an approval from the board of a target firm. The rapid increase of global FDI, especially during the 1990s, has led to significant revisions in investment regimes in most countries that earlier had placed restrictions on FDI. However, liberalisation of the investment policy alone does not necessary increase FDI in certain country. For example, Japan has historically run enormous current account surpluses on its merchandise trade balance and its international investment income account (Robinson and Shimizu 2006). Japan's export led economy and its status as a huge international creditor reflect that large inflows of capital were not required and therefore inward FDI was not priority for Japan during the phase of rapid post-war growth. Despite a global presence of companies such as Toyota, Honda, Canon and Sony, Japan's integration into the world economy is surprisingly weak. Japan has the lowest levels of import penetration, inward FDI and foreign workers in the OECD (Jones and Yoon 2006; OECD 2006). Japan was characterised as a country with

high FDI potential but low FDI performance, even after the investment policy was fully liberalised in the 1980s. Yoshitomi and Graham (1996) extensively discuss why Japan is such an outlier. The partial reason is the past regulatory framework that had restricted inward flows of goods and investment from the post-war period in order to protect growing domestic producers. Complicated regulations governing particular product market were placed in order to deter foreign firms entering in Japan. There is, for instance, the notorious story about "Japanese snow is different" to keep out the French and Italian ski manufacturers in the Japanese market (Trevor 2001,p14; Economist 2007). In addition, restrictive market practices such as a closed distribution system, cartel-like behaviour, and entrenched arrangements make it difficult for foreign entrants to compete in terms of product, service and price.

The final ten years of the twentieth century have been called a 'lost decade' - Japan's deepest and longest post-war recession. This is a period when the Japanese economy imploded with the collapse of the land and equity price bubbles, the insolvent financial sectors, and the skyrocketing unemployment rate. The corporate sectors are burdened by the three excesses: namely, debt, capacity, and labour (Citrin and Wolfson 2006). The severity of the structural problems led to the vicious circle of low demand and deflations that persisted for over a decade. The traditionally insular nature of the Japanese economy, the lack of openness to foreign penetration, and elements of industrial policies intended to promote economic development brought negative side effects that

would later retard growth and productivity (Alexander 2002). For example, the extensively regulated financial sector until the 1980s that was the model of stability and that financed much of Japan's economic post-war miracle was of little help in supporting innovative firms seeking venture capital (ibid). The banking sector was in favour of supplying funds to heavy industrial borrowers at what were below market rates. Voluminous literature highlights and attempts to investigate the cause and effect on the plight of the Japanese economy (Cowling and Tomlinson 2000; Cowling and Tomlinson 2002; Bailey and Sugden 2007; Werner 2007). Until the mid-1990s, the amount of FDI in Japan was miniscule and the role of foreign firms in the Japanese economy remained relatively negligible. The Japanese economy has, however, experienced an important transitional period; FDI is one area in which the transformation is remarkable. In commercial sectors, unprecedented changes have taken place. FDI inflows to Japan have apparently increased from the late 1990s. During the just five years from 1998 to 2002 alone, Japan has received more FDI inflows than in the entire post-war period. Furthermore, foreign joint ventures have received prominent and largely positive media coverage. It was unthinkable before that some of Japan's leading companies would be taken over by foreign competitors. Nevertheless this is what happened with such institutions as Nissan, Mazda, Mitsubishi Motors, the Long Term Credit Bank, Yamaichi Securities and numerous others (Paprzycki 2004). The surge in FDI in Japan witnessed during this period is perhaps the result of a combination of changes in the improvements in the policy framework for FDI and the institutional

structure, including cross shareholding by keiretsu, labour market, and so forth. Many of the implicit and explicit barriers that had constrained the entry of foreign firms in the Japanese market in the past seem to be progressively eliminated. Furthermore, foreign investors react very differently to economic recessions of the host economy. Whilst they may postpone their investment plans until the uncertainty related to crisis is over, they may see the recession as an ideal opportunity to enter a new market or expand existing their operations depending on their industrial and financial positions. The lower prices of land, commercial rents, and equity shares in Japan compared with the 1985-90 bubble economy period, as well as the financial crunch affecting many Japanese firms, provide foreign firms with an excellent opportunity to set up, expand, or buy business in Japan. The Japanese government also liberalised its investment policy drastically and welcomed large-scale inward FDI into the country for the first time. The rapid change and its consequences are worth detailed analysis.

The prolonged and severe economic crisis that began in the early 1990s has clearly led to Japan reconsidering the potential benefits of inward FDI. Structural reforms in product and labour markets and in promoting inward FDI will enhance domestic productivity and competitiveness (Blomstrom et al. 2001; Jones and Yoon 2006). Inward FDI is one of most effective means for revitalising the economy by introducing the latest technology, new business models, and innovative managerial expertise (Bailey and Driffield 2007;

Kimura and Kiyota 2007). Moreover, the entry of foreign firms increases competition in the hosting economy, thereby further stimulating domestic firms to operate more efficiently (Driffield 2001). As a result, domestically owned firms are expected to have their efficiency gains. Foreign invested firms in Japan are generally found to be more productive than domestically owned counterparts (Fukao et al. 2005; Fukao and Murakami 2005; Tomiura 2007). This is attributed to the ability of foreign firms' efficient exploitation of firm-specific assets that allow multi-plant operations and the transfer of accumulated tacit and specialized knowledge on production in the host economy (Todo 2006; Kimura and Kiyota 2007). With the decline of population and the aging society, an increased domestic demand can no longer be relied upon. The use of advanced technologies and expertise to increase the productivity, and the encouragement of inward FDI will therefore play increasingly important roles than has previously been considered.

Following a decade of economic slump, the Japanese economy has started to recover since the early 2000 and has finally settled into a stable growth trajectory. While the recovery was initially driven mainly by exports, recent robust growth has been led by buoyant domestic private spending in both consumption and investment (JETRO 2007). In addition, the condition of unemployment is improving with solid company performance. From the investors' perspective, Japan should be, at least in theory, an attractive investment destination, as the country is endowed with a highly skilled

workforce, advanced technology, and a lucrative consumer market with large purchasing powers. Furthermore, Japan's geographic position provides the locational advantage as the East Asia region is expected to remain a growth centre of the global economy for the future.

Given the significance of contemporary debates over FDI that have been expressed, empirical evidence on the role of FDI in Japan should be provided in the best possible state. There is a lack of systematic empirical research to identify the determinants and the impacts of inward Japanese FDI. The study is motivated by the fact that, compared with Japanese outward FDI, inward FDI in Japan has so far attracted relatively little attention from researchers. The role of Japan will play as an FDI destination and the impacts of a foreign presence on the Japanese economy have been under-researched. The broad objective of the present study is therefore to provide systematic and rigorous empirical investigation for FDI in Japan.

1.2. Research Questions

The preceding section has provided background information and motivation to the proposed research. A review of the literature related to inward FDI in Japan reveals that there are only a few comprehensive studies and existing statistical evidence provides ambiguous results. The earlier studies have been broadly concerned with two set of issues. One is related to identifying industry characteristics that affect inward FDI and another is to examining the impacts

of a foreign presence on the productivity performance of Japanese firms.

An extensive empirical literature has evaluated various determinants of FDI in the US, EU, and the transitional economies. Despite this, there is no systematic econometric work that has sought to link source country characteristics with FDI flows into Japan. From a methodological point of view, most existing studies have applied a simple pooled technique that neglects an unobserved country specific heterogeneity. The current study attempts to provide robust empirical evidence on the main hypotheses proposed in the literature to identify macro determinants of FDI in Japan using panel based techniques.

With respect to industry level determinants, existing studies (Lawrence 1993a; Weinstein 1996; Ito and Fukao 2005) has focused on analysing distributions and variations of foreign penetration in Japan's industrial sectors with a particular emphasis on the role of *keiretsu* (corporate grouping). *Keiretsu* is defined as "clusters of independently managed firms maintaining close and stable business ties, cemented by governance mechanisms such as Presidents' Councils, partial cross-ownership, and interlocking directorates" (Lincoln and Gerlach 2004, p15). There has been little empirical work on the impact of *keiretsu* linkages on inward FDI, partly due to the conceptual ambiguity of keiretsu (Miwa and Ramseyer 2002), and partly due to the lack of consistent keiretsu data. The available statistical evidence on the role of keiretsu in influencing inward FDI is limited, mixed and in most cases

contradictory. The evidence that does exist tends to be based on highly aggregated data (Lawrence 1993a; Weinstein 1996) and does not show how vertically and horizontally linked keiretsu across sectors have influenced the pattern of FDI over time (Ito and Fukao 2005). We highlight that there appears to be a difference between the conceptual work, which suggests that keiretsu affiliations deter FDI into Japan, and existing empirical works based on the cross-sectional analysis that cannot provide a robust relationship between *keiretsu* and inward FDI at the industry level.

With regard to knowledge spillovers from FDI on the productivity performance of Japanese firms, existing studies (Kiyota 2006; Todo 2006; Murakami 2007) have evaluated the aggregate impact of a foreign presence only within sectors (horizontal spillovers). The empirical work that investigates vertical spillovers for Japan is virtually absent. Moreover, transactional linkage effects from FDI with the role of a keiretsu presence are also unexplored. The present study aims to fill those gaps or shortcomings identified from existing literature specifically related to Japan, where very little is known and little in-depth research had been undertaken. We suggest that earlier works need to be investigated further.

We formulate following specific research questions that correspond to each empirical chapter in the thesis.

Question 1 (Chapter 2)

What are the macro characteristics from source countries that affect the inflows

of FDI in Japan?

Question 2 (Chapter 3)

What are the sectoral characteristics that determine foreign penetration in the Japanese manufacturing sector? More specifically, how does a presence of keiretsu networks influence foreign penetration?

Question 3 (Chapter 4)

How do transactional linkages (backward and forward) from inward FDI influence the productivity performance of Japanese manufacturing firms? Is there any essential role that the keiretsu network plays in influencing the transactional linkages on the productivity of Japanese manufacturing firms?

The first two questions focus on how the investment decision of MNEs (multinational enterprises) is associated with certain country and industry specific factors, whilst the final question is concerned with how those chosen foreign investments affect the productivity performance of Japanese manufacturing firms. Furthermore, research questions 2 and 3 seek to explore in particular the dominant role played by keiretsu affiliations and how this is linked with foreign penetration. The reasons for focusing on keiretsu effects are that the keiretsu system is a key distinctive feature of the Japanese industrial and institutional characteristics. It also represents the most distinctive form of network organization in Japan. Second, despite such importance, this factor has been insufficiently and inadequately related to the literature on determinants of inward FDI and of knowledge spillovers from FDI. These are all significant

research problems that merit further study and establish a practical application that needs to be addressed for policy implications. The absence of such empirical analysis on inward FDI undermines government policy objectives to promote FDI.

1.3. Methodology

The present study not only proposes the models with improved methodology to guide empirical research but also focuses on FDI in a single host country, which make it possible to provide in-depth and comprehensive analysis. The distinctive feature of the current study is empirical applications with the panel data approach. Given the short history of FDI in Japan discussed, the time series analysis using annual data sets are apparently inappropriate. Furthermore, cross section analysis neglects changing trends and variations of FDI and factors that determine its growth over time. It is also inefficient and gives little insight to an aspect of time sensitive phenomena due to the very limited of number of observations. In particular, determinants and impacts of MNEs activities on the host economies should be seen as a dynamic process (Dunning 1993; Caves 1996). Therefore, the use of panel data provides the most appropriate and efficient way of conducting our empirical investigation. From a methodological point of view, the panel data approach offers various advantages over conventional cross section and time series analysis. It gives more informative, more variability, less collinearity among the variables, more degrees of freedom, and higher efficiency (Baltagi 2001; Hsiao 2003). In

addition, panel estimations allow us to control for unobserved individual country, industry, and firm heterogeneities, thereby enabling us to minimise serious misspecification problems. This also allows the diversity and the specificity of various investors' behaviours to be controlled for in the models. As a result, the reliability of the estimated regression parameters is improved with a panel specification. The present research project explores the topic on FDI by employing an overarching empirical methodology.

1.4. Summary Findings and Main Contributions

The first empirical study examines how source country characteristics affect the aggregate FDI inflows in the Japanese economy during the 1989-2002. Particularly, the focus of analysis is placed on various macro economic and political factors that are likely to influence the investment decisions. Although there has been abundant empirical research in this area for industrialised and transitional economies, the chapter is the first empirical application for Japan. The present study points out certain methodological and theoretical weaknesses in the previous literature and explains hitherto ambiguous results. Specifically, it highlights the importance of panel data approach with an identification of fixed effects rather than simple pooled regressions. Indeed, we argue that many of the results reported elsewhere are a feature of this mis-specification. After controlling for unobservable country heterogeneity, the results show that relative exchange rate volatility, a higher borrowing cost of the investing country, and stable home country environments are essential factors inducing

FDI inflows to Japan. By contrast, the export performance of the source country is negative effects of the size of FDI inflows, indicating that international trade and FDI are substitutes. Despite supporting evidence on the existing literature, there is rather weak statistical support for the relationship between several key economic factors and FDI inflows. The result suggests that market size, exchange rates, and labour costs are statistically insignificant effects on FDI inflows into Japan. This inconsistency appears to be largely attributable to the failure to employ panel-based techniques in previous studies.

The second empirical study analyses the variations of foreign penetration across Japanese manufacturing sectors at the three-digit level during the period of 1997-2003. More importantly, this study examines the moderating effects of keiretsu affiliations on the relationship between various sectoral characteristics and foreign participation. The appropriate panel estimation techniques are carefully chosen in order to avoid the methodological pitfalls identified in chapter 2. The chapter employs several methodologically rigorous estimation techniques to address specific issue about the impacts of keiretsu networks. The approach adopted in the chapter is substantially different from the previous studies. First, the study progressively compares two alternative proxy measures for inward FDI, namely sales and employment share accounted for by foreign firms, as dependent variables. Both measures have been used not only to compare the finding with previous studies but also to test the robustness of the relationship between these alternative measures of foreign penetration and

explanatory variables. Second, given the complexity of industry structure in the presence of inter-firm keiretsu affiliations in the Japanese market, interaction terms are introduced to investigate whether the conditional relationships exist between the sectoral attributes and keiretsu network with their effects on the investment decision of foreign firms. Third, the quadratic model is used to explore the relationship between the keiretsu networks and foreign participation, unlike previous studies that have restricted themselves to linear specifications. Finally, to examine the keiretsu impact on the role of inward FDI more precisely, the entire samples are sub-divided and compared in accordance with the degree of technological sophistication. Our results provide a strong empirical support from hypotheses that R&D intensity as an essential source of the proprietary knowledge and domestic market size as a location specific advantage. The evidence of both horizontal and vertical keiretsu impacts on foreign penetration depends on not only different proxy measures used for inward FDI, but also on the degree of technological sophistication in given sectors. In general, our result demonstrates that networking and information sharing effects of horizontally linked keiretsu are positively associated with foreign productions in knowledge-intensive sectors. By contrast, this effect becomes a significant entry barrier to foreign employment in low-tech sectors. Our statistical results suggest that both government regulation and market openness in industrial sectors dominated by horizontal keiretsu positively influences the sales activities of foreign firms. Furthermore, there is evidence that economies of scale and industry performance in vertical

keiretsu-intensive sectors are likely to induce foreign sales. On the other hand, the advertising intensity with vertical keiretsu network are negatively correlated with foreign sales penetration. Finally, the result from the quadratic specifications points to the presence of nonlinear threshold effects. The benefits of foreign penetration are more likely to materialise once greater information sharing effects across the horizontal keiretsu have accumulated. Keiretsu affiliations may initially have pre-emptive effects on foreign entrants due to fierce competition. However, after reaching a certain threshold level, a presence of keiretsu networking becomes a facilitating device for FDI. In summary, the main theoretical contribution in this chapter is that essential determinants of inter-industry variations of inward FDI are dependent on the moderating effects of dominant roles played by keiretsu network. Furthermore, there is evidence of a non-linear relationship between the keiretsu affiliations and inward FDI.

The final research task evaluates the impacts of a foreign presence on the productivity of Japanese manufacturing firms over the period of 1997-2003. More specifically, the current study examines not only horizontal spillovers but also identifies possible different transactional linkage effects (vertical spillovers) from inward FDI through backward and forward linkages across sectors. The main theoretical contribution of the chapter rests in exploring jointly the conditional relationship between technological spillovers from foreign multinationals and the presence of vertical and horizontal keiretsu

networks with their effects on the productivity of Japanese manufacturing firms. The evidence from the preceding chapter suggests that the presence of keiretsu affiliations is an essential Japanese specific institutional characteristic that determines foreign penetration. Much of existing literature has largely ignored linking inward FDI spillovers with the role played by keiretsu affiliations. In order to provide further insights, our empirical model is augmented by including interaction terms between various FDI spillovers and the keiretsu variables. The present study therefore offers substantial theoretical contribution by being the first to bridge these two separate issues in an integrated manner. In contrast with previous studies for Japan, we also propose several methodological advances in this chapter. First, the measurement of TFP (Total Factor Productivity) is significantly improved by the use of a semi-parametric approach that carefully controls input endogeneity. Second, whilst virtually all previous studies exclusively rely on government survey data, this study uses new commercial database for the first time for Japan, which may provide new insights into the determinants of FDI spillovers. Our empirical results suggest that spillover effects largely differ according to the level of technological sophistication and revealed industry comparative advantage of indigenous firms involved. In general, potential productivity spillovers are generated from forward linkages where Japanese firms purchase the intermediate inputs from foreign invested firms. High quality intermediate inputs and services provided from upstream foreign suppliers and domestic firms' ability to fully utilise such inputs contribute to foster the local distribution and the sales network in the

host economy. The presence of keiretsu alone is generally negative effects on the productivity of Japanese manufacturing firms. The traditional inter-corporate relations among production keiretsu and financial centred keiretsu are possibly being undermined by competition for resources, internationalisation, and external pressure to liberalise the Japanese market. However, there are greater efficiency gains in keiretsu-intensive sectors for domestic firms that possess sufficient absorptive capacity from a foreign presence in downstream and upstream sectors. Local suppliers/buyers that are facilitated by the prevalent role of information sharing and networking from keiretsu are very efficient in assimilating foreign knowledge with their own economic activities. Japanese firms in keiretsu-intensive sectors therefore have the opportunity to benefit from access to technologies, innovation, and know-how that would not otherwise have been available in the domestic arena. By contrast, intra industry spillovers from inward FDI in sectors dominated by vertical keiretsu network reduce and deteriorate the productivity level of local firms with high absorptive capacity due to adverse competition and crowding-out effects. Over all, FDI into different sectors dominated by keiretsu contributes to the capabilities and resource of local enterprise more effectively than FDI within keiretsu intensive sectors. The findings of this study are particularly important in light of previous research that has been limited to an assessment of either horizontal spillovers from inward FDI or spillovers from a keiretsu presence. We also argue that keiretsu issue may have implications that extend far beyond the Japanese context, namely *chaebol* in Korea or various

network clusters recognised in various industrialised economies. Ultimately, FDI spillovers and keiretsu network in the existing literature had focused on these two separate issues isolated from one another. Integrating these coexisting topics to bridge the gap significantly advances our scientific knowledge on this subject area. The present study has made a first step for this direction.

1.5. Structure of Thesis

The thesis consists of five chapters. Chapter 2-4 are all empirical studies that are devoted to answer the specific research questions identified. Chapter 2 investigates in particular the source country characteristics that influence the FDI inflows to Japan. The empirical model integrates potential economic and political factors affecting the investment decision of MNEs based on the existing literature. This chapter also demonstrates that the use of appropriate econometric specification can significantly alter the findings from previous studies that have employed simple pooled models. Chapter 3 evaluates the distributions and the variations of foreign penetration across Japanese manufacturing sectors at the three-digit level. More specifically, this chapter attempts to identify sectoral level determinants with particular emphasis on the role played by the vertically and the horizontally linked keiretsu networks. Chapter 4 examines whether there are productivity externalities from inward FDI in Japanese manufacturing sectors. This study further extends to an investigation of not only horizontal spillovers but also vertical spillovers

through backward and forward linkages. As with chapter 3, the role of keiretsu network is also linked with the spillover analysis. This provides further insights on whether the conditional relationship exists between technological spillovers from foreign multinationals and the presence of vertical and horizontal keiretsu networks with their effects on the productivity of Japanese manufacturing firms. Finally, chapter 5 draws overall conclusions from empirical studies, offers some implications for policy makers, and discusses limitations and future research.

Chapter Two

2. Macro Determinants of FDI Inflows to Japan: An Analysis of Source Country Characteristics

2.1. Introduction

In recent years, there has been significant growth in the observed levels of FDI flows, as well as the academic literature seeking to explain these flows in the context of both host and source countries. A variety of views has been expressed concerning the importance to the Japanese economy of attracting FDI. It has been widely recognised that Japan attracts a disproportionately low level of inward FDI relative to other leading advanced nations, as for example illustrated by Yoshitomi and Graham (1996). There are essentially two arguments for why Japan should seek to increase its share of inward FDI, the first is based on the standard arguments applied to western economies, that inward investment boosts employment, output and productivity (Driffield and Munday 2000; Driffield and Taylor 2000; Driffield 2001; Driffield and Girma 2003). The second is more general, and argues that inward investment is an

indicator of openness, and the opening of the economy is beneficial for growth[2]. This is seen as particularly important in the context of Japan, given the traditionally insular nature of the Japanese economy, and its recent stagnation (Bailey 2003a). Japan has eliminated most of the formal restrictions on inward direct investment[3] that were put in place in the 1970s, but western governments and firms continue to criticise the barriers that deter foreign penetration of the Japanese market, both in terms of trade and FDI (Southwick 2000). Restrictive market practices such as a closed distribution system, cartel-like behaviour, and entrenched arrangements that make it difficult for new entrants to compete in terms of product, service, and price are frequently cited structural impediments that are peculiar to Japan.

Over much of the post war period, and through the 1970s and 1980s in particular, inward investment was not a priority for Japan. Japan's export-led economy had high growth rates and this suggested that large inflows of capital were not required. However, the prolonged and severe economic crisis that began in the early 1990s has led to Japan reconsidering the potential benefits of inward FDI, and there is an extensive literature highlighting the plight of the Japanese economy (Ozawa 1996; El-Agraa 1997; Cowling and Tomlinson 2000; Cowling and Tomlinson 2002; Bailey 2003a). Moreover, the government is now actively seeking to promote and stimulate FDI into Japan, by giving

[2] There is a very large literature testing the relationship between openness and growth, for a summary of this see Baldwin (2003).

[3] Discussion of the historical aspects of Japanese regulations with respect to inward FDI is beyond the scope of our study. However, these details are well documented in, for example, Mason (1992), Bailey(2003b), and El-Agraa (1997).

incoming foreign firms tax incentives, providing credit guarantees, and facilitating more takeover activities by allowing equity swaps or share exchanges (Bailey 2003b).

Recent empirical evidence (Fukao et al. 2005) shows that foreign affiliated firms have higher level of TFP and profitability than their Japanese counterparts, and that this is partially attributable to more vigorous capital investment and R&D. Accordingly, Japan can potentially benefit from the transfer of such intangible assets by foreign owned firms. Inward FDI is also expected to bring Japan superior foreign technology, new business models, innovative management, and marketing know-how (Blomstrom et al. 2001). In addition, the entry of foreign firms increases competition in the host country, thereby further stimulating domestic firms to operate more efficiently (Driffield 2001). Thus, inward FDI can potentially play an important role in revitalising the Japanese economy by helping to accelerate the ongoing process of structural adjustment.

In this context, the identification of the main determinants of FDI has become a subject of considerable interest to academics and policy makers in recent years. There is now a relatively large literature on source country determinants for the US, EU and increasingly other parts of Asia (Ajami and BarNiv 1984; Culem 1988; Grosse and Trevino 1996; Pan 2003; Zhao 2003; Deichmann 2004). Despite this, and the particularly skewed distribution in the

sources of FDI into Japan, as illustrated by Figure 2-1, we are not aware of any other empirical work that has sought to link source country characteristics with FDI flows into Japan. The absence of such empirical analysis on inward FDI undermines government policy[4] objectives to promote FDI. Figure 2-1 also illustrates the main sources of FDI inflows into Japan are major OECD economies.

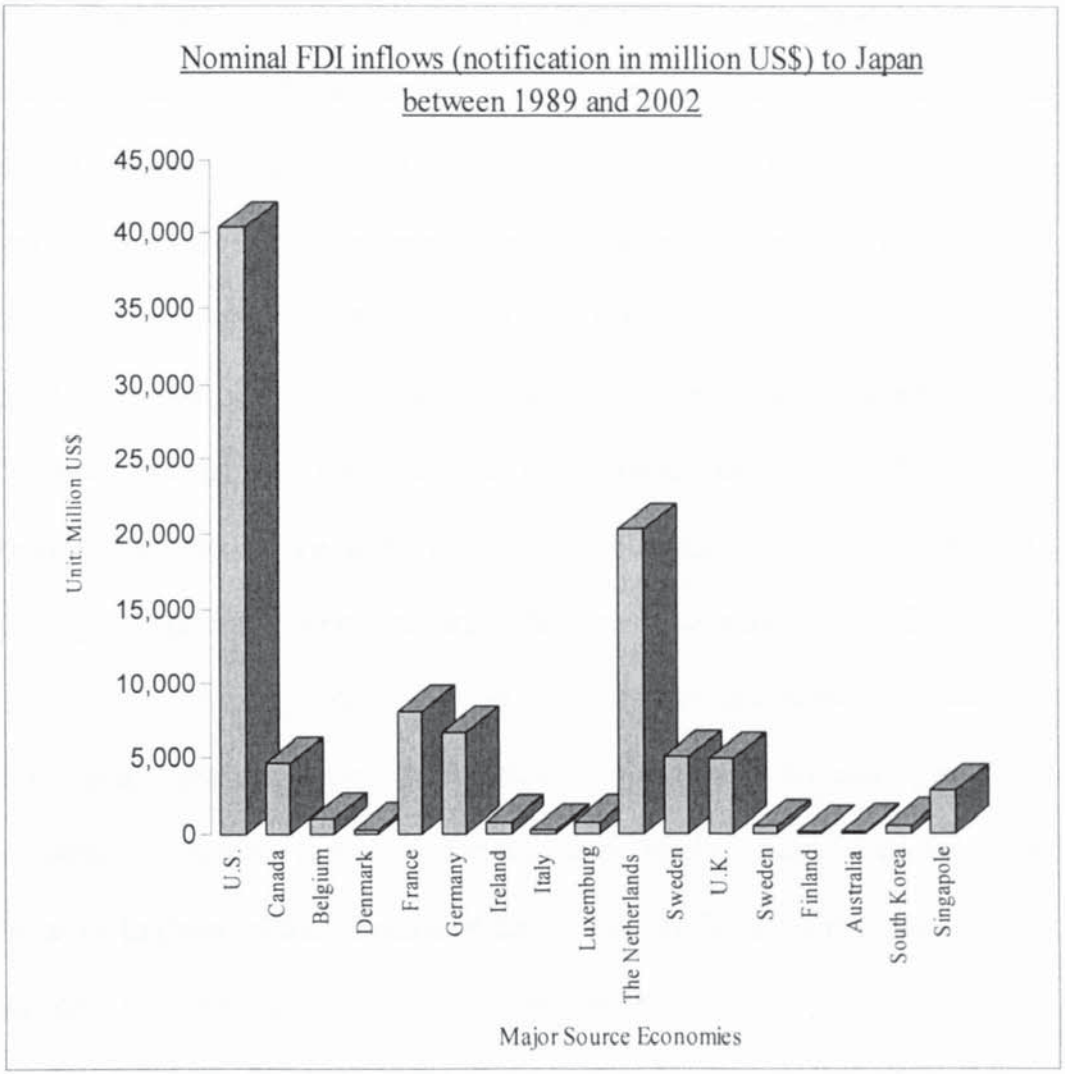
Given the potential importance of FDI in facilitating the restructuring of the Japanese economy, it is perhaps surprising that FDI into Japan has received so little comment, particularly in terms of the characteristics of the investing countries. The main purpose of this chapter is therefore to explore the link between a range of economic and location specific factors for investing counties, and inward FDI flows into Japan. However, the study also demonstrates that the use of an appropriate econometric specification, particularly the employment of a fixed effects panel specification, can significantly alter the findings with regard to the determinants of FDI, relative to much of the previous work that has employed pooled data. As several past studies have based their findings solely on such pooled models (Grosse and Trevino 1996; Thomas and Grosse 2001; Pan 2003; Zhao 2003; Deichmann 2004), this study also seeks to highlight this potential misspecification and thereby suggest that these past findings with regard to the determinants of

[4] A number of empirical studies have sought to identity the impact of host government policies. However, FDI policies are often sectoral in nature, and therefore difficult to quantify at macro level. Japan is a country that has imposed a wide range of FDI policies; many of them include sector-specific restrictions on foreign ownership and entry. Such restrictions have been placed on sensitive sectors such as banking, communications, broadcasting, education, medical services, and electricity, gas, and water supply.

inward FDI inflows may be biased.

The remainder of the chapter is structured as follows. The following section reviews the extant empirical literature on the macro determinants of FDI and identifies several potential key determinants of FDI that are subsequently tested in our empirical specification. Section 3 illustrates the empirical model used to examine the relationship, describes the variables, and briefly discusses the results of unit root tests that were undertaken on these variables. Section 4 then presents model specifications along with relevant test results and the final section offers some overall conclusions.

Figure 2-1: FDI Inflows to Japan



2.2. The Key Determinants of Inward FDI Identified in Previous Studies

Our approach to modelling Japanese FDI inflows builds on previous analysis of FDI into other industrialised economies (Culem 1988; Tallman 1988; Grosse and Trevino 1996) as well as transitional economies (Thomas and Grosse 2001; Wei and Liu 2001; Pan 2003; Zhao 2003; Deichmann 2004; Hsiao and Hsiao 2004). Our selection of FDI determinants is therefore based on consideration of previous studies that have used a multidimensional model. The chosen determinants, which are often cited as location specific factors in the OLI paradigm (Dunning 1993; Dunning 1995), are likely to affect FDI inflows, even if, as we will see, much of the previous literature has generated conflicting results. These determinants, which are discussed in detail immediately below, are: Source Country Market Size, Bilateral trade, Relative Exchange Rates, Exchange Rate Volatility, Relative Borrowing Costs, Relative Labour Costs, and Source Country Risk.

The dominance of large developed countries in terms of inward investment into Japan suggests that the key motivation to invest there is market seeking. Markusen (1998) and Dunning (1993) for example suggest that most FDI occurs between high-income developed countries, where firms are looking to either expand into markets similar to their own, or protect their home market from foreign competition. Figure 2-1 suggests that it is reasonable to assume that FDI into Japan is motivated by similar considerations. This is important in the context of Japan, and is an argument dating back to Kobrin (1976). This

suggests that in terms of current terminology, "market seeking" FDI is more susceptible to changes in explanatory variables such as market size or exchange rate differences, compared with vertical FDI motivated by the access to raw materials or low cost labour for assembly operations.

Source Country Market Size

Affluent countries with a large number of competitive multinational firms should be able to make larger investments in the international market. Larger economies imply greater availability of capital resources and intangible assets such as technical knowledge and marketing expertise that can be used to establish foreign productions to meet consumer demand in a target country. Thus, we might expect a positive relationship between source country size and FDI. Moreover, Figure 2-1 suggests that a similar relationship may exist for Japan, given the relative magnitude of FDI flows from the US, which is the world's largest economy.

Nevertheless, the past evidence with regard to source country market size is inconclusive, as illustrated by the the contradictory results found in studies such as Stone and Jeon (1999), Grosse and Trevino (1996), Tallman (1988), Kyrkilis and Pantelidis (2003) or Thomas and Grosse (2001). We would argue that the cause of this ambiguity in the previous empirical evidence may be related to the econometric methodology employed, which largely has been OLS on pooled data. This neglects country specific effects, such that variables which little relative inter-temporal variation are likely to be overstated in

importance. For example, the country size variable may simply serve as a proxy for these uncontrolled effects, and will therefore give a biased estimate of the actual impact of market size on FDI flows. Indeed, as our below results for Japan suggest, inappropriate econometric specifications may be the source of much of the confusion in the literature with regard to the impact of market size on FDI flows.

Bilateral Trade

Determining whether FDI and trade are substitutes or complements has been the subject of debate in both the FDI and international trade literature. Again, much of the empirical literature produces conflicting results. Conventional neoclassical trade theory suggests that multinational activities motivated by market penetration or barriers to trade tend to substitute for trade, indicating a negative association. Conversely, resource extraction and outsourcing FDI lead to an increased trade volume, thereby suggesting a positive complementary effect. According to internationalisation theory (Hedlund and Kverneland 1983; Andersen 1993), manufacturing firms are likely to undertake incremental steps to serve unknown foreign markets by exporting until sufficient experience and necessary knowledge are accumulated to operate a direct subsidiary. This is because exporting requires less investment in sunk costs than FDI and is the least risky mode of serving unknown overseas markets. In this context, internalisation theory postulates that FDI is a substitute for exports only when higher fixed costs associated with foreign productions (i.e.

constructing new plants) can offset external transaction costs (Buckley and Casson 1976; Dunning 1993). In general, however, Japan is unlikely to be an attractive location for outsourcing, or an export platform for the region. As such, it is likely that trade and FDI into Japan are substitutes rather than complements.

Despite this conceptual complexity and empirical ambiguity, there has been growing evidence to suggest that international trade has a positive and complementary influence on outward FDI in industrialised economies. For example, Barrell and Pain (1999a) articulate that Japanese outward FDI has a trade creating effect, while similar results are reported by Pantulu and Poon (2003) and Farrell et al. (2004). Blonigen (2001) examines disaggregated product level data for Japanese automobile parts in the US market and obtains results of both substitution and complementary effects between Japanese exports and affiliate productions in the US. In analysis of US manufacturing FDI in selected industrialised economies, Narula and Wakelin (1997) demonstrate partial support of trade displacing impact on horizontal FDI.

Relative Exchange Rates

There are several arguments concerning the mechanisms by which currency exchange rate movements affect FDI. These arguments relate to the different types of multinational activities undertaken in a particular location, the destination of the finished goods or service produced, and the sources of intermediate inputs. For example, Kiyota and Urata (2004) find that real

exchange rates play an influential role for the locational determinants of the FDI of Japanese firms in aggregated and disaggregated industries. The theoretical relationship between FDI and trade discussed earlier is also influenced by relative cost factors. Appreciation of the home currency reduces the cost of capital, enabling firms to more easily invest abroad relative to firms in countries with a depreciated currency (Benassy-Quere et al. 2001). Conversely, when MNEs use the local market as an export-platform, then FDI and trade will become complements.

Froot and Stein (1991) find that depreciation of the host currency leads to larger FDI inflows. They argue that appreciation of the source country currency relative to that of the host currency increases the wealth position of firms, reducing the relative cost of capital and allowing them to invest more actively in the foreign market. Overall, our a priori expectation is that countries with an appreciating currency relative to the Japanese Yen will demonstrate higher levels of FDI, as this reduces the relative cost of capital in Japan for inward investors.

Exchange Rate Volatility

The existing literature in this area is perhaps even more ambiguous than that concerning the relationships discussed above. Goldberg and Kolstad (1995) reveal that short run real exchange rate volatility stimulates outward FDI by risk-averse multinational firms. This finding is in line with an earlier finding of Cushman (1985) which demonstrates that an increase in risk raises FDI, partly

because FDI is preferred to exports as a means of serving the foreign market under exchange rate uncertainty. However, several recent studies find either a negative or a negligible impact of currency volatility on FDI. Amuedo-Dorantes and Pozo (2001) report significant negative short and long rum impacts of volatility on FDI, while Crowley and Lee (2003) and Gorg and Wakelin (2002) reveal only weak relationships between currency volatility and outward FDI. As such, the previous work is inconclusive, and any a priori expectation is therefore unclear.

Relative Borrowing Costs

When the costs of borrowing in the source country is lower relative to those in the host country, MNEs from countries with relatively low interest rates have a greater cost advantage over indigenous rivals when they establish overseas production plants and services (Cushman 1985). However, this ignores the possibility of MNEs raising funds within the host country or elsewhere in the world. If interest rates in the host nation are lower relative to world interest rates, foreign MNEs will raise more funds within the host country and a smaller amount of funds will flow in from abroad. Barrell and Pain (1996) extend this argument to broader measures of the user cost of capital, and in contrast to the work discussed above suggest that investing countries with a higher user cost of capital are more likely to engage in outward FDI. In a similar vein, Wei and Liu (2001) also find contradictory results regarding the level of FDI in China and borrowing costs. This indicates that FDI inflows

decrease as borrowing costs in the host country rise relative to those in the source country.

Relative Labour Costs

Because of the international immobility of labour, wage differentials between source and host countries are often considered to be a major determinant of FDI flows. The conventional rationale for this is that a rise in host country wages relative to those in the source country is an impediment to FDI inflow, particularly for MNEs that engage in labour-intensive production. Nevertheless, higher wages do not necessarily deter FDI into all industries because higher wages may well reflect higher productivity, notably in high tech industries in which the quality of labour is particularly important. Thus, there is often ambiguous empirical evidence with regard to the labour cost effect on FDI even after allowing for differences in labour productivity and labour skill.

Nevertheless, in an analysis of the locational determinants of FDI, Culem (1988) suggests that higher unit labour costs are an impediment to inward bilateral FDI flows among industrialised countries. The results for intra-European FDI, on the other hand, are found to be more subtle: MNEs do seem to be attracted by lower labour costs in destination countries, but once a location decision is made, FDI is then associated with higher wages and better quality labour. Hatzius (2000) examines the effect of unit labour cost differentials on British and German bilateral FDI flows to and from OECD partner countries and shows that higher unit labour costs stimulate FDI

outflows. This study concludes that British multinationals seem to be attracted to locations with the lowest cost production worldwide, whereas German counterparts seem to do so only within Europe. In a study of Japanese outward FDI for the whole economy and for the manufacturing sector in the US and EC panel members, Barrell and Pain (1999a) demonstrate that higher labour costs in target countries have a noticeable negative impact on FDI. Taylor (2000) also supports this view by providing evidence that the wage rates of 39 host countries are negatively associated with changes in the assets of US owned affiliates. Likewise, further evidence is presented in the case of industrialised economies such as US manufacturing FDI in Europe (Barrell and Pain 1998; Barrell and Pain 1999b), and German outward FDI in both manufacturing and service sectors in EU countries and the US (Pain and Lansbury 1997).

Source Country Risk

Empirical studies that examine the impact of source country risk on FDI are extremely limited and lack solid empirical evidence. The extent to which political factors affect the FDI decisions of MNEs depends largely on the managerial perceptions toward risk and the nature of political conditions in the source and host countries. A positive overall investment climate in the host country has a direct effect on its ability to attract FDI. Thus, with a less risky investment climate, more FDI will flow in (Schneider and Frey 1985). Loree and Guisinger (1995) accordingly demonstrate that the political stability of recipient countries had a significant and positive impact on US FDI in 1982. In

a similar vein, business climate and political stability play a vital and positive role in FDI location decisions in the transitional economies of Central and East Europe, as well as in developing economies (Carstensen and Toubal 2004; Janicki and Wunnava 2004). However, the evidence is rather mixed. Pan (2003) finds that a favourable host country credit rating is associated with a decrease in FDI, while Sethi *et al.* (2002) find no such relationship. A partial explanation for this empirical ambiguity is that a certain political and economic events might be linked with various responses of the source countries rather than those of host countries toward different degrees of risks (Noorbakhsh et al. 2001). In a study of major industrialised countries between 1974 and 1980, Tallman (1988) demonstrates that domestic conflicts in the investing country, which produce a poorer business climate and a higher risk stimulate FDI inflow to relatively stable countries like United States. However, in the context of FDI between mature, developed economies, the importance of political risk is less clear. It may be that certain potential investors are unclear of the potential risk of appropriation of assets in Japan, though it is unlikely that will be a major factor. For example, Thomas and Grosse (2001) argue that a source country's attitude to risk does not explain variations in source country FDI flows into a transitional host economy like Mexico (Thomas and Grosse 2001).

The Potential Determinants of Inward FDI in Japan

As we have seen, there is considerable ambiguity in the previous literature with regard to the potential impact of our chosen determinants on inward FDI flows.

Some of these conflicting results can be explained by theoretical ambiguity: However, they are also related to a lack of internationally comparable data, particularly in terms of the explanatory variables, and the econometric treatment of country specific effects and time invariant variables. These issues are discussed in more details in section 3 below. Nevertheless, the literature is consistent in terms of identifying the important likely determinants of FDI flows from source countries, and we therefore wish to test whether and how these determinants influence FDI into Japan. Based on the above discussion, it is possible to develop six hypotheses concerning the determinants of FDI flows into Japan.

Hypothesis 1: There is a positive relationship between the market size of source countries and FDI inflows to Japan.

Hypothesis 2: There is a negative relationship between source country exports and FDI inflows to Japan.

Hypothesis 3: There is a positive relationship between appreciation of the source country currency and FDI inflows to Japan.

Hypothesis 4: There is a negative relationship between the cost of borrowing differentials and FDI inflows to Japan.

Hypothesis 5: There is a positive relationship between labour cost differentials and FDI inflows to Japan.

Hypothesis 6: There is a positive relationship between the investment climate of source countries and FDI inflows to Japan.

2.3. Empirical Model Specification and Data Description

The data consists of a panel of 17 source countries for the period 1989-2002[5]. These data are drawn together from numerous sources, presenting problems of converting to uniform currency. Detailed descriptions of the variables, descriptive statistics, and information on data sources are provided in the data Appendix-A. All listed nominal variables, except the hourly compensation cost index and country risk were converted to real terms by using relevant price indices. The choice of investing countries and time period is largely determined by the extent to which sufficient information is available to permit the construction of consistent measures of the selected variables over time.

With only 14 annual observations for each source country, the application of panel techniques is likely to yield more efficient parameter estimates than separate single country equations. From a methodological point of view, utilising panel data provides various advantages over conventional cross section or time series data. It gives, for example, more informative data, more variability, less collinearity among the variables, and more degrees of freedom, and higher efficiency (Baltagi 2001; Hsiao 2003). Panel estimation also allows us to control for individual country heterogeneity, thereby enabling us to minimise serious misspecification problems. As a result, the reliability of the estimated regression parameters is improved with a panel specification.

[5] The source countries are the US, UK, Australia, Germany, Belgium, Canada, Denmark, Finland, France, Ireland, Italy, South Korea, The Netherlands, Singapore, Sweden, Switzerland, and Luxembourg. In practice, only one country/year observation is missing.

Moreover, this highlights a potential source of ambiguity in previous empirical studies such as Pan (2003) and Deichmann (2004), ambiguity that derives from the use of straightforward pooled data with a relatively short time frame and limited number of countries. This pooling approach omits any unobserved country specific effects, and can potentially lead to inappropriate parameter estimates. In contrast, employing a fixed or random effects model effectively allows the intercept to vary over the sample of countries, which is an appropriate approach to examining the determinants of FDI in Japan. This is because the effects of omitted variables can be absorbed into the intercept term of the regression model. This ultimately allows both diversity and the specificity of various investors' behaviours to be controlled for in the model.

We therefore postulate the following panel model, with variables chosen based on our discussion in section 2, in order to explain variations in source country FDI into Japan:

$$\begin{gathered}\ln FDI_{it} = \ln \alpha_i + \beta_1 \ln GDP_{it} + \beta_2 \ln EXPO_{it} + \beta_3 \ln EXR_{it} \\ + \beta_4 \ln EXRV_{it} + \beta_5 \ln LR_{it} + \beta_6 \ln LC_{it} + \beta_7 \ln CRSK_{it} + v_{it} \\ i = 1,2,3,.....N; t = 1,2,3,.....T \\ where \quad v_{it} = u_i + \varepsilon_{it}\end{gathered} \tag{2.1}$$

FDI is annual inflows from source countries to Japan, and subscripts i and t respectively index cross section units of a specific source country varying from 1 to 17 and time starting from year 1989 to 2002. GDP is market size of source

countries, and EXPO is export performance of the source country.[6] Exchange rate levels and volatility are respectively captured by EXR, the relative bilateral exchange rate, and EXRV. LR captures borrowing cost differentials, LC is relative labour cost, CRSK is the risk ratings of the source country. The overall error term v_{it} is composed of u_i, which is time-invariant and accounts for any unobservable individual source country specific effect that is not explicitly included in the regression, and ε_{it}, which is assumed to be white noise.[7]

Table 2-1 presents the results of integration tests employing three alternative ADF-based test statistics, namely, IPS (Im et al. 2003), MW (Maddala and Wu 1999), and Choi (Choi 2001). The tests that include an individual linear time trend reject the null hypothesis of unit roots for all time variant variables in levels. This indicates that all variables are *I*(0), that is stationary. The specifications without a time trend provide identical results, except in the case of country risk, where we cannot reject the null hypothesis when a time trend is not included. Since the country risk variable exhibits clear annual trends, it is necessary to allow both an intercept and a time trend as appropriate deterministic components to enter the regression model and to test for a unit root. Nevertheless, non stationarity of country risk will not pose

[6] We considered using bilateral trade, separate export and import variables in levels, and normalised trade variables as in previous studies. However, given the presence of sever multicollinearity between GDP and all trade variables, and a persistent finding of *I*(1) in the imports variable, we measure net trade balance as export performance relative to imports following Root and Ahmed (1978) and Erdal and Tatoglu (2002).

[7] We also tested for the presence of time specific effects but these were found to be statistically insignificant in all specifications.

problems since both Johansen's trace and maximum eigenvalue cointegration tests reject the null hypothesis of no cointegration. This suggests that there is a long-run relationship between the set of variables. We therefore can proceed with the panel based fixed and random effects specifications suggested above.

Table 2-1: Unit Roots Tests

	Unit Root (assumes individual unit root process)					
	(1) IPS-ADF		(2) Fisher-ADF		(3) Fisher-ADF	
	W-stat		Chi-Sq (MW-test)		Z-stat (Choi-Test)	
Variables in Levels	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend
FDI	-3.95***	-5.88***	80.07***	92.30***	-3.88***	-5.58***
GDP	-4.41***	-4.29***	84.51***	76.36***	-4.31***	-4.16***
Export performance	-4.13**	-3.31***	78.48***	65.36***	-3.50***	-2.74***
Exchange rate	-6.92***	-5.95***	108.73***	92.38***	-7.02***	-5.99***
Currency volatility	-7.78***	-3.74***	118.20***	66.98***	-7.57***	-4.21***
Labour cost	-4.08***	-2.85***	70.53***	55.16**	-4.13***	-2.88***
Borrowing cost	-4.32***	-2.38***	80.05***	62.38***	-3.21***	-2.41***
Country risk	3.40	-2.41***	13.07	56.86***	3.98	-2.19**

Note: All variables are expressed in natural logarithms. Lag lengths are based on automatic maximum selections of AIC: 0-2. *** and ** denote the levels of significance at 1% and 5% respectively.

2.4. Results

Table 2-2 presents regression results along with relevant test statistics for pooled ordinary least squares (PLS), fixed effects (FE) and random effects (RE) specifications. The estimated individual coefficients of the PLS specification (1) are highly statistically significant and are generally consistent with the previous literature. As discussed in earlier sections, the use of a simple pooled regression that neglects country specific effects may lead to an aggregation bias, which will lead to false inferences. As indicated, both the F-

test and the Likelihood Ratio (LR) test reject the null hypothesis in favour of the FE model, clearly suggesting that a pooled regression model with a single constant term is inappropriate for the dataset. Similarly, the Lagrange Multiplier (LM) statistic reveals strong evidence of a country specific effect for each source country, indicating that RE is a more efficient estimator than PLS. Taken together, the high statistical significance of these tests demonstrates the presence of heterogeneity across investing countries' behaviours. This suggests that a PLS specification is inappropriate, and will therefore provide statistically unreliable results. In other words, additional country specific differences not otherwise controlled for in the PLS model are contributing to the variation of FDI inflows in Japan. This suggests that a simple pooled OLS regression model that does not control for heterogeneity will lead to an unacceptable degree of aggregation bias and to statistically meaningless results.

Table 2-2: Regression Results

Independent Variables and expected signs	Dependent Variable: FDI				
	(1) PLS	(2) FE	(3) RE	(4) FE	(5) RE
Constant	-42.331***	-33.543***	-34.394***	-27.104 ***	-35.297***
	(4.809)	(7.249)	(7.902)	(9.606)	(7.833)
Source Country GDP (+)	0.791***	0.897	0.777***		0.741***
	(0.071)	(0.835)	(0.157)		(0.175)
Source Country Export Performance (-)	-0.653***	-1.640***	-1.181***	-1.457**	-1.180***
	(0.184)	(0.558)	(0.324)	(0.599)	(0.321)
Relative Exchange Rate (+)	2.032***	0.619	1.408		
	(0.736)	(0.972)	(0.943)		
Relative Currency Volatility (+/-)	0.443	0.466	0.456*	0.570*	0.478*
	(0.281)	(0.376)	(0.261)	(0.294)	(0.283)
Relative Borrowing Cost (-)	-0.385***	0.187	0.036	0.238*	
	(0.070)	(0.127)	(0.083)	(0.123)	
Relative Labour Cost (-)	2.599***	-0.288	0.875		
	(0.539)	(0.702)	(0.902)		
Source Country Risk (+)	8.228***	5.487***	6.190***	6.571***	6.414***
	(1.044)	(1.852)	(1.662)	(2.142)	(1.850)
Number of Observations	235	235	235	235	236
R-squared	0.509	0.675	0.464	0.672	0.448
Adjusted R-squared	0.494	0.640	0.448	0.641	0.438
Sum of Squared Residuals	663.14	438.628	722.717	443.215	746.085
Test statistics:					
PLS (1) vs. FE (2)	F-Test[16,211]=6.75***				
	Likelihood Ratio Test~Chi-Sq.[16]=97.13***				
PLS (1) vs. RE (3)	Lagrange Multiplier Test~Chi-Sq.[1]=64.84***				
FE (2) vs. RE (3)	Hausman Test~Chi-Sq.[7]=13.70*				

Note: White Standard Errors in parentheses and degrees of freedom in brackets. ***, **, and * denote the levels of significance at 1%, 5%, and 10% respectively. The Random effect model is estimated by employing the Swamy and Arora estimator of component variances.

Both the FE and RE approaches in columns (2) and (3) of Table 2-2 yield broadly similar results. However, while the Hausman statistic is significant at the 10% level it is only marginally insignificant at the 5% level, thereby suggesting that the FE specification is marginally favourable to the RE specification. Moreover, in our application the FE specification is arguably superior to the RE specification, because it does not require the assumption of no correlation between the country specific effects and the regressors. From an

applied perspective, there is little justification for treating the individual effects as uncorrelated with the other regressors when almost no macroeconomic variables can be said to be truly exogenous.

Controlling for country specific heterogeneity causes several variables that are significant in the PLS specification to become statistically insignificant. Columns (4) and (5) provide results from the FE and RE estimation of the parsimonious specifications after the removal of jointly and individually insignificant variables[8]. Given the superiority of the FE specification discussed above, the parsimonious FE specification (4) is arguably the most efficient and appropriate specification reported in Table 2-2 and we will therefore base our further discussion on this model.[9]

The parsimonious FE model demonstrates that, once unobservable source country heterogeneity is controlled for, there is rather weak statistical support for the relationship between several key economic factors and FDI inflows. Thus, while the existing literature suggests that corporate decisions can often be influenced by the size of national economies and movements in exchange

[8] Several further robustness tests were conducted. Firstly, after splitting the sample, separate regressions were run to test for a structural break. However, we could not reject the hypothesis of identical error variances for the first and second half of the sample, thereby suggesting no evidence of a structural break over time. Similarly, regressions were run separately for EU and non-EU countries to test whether these two sub-samples behave differently. This F-test fails to reject the null hypothesis that these two sub-samples can be pooled together, thereby suggesting no systematic difference between EU and non-EU countries.

[9] We note that in the parsimonious specifications we found similar test results to those reported in Table 2-2 indicating that a FE specification was most appropriate.

rates and labour costs, once country differences are controlled for, these macro economic variables do not exert a statistically significant influence on FDI into Japan in our panel model.[10] We therefore find evidence contrary to hypotheses 1, 3, and 5.

Moreover, while the estimated coefficients on source country export performance, relative currency volatility, relative borrowing costs, and source country risk are statistically significant, one of these has a sign different from those hypothesised earlier, and as a result only hypotheses 2 and 6 are supported by our results. The results strongly suggest that the most important source country factors affecting the level of FDI inflows into Japan are export penetration and stability of business climate. These findings are now discussed in detail.

The export performance coefficient is statistically significant and negative, supporting the prior theoretical arguments of a trade substitution effect on horizontal FDI. Gray (1998) also suggests that market seeking production and service generates a trade displacing effect, whereas efficiency seeking FDI tends to create a trade stimulating effect. Market seeking investments take place when MNEs prefer to serve a particular market by local production rather than by exports (Nachum et al. 2000). The relationship between FDI and export

[10] The market size result depends on the model specification, as comparison with the parsimonious RE model demonstrates. We would argue that not only the Hausman test reported in Table 2-2, but also the inappropriateness of RE assumptions discussed in the main text justify the discounting of these results.

performance therefore suggests an alternative means of penetrating overseas markets. The negative coefficients indicate that source countries with stronger export performance are less likely to establish direct production in the Japanese market.

This substitution rather than complementary effect may particularly hold for FDI in Japan for several reasons. First, FDI in Japan is still a relatively recent phenomenon. As internationalisation theory (Hedlund and Kverneland 1983; Andersen 1993) suggests, many multinational firms may take an incremental step of serving the Japanese market with exports until sufficient experience and knowledge is acquired to operate directly in the new market. Knowledge and experience are essential requirements because multinational firms need to understand the culture, language, marketing/distribution networks, and consumer tastes in the destination country. In order to achieve internal economies from cross border operations, multinational firms should be capable of adopting and integrating local organisational and managerial practices effectively with their organisations (Graham 1996). Furthermore, when compared with FDI, exporting requires less resources and a less risky mode of penetrating unknown foreign markets. Second, trade displacement effects on FDI are more likely to occur before exports reach a critical level. Exports require higher costs per unit given potential tariffs and greater transportation costs, whereas FDI involves higher fixed costs such as the cost of constructing new plants. Firms with lower sales levels may therefore prefer to export in order to avoid the costs associated with foreign production until they can offset

external transaction costs. This is consistent with internalisation theory (Buckley and Casson 1976; Dunning 1993), which postulates that FDI displaces exports when there are sufficient costs to external transactions (i.e. export or licensing). Several authors (Graham 1996; Mirza et al. 1996; Buckley et al. 1999) note that foreign MNCs have found it very difficult to internalise their ownership advantages in Japan. In other words, 'the cost facing foreign firms in internalising markets for intermediates products and labour services are uniquely high' (Buckley et al. 1999, p66). As the analysis presented in this study shows, these two aspects seem to apply in the case of FDI into Japan.

The coefficient for relative currency volatility is positive and statistically significant at the 10% level, supporting earlier findings by Cushman (1985). This positive coefficient suggests that the level of multinational activities increases as the exchange rate variability of investing counties rise relative to the Yen. This is because engaging in market seeking FDI becomes a substitute for exports when the uncertainty of exchange rate movements increases (Cushman 1985). In the presence of barriers to international trade, foreign production may be an alternative way of entering foreign markets. Thus, real exchange rate volatility may reduce trade, but may induce a greater level of FDI inflows. In other words, MNEs facing large currency fluctuation will produce locally if output to be produced and sold in that destination market by using imported intermediate inputs from their home country, yet will refrain from doing so if such produced output is destined for a third country. Given the

case of FDI into Japan, it is apparent that the country is not used as an export platform.

With respect to other relative cost factors, the borrowing costs differential is statistically significant at the 10 percent level in the parsimonious fixed effects specification. However, the direction of effect is contradictory to the prior predictions made in hypothesis 3. The positive coefficient suggests that the level of FDI in Japan increases by 0.2 percent as the lending rate of source countries rises by 1 percent relative to those of Japan. This effect can be explained by Barrell and Pain (1996, p205) who report similar results in the case of US outward FDI. A positive relationship between relative capital costs and outward direct investment implies that "a rise in the relative costs of production will lead to a diversion of resources away from domestic sites" (Barrell and Pain 1996, p205). Our result is also consistent with a finding by Ma, et al. (2000) Thus, a higher source country lending rate is consequently associated with an increase of FDI in Japan.

Another possible explanation is related to the joint venture arguments provided by (Wei and Liu 2001) which reports findings consistent with the results of this study. Hypothesis 3, which is derived from extant theory, implicitly assumes that MNEs will raise all necessary funds for overseas operations from their home countries. However if such operations are undertaken by means of shared foreign ownership through joint ventures rather

than through a wholly owned subsidiary, the theory becomes less convincing. "Using the joint venture route reduces capital costs, allows the entrant to test the market, and crucially facilitates learning" (Buckley et al. 1999, p64). The same can be said of foreign ownership that occurs through FDI, where the finance is raised in the host country or a third country's capital market.

We also note that the FDI data used in this analysis is notification inflow, and it therefore does not necessarily reflect the realised value, as would be the case with balance of payment statistics. This may be interpreted as an *"intention"* of firms to undertake multinational activities in Japan. The current data are unable to distinguish whether FDI takes the form of an equity joint venture or of a wholly owned firm. Nevertheless, the lower lending rate in Japan compared to other countries seem to attract FDI inflows when foreign MNEs *intend* or *anticipate* forming joint ventures with indigenous Japanese partners, and when MNEs can access lower borrowing costs.

After controlling for unobservable country heterogeneity, exchange rates and labour costs do not play a statistically significant role in affecting the level of FDI inflows in any of the specifications, and we therefore find no evidence in support of hypotheses 3 and 5. Weak evidence here is partly anticipated since market seeking FDI is predominant in Japan. Caves (1996), for example, points out that relative labour cost or wage factors are more likely to respond significantly and negatively to export-oriented FDI or efficiency seeking FDI.

As proposed in hypothesis 6, we find that FDI flows increase with the stability of the business and investment climate in the source country. Using source countries attitude to risk provides new insight by resolving the ambiguity of previous finding that have used variability of returns in the host country. These results also suggest that horizontal multinational activities are particularly sensitive to the business climate. In other words, market-seeking FDI is less likely to occur when the credit worthiness of the source country decreases or the fragility of its banking sector increases. Our current data does not allow distinguishing between vertical and horizontal FDI flows. However, there is considerable empirical evidence, showing that Japan is used as a market serving destination rather than as an export platform. For example, Khan and Yoshihara (1994) present a survey-based analysis suggesting that the main motivation for investing in Japan was the host country market size, and a desire to establish a presence in one of the world's major economies. Likewise, Buckley et al. (1985; 1999), and Mirza et al.(1995; 1996) have also found that the underlying objective of foreign investors in Japan is to achieve market access and to demonstrate a local presence. Since most source countries in these data can be assumed to have a stable and favourable business climates, political and economic stability are relative terms here. None the less, it appears that home country stability increases FDI inflows from these countries.

a. The importance of geographic and cultural distance

Previous studies on the determinants of FDI into various host countries have argued that both geographic and cultural distance are important determinants of FDI flows, see for example Lin (1996) and Drake and Caves(1992). Recently Guerin (2006) has shown that physical distance is negatively associated with FDI flows, ascribing this to increased information costs. In terms of cultural distance, Hofstede's index (1980; 2001) has often been used as a proxy for transaction costs generated through cultural differences. However, it is well known and documented that such cultural distance constructs have theoretical and methodological drawbacks (Brouthers and Brouthers 2001; Shenkar 2001; Cho and Padmanabhan 2005). In the context of Japan, we have several concerns with these measures. Firstly, Shenkar (2001) points out that constructs of cultural distance suffer from the illusion of symmetry (e.g. the cultural distance from Japan to the UK is the same as the distance from the UK to Japan). Secondly, such measures are merely reported at a point in time, with the assumption that they are time invariant. In terms of the econometric modelling, they are therefore correlated with the unobservable fixed effects. In order to include such variables as independent variables, one must relax the assumptions of the fixed effects model, and use a random effects specification. However, we have already argued above that the fixed effects approach is both conceptually and statistically more appropriate in our analysis. Thirdly, on a more practical level, with the exception of South Korea and Singapore, all of the source countries are much nearer, both geographically and culturally, to

each other than they are to Japan, and such limited within-sample variation may lead to biased results. Nevertheless, in order to allow comparison to our preferred specification, Table 2-3 presents model estimates after the inclusion of cultural (CDIST) and spatial distance (SDIST) measures. The definitions and sources of the spatial and cultural distance measures are given in the data Appendix-A. Comparing Table 2-3 with column 3 of Table 2-2, it is clear that the results presented in Table 2-2 are robust to the inclusion of these distance variables, and that the distance variables themselves are at best only borderline significant.[11]

[11] The published measures of cultural distance are composites of several individual measures, including Power Distance, Uncertainty Avoidance, Individuality, Masculinity, and Long Term Orientation. These are discussed in some detail by Hofstede (2001). We experimented with various combinations of these individual measures, but resolved to use the publicly quoted index, as this is not only most methodologically consistent with previous studies but also generated the statistically most significant results.

Table 2-3: Results including Distance Variables

Independent Variables and expected signs	(1) RE	(2) RE	(3) RE
Constant	-39.787***	-33.231***	-40.921***
	(7.213)	(6.226)	(7.459)
Source Country	0.755***	0.768***	0.781***
GDP (+)	(0.126)	(0.136)	(0.128)
Source Country	-1.227***	-1.207***	-1.189***
Export Performance (+/-)	(0.364)	(0.391)	(0.350)
Relative Exchange	1.573	1.190	2.024*
Rate (+)	(1.008)	(1.082)	(1.121)
Relative Currency	0.462	0.463	0.447
Volatility (+/-)	(0.337)	(0.334)	(0.342)
Relative Borrowing	0.019	0.053	-0.007
Cost (-)	(0.110)	(0.105)	(0.105)
Relative Labour	1.001	0.638	1.468
Cost (-)	(0.826)	(0.758)	(0.906)
Source Country	6.571***	6.336***	6.074***
Risk (+)	(1.507)	(1.541)	(1.341)
Geographic Distance	-0.503*	-0.203	
	(0.302)	(0.297)	
Cultural Distance	1.678*		1.429*
	(0.888)		(0.764)
Number of Observations	235	235	235
R-squared	0.498	0.466	0.493
Adjusted R-squared	0.478	0.447	0.475
Sum of Squared Residuals	678.392	721.880	684.611

Note: White Standard Errors in parentheses. ***, **, and * denote the levels of significance at 1%, 5%, and 10% respectively. Random effects model is specified by Swamy and Arora estimator of component variances. The correlation between geographic and cultural distance is 0.42.

2.5. Concluding Remarks

The primary purpose of this chapter was to investigate whether and to what extent a broad set of source country economic attributes, which have been previously applied in multidimensional models, have influenced FDI inflows into Japan during the 1989-2002 period. Contrary to the results of the existing literature, rather statistically weak evidence was found with regard to the effect of some source country characteristics on FDI in Japan. This appears to be

largely attributable to the failure to employ panel-based techniques in previous empirical studies, as we have provided strong evidence of unobservable country specific heterogeneity in our application. Moreover, we have also demonstrated that once unobservable country specific effects are taken into account, several coefficients, which are statistically significant and consistent with hypotheses drawn from the previous literature in a pooled regression model, are no longer supportive of these hypotheses. Thus, the second contribution in this chapter is to demonstrate that we must control for such unobserved country characteristics, if we wish to provide unbiased estimates of the determinants of FDI flows.

Our study also demonstrates that many of the previously theorised links influencing inward FDI in other developed and transitional economies do not necessarily hold and cannot be generalised in the context of Japan. Thus, despite the conventional wisdom and previous empirical evidence regarding the effects of market size, exchange rates, and labour costs on FDI, our empirical evidence suggests that all of these factors have a statistically insignificant effect on FDI flows into Japan. Nevertheless, with respect to other economic and country specific influences on the inflow of FDI in Japan, relative exchange rate fluctuation, a higher borrowing cost of investing countries, and the stability of the business climate in the investing country are all strong incentives for inducing FDI inflows to Japan. By contrast, the export performance of the source country was found to have a negative impact on the

level of multinational activities in Japan. We would note that the most consistent and highly significant results obtained, after controlling for unobservable heterogeneity, are related to the export performance of the source country and the stability of the business climate of the source country.

In general, research on inward FDI in Japan has been scarce, and there has been limited study into why foreign penetration is observed in certain industrial sectors but not others. As this study focused on the aggregate FDI inflows, it was not possible to consider many unique characteristics of the Japanese economy that may influence FDI. These include *keiretsu* (corporate grouping) activities that are often cited as a cause of the closed nature of the Japanese market and as such institutional deterrents to inward direct investment. Such activities are found to vary across industrial sectors and therefore may have a significant influence on disaggregated levels of FDI. Thus, while our macro based study has provided important insights into the determinants of Japanese FDI inflows, we conclude by noting that future research should be conducted at a more disaggregated level. Such analysis will allow us to better identify how the characteristics of the Japanese economy, as opposed to the characteristics of source countries, influence Japanese FDI inflows.

Chapter Three

3. Determinants of Inward FDI in Japanese Manufacturing Sectors: Does a Presence of Keiretsu Matter?

3.1. Introduction

Chapter 2 of the thesis has examined how the macro characteristics of the source country influence FDI (Foreign Direct Investment) inflows into Japan. In order to provide better insights into the study on the determinants of inward FDI, this chapter analyses variations in foreign penetration across Japanese manufacturing sectors. This enables us to take into account the unique industrial organisation of the Japanese economy for example *keiretsu* (industrial groupings) and to investigate these at a less aggregated level. Japan's peculiar industrial structure has often been cited as *one* of the reasons

for structural and institutional impediments to foreign penetration[12] (Lawrence 1991; Encarnation 1992; Mason 1992; Lawrence 1993a; Lawrence 1993b; Dunning and Lundan 1997; Buckley et al. 1999). It has been argued that keiretsu favour doing business within their member firms rather than with non-member firms or foreign firms in Japan. One aspect of their business approach is that procurement methods are less transparent. For example, *keiretsu* are often accused of exclusionary business practices such as implicitly preventing foreign goods from entering the Japanese distribution system. It is also difficult for foreign firms to acquire an equity stake of firms that belong to *keiretsu* because of cross-share holdings among member firms (Pease et al. 2006). In general, foreign firms in Japan possess sufficient competitive advantages over indigenous counterparts (Wakasugi 1996). However, the continuous development of such advantages may be hindered by restrictive market practices and the cartel-like behaviour of keiretsu affiliations. (Dunning 1996; Mirza et al. 1996; Buckley et al. 1999)

The primary objective in this study is to examine how sectoral level FDI responds to the industry characteristics of the host economy. In particular, we are interested in whether horizontal and vertical keiretsu linkages that represent Japan's distinctive inter-corporate groupings influence foreign penetration across manufacturing sectors in Japan. There has been little empirical work on the impact of keiretsu linkages on inward FDI, partly due to the conceptual

[12] Ki mura and Kiyota (2007), for example, argue that small proportions of inward FDI in Japan are the result of the combination of many factors. These include historical government restrictions, a strong Yen, competitive Japanese firms, and the lack of deliberate strategies of foreign firms entering the Japanese market.

ambiguity of keiretsu (Miwa and Ramseyer 2002), and partly due to the lack of consistent keiretsu data. The available statistical evidence on the role of keiretsu in influencing inward FDI is limited, mixed and in most cases contradictory. The evidence that does exist tends to be based on highly aggregated data (Lawrence 1993a; Weinstein 1996) and does not show how vertically and horizontally linked keiretsu across sectors have influenced the pattern of FDI over time (Ito and Fukao 2005). This study therefore attempts to fill this gap by developing a model for inter-industry variations of inward FDI that incorporates networking of inter-keiretsu firms.

The present study differs from existing empirical works in the following aspects. Firstly, the analysis is carried out within a panel framework rather than with a cross sectional data set in order to control for unobserved heterogeneity of sectoral characteristics. The limitations of cross sectional analysis (i.e. each industry representing a single data point), which has often been used in the previous studies for Japan (Lawrence 1993a; Nakamura et al. 1995; Ito and Fukao 2005), are well acknowledged. This makes it impossible to capture changing trends and variations of FDI and factors that determine its growth over time. Beyond the simple use of a panel approach, the analysis also introduces and controls for as many observable sectoral attributes as possible to develop the model of keiretsu impact on foreign penetration. Furthermore, the study progressively compares two alternative proxy measures for inward FDI as dependent variables. These are the sales and employment share accounted

for by foreign affiliated firms. Both measures have been used not only to compare the finding with previous studies (ibid) but also to test the robustness of the relationship between these alternative measures of foreign penetration and explanatory variables. Next, given the complexity of industry structure in the presence of inter-firm keiretsu affiliations, interaction terms are introduced to investigate whether conditional relationships exist between sectoral attributes and keiretsu network with their effects on investment decisions of foreign firms. Whilst there is no universally accepted definition of keiretsu (Ueda and Sasaki 1998; Miwa and Ramseyer 2002), keiretsu nonetheless represent as the major institutional characteristics of Japanese firms. For the purpose of this study, keiretsu are defined as "clusters of independently managed firms maintaining close and stable business ties, cemented by governance mechanisms such as Presidents' Councils, partial cross-ownership, and interlocking directorates"(Lincoln and Gerlach 2004, p15). The existing literature (Dewenter 2003; Blonigen et al. 2005b) commonly classifies keiretsu as both horizontally and vertically linked value chains. The former consist of member firms operating in unrelated industrial sectors and centre on large financial institutions (i.e. city banks, trust banks and insurance companies) as the core of the group. The latter are networks of suppliers, wholesale and retail distributors, grouped around major large-scale assembly manufacturers such as Toyota in the automobile industry or Toshiba in the electronics industry (Belderbos and Heijltjes 2005). Sambharya and Banerji (2006) assert that those core firms that occupy central position among members become the hub

through which resources and information flows are channelled to various other members of the keiretsu. This difference in the institutional infrastructure of conducting business in Japan compared with other leading industrial countries may significantly increase the transaction costs of foreign entrants and the risk of failure in an unfamiliar environment. We assume that a keiretsu presence in a given sector induces a moderating effect on foreign penetration and other control variables. Finally, to examine the keiretsu impact on the role of inward FDI more accurately, the samples are sub-divided and compared in accordance with the degree of technological sophistication of industries.

The results of this study should provide guidance for policy makers in their pursuit of a more effective scheme to promote inward FDI, which may reverse Japan's sluggish economic performance. This study attempts to contribute to the pertinent literature by analyzing various factors that affect FDI in this relatively unexplored but potential investment destination. Geographically, Japan is positioned to function as an international business hub for the fast-growing East Asian region. UNCTAD's (United Nations Conference on Trade and Development) Inward FDI Potential Index also ranks Japan 11th and 16th out of 140 countries from late 1990s to early 2000, despite the small proportion of FDI relative to the size of Japan's economy[13]. Indeed, FDI inflows to Japan have increased from about US$ 493 million (current terms) in 1984 to more than US$ 37.5 billion in 2004. In terms of FDI inflows by

[13] Source:
http://www.unctad.org/sections/dite_dir/docs/Potential_Index_1998-2000_en.pdf
(accessed in April 2007)

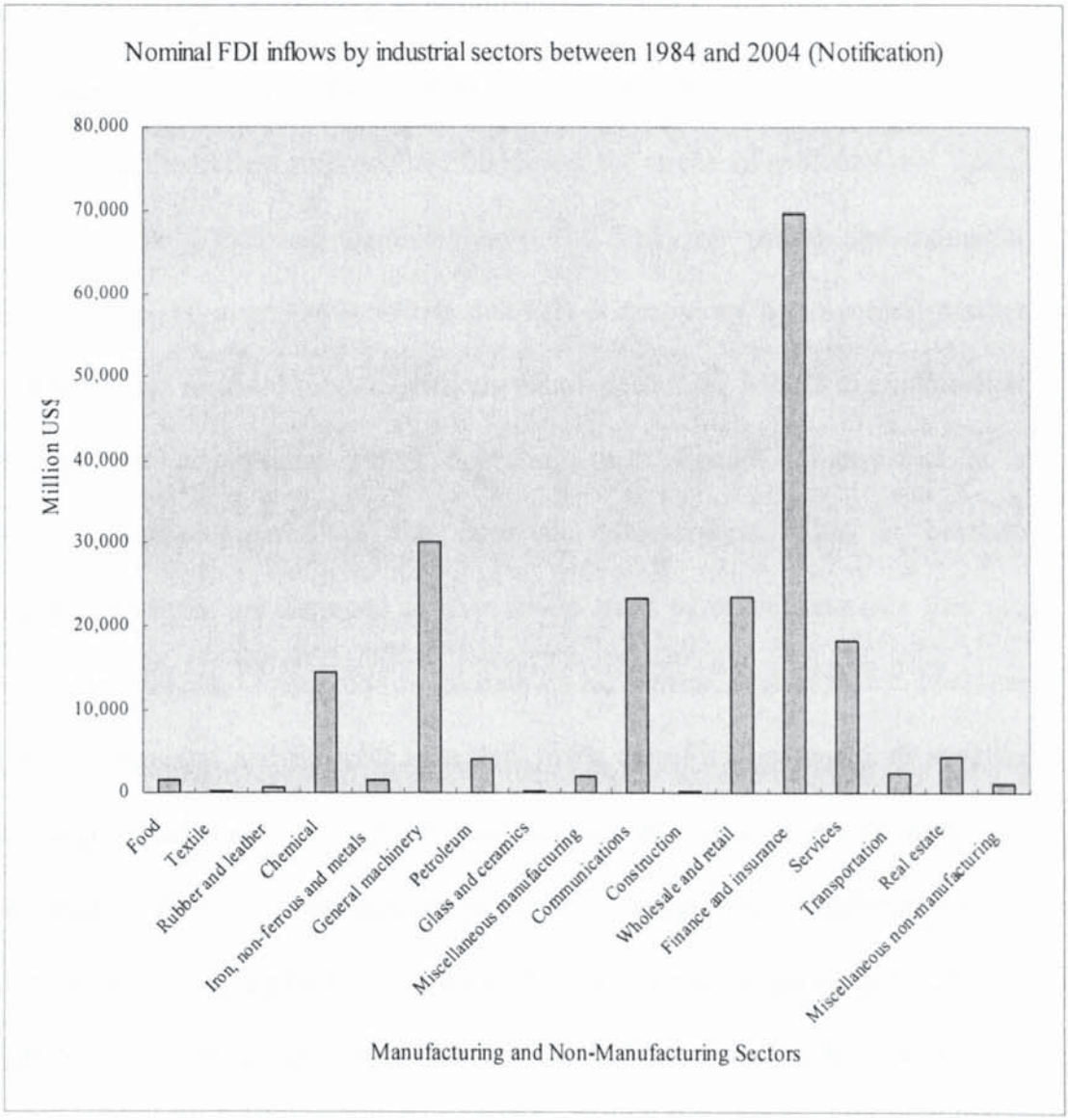
industrial sectors in this period, Figure 3-1[14] shows that Japan has performed comparatively well in attracting investments in non-manufacturing industries. Investment projects undertaken in the manufacturing sector are less significant, accounting for less than one third[15] of total inflows in to the economy. Moreover, general machinery and chemical sectors attract more than 80 percent of total FDI inflows in manufacturing investment.

The remainder of the chapter is organised as follows. Section 2 briefly reviews the theoretical background and the existing literature on the determinants of FDI that form the basis of the variables selected for the econometric model. Section 3 develops the empirical models for the inter-industry variation of inward FDI and defines chosen variables. Sections 4 and 5 discuss the data used in the analysis and the econometric procedures. Section 6 presents the empirical results which are then discussed in the final concluding section of the chapter.

[14] Sources: Prepared by JETRO from Ministry of Finance (MOF) statistics for Japan's inward and outward FDI, MOF Policy Research Institute Monthly Finance Review, and Bank of Japan foreign exchange rates.

[15] The majority of investments (notification basis) were undertaken in Communications, Finance, Insurance, Trading, and Services in non-manufacturing sectors during the 1997-2003 periods.

Figure 3-1: Nominal FDI Inflows (current million US$) to Japan by Sectors



3.2. Literature Review

3.2.1. Theoretical Background

An extensive body of literature on FDI and MNEs has developed from several alternative theoretical approaches, including the areas of international trade, capital markets, classical location theory, the firm, innovation, and industrial organisation. Hymer (1960) asserts that FDI is motivated by structural market imperfections for final product markets which permit the MNEs to exploit their oligopolistic advantages. Firms operating in a foreign country are at a disadvantage compared to the domestic counterparts. This is because indigenous firms are assumed to have lower costs of operation since they are more familiar with local conditions such as legislation, legal system, business ethics, language, and so forth. Foreign firms therefore possess firm specific advantages to balance out various disadvantages of entering the foreign market in order to compete with indigenous firms. Firm specific advantages include economies of scale, proprietary knowledge, brand names, privileged access to inputs and management expertise in foreign markets. The majority of subsequent theoretical approaches within the industrial organisation school tend to follow Hymer's argument. Kindleberger (1969) and Caves (1971), for example, focus on the concept of "monopolistic advantage" to explain why firms enter foreign markets. Internalisation theory postulates that various MNE activities are linked with intermediate products not only in the form of semi-processed materials but also knowledge and information embodied within human capital and goods (Buckley and Casson 1976). There are incentives for

MNEs to develop their own organisational structure to accomplish internal activities. This occurs when knowledge intensive products are difficult to internalise in external markets and the expected net benefit of FDI must exceed those of other modalities such as licensing or non-equity cooperative ventures. Dunning (1988; 1993) further proposes the Eclectic Paradigm (OLI framework) to synthesise the different approaches and hypotheses discussed above together with location factors that are separately rooted in the discipline of international economics. First, the ownership tenet asserts that the greater the competitive advantages of investing firms relative to other firms in the market, the larger the possibility for firms to engage in FDI. Second, the location tenet avers that the more the immobile, natural or created endowments, which investing firms need to utilise along with their ownership advantages, the more firms will choose a foreign location and engage in FDI in order to augment their assets. The present study evaluates such privileged ownership specific resources (Oa) and capabilities (Ot)[16] possessed by non-Japanese as opposed to indigenous Japanese firms. The research below examines these resources and capabilities with various location specific determinants.

In addition to these conventional factors, distinctive inter-corporate groupings (*keiretsu*) may affect the investment decision of MNEs. Japanese market entry might be impeded by collusive practices of vertical and horizontal

[16] Oa and Ot represent ownership specific asset advantage and ownership transaction advantage (Dunning 2000a).

keiretsu[17] within which long-term relationships exist between suppliers, manufacturers, and main banks[18]. Such relationships are facilitated by stable shareholdings, financial ties (i.e. intra group soft loans), and the exchanges of personnel that create informational and transactional efficiencies across the boundaries of member firms (Lin 2005). These practices provide the inherent cost of capital advantages and reduce the transaction costs for keiretsu member firms relative to those of outsiders. In other words, there are possible efficiency gains through better information exchange, coordination, and monitoring that can outweigh the implicit costs of maintaining in-group preferences. In addition, stable cross-shareholdings make it difficult for foreign firms entering the Japanese market through acquisitions[19], which have been the most common form of entry among industrialised countries. FDI from advanced economies, namely the US and Europe, has primarily been associated with the various distinctive ownership advantages discussed earlier. However, such privileged advantages that foreign firms possess may well be dampened by the inter networking of keiretsu firms in Japan.

3.2.2. Empirical Evidence

[17] It should be noted that the affiliated member firms between horizontal and vertical value chains largely overlap given the simple classification.

[18] Main bank is rather amorphous in the concept of keiretsu, however "empiricists usually define a firm's main bank or institution from which it borrows the most funds" (Miwa and Ramseyer 2002, p7).

[19] The investment climate toward mergers and acquisitions is gradually changing in Japan. However, the paucity of M&A relative to other advanced economies is well represented according to Galah (1987, p135): "In Japan, the firm is not a commodity to be exchanged on the open market, but a social collective to be preserved and protected within the framework of a joint business alliance. As a result, mergers and acquisitions take place only among the parties closely familiar with each other, and hostile takeovers are virtually non-existent".

It is difficult to test directly the tenets discussed above since the ownership specific factors of the FDI decision are intrinsically unobservable. As a result, R&D intensity and advertising intensity have become standard proxies for the presence of intangible assets and are then used as standard explanatory variables in firm level or sectoral studies (Blonigen 2005a). The empirical evidence from previous studies is briefly summarised as key determinants in Table 3-1. The literature suggests that R&D intensity is almost invariably positively correlated with FDI, whilst the evidence on the advertising intensity is much more mixed. Caves (1996, p8) also concludes that "research and development intensity is a thoroughly robust indicator" of multinationality, and that "advertising intensity has proved nearly as robust". Most existing studies on the inter-industry determinants of FDI are cross sectional in nature and the application of panel data to control for unobserved sector-specific effects is still limited. Driffield (2002) develops a model that incorporates ownership and location specific advantages in the UK manufacturing sector over the 1984-1992 period, using the GMM estimator in a dynamic panel framework. The results suggest that various ownership factors represented by R&D intensity, capital intensity and advertising intensity are positively correlated with the capital expenditure of foreign owned firms in the UK. As for location factors, the previous levels of inward investments, agglomeration effects, market size and profitability encourage inward FDI. This is broadly consistent with earlier findings from Driffield (1999; 2001), and Driffield and Munday (2000). Girma (2002) examines the impact of the European Internal Market

Program on acquisition and green field inward FDI in UK manufacturing by non-EU firms. The author employs a two-step count model by using various industry control variables to take account of both occurrence of zero FDI and positive FDI in a given sector. Whilst the factors affecting the distribution of FDI vary between the two types of entry channels (acquisition vs. green field), the results indicate that the scale of economies, EU market size, export performance, wages of the skilled workforce, and agglomeration effects play a significant role in the entry of foreign affiliates.

Table 3-1: Summary of Empirical Evidence from Existing Literature

Determinants	Proxy	Positive	Negative	Insignificant
Proprietary knowledge	R&D intensity	(Caves 1974; Lall 1980; Gupta 1983; Clegg 1987; Kogut and Chang 1991; Lawrence 1993a; Blonigen and Feenstra 1995; Kim and Nichols 1995; Nakamura et al. 1995; Pugel et al. 1996; Driffield 1999; Driffield and Munday 2000; Driffield 2001; Driffield 2002; Pradhan 2004; Ito and Fukao 2005; Kimura and Kiyota 2007)	(Love and Lage-Hidalgo 1999)	(Gorecki 1976; Lall and Siddharthan 1982; Wakasugi 1996)
Product differentiation	Advertising intensity	(Caves 1974; Buckley and Dunning 1976; Lall 1980; Owen 1982; Gupta 1983; Nakamura et al. 1995; Pugel et al. 1996; Anand and Kogut 1997; Driffield and Munday 2000; Driffield 2002; Giulietti et al. 2004)	(Driffield 1999)	(Gorecki 1976; Lall and Siddharthan 1982; Kogut and Chang 1991; Kim and Nichols 1995; Pradhan 2004; Ito and Fukao 2005)
Financial asset advantage	Capital intensity	(Lall 1980; Gupta 1983; Kim and Nichols 1995; Nakamura et al. 1995; Driffield 1999; Love and Lage-Hidalgo 1999; Driffield 2002; Giulietti et al. 2004; Ito and Fukao 2005; Kimura and Kiyota 2007)		(Lall 1980; Clegg 1987)
Market structure	Home concentration ratio or HHI	(Kogut and Chang 1991; Lawrence 1993a; Pugel et al. 1996; Anand and Kogut 1997)		(Lall 1980; Owen 1982; Pugel et al. 1996)
	Host concentration ratio or HHI	(Ito and Fukao 2005)	(Kogut and Chang 1991; Nakamura et al. 1995; Pugel et al. 1996; Anand and Kogut 1997; Driffield and Munday 2000; Driffield 2002; Giulietti et al. 2004)	(Buckley and Dunning 1976; Ito and Fukao 2005)
Economies of scale or minimum efficient scale	Average industry size per plant	(Caves 1974; Gorecki 1976; Lall 1980; Owen 1982; Chappell et al. 1990; Anand and Kogut 1997; Driffield and Munday 2000; Driffield 2002; Girma 2002)	(Driffield 1999)	(Saunders 1982; Kohpaiboon 2005)
Industry advantage	Revealed comparative advantage	(Driffield 1999)		
Inter firm networking	Vertical keiretsu		(Lawrence 1993a)	(Nakamura et al. 1995; Ito and Fukao 2005)
	Horizontal keiretsu		(Lawrence 1993a)	(Nakamura et al. 1995; Weinstein 1996; Ito and Fukao 2005)

3.2.3. Empirical Evidence on Inward FDI in Japan

Several empirical studies of inward FDI in Japan have incorporated some of the above factors in order to find explanations for the pattern of FDI. We highlight that there appears to be a difference between the conceptual work, which suggests that keiretsu affiliations deter FDI into Japan, and existing empirical works based on cross section analysis that are unlikely to provide robust estimates of the relationship between *keiretsu* and inward FDI at the industry level. For example, Lawrence (1993a) attempts to examine the effect of a *keiretsu* presence on inward investment. In an inter-industry analysis with only 10 observations the author finds that the share of both horizontal and vertical *keiretsu* firms in industry sales has a significant and negative effect on the market share of foreign-affiliated firms. However, the result is based on an inordinately small number of observations with a single cross section of industry level data and should therefore be interpreted with caution. Similarly, Weinstein (1996) extends Lawrence's work (1993a) by combining cross industry and time series analysis with different specifications, and finds a negative sign of horizontal *keiretsu* presence on inward FDI. However, this coefficient is not significant in most cases and the magnitude of the *keiretsu* effect was small relative to the positive time trend in FDI inflows. The result is also contentious due to the possibility of omitted variables bias. The model is formulated without potential variables that represent proprietary knowledge such as R&D intensity, advertising intensity, and capital intensity. Nakamura et al.(1995) offer a more comprehensive cross section analysis of inward FDI in

the Japanese manufacturing sector, utilising the mandatory METI survey that allows the analysis of foreign firms' sales shares in 38 industrial sectors. The results do not support the collusion hypothesis raised in an earlier study of Lawrence (1993a), namely, that the presence of horizontal and vertical keiretsu distorts inward FDI. In contrast, the intangible asset hypotheses proxied by R&D intensity, advertising intensity, capital intensity, and market structure are able to explain much of the distribution in foreign production. These conventional variables support the view that a foreign firm possesses a significant source of monopolistic advantage in knowledge, technological innovation and marketing skills. Wakasugi (1996) finds that foreign firms' sales shares in Japan are significantly and positively correlated with their dependence on the supply of technological knowledge from a parent firm, the transfer of managerial resources through intermediate products, and the dispatch of non-Japanese managerial staff. All these results suggest that the ownership-specific factors are an important determinant of FDI variations in the Japanese manufacturing sector. In other words, industry specific factors are not entry barriers that distort decisions on the entry of foreign MNEs. A recent cross industry analysis by Ito and Fukao (2005) establishes that the degree of foreign involvement in the Japanese economy is much smaller relative to that of the US. The study finds that R&D intensity, capital intensity and skilled labour intensity are essential factors that explain the variation of foreign penetration in the Japanese manufacturing sector. In contrast, a foreign presence in service sectors is associated with high market concentration ratio,

low restrictions on inward FDI, and low domination of government activities. The presence of both horizontal and vertical keiretsu fails to reach significance in any of the regressions and is therefore not a factor that influences the share of foreign employment in both manufacturing and service sectors. The authors do not offer any explanation as to why the apparent relationship between keiretsu and inward FDI are not captured in the regressions.

In sum, previous empirical work indicates that on balance that the extent and form of foreign involvement of Japanese industries is determined by the nature of proprietary knowledge, marketing advantages, and capital abundance of foreign firms. The econometric evidence to date of keiretsu effects on inward FDI in Japan is limited and somehow contradictory. However, keiretsu group linkages appear to encourage the decision to set up Japanese manufacturing plants abroad (Head et al. 1995; Belderbos and Sleuwaegen 1996; Belderbos and Carre 2002). In a recent study, Blonigen et al (2005b) also examine the agglomeration and networking effects on Japanese outward manufacturing FDI by horizontal and vertical keiretsu affiliated firms from 1985 to 1991. The result indicates that location decisions of FDI by keiretsu affiliated firms increase the probability of a member firm being located in the same region by 20 percent. This is because the networking of keiretsu may lower the costs of acquiring information about suitable sites for future affiliates in a foreign country, leading to a positive effect of outward FDI by keiretsu firms.

3.3. Empirical Model

This section develops the baseline model, and further proposes the linear interactions and the quadratic specifications that are likely to capture the impact of keiretsu. This is followed by descriptions of the chosen variables.

3.3.1. Static Linear Model

An empirically testable model of the determinants of inward Japanese FDI can be specified with the following static model based on the discussion above:

$$FP_{it} = \alpha_0 + \sum \beta_k X_{it} + \gamma_k HK_{it} + \delta_k VK_{it} + \varepsilon_{it} \qquad (3.1)$$

where FP_{it} is the share of sales (FPSALES) or of employment (FPEMP) accounted for by the foreign subsidiary in the corresponding sub-sector i in year t. X_{it} denotes the observable vector of regressors that explain inter-industry variations of foreign involvement in year t, and the construction of these variables are discussed in more detail below. HK is a measure of the intensity of financial centred horizontal keiretsu relationships and VK is the top n-firm concentration ratio accounted for by manufacturing centred vertical keiretsu in the respective sector. These independent variables are our primary interest and are meant to serve as proxies for information sharing and networking effects in a given sector. However, keiretsu membership is not clearly definable since there are no agreed criteria that classify a firm as a

member. The criteria used to define the boundaries and to identify the members of keiretsu vary considerably across studies because of the informality of group membership. Following Blonigen et al (2005b), horizontal keiretsu (HK) in this study are defined as firms that hold membership of the Presidents' Club[20] of so called 'Big Six'[21] - Mitsui, Mitsubishi, Sumitomo, Fuyo, Sanwa, and DKB. A number of other studies (Kimura and Pugel 1995; Ueda and Sasaki 1998; Sakakibara and Serwin 2000; Nakamura 2002) have also used this classification. Executives of the largest firms in a keiretsu regularly participate in Presidential Council meetings (CEO meetings) that provide a greater opportunity for information exchange and networking between member firms. The President Club is therefore an institutionalised forum for regular communication among the chief executives of member firms (Dewenter 2003). This is perhaps the narrowest and most restrictive definition of horizontal keiretsu, in which only the "core members" of each group are listed. Membership in the Presidents' Club is therefore an appropriate proxy for horizontal keiretsu in our analysis for several reasons. First, we are interested in networking and information sharing effects rather than in the importance of financial linkages based on equity and debt holdings or banking relationships.

[20] The members of Presidents' Clubs consist of representatives of the largest companies closely affiliated with each of the Six keiretsu, which are comprised of city banks, trust banks, insurance companies, general trading firms, and major manufacturing firms from different industries. The city bank, or "main bank", of each of the Six is the principle lender to most of the non-financial members of the Presidents' Club with which it is affiliated. The club members meet once a month to share information between keiretsu affiliations and to make plans for their joint businesses. It should be noted that those memberships are not mutually exclusive. For example, Hitachi is affiliated with the President Clubs of Fuyo, Sanwa, and DKB.

[21] Between 1999 and 2002, the Big Six have been merged to the Big Four (Mitsubishi, Mitsui-Sumitomo, Mizuho and UFJ) following the major restructuring of Japan's finance sector.

Presidents' clubs often take the essential role as a coordination mechanism for information sharing and exchange among affiliated member firms (Weinstein and Yafeh 1995; Blonigen et al. 2005b). Second, Dewenter (2003) notes that the member firms of the Presidents' Club have largely remained constant and stable despite severe restructuring during the years of recession in the 1990s. Furthermore, the list of member firms does not significantly vary with the data sources we use, so that we are able to expect consistent results using this proxy. Third, our 7-year period also allows a more robust measure of keiretsu intensity compared to most existing sectoral studies, which cover only a single period. This enables us to draw meaningful inferences on the effects of keiretsu on investment decisions of MNEs. We excluded the keiretsu firms that did not appear in the data source for seven consecutive years due to bankruptcy or market exit. Given this discussion, horizontal keiretsu intensity is measured using the sales share accounted for by the member firms of the Presidents' Club. The obtained sales data at firm level are aggregated up to the industry classification (3 digits) used in this study.

With respect to the network of vertical keiretsu, concentration ratios are used as a proxy of supplier-buyer relationships. In the absence of a commonly accepted measure of keiretsu, the group affiliations are defined using top four and eight firm concentration ratios by sales share (VK4 and VK8) in the electric machinery and motor vehicles sectors. Sambharya (2006) and Kimura and Pugel (1995) argue that electronics and motor vehicles manufacturers

occupy the central and dominant positions among vertical keiretsu system. Resource and information flows are channelled from core firms as the hub of vertical keiretsu to various other members of the keiretsu. Accordingly, vertically linked supplier-buyer relationships represent exclusive information sharing between inter-firms (Belderbos and Carre 2002). The primary interest of our study lies in the coefficients on these variables (HK and VK), as to whether they facilitate or distort foreign penetration. Given the lack of solid empirical evidence on the relationship between inward FDI and keiretsu, the directions of γ and of δ are indeterminate.

3.3.2. The Linear Interaction Model and the Quadratic Model

The linear static equation (3.1) considers that the effects of the predictors are additive. We also estimate alternative specifications designed to test whether keiretsu networks (VK or HK) in given sectors have a moderating effect on the relationship between foreign penetration (FP) and other sectoral attributes Xs. The rationale behind the inclusion of multiplicative terms[22] is that keiretsu on their own may not be sufficient to influence the investment decision of foreign MNEs, but may have the moderating effects on FDI. Thus, it is possible that the keiretsu may not have an impact in isolation from other industry level phenomena. Accordingly, an interactive model will describe the conditional relationship, that is, the effects of sectoral attributes Xs on FP vary according to

[22] An interaction term and its constituent variables are notably highly correlated. Nevertheless, this multicollinearity does not distort and impair the coefficients in an interactive model as compared with an additive model. Therefore, the interpretation of the regression results is not potentially obscured given the presence of multicollinearity.

the level of HK or VK. Significant cross product terms indicate that the two groups differ with respect to the slope of their separate regression lines.

Existing studies that consider linear relationship between inward FDI and keiretsu have so far provided ambiguous statistical evidence. Given that the keiretsu are complex forms of business relationships, they are unlikely to have a linear impact on FDI. In order to allow for possible non-linearity, the quadratic terms for the keiretsu are also included in the baseline model specification in (3.1) as a robustness check.

3.3.3. Foreign Penetration

Table 3-2 summarises the variables used in the empirical models along with the descriptive statistics. All monetary values are converted to real terms using the Corporate Goods Price Index (an equivalent to the PPI) to adjust for inflation. Before looking in detail at the control variables, it is useful to discuss how one might appropriately measure the degree of foreign penetration. Various measures have been put forward in the literature including, output, employment, fixed assets, and capital expenditure. These FDI measures are likely to capture different aspects of foreign penetration. This begs the question of which measure really captures the likely source of the effect. For the purpose of comparison, this study uses two available proxy measures of inward FDI as dependent variables: sales (FPSALES) and employment (FPEMP) share accounted for by foreign affiliated firms. This allows us not only to compare the results from previous studies (Lawrence 1993a; Nakamura et al. 1995; Ito

and Fukao 2005) but also to test the robustness of the relationship between these alternative measures of foreign involvement and various sectoral attributes.

A large share of affiliate sales in the manufacturing sector in Japan is likely to consist of *sales of services* rather than of production[23] of goods per se. The sales measure (FPSALES) is well linked with not only production goods but also with knowledge diffusion of the superior product and marketing or distribution activities. Similarly, the employment share (FPEMP) might be linked with productivity, wages, or job creation. Each proxy measure therefore captures attributes of considerable importance in the Japanese context.

[23] As matter of the fact, many foreign firms that are categorised as manufacturing companies are associated with service and distribution activities rather than production per se.

Table 3-2: Variables Definition, and Summary Statistics

Variable Name	Definition	Description	Mean	S. D.
FP (FPEMP)	Foreign presence measured by the share of employment	The number of employees by foreign owned firms / Total industry employment	0.032	0.057
(FPSALES)	Foreign presence measured by the share of sales	Sales of foreign firm / Total industry sales in sectors	0.044	0.079
AD	Advertising intensity	Advertising expenditure / Total industry sales	19.469	19.716
KL	Capital labour intensity	Tangible asset / Total employment	0.022	0.022
RD	R&D intensity	R&D expenditure / Total industry sales	0.009	0.010
REG	Regulation	Weight index of government regulations in a given sector, ranging between 0 and 1. 0 for the weakest and 1 for strongest restrictions.	0.260	0.358
MSIZE	Domestic market size	Gross Output + Net Import (in logarithm)	16.152	0.952
SCALE	Economies of scale	Average value added per establishments accounting for the upper half of industry value added divided by the total value added in sectors	0.0010	0.0017
OPEN	Openness to trade	(Real net export + Real net import)/Real gross output	2.747	2.060
RCA	Revealed industry comparative advantage	(Real net export - real net import)/ (real net export + real net import	-0.160	0.522
HK	Intensity of Horizontal Keiretsu	Share of sales by Horizontal Keiretsu firms that belong to President Clubs from BIG SIX (Mitsui, Mitsubishi, Sumitomo, Fuyo, Sanwa and DKB) corporate groups.	0.212	0.245
VK8	Top eight firm concentration ratio by Vertical Keiretsu	The concentration ratio of Vertical Keiretsu defined as the sales accounted for by the largest eight firms in Electronics and Transport sectors	0.069	0.202
VK4	Top four firm concentration ratio by Vertical Keiretsu	The concentration ratio of Vertical Keiretsu defined as the sales accounted for by the largest four firms in Electronics and Transport sectors	0.049	0.147

To account for inflation, all monetary values (millions of Japanese yen) are adjusted to real terms using Corporate Goods Price Index (2000=100). S.D. denotes standard deviation.

3.3.4. Control Variables

Based on the literature discussed in section 3.2, several industry characteristics are included in the empirical model in order to control the systematic differences in industry structure. The vector of regressors X_{it} therefore consists of the industry specific variables[24] that represent Oa-, Ot-advantages and location specific factors. Oa-advatanges include advertising intensity (AD), capital labour intensity (KL), and R&D intensity (RD), while Ot-advantage is economies of scale (SCALE). Various location specific advantages and disadvantages include domestic market size (MSIZE), openness to trade (OPEN), revealed comparative advantage (RCA), and regulations on inward FDI (REG). Table 3-2 provides definitions of these variables. Foreign MNEs are capable of introducing their new products in the host market through product variations and intensive advertising. Such market goodwill is often protected by well-known brand reputation and trademarks. In line with many existing studies that are based on the industrial organisation approach (Driffield 2002; Giulietti et al. 2004), the propensity for product differentiation skills and marketing advantages, (AD), are assumed to encourage inward FDI.

MNEs may favour participating in investment projects which require

[24] It should be noted that the equations do not include industry concentration ratios to represent the possible effect of oligopolistic rivalry on FDI decision. This is for several reasons. As argued in Pugel et al(1996, p210), the role of concentration as an independent causal influence on foreign presence is conceptually controversial. Industry concentration can be considered more as the *result* of the various monopolistic advantages than a cause of such advantages themselves (Lall 1980, p112). Secondly, historical concentration data for Japan are available at commodity levels that do not match our data set at 3-digit level, without having an appropriate weight. See also modelling framework without concentration data (Kimura and Pugel 1995).

relatively large capitalisation. Those firms can more easily raise the financial capital necessary to establish facilities in the foreign market with a minimum efficiency scale. Such capital cost advantages (KL) become an incentive for MNEs to invest and therefore foreign entry tends to occur in industries with high capital intensity (Driffield 1999; Ito and Fukao 2005). Another well-established ownership specific advantage is proprietary technology resulting from continuing R&D to create new knowledge. Foreign entrants with such advantages are more likely to locate their knowledge generating activities in technologically intensive sectors. The (RD) capabilities are found to be the most robust and important predictors of FDI. Besides those Oa specific factors, the size of foreign firms is generally larger than that of their Japanese counterparts, and this would be a significant contributor to overcoming host country entry barriers. Therefore, economies of scale (SCALE) as an Ot advantage are expected to be positively correlated with foreign penetration. MNEs are more likely to establish their affiliates in large domestic markets to exploit Oa and Ot advantages and hence sector size (MSIZE) induces more foreign involvement. (MSIZE) is also used to control for the possibility of a spurious correlation between (FPSALES) or (FPEMP) and keiretsu variables since larger keiretsu firms tend to be in larger sectors. The regulatory environment (REG) is included as a weighted indicator that covers mainly statutory barriers such as corporate governance mechanisms, screening and notification procedures, as well as personnel and operational controls on businesses. Restrictive host environments are hypothesised to

discourage the degree of foreign involvement in that sector. Finally, two trade performance measures are introduced as conventional indicators of location factor endowments, that is, whether Japan is an open and attractive investment destination. Foreign entrants are expected to be attracted in the sector where the openness to trade (OPEN) and revealed comparative advantages (RCA) in terms of industry performance are the greatest. In sum, we hypothesise that all $\beta_k > 0$, except the coefficient of (REG), which is hypothesized to be negative.

3.4. Data

As discussed in section 3.1, non-manufacturing investments in industries such as communications, finance, insurance, trading, and services sectors attract more incoming FDI than manufacturing investments during the observation period. Our analysis will nevertheless focus on the manufacturing sector for the following reasons. Firstly, the service sector requires very little capital and so the decision to establish a foreign subsidiary is less strategically important as compared to manufacturing. Secondly, most services are still non-tradable in nature and require production and consumption to occur simultaneously, and a foreign commercial presence is therefore the only option available to serve the host market. This means that service transactions in most cases require the spatial and temporal proximity of buyers and sellers at the same time (Blind and Jungmittag 2004).

Our analysis covers 40 Japanese manufacturing sectors at what approximates the 'three-digit' level for the period 1997-2003. This is the maximum level of disaggregation for which the available data can be consistently matched over time. Appendix-B details the data sources used in our analysis. However, the sample of keiretsu-affiliated firms is assembled through the combination of several data sources. The main data set used in this study is based on the results of the Basic Survey of Japanese Business Structures and Activities[25] from the Ministry of Economy, Trade and Industry (METI). METI surveys firms that employ more than 50 workers, possess a capital base above 30 million yen, and classifies firms according to their industry codes. However, the sectoral classification made by METI does not directly correspond to industries as defined under the Japanese SIC system. During our observation period, there is an average of 26,000 firms each year, and half are manufacturing firms. This survey is one of the few official sources containing information on foreign affiliate firms in the Japanese economy[26] and enables us to construct consistent panel data for the sectoral analysis[27]. METI defines a foreign affiliate as a firm with foreign equity participation of at least 33.4 percent. Given the confidentiality issue (i.e. no data must be published that would disclose the operations of an individual establishment or

[25] The survey was first carried out in 1991 and then annually from 1994 afterwards to capture the corporate activities of Japanese firms in mining, manufacturing, wholesale and the retail trade sectors in light of globalization, R&D expenditure and information technology.

[26] A detailed discussion of the various data sources concerning FDI in Japan is documented in Ito and Fukao(2005).

[27] Matsuura and Kiyota (2004) discuss at length how the panel data in METI survey can be used.

company, in accordance with existing Japanese Statistical Law governing survey reports), data at this level are highly aggregated and therefore comprise fairly heterogeneous sub-sectors. For example, Table 3-3 shows that industrial sub-sector 18 contains a variety of chemicals as well as other synthetic products. This aggregation might be misleading when dealing with industry specific variables as a source of firm specific advantages. However, despite such limitations, we implicitly assume that our sectoral data represents the activities and characteristics of firms in a corresponding sector.

Table 3-3 also illustrates that in nearly one third of Japanese manufacturing sectors no foreign involvement is observed. Moreover, there are only five sectors, which are greater than 10 percent in terms of the share of industry activity generated by foreign affiliates. Among these are petroleum refining, drug and medicine, miscellaneous chemical and allied products, electrical machinery, and motor vehicles. As can be seen, Japanese manufacturing has absorbed comparatively high inward FDI in technologically intensive sectors, which are characterised by relatively capital intensive, sophisticated manufacturing technologies and products requiring high R&D expenditure. In contrast, labour intensive investments in sectors such as textile and glass products are scarce. Whilst two measures of foreign penetration generally show identical patterns and are similar in magnitude, they significantly vary in some sub-sectors. Foreign firms have, for example, a much larger sales share as compared with the employment shares of firms in petroleum refining and electrical machinery sectors. As such, an employment share tends to

underestimate the actual role of a foreign subsidiary, which becomes particularly apparent in those industrial sectors. The sales share for the petroleum-refining sector accounts for nearly 30 per cent of foreign involvement, whilst the employment share is just 18 percent. The large-scale petrochemical plants and oil refineries are notably capital intensive, and use advanced and sophisticated technologies. Furthermore, a substantial amount of capital investment is also required for after sales, service facilities and for tailoring the products to meet local customer specifications in the electrical machinery sector. Ultimately, expressing foreign penetration as sales and employment share is likely to capture these different aspects of foreign activities.

Table 3-3: Yearly Average of Foreign Penetration (in % share) between 1997-2003

	Industrial Sectors	Sales	Employment
1	Livestock products; Miscellaneous foods and related products	0.512	0.439
2	Seafood products	0.000	0.000
3	Flour and grain mill products	0.000	0.000
4	Soft drinks and carbonated water; Alcoholic beverages; Tea and coffee; Tobacco manufactures	0.040*[28]	0.021*
5	Prepared animal foods and organic fertilizers	0.000	0.000
6	Silk reeling plants; Spinning mills	0.000	0.000
7	Woven fabric mills; Knit fabric mills	0.000	0.000
8	Dyed and finished textiles	0.000*	0.000*
9	Miscellaneous textile mill products	0.000*	0.000*
10	Textile outer garments and shirts, including bonded fabrics and lace, except Japanese style	0.000*	0.000*
11	Other textile apparel and accessories; Miscellaneous fabricated textile products	0.000	0.000
12	Sawing, Planning mills and wood products; Millwork, plywood and prefabricated structural wood products	0.000*	0.000*
13	Miscellaneous manufacture of wood products, including bamboo and rattan	0.000	0.000
14	Furniture; Miscellaneous furniture and fixtures	0.000*	0.000*
15	Pulp; Paper	0.000	0.000
16	Paper products; Miscellaneous pulp, paper and paper worked products	0.000*	0.000*
17	Printing; Service industries related to printing trade	0.300	0.285
18	Chemical fertilizers; Industrial inorganic chemicals; Chemical fibbers; Oils and fat products, soaps, synthetic detergents, surface-active agents and paints	6.577	4.296
19	Industrial organic chemicals	4.785	3.520
20	Drugs and medicines	25.955	23.261
21	Miscellaneous chemical and allied products	13.785	10.841
22	Petroleum refining; Miscellaneous petroleum and coal products	29.817	17.743
23	Plastic plates, bars and rods, pipes and tubes, pipe fittings and profile extrusions; Plastic films, sheets, floor coverings and synthetic leather; Industrial plastic products; Formed and reinforced plastic products; Compounding plastic materials, including reclaimed plastics; Miscellaneous plastic products	2.533	1.604
24	Tires and inner tubes; Miscellaneous rubber products	1.790	2.272
25	Leather tanning and finishing; Fur skins	0.000	0.000
26	Glass and its products; Cement and its products; Miscellaneous ceramic, stone and clay products	0.020*	0.018*
27	Iron industries; Steel with rolling facilities; Steel materials except made by smelting furnaces and steel works with rolling facilities except coated steel	0.012*	0.014*
28	Ferrous metal machines parts and tooling products; Miscellaneous iron and steel	0.000	0.000
29	Primary smelting and refining of non-ferrous metals;	2.465	1.279

[28] * denotes that figures for those sub-sectors are averaged from available data. Some observation years are not disclosed because the confidentiality is obstructed by the announcement of the figures.

	Industrial Sectors	Sales	Employment
	Secondary smelting and refining of non-ferrous metals, including non-ferrous alloys; Rolling of non-ferrous metals and alloys, including drawing and extruding; Electric wire and cable; Non-ferrous metal		
30	Fabricated constructional and architectural metal products, including fabricated plate work and sheet metal work	0.000	0.000
31	Miscellaneous fabricated metal products	0.333	0.326
32	Metal working machinery; Special industry machinery; Office, service industry and household machines	5.103	4.131
33	Miscellaneous machinery and machine parts	2.773	3.004
34	Electrical generating, transmission, distribution and industrial apparatus; Household electric appliances; Electronic equipment; Communication equipment and related products; Electronic data processing machines, digital and analogue computer, equipment and accessories	14.736	9.046
35	Miscellaneous electrical machinery equipment and supplies	3.239	4.044
36	Electronic parts and devices	8.740	5.928
37	Motor vehicles, parts and accessories	19.663	14.586
38	Miscellaneous transportation equipment	1.893	1.740
39	Medical instruments and apparatus; Optical instruments and lenses; Watches, clocks, clockwork-operated devices and parts; Miscellaneous precision instruments	3.148	2.188
40	Miscellaneous manufacturing industries	6.171	2.788
	Mean	4.371	3.201
	Standard Deviation	7.867	5.708

3.5. Methodology

In all estimations, diagnostic tests are carried out for the selection of appropriate statistical models among OLS, and panel models with fixed effects or random effects. The differences among them lie mainly in their assumptions regarding intercept and disturbance terms. An error term ε_{it} in equation (3.1) in section 3.3.1 can be decomposed into the following two elements:

$$\varepsilon_{it} = u_i + v_{it} \tag{3.2}$$

where u_i accounts for any unobservable industry specific effects not included

in the regression and v_{it} represents remaining disturbances that vary over industry and time. The assumption of OLS is least likely to occur in the empirical setting where the unobservable effects of u_i always takes the constant value for all industrial sub-sectors. Both fixed effects and random effects control for such unobservable industry specific attributes. This allows us to account effectively for observable and unobservable sectoral heterogeneity in order to mitigate aggregation bias.

The first part of our analysis of FDI determinants involves testing an equation using the entire sample of 40 industries to obtain parameter estimates for the manufacturing sector. The primary objective is to investigate the factors that influence the penetration of foreign affiliated firms. To test the robustness of this specification, the whole sample is divided into different sub-groups, which are defined depending on the level of technological sophistication associated with sectors. This helps to determine how these industry characteristics affect the activities of multinational firms because firms in high-tech industries on average tend to spend more on R&D than firms in low-tech industries.

To capture the systematic influence of industry composition, the variation in the annual average of R&D intensity between the two sub-samples is used. The sector with an average R&D intensity of more than 2 per cent are allocated to high-tech sectors and those with below 2 per cent to low-tech sectors[29]. To

[29] See Appendix-B for the detailed allocation of sectors.

justify the formation of the two sub-samples based on the degree of technological sophistication, a standard Chow test is applied to test the equivalence of the regression estimates for an equation between sub-groups of these industries. The result shows that F-statistics [11, 234] = 2.158 (p=0.017), which are statistically significant at 5% level, validating the division of these two pairs.

Prior to econometric estimation, several diagnostic tests were applied in order to detect suspected outliers. As all the standardised residuals are less than 3.3 corresponding to the .001 alpha level and Cook's distance is less than the absolute value of 2, this suggests that the removal or the transformation of observations from suspected outliers is unnecessary. In earlier literature, Saunders (1982) and Gupta (1983), have pointed out that R&D and advertising intensities may be endogenous and are therefore likely to be correlated with disturbance terms. Therefore, before proceeding to the estimation, the endogeneity of those suspected variables is jointly tested using auxiliary regressions through the Durbin–Wu–Hausman (DWH) specification test. This test is carried out by including the residuals of each endogenous right-hand side variable as a function of all exogenous variables in a regression of the original model. Such a diagnostic test becomes, however, invalid in the presence of heteroscedasticity, which can be corrected by the use of robust standard errors in the regression (Baum et al. 2003). The result of the DWH χ^2 test is 4.01 (p=0.135) and hence does not reject a null hypothesis of exogeneity, thereby

indicating that the variables under investigation can be assumed to be predetermined. This suggests that methods such as instrumental variables or two (or three) stage least squares may yield estimators that are consistent but not efficient in our analysis[30]. To minimise the possibility of simultaneous bias and endogeneity as well as to better distinguish cause and effect, we also estimated with one period lag specification to see as to whether the current level of foreign penetration is recognised with the delay in decision-making. However, in comparison with contemporaneous model this specification underperforms and behaves erratically. The equations were also specified with two other alternative methods to control for a relatively large proportion (over 40 percent) of zero values for foreign penetration in our data. First, we employed a random effects (RE) Tobit[31] through the weighted maximum likelihood procedure by controlling the unobserved industry specific effects, which allows for the FDI value being censored at zero. The overall results of fixed effects and RE Tobit are qualitatively similar in terms of the statistical significance of the coefficients. Tobit model, however, assumes the two choices (i.e. whether to invest or not and how much to invest) are the same. In such case, the independent variables will affect investors and non-investors in the same way. In order to account for the possibility of such selectivity bias, Heckman's (1979) two step procedure is used. Nevertheless, we cannot reject

[30] T he use of 2SLS, lagged FPSALES/FPEMP variables did not qualify as instruments in our analysis since they are highly correlated with current FPSALES or FPEMP, but also correlated with the error term.

[31] Given the panel structure of the data set, the fixed effects Tobit model would be ideal to take into account of the unobservable industry specific heterogeneity. However, at present there has not been sufficient theoretical development on the conditional fixed effects estimation of Tobit model to make it possible to separate fixed effects from the likelihood.

the hypothesis that Heckman's lambda equals zero in any of the estimations, suggesting that there is no evidence of a sample self-selection problem in our data set. Ultimately, among those techniques, the contemporaneous static panel model performs best for the explanation of inward FDI in the Japanese manufacturing sector.

3.6. Empirical Results

The results from baseline specifications and interaction models

Table 3-4 sets out the results of contemporaneous baseline models that compare the determinants of foreign penetration, as measured by employment share (column 1) and sales share (columns 2-5), using the entire sample of 40 sectors for the period 1997-2003.

Columns 2 and 3 present the statistical results for estimates of equations where both horizontal and vertical keiretsu are included. Columns 4 and 5 provide results where either horizontal or vertical keiretsu are included. Hausman tests at the bottom of both tables reject the model with random effects over fixed effects. The estimates between sales and employment models indicate without large systematic differences and the coefficients in the table are broadly similar in magnitudes except keiretsu (HK), openness to trade (OPEN), and revealed comparative advantages (RCA). The insignificant horizontal keiretsu variable in the employment model turns out to be significant when the dependent variable is measured by the sales share. By contrast, the significance of coefficients on OPEN and RCA in the employment

model disappears in the sales model. As noted in sub-section 3.3.1, each proxy measure of inward FDI reflects and captures different aspects of foreign involvement in the Japanese manufacturing sector. In general, the results reported in Table 3-4 are largely consistent and in line with prior expectations. R&D intensity as a proprietary knowledge and domestic market size as a location-specific advantage play significant roles in influencing the degree of foreign participation by employment and sales in the Japanese manufacturing sector.

The coefficient on R&D intensity (RD) is significantly different from zero at the 1 percent level with a theoretically expected positive sign. A 1 percent increase in technological innovation generates, on average, around a 1.7 percent and 1.2 percent increase in foreign sales and employment, respectively. This provides strong support for the intangible asset hypotheses based on industrial organisation theory that foreign firms embodied with innovative capacity opt for direct subsidiary production in the Japanese manufacturing sector. The result is consistent with findings from the recent cross section study by (Ito and Fukao 2005) on the determinants of inward FDI in Japan and the dynamic panel model estimate reported by Driffield (2002) and Driffield (2001) for the analysis of foreign entry to UK manufacturing. In brief, the presence of a strong correlation between knowledge capital and FDI in Japan will allow only foreign entrants with very robust competitive advantages to make headway in the Japanese market. The role of domestic market size (MSIZE) is also a positive and significant predictor of inward FDI. A similar

result is reported by Girma (2002), stating that the UK market size is an important determinant for Greenfield investments and acquisition entries by non-EU MNEs in UK manufacturing. The size effect on sales penetration is particularly pronounced, whereas the effects on the employment are marginally significant (at the 10 percent significance level). An increase in Japanese industry size by 1 percent generates an over 0.4 percent increase in foreign sales. This supports the hypothesis that the domestic market with a large level of final demand for the products in a given location provides greater potential and incentives for foreign entrants. Whilst this result confirms that a large market size absorbs more inward FDI, it also helps to negate the assumption that the keiretsu impact is driven by industry size.

The coefficient on the regulation variable (REG) is statistically significantly different from zero at the 1 percent level, but has a counter intuitive positive sign. Therefore, it is rather difficult to draw unequivocal conclusions regarding the effect of public policy on inward manufacturing FDI. It seems implausible that the greater the regulation on inward FDI in a given sector, the larger the affiliate activities of foreign firms. A possible explanation for this positive impact is that regulations might exist during a period of our analysis that are different from those prevailing when much of the FDI in Japan had taken place. Put simply, regulations may initially have been high in sectors into which foreign investment was attracted, but were lowered after investment was in place. Another likely explanation for positive signs could be that restrictions were solely driven by the petroleum refining and pharmaceutical

(drug and medicine) sectors where inward FDI has been historically dominated and controlled by foreign interests. US and European firms that possess strong international competitiveness in those sectors have aggressively developed their presence in Japan from an early stage. In particular, the foreign domination of petroleum refining is a direct result of post-war requirement to secure a stable energy supply in Japan. As such, the leading US and European firms with advanced and sophisticated technology had substantial bargaining power in negotiation with the Japanese government. In general, restrictions were put into place in industrial sectors where indigenous Japanese firms were lagging behind relative to foreign competitors. It seems that a positive link is revealed between such restrictions and foreign firms' ownership advantages and therefore FDI.

Conventional factor endowments, the coefficients on openness to trade (OPEN) and revealed comparative advantage (RCA), are only statistically significant in the employment model. This reflects the perception that host market openness and better industry performance attract foreign involvement by employment, but do not necessarily provide sales penetration. In other words, various location specific advantages are likely to be associated with generating job opportunities for foreign affiliates. Another difference between the employment and sales equations is the networking effect of horizontal keiretsu (HK). Column 2 shows that (HK) becomes statistically significant at the 5 per cent level in the baseline sales model when the concentration of the eight largest vertical keiretsu firms in the electronics and motor vehicles

sectors are controlled for together. However, neither the coefficients on the horizontal (HK) nor the vertical keiretsu (VK8) or (VK4) alone reach statistical significance in columns 4 and 5. This indicates that the evidence of both horizontal and vertical keiretsu impacts is not consistent and nor robust enough to suggest that networking and information sharing effects alone influence foreign penetration of the entire Japanese manufacturing sector.

Since the reported baseline results in Table 3-4 are vulnerable and sensitive to changes in alternative model specifications, further investigation of their relationship is worthwhile. The insignificance of keiretsu variables in the employment model suggests that the impact of keiretsu is more likely to be captured by sales. We therefore undertake this investigation by introducing interaction terms between each keiretsu variable and other sectoral attributes in the sales model. Table 3-5 provides the results of the fixed effects estimates that include interaction terms.

Table 3-4: Results for the Full Sample (Fixed Effects Model)

	Dependent Variable:				
	FPEMP	FPSALES			
	(1)	(2)	(3)	(4)	(5)
Constant	-0.40*	-0.70**	-0.75***	-0.79***	-0.62***
	(-1.73)	(-3.36)	(-3.69)	(-4.11)	(-3.00)
AD	-0.41	-0.56	-0.59	-0.62	-0.49
	(-1.05)	(-0.94)	(-0.98)	(-1.04)	(-0.84)
KL	0.00	0.00	0.00	0.00	0.00
	(1.44)	(0.47)	(0.53)	(0.55)	(0.27
SCALE	-1.01	1.56	1.45	1.39	1.59
	(-0.36)	(0.58)	(0.51)	(0.47)	(0.65)
RD	1.18***	1.69***	1.66***	1.60***	1.69***
	(3.93)	(3.13)	(3.12)	(2.96)	(3.03)
REG	0.13***	0.25***	0.25***	0.25***	0.25***
	(2.91)	(3.48)	(3.61)	(3.51)	(3.41)
MSIZE	0.02*	0.04***	0.04***	0.04***	0.04***
	(1.82)	(3.33)	(3.54)	(3.65)	(2.88)
OPEN	0.003*	0.00	0.00	0.00	0.00
	(1.66)	(1.22)	(1.26)	(1.25)	(0.97)
RCA	0.02**	-0.01	-0.02	-0.02	-0.02
	(2.34)	(-0.73)	(-0.80)	(-0.81)	(-1.17)
HK	0.01	0.06**	0.06*	0.05	
	(0.41)	(2.40)	(1.82)	(1.42)	
VK8	-0.00	-0.00			-0.00
	(-0.66)	(-1.11)			(-0.82)
VK4			-0.00		
			(-0.68)		
# of Obs.	256	256	256	256	256
Adj. R-Sq.	0.85	0.84	0.84	0.84	0.84
Hausman Test Chi-Sq.[10] FE vs. RE	17.66*	18.85**			

Note: t-Statistics in parentheses and degrees of freedom in brackets. ***, **, and * indicate that the coefficient is significantly different from zero at the 1%, 5%, and 10% respectively. Standard errors are corrected by using White heteroscedasticity consistent covariance matrix estimator. Hausman specification test for fixed effects (FE) and random effects (RE) reject null hypothesis that random effects are efficient

An important implication of the results from the first five columns of Table 3-5 is that several sectoral attributes that are individually insignificant (see column 2-5 in Table 3-4) are significantly modified by the inclusion of

interaction terms[32]. This implies that a keiretsu presence has an enhancing ability as a moderator. For example, equation (2) in Table 3-5 shows that the interaction term measured by the cross product of horizontal keiretsu and openness (HK*OPEN) becomes positive and statistically significant at the 5 per cent level. This suggests that market openness would have a significant and positive impact on sales penetration of foreign firms when a minimum threshold of information sharing effect by horizontal keiretsu in a given sector exists. Neither the marketing skill (AD) nor vertical keiretsu (VK8 or VK4) alone is sufficient to affect FDI inflows to the Japanese market (see columns 4-5 in Table 3-4). However, the coefficient on cross product term between vertical keiretsu and advertising intensity (VK8*AD) becomes statistically significant and negative. In the consumer goods industry in particular, indigenous Japanese firms are predominantly well equipped with their advantages in advertising, marketing, product introduction targeting local consumers, in addition to having established brand names and solid distribution networks. These abilities are further enhanced by the presence of a vertical keiretsu networks. The need and the ability to create new product segments tailored to the local market and consumer loyalty in the Japanese market act as an entry barrier for foreign entrants. We can therefore infer that product differentiation skills together with the domination of vertical keiretsu are significant sources of monopolistic *disadvantage* for foreign production in the Japanese manufacturing sector. In contrast, eq. (4) shows that an interaction

[32] Table 3-5 presents specifications with only significant coefficients of interaction terms between sectoral characteristics and keiretsu variables.

variable, which attempts to capture the aspect of economies of scale dominated by vertical keiretsu (VK8*SCALE) is significant with a positive coefficient. This result seems to support the prediction that the Japanese market is capable of allowing foreign affiliates to increase returns to scale by achieving large production volumes in keiretsu intensive sectors. Therefore, this reduces the costs in the long run and increases the competitive advantage over rivals. As indicated in columns 1, 7 and 8, the government regulatory environment has a positive influence on foreign penetration, varying according to the domination of horizontal keiretsu (HK*REG). There seems to be a robust interactive relationship between the two variables that encourages a greater foreign involvement. Moreover, another factor endowment, namely Japan's industry performance with a presence of vertical keiretsu network (VK8*RCA), becomes a strong incentive for generating foreign sales.

Table 3-5: Results for the Full Sample (Fixed Effects Model) with Interaction Terms

	Dependent Variable: FPSALES							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-0.67**	-0.64***	-0.66***	-0.70***	-0.85***	-0.73***	-0.71***	-0.71***
	(-2.79)	(-3.14)	(-3.15)	(-3.52)	(-4.14)	(-3.61)	(-3.28)	(-3.28)
AD	-0.53	-0.45	-0.40	-0.53	-0.62	-0.36	-0.36	-0.36
	(-0.90)	(-0.75)	(-0.73)	(-0.88)	(-0.99)	(-0.62)	(-0.64)	(-0.63)
KL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.64)	(0.33)	(0.35)	(0.45)	(0.53)	(0.27)	(0.38)	(0.38)
SCALE	0.88	2.29	0.55	1.04	2.11	1.84	1.02	0.85
	(0.30)	(0.94)	(0.21)	(0.37)	(0.74)	(0.73)	(0.35)	(0.28)
RD	1.74***	1.65***	2.07***	1.71***	1.77***	2.05***	2.10***	2.06***
	(3.26)	(3.04)	(3.59)	(3.41)	(3.41)	(3.65)	(3.73)	(3.63)
REG	0.21***	0.24***	0.25***	0.25***	0.24***	0.22***	0.20***	0.19***
	(3.57)	(3.23)	(3.65)	(3.40)	(3.41)	(3.32)	(3.80)	(3.51)
MSIZE	0.04***	0.04***	0.04***	0.04***	0.05***	0.04***	0.04***	0.04***
	(2.75)	(3.17)	(3.06)	(3.47)	(4.22)	(3.61)	(3.29)	(3.29)
OPEN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(1.30)	(0.50)	(1.51)	(1.38)	(1.31)	(0.74)	(1.10)	(1.09)
RCA	-0.01	-0.02	-0.02	-0.01	-0.03	-0.03	-0.03	-0.03
	(-0.69)	(-0.79)	(-0.88)	(-0.70)	(-1.38)	(-1.42)	(-1.32)	(-1.38)
HK	-0.01	0.03	0.05	0.07***	0.05**	0.00	-0.04	-0.04
	(-0.24)	(0.95)	(1.43)	(2.90)	(2.02)	(0.07)	(-1.13)	(-1.14)
VK8	-0.00	-0.00	-0.00	-0.00	-0.01**	-0.00	-0.00	-0.00
	(-1.09)	(-1.03)	(-0.27)	(-1.66)	(-2.13)	(-1.33)	(-1.15)	(-1.16)
HK*REG	0.24***						0.19**	0.20**
	(3.40)						(2.55)	(2.56)
HK*OPEN		0.02**				0.02***	0.01	0.01
		(2.55)				(2.87)	(1.57)	(1.61)
VK8*AD			-0.25**			-0.22*	-0.23*	-0.19
			(-2.20)			(-1.75)	(-1.82)	(-1.34)
VK8*SCALE				4.82***				2.70
				(2.85)				(0.72)
VK8*RCA					0.004***	0.004***	0.003***	0.003***
					(3.40)	(3.38)	(3.35)	(3.66)
# of Obs.	256	256	256	256	256	256	256	256
Adj. R-Sq.	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84

Note: t-Statistics in parentheses and degrees of freedom in brackets. ***, **, and * indicate that the coefficient is significantly different from zero at the 1%, 5%, and 10% respectively. Standard errors are corrected by using White heteroscedasticity consistent covariance matrix estimator. Hausman specification test for fixed effects and random effects reject null hypothesis that random effects are efficient.

The results from the quadratic model with fixed effects

To investigate the possible nonlinear relationship between FDI and keiretsu, the quadratic specifications are introduced in Table 3-6. As reported, the impact of a keiretsu presence on the entry of foreign firms follows a U-shaped relationship. Increasing the intensity of horizontal keiretsu may initially harm the penetration of foreign firms' employment and sales share due to increasing competitive pressures. However, after reaching a certain threshold value, the positive benefits of networking effects by keiretsu outweigh the negative factors, hence fostering the development of foreign involvement in the Japanese manufacturing sector. For example, foreign employment share is negatively affected by the increase in networking effects from horizontal and vertical keiretsu up to turning points of 0.24 (horizontal) and of 0.64 [33](vertical), but after that this effect diminishes as a keiretsu presence increases. In the sales equation, the estimated threshold level of horizontal keiretsu intensity is 0.21. Firms embarking on FDI in keiretsu intensive sectors are generally expected to face significant adjustment costs in the initial entry stage, yet after the initial setback, information spillovers through keiretsu networks are likely to facilitate foreign productions.

[33] The turning points are calculated using the delta method. The confidence interval (at 95% level) ranges between -0.05 and 0.51 for horizontal keiretsu and between 0.47 and 0.81 for vertical keiretsu.

Table 3-6: Results for the Quadratic Model (with Fixed Effects)

	Dependent Variables:	
	FPEMP	FPSALES
Constant	-0.40***	-0.70**
	(-1.93)	(-3.18)
AD	-0.35	-0.42
	(-0.92)	(-0.72)
KL	0.00	0.00
	(1.11)	(0.35)
SCALE	-0.72	1.76
	(-0.30	(0.75)
RD	1.28***	1.88***
	(4.87)	(4.06)
REG	0.12***	0.23***
	(3.26)	(3.69)
LNMSIZE	0.02	0.03**
	(1.64)	(2.67)
OPEN	0.00	0.00
	(1.30)	(0.64)
RCA	0.02**	-0.02
	(2.37)	(-0.92)
HK	-0.05**	-0.15*
	(-2.07)	(-1.72)
HK^2	0.11**	0.35***
	(2.71)	(3.08)
VK8	-0.02***	-0.03*
	(-3.34)	(-1.78)
VK8^2	0.0002**	0.00
	(2.37)	(1.45)
# of Obs.	256	256
Adj. R-Sq.	0.86	0.84

Note: t-Statistics in parentheses and degrees of freedom in brackets. ***, **, and * indicate that the coefficient is significantly different from zero at the 1%, 5%, and 10% respectively. Standard errors are corrected by using White heteroscedasticity consistent covariance matrix estimator. Hausman specification test for fixed effects and random effects reject null hypothesis that random effects are efficient. The values of HK and VK8 are centred using the deviation from the mean in place of original values to take account of colinearity.

The results for high and low technological sectors

As a robustness check, the static linear model (eq. 3.1) is separately estimated for high and low tech sectors according to the degree of technological sophistication. These are presented in Tables 3-7 and Table 3-8. As shown in both tables, these results are remarkably different between the two pairs based on industry level of technological opportunity as well as the measure of foreign penetration used.

The first four columns in Table 3-7 provide the statistical estimates for high R&D intensive sectors when the dependent variable is measured by employment. The last four columns show the results for the sales model and most coefficients have theoretically expected signs as hypothesised. The noticeable difference between employment and sales equations are capital intensity (KL), economies of scale (SCALE), and industry performance (RCA). This supports an earlier discussion on how these two measures of foreign involvement capture different determinants in the Japanese manufacturing sector. It is noteworthy that the coefficients on capital intensity (KL) are significant and negative in the employment model, suggesting that the role of capital-intensive production in technologically advanced sectors has become a strong entry barrier for foreign entrants. Interestingly, the effect disappears in case of foreign involvement by sales, but the result here is not as tenable as existing studies find the significant and positive impact of capital intensity on inward manufacturing FDI in Japan (Ito and Fukao 2005), the UK (Driffield 2002), and for the US (Kim and Nichols 1995). A possible explanation for this

result is that even capital intensive foreign MNEs may be deterred from entering technologically intensive Japanese manufacturing sectors where relatively large capitalisation is required and indigenous firms have access to the capital market at favourable rates. The ability to generate the productivity or create jobs for foreign entrants in such sectors can be impeded. The coefficient on economies of scale (SCALE) is marginally significant and positively associated with foreign sales, yet fails to reach any significance level concerning foreign employment. In contrast, a foreign presence by employment is encouraged in sectors where industry performance (RCA) is high.

The prime interest of our study, the coefficients on horizontal keiretsu (HK), is statistically and significantly different from zero for both employment and sales equations (see columns 1-3 and 5-7). This suggests that inward FDI in highly innovative sectors is attracted where network and information sharing effects of horizontal keiretsu are greatest. The result here contrast the earlier statistical findings of Lawrence (1993a) and Weinstein (1996) who found that a presence of keiretsu deter inward FDI in Japan. Our findings also cast doubt on the widely held belief that the keiretsu and their associated activities per se are a significant source of impediments for foreign entrants. After controlling for various observed and unobserved sectoral specific effects, existing keiretsu networks through horizontal linkages do not exert negative impacts on foreign involvement in knowledge intensive sectors. Instead, our results support previous empirical findings from Kimura and Pugel (1995), Belderbos and

Sleuwaegan (1996), and Blonigen et al (2005b). These studies show that greater information sharing and networking of keiretsu firms increase their outward FDI activities. This is because the networking between keiretsu member firms is likely to allow for investing firms to obtain easily the necessary market knowledge of a foreign country's environment (i.e. regulations, local customs, legal issues, and so forth). Hence, networking helps to reduce the transaction cost for multi-plant operations. Such effects are not only confined within keiretsu-affiliated firms investing abroad but are also assimilated by foreign entrants in Japan. It is possible that the prolonged recession in the Japanese economy has necessitated keiretsu member firms to behave differently towards foreign investors than most existing anecdotal evidence suggests. As such, the positive correlation is possibly capturing the joint venture relationship between foreign firms and keiretsu affiliated firms. In sum, the important determinants of inward FDI for technologically sophisticated sectors are highly innovative skills, government regulation, large domestic market size, market openness, and the greater networking activities of horizontal keiretsu.

Table 3-7: Results for the High Technology Sector (Fixed Effects Model)

	Dependent Variable:							
	FPEMP				FPSALES			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-2.72**	-2.76**	-2.71**	-2.50*	-3.11*	-3.18**	-3.21**	-2.74
	(-2.05)	(-2.19)	(-2.67)	(-1.91)	(-1.98)	(-2.12)	(-2.65)	(-1.63)
AD	-2.67	-2.69	-2.66	-3.25	-1.84	-1.87	-1.88	-2.81
	(-1.16)	(-1.18)	(-1.18)	(-1.43)	(-0.48)	(-0.49)	(-0.50)	(-0.79)
KL	-0.001*	-0.001**	-0.001**	-0.002**	-0.00	-0.00	-0.00	-0.00
	(-1.90)	(-2.11)	(-2.07)	(-2.11)	(-0.12)	(-0.11)	(-0.11)	(-0.39)
SCALE	6.07	2.76	6.91	3.17	153.40*	148.63*	146.38**	148.52
	(0.10)	(0.04)	(0.11)	(0.05)	(1.93)	(1.94)	(2.30)	(1.63)
RD	1.28***	1.26***	1.29***	1.22**	1.86***	1.84**	1.82***	1.76**
	(3.30)	(3.31)	(3.30)	(2.80)	(3.12)	(3.19)	(3.21)	(2.58)
REG	0.49**	0.49**	0.49**	0.54**	0.82***	0.82***	0.82***	0.90***
	(2.66)	(2.70)	(2.74)	(2.42)	(3.09)	(3.11)	(3.13)	(3.07)
MSIZE	0.15**	0.15**	0.15**	0.14*	0.17*	0.17*	0.17**	0.15
	(2.06)	(2.20)	(2.66)	(1.95)	(1.88)	(2.02)	(2.49)	(1.56)
OPEN	0.01**	0.01***	0.01***	0.01**	0.01*	0.01**	0.01**	0.01
	(2.79)	(2.95)	(3.45)	(2.42)	(2.19)	(2.39)	(2.82)	(1.52)
RCA	0.15*	0.15*	0.15*	0.16*	0.07	0.08	0.08	0.08
	(1.87)	(1.95)	(1.92)	(1.87)	(0.68)	(0.71)	(0.71)	(0.72)
HK	0.09**	0.08**	0.09*		0.14**	0.14**	0.14**	
	(2.40)	(2.14)	(1.90)		(2.38)	(2.24)	(2.27)	
VK8	0.00			0.00	-0.00			0.00
	(0.03)			(0.24)	(-0.23)			(0.11)
VK4		0.00				-0.00		
		(0.19)				(-0.09)		
# of Obs.	98	98	98	98	98	98	98	98
Adj. R-Sq.	0.85	0.84	0.84	0.84	0.69	0.69	0.70	0.69
Hausman Test Chi-Sq. FE vs. RE	21.95** [10]				16.40* [10]			

Note: t-Statistics in parentheses and degrees of freedom in brackets. ***, **, and * indicate that the coefficient is significantly different from zero at the 1%, 5%, and 10% respectively. Standard errors are corrected by using White heteroscedasticity consistent covariance matrix estimator. Hausman specification test for fixed effects and random effects reject null hypothesis that random effects are efficient.

Table 3-8 reports the statistical estimates for low technology sectors. The application of low-tech sectors produces less significant variables compared with high tech sectors. Many of the variables that are significant in the full sample (Table 3-4) and high tech sector model (Table 3-7) become statistically insignificant in low-tech sectors (Table 3-8). Compared with high technology

sectors, the results revealed by the employment and the sales equations are remarkably different for low technology sectors. For example, capital intensity (KL) is positively correlated with the level of foreign sales in low technology sectors. Equally, MSIZE is statistically significant with positive coefficients, indicating that a large domestic market size that requires higher product demands acts as an incentive to inward FDI. One interesting feature of our regression results is that the impact of networking and information sharing effects by horizontal keiretsu (HK) on a foreign presence is statically significant with both positive and negative signs. As in high tech sectors, the horizontal linkages (HK) are statistically significant with positive coefficients for sales. This implies that sales penetration by foreign affiliates increases with the domination of horizontal keiretsu in a given sector, whilst the employment penetration decreases with a keiretsu presence acts to deter FDI.

Table 3-8: Results for the Low Technology Sector

	Dependent Variable:							
	FPEMP				FPSALES			
	FE	FE	FE	RE	RE	RE	RE	RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.04	0.04	0.04	-0.12	-0.34***	-0.34***	-0.35***	-0.36***
	(0.36)	(0.31)	(0.31)	(-1.60)	(-2.88)	(-2.90)	(-2.99)	(-3.03)
AD	0.19	0.18	0.18	-0.12	-0.36	-0.37	-0.38	-0.37
	(1.43)	(1.37)	(1.37)	(-0.68)	(-1.30)	(-1.30)	(-1.36)	(-1.33)
KL	0.00	0.00	0.00	0.0008***	0.001***	0.001***	0.001***	0.001***
	(1.22)	(1.19)	(1.17)	(6.16)	(4.32)	(4.36)	(4.70)	(4.84)
SCALE	-0.87	-0.84	-0.82	1.32	4.79*	4.81*	4.89*	4.81*
	(-0.69)	(-0.65)	(-0.64)	(0.80)	(1.81)	(1.81)	(1.86)	(1.81)
RD	0.57	0.57	0.57	-0.09	-0.82	-0.83	-0.86	-0.63
	(1.60)	(1.60)	(1.62)	(-0.25)	(-1.36)	(-1.36)	(-1.43)	(-1.05)
REG	0.00	0.00	-0.01	0.03*	0.03	0.03	0.03	0.03
	(-0.44)	(-0.49)	(-0.64)	(2.02)	(1.58)	(1.54)	(1.49)	(1.63)
MSIZE	-0.00	-0.00	-0.00	0.01	0.02**	0.02**	0.02***	0.02***
	(-0.21)	(-0.18)	(-0.20)	(1.49)	(2.78)	(2.79)	(2.88)	(2.95)
OPEN	0.00	0.00	0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.18)	(0.13)	(0.07)	(-0.56)	(-1.30)	(-1.33)	(-1.50)	(-1.50)
RCA	0.01**	0.01**	0.01**	0.01	-0.01	-0.01	-0.01	-0.01
	(2.33)	(2.22)	(2.27)	(0.88)	(-0.71)	(-0.76)	(-1.02)	(-0.73)
HK	-0.06***	-0.06***	-0.06***		0.04**	0.04**	0.04**	
	(-3.05)	(-2.99)	(-2.93)		(2.17)	(2.15)	(2.12)	
VK8	-0.00			-0.00	-0.00			-0.00
	(-1.06)			(-0.58)	(-0.62)			(-0.36)
VK4		-0.00				-0.00		
		(-0.70)				(-0.49)		
# of Obs.	158	158	158	158	158	158	158	158
Adj. R-Sq.	0.85	0.84	0.84	0.74	0.71	0.72	0.73	0.72
Hausman Test Chi-Sq. FE vs. RE	23.41** [10]			11.73 [9]	14.78 [10]			

Note: t-Statistics in parentheses and degrees of freedom in brackets. ***, **, and * indicate that the coefficient is significantly different from zero at the 1%, 5%, and 10% respectively. FE and RE denote fixed effects and random effects, respectively. Standard errors for fixed effects models are corrected by using White heteroscedasticity consistent covariance matrix estimator. Swamy and Arora estimator of component of variances are used for random effects model.

3.7. Conclusions

The purpose of this chapter is to examine the distribution of inward FDI across Japanese manufacturing sectors at the three-digit level during the period of 1997-2003 using panel data sets. More specifically, we have investigated whether the presence of horizontally and vertically linked keiretsu networks influences FDI inflows to the Japanese market. Our results indicate that the impact of keiretsu linkages on a foreign presence depends on not only different proxy measures used for inward FDI, but also on the degree of technological sophistication in given sectors. In general, our result demonstrates that networking and information sharing effects of horizontally linked keiretsu are positively associated with foreign production in knowledge intensive sectors. In contrast, this effect becomes a significant entry barrier for foreign involvement in terms of employment in technologically lagged sectors. Furthermore, the keiretsu variables and other sectoral attributes are interacted to explore whether the relationship between foreign penetration and other sectoral attributes are conditional on the presence of keiretsu networks. Our statistical results suggest that both government regulation and market openness in the industrial sector dominated by horizontal keiretsu positively influence the sales activities of foreign firms. Furthermore, there is evidence that economies of scale and industry performance facilitated by the presence of vertical keiretsu are likely to induce foreign sales. On the other hand, the advertising intensity with the presence of vertical keiretsu are negatively correlated with foreign sales penetration. This suggests that the marketing

knowledge with keiretsu network in Japan acts as an entry barrier to inward FDI. Finally, the quadratic specifications are introduced to take into account the possible non-linear relationships between inward FDI and the dominance of keiretsu. The results point to the presence of nonlinear threshold effects: the benefits of foreign penetration are more likely to materialise once greater information sharing effects across the horizontal keiretsu have accumulated. Furthermore, keiretsu affiliations in the sector may have the effect of foreclosing markets for foreign entrants due to fierce competition. However, after reaching a certain threshold level, the presence of keiretsu networking becomes a facilitating device for generating foreign sales and employment shares. With regard to other sectoral attributes, we find that the technological innovation, large domestic market size and government regulations play important roles in determining inter-industry variation of FDI. This reflects that multinational productions take place in sectors where ownership-specific assets and location factors are significant.

As with all empirical research, there are limitations. In the context of this study, the concept behind the inter-firm keiretsu affiliation is complex and difficult to tract, and the effect of this variable may not be econometrically measurable with a single data source or by sectoral level study. In addition, the unavailability data has hindered us to carry out a sensitivity analysis to check the robustness of the results on keiretsu effects. Because of this limitation, we were unable to use several different data sources as was done in the studies by Noland (1997) and by Sakakibara and Serwin (2000). We were also not able to

conduct a more disaggregated firm level analysis. Nevertheless, our results can be used to establish the fact that a keiretsu presence appears to stimulate inward Japanese FDI in the manufacturing sector in some cases. The positive correlation is perhaps capturing the joint venture relationship between foreign firms and keiretsu affiliated firms.

Finally, some of policy implications can be drawn from our empirical results. Japan's investment climate can be much improved by an increased clarity of administrative policy, and by liberalising and abolishing oligopoly in certain areas, particularly in regards to distribution networks. There is perhaps a need to monitor closely keiretsu activities so that affiliated group firms do not carry out exclusionary transactions or exert monopoly control in the market. The current impression given in the public is that dealing with keiretsu following the entry into the Japanese market is difficult and challenging. Clearly, the Japanese government needs to maximise its efforts to improve the overall image of Japan as a market that remains relatively *closed* to foreign entrants. Effective public relations activities and dedicated policy measures are required to create a better perception of the investment climate faced by potential foreign investors.

Chapter Four

4. Productivity Spillovers from FDI in Japan: The Importance of Keiretsu

4.1. Introduction

The first two empirical chapters of the thesis have examined and identified the various factors that affect inward FDI in Japan at macro and industry levels respectively. This chapter aims to investigate the impact of foreign multinationals on the productivity of domestic firms in the Japanese manufacturing sector during the period of 1997-2003. The firm level analysis is the main feature of this study. Our prime objective is specifically to examine the possible different transactional linkage effects of a foreign presence across sectors to identify the various mechanisms through which knowledge spillovers can take place.

Japan pursued restrictive foreign investment regimes until the early 1980s, which virtually eliminated foreign competition for the Japanese economy.

However, potential benefits arising from a presence of foreign multinationals have been highlighted since the prolonged recession in 1990s. Inward FDI is one of most effective means for revitalising the economy and promoting structural reform by introducing competition, the latest technology, new business models, and innovative managerial know-how. As a result, domestically owned firms are expected to make efficiency gains. Foreign invested firms in Japan are generally found to be more productive than domestically owned counterparts (Fukao et al. 2005; Fukao and Murakami 2005; Tomiura 2007). This is attributed to the ability of foreign firm to efficiently exploit firm-specific assets that allow multi-plant operations and the transfer of accumulated tacit and specialised knowledge on production in the host economy (Todo 2006) .

There have been only a few comprehensive studies examining the impact of foreign multinationals on the productivity or the performance of indigenous firms in Japan. Todo (2006) analyses the effects of technology spillovers from FDI in Japanese manufacturing firms. The results provide supporting evidence on intra-industry spillovers through R&D activities of foreign invested firms. In a similar vein, the benefits of R&D related FDI on productivity growth are also confirmed by the econometric analysis of Kiyota (2006). By contrast, Murakami (2007) finds that a presence of foreign multinationals negatively affects productivity growth of local firms, particularly in the short run, as a result of the decline in market share. This is because foreign invested firms can monopolise markets and draw demand away from domestic firms, causing

them to reduce their efficiency (Aitken and Harrison 1999). However, long run impacts of externalities turned out to be positive, implying that spillover effects will be recognised with the delay.

We extend our analysis from those existing studies in the following ways: Firstly, existing studies evaluate the aggregate impacts of a foreign presence only within sectors (horizontal spillovers), see for example, Todo (2006), Kiyota (2006), and Murakami (2007). Given the growing importance on vertical spillovers, we distinguish transactional linkage effects by two mechanisms through backward and forward linkages across different sectors. Secondly, we postulate that the spillover effect generated from foreign MNEs is moderated by the presence of keiretsu affiliations. The preceding chapter suggests that the presence of keiretsu networks is an important Japanese institutional characteristic that determines foreign penetration. Much of existing literature has largely ignored linking FDI spillovers with the role of keiretsu. The model is therefore augmented by including interaction terms between various FDI spillovers and the keiretsu. This provides further insights into whether the conditional relationship exists between technological spillovers from foreign multinationals and the presence of vertical and horizontal keiretsu networks with their effects on the productivity of Japanese manufacturing firms. We emphasise that the role of transactional linkages effects with keiretsu has been unexplored at any rigorous and systematic empirical applications. Thirdly, Kiyota (2006) and Murakami (2007) both neglect input endogeneity on the measurement of TFP. We improve the TFP

measurement using semi-parametric approach developed by Levinsohn and Petrin (2003) to control for endogeneity and simultaneity issues. Lastly, the use of a new dataset that is not used for previous studies may provide new insights into the determinants of FDI spillovers in Japan. The remainder of this chapter is organised as follows. The next section briefly reviews key literature. Section 3 provides the empirical methodology whilst section 4 describes the data set and the variable construction. Section 5 discusses the regression results and the final section concludes the chapter.

4.2. Literature Review

There is a large body of empirical literature examining the role of foreign multinationals on the productivity performance of the domestic economy. Rather than review all literature, this section focuses on selected econometrics studies that can highlight the main argument related to our empirical analysis. Previous literature is extensively reviewed in Blomstrom and Kokko (1998), Gorg and Greenway (2004), and more recently in Crespo and Fontoura (2007). According to their reviews, existing studies have often produced mixed and inconclusive results, which are mainly attributed to the differences on firms, home/host country characteristics, time period in the dataset used, and various estimation techniques applied.

International technology diffusions from MNEs to the host economy may take two-way processes. The first is the intra-firm technology transfer, where knowledge is transferred from a parent company of a MNE in an advanced

home base to its foreign affiliates. The second is technology spillovers, where knowledge is transferred from foreign affiliates to local enterprises. Most of the existing empirical literature noted below implicitly assumes that foreign affiliates *automatically* source technology from their parents. The knowledge from foreign affiliates then spills over to local enterprises in the host economy by imitation, skill acquisition, and competition (Gorg and Greenaway 2004). Under this assumption, FDI is considered an essential channel through which MNEs help in creating knowledge spillovers, subsequently contributing the growth process of the host economy. Nevertheless, from a practical point of view, there is no guarantee that the intra-firm technology transfer and technology spillovers will take place since MNEs often attempt to internalise their knowledge and avoid the leakage of full values of their frontier technology to third parties (Driffield et al. 2008).

The empirical evidence based on a firm-level panel dataset for industrialised countries has generally documented the positive impact of technology spillovers from a foreign presence on the productivity of local firms (intra-industry spillovers from FDI). Keller and Yeaple (2005) analyse the effects of imports and FDI in US manufacturing firms by effectively controlling for endogeneity, firm heterogeneity, and selection bias. Their results suggest that current and lagged FDI are positively linked with the productivity of domestic firms, but have a weaker effect for imports. Whilst the relationship is found to be robust only for high tech firms, inward FDI generates around 11% of the productivity gains experienced US firms between 1987 and 1996.

Using the plant-level data for UK manufacturing for the period 1973–1992, Haskel et al (2007) find a significant and positive correlation between the performance of a domestic firm and the share of foreign affiliated firms in the industry to which the firm belonged. The estimates in their study indicate that a 10 percentage-point increase in a foreign presence in the UK industry raises the TFP of domestic firms by about 0.5 percent. However, despite common perception, there is no robust evidence on the role of absorptive capacity, suggesting that the externalities seem to affect all leading and lagging domestics firms equally regardless of their learning capabilities. This implies that the lower absorptive capacity does not necessarily hinder the domestic firms' ability to learn and apply the foreign technology. The weak evidence on the role of absorptive capacity is that their groupings do not adequately capture the capacity differences.

There is now growing literature emphasising the importance of inter-industry (vertical) spillovers from FDI in developing, transitional, and developed economies, see recent empirical examples (Harris and Robinson 2004; Javorcik 2004; Javorcik and Spatareanu 2005; Bwalya 2006; Kugler 2006; Halpern and Muraközy 2007; Girma et al. 2008; Javorcik and Spatareanu 2008; Liu 2008). Knowledge spillovers can take place when indigenous firms are capable of improving their performance as a result of their interactions with foreign invested firms through buyer-supplier linkages. The consensus in the literature is that such transactional linkages can make an important contribution for domestic firms' technical, managerial and organisational capabilities

(Dunning 1993). For example, foreign invested firms may augment the capabilities of domestic suppliers or customers by upgrading the quality and efficiency of production, design, human and managerial resources, or by adopting/imitating the marketing techniques used by multinationals (Driffield et al. 2002). Externalities generated from downstream multinationals to upstream local suppliers in the supply chains are referred as backward spillovers. Foreign firms can increase the demand for existing local inputs and intermediate goods or generate a demand for new inputs in upstream industries through backward linkages. Ultimately, domestic firms can benefit by expanding and achieving economies of scale in such supply chains. Similarly, foreign firms in upstream industries can bring new or higher quality inputs to domestic customers and thus increase the demand for domestic output in downstream industries through forward linkages. Forward linkages with domestic customers in downstream sectors appear to be crucial but are addressed less frequently in empirical research. By exception, Driffield et al (2002) distinguish four different mechanisms of technology generated by foreign affiliates in UK manufacturing industries: backward and forward linkages within and across sectors. The result indicates that forward linkages contribute more to domestic spillovers than backward linkages. This suggests that domestic firms benefit from high quality components, better technology, and competitive prices. Similarly, Harris and Robinson (2004) use the data for UK manufacturing industries and point out that inter-industry spillovers are generally more prevalent than intra-industry spillovers. Using Spanish

manufacturing firm data over the period of 1990-2000, Jabbour and Mucchielli (2007) find that the employment share of a foreign presence in upstream and downstream sectors has a positive and significant impact on the TFP level of local firms. By contrast, there is no robust evidence on the existence of knowledge spillovers from horizontal channels (intra-FDI) through demonstration effects and labour turnovers. They conclude that the positive effect of inter-industry (vertical) spillovers from FDI is driven by industrial dynamism and demand creation generated by the foreign entrant. There is also evidence on the importance of absorptive capacity, suggesting that the benefits of externalities through backward and forward linkages are recognised only with highly productive domestic firms. Girma et al (2008) analyse the determinants of spillovers from export oriented FDI and domestic market oriented FDI in UK manufacturing between 1992 and 1999, distinguishing the transactional linkage effects according to the export activities of domestic firms. The results show that all domestic firms (export and non-export oriented) benefit from forward linkages from domestic market-oriented FDI. Furthermore, export-oriented FDI generates positive impacts in upstream sectors through backward linkages.

4.3. Empirical Methodology

Production Function

One of most common approaches found in the empirical literature of knowledge spillovers is to estimate the following Cobb-Douglas production

function using the 'two-step' procedure. The first step involves the process below to calculate the productivity of firms.

$$VA_{it} = A_{it} L_{it}^{\beta} K_{it}^{\beta} \tag{4.1}$$

where VA, L and K denote value added, labour, and physical capital respectively. A is Hicksian neutral productivity level unobservable to researchers, subscripts i and t stand for firms and years respectively. Transforming an equation (4.1) to natural logs derives a linear production function,

$$va_{it} = \beta_0 + \beta_k l_{it} + \beta_l k_{it} + \omega_{it} + \eta_{it} \tag{4.2}$$

where the lower-case letters represent natural logarithms and $\ln(A_{it}) = \beta_0 + \omega_{it} + \eta_{it}$. β_0 measures the average productivity level across firms and over time. ω_{it} denotes a productivity shock that is not observed by the researchers but is known to the firm managers, whilst η_{it} is the an i.i.d. component capturing unpredictable shocks, which is uncorrelated with input choices. The traditional method when analyzing the productivity is to estimate the production function and use the residuals not explained by the input factors (capital, labour) as a proxy for TFP (Solow residuals). The essential difference between ω_{it} and η_{it} is that the former is a state variable and thus influences the firm's choice of inputs. Since firm managers are able to adjust their variable inputs based on their prior knowledge or expectations of the productivity component (ω_{it}), the error terms ($\omega_{it} + \eta_{it}$) and the independent variables are correlated. This appears because profit-maximizing firms respond to an

increase in productivity by raising the usage of factor inputs. It is difficult for researchers to observe and quantify the differences in the quality of human resources, capital intensity, and impacts of demand shocks across firms as well as industries. Thus, a method that ignores the endogeneity, for example OLS, inevitably leads to inconsistent estimates of the parameters of the production function.

In response to such methodological concern we employ a semi-parametric approach suggested by Levinsohn and Petrin (LP) (2003), which is an extended and modified version of the Olley and Pakes (OP) estimator (1996), see recent empirical applications on LP (Blalock and Gertler 2004; Driffield et al. 2007; Temouri et al. 2008). This method allows for the firm specific productivity differences that exhibit idiosyncratic changes over time by controlling the endogeneity of input selections (Javorcik and Spatareanu 2008). Both OP and LP estimators are able to resolve simultaneity issues by using a proxy variable to substitute for an unobserved productivity, assuming a strict monotonic condition. The LP estimator is fully analogous to the approach used by OP apart from using the intermediate inputs instead of the investment as a proxy[34] and omitting the survival correction in the second stage. LP argue that the intermediate inputs can smoothly respond to the entire productivity shocks, as they are not typically state variables. On the other hand, the investment is very lumpy due to substantial adjustment costs and thus may react only to the news in the productivity (Van Beveren 2007). Moreover, the investment data are not

[34] The LP estimation treats labour inputs as a freely variable and capital as a quasi-fixed state variable.

often available since many firms do not disclose information regarding investments.

The procedure of LP estimation algorithms is detailed below. LP assume that the demand for intermediate inputs m_{it} depends on the monotonic function of firms' capital k_{it} and an unobserved productivity shock ω_{it}.

$$m_{it} = f(k_{it}\omega_{it}) \tag{4.3}$$

Assuming that the demand function is monotonically increasing in ω_{it} allows an inversion of the function (4.3). Therefore, ω_{it} can be written as a function of k_{it} and m_{it}.

$$\omega_{it} = \phi(k_{it}m_{it}) \tag{4.4}$$

The unobservable productivity term is now expressed as a function of two observed inputs. m_{it} is a variable input whose choice is affected by the ω_{it}, whilst k_{it} is determined by the past values of the productivity. The final identification restriction assumes that the productivity follows a first-order Markov process $\omega_{it} = E[\omega_{it} \mid \omega_{it-1}] + \xi_{it}$, where ξ_{it} represents an innovation to the productivity that is uncorrelated with k_{it}. In the first stage of procedure, we get the following equation by substituting (4.4) into (4.2)

$$va_{it} = \beta_0 + \beta_k l_{it} + \beta_t k_{it} + \phi_t(k_{it}, m_{it}) + \eta_{it} \tag{4.5}$$

Since the functional form of $\phi_t(k_{it}, m_{it})$ is unknown, the coefficient on capital cannot be estimated from (4.5). However, by substituting a third-order polynomial approximation in k_{it} and m_{it} in place of $\phi_t(k_{it}, m_{it})$, it is

possible to consistently estimate the parameters of the equation (4.2) using OLS

$$va_{it} = \beta_0 + \beta_l l_{it} + \sum_{i=0}^{3}\sum_{j=0}^{3-i} \delta_{ij} k_{it}^{i} m_{it}^{j} + \eta_{it} \tag{4.6}$$

where β_0 is separately identified from the intercept of $\phi_t(k_{it}, m_{it})$. In this first stage of the estimation, an estimate of β_l and an estimate of ϕ_t (up to the intercept) are obtained.

In the second stage, the estimated $\hat{\phi}_t$ is derived from

$$\hat{\phi}_t = \hat{va}_{it} - \hat{\beta}_l l_{it} = \hat{\beta}_0 + \sum_{i=0}^{3}\sum_{j=0}^{3-i} \hat{\delta}_{ij} k_{it}^{i} m_{it}^{j} - \hat{\beta}_l l \tag{4.7}$$

For the value of β_k^*, we get (up to scalar constant) an estimated $\hat{\omega}_{it}$ for all periods using $\hat{\omega}_{it} = \hat{\phi}_t - \beta_k^* k_{it}$. From this, non-parametric approximation to $E[\omega_{it} \mid \omega_{it-1}]$ is given by the predicted values from the following equation

$$\hat{\omega}_{it} = \gamma_0 + \gamma_1 \omega_{it-1} + \gamma_2 \omega_{it-1}^2 + \gamma_3 \omega_{it-1}^3 + \varepsilon_{it} \tag{4.8}$$

The elasticity of capital $\hat{\beta}_k$ is defined as the solution to the minimisation of squared sample residuals of the production function

$$\min_{\beta_k} \sum_{t} (va_{it} - \hat{\beta}_l l_{it} - \beta_k^* k_{it} - \hat{E}[\omega_{it} \mid \omega_{it-1}])^2 \tag{4.9}$$

The above procedure[35] generates the consistent time varying firm-specific measures of productivity even in the presence of input share being affected by

[35] The LP estimator is implemented in Stata programme (Petrin et al. 2004) where a bootstrap technique is employed to derive standard errors.

the private knowledge of firms' productivity. After consistent estimates of the input elasticities are obtained, the log of productivity $\hat{\omega}_{it}$ can then be expressed as the difference between value added and labour and capital, multiplied by their estimated coefficients: $\hat{\omega}_{it} = va_{it} - \hat{\beta}_k l_{it} - \hat{\beta}_l k_{it}$. The estimation algorithms are separately performed for each two-digit sector and the obtained measure of firm-specific TFP is used for the spillover analysis below.

Spillover Equation

In the second step, the estimated TFP is regressed against various externality terms in questions and other control variables within a fixed effects framework[36]. The baseline specification is as follows:

$$\ln TFP_{it}^{D} = \delta_0 + \delta_1 \ln INTER\_BACK_{j,t-1} + \delta_2 \ln INTER\_FOR_{j,t-1} + \delta_3 \ln INTRA\_FDI_{j,t-1} + \delta_4 \ln MS_{it} + \delta_5 \ln RD_{it} + \nu_j + \nu_t + \varepsilon_{jt} \quad (4.10)$$

$INTER\_BACK_{j,t-1}$ is backward linkages where local suppliers sell the intermediate products to foreign firms in downstream sectors in j and a lagged year $t-1$. $INTER\_FOR_{j,t-1}$ is forward linkages where local firms purchase the intermediate products from foreign suppliers in upstream sectors. $INTRA\_FDI_{j,t-1}$ is the proportion of a foreign presence within sectors. The

[36] Hausman test rejects rando m effects against fixed effects.

construction of these spillover variables is discussed in more details in section 4. MS_{it} denotes the market share of a domestic firm i in terms of revenues in sectors j and year t. This control variable enables us to isolate the effects on the productivity and market stealing effects of foreign firms as well as the monopoly power of domestic firms, see recent empirical models (Keller and Yeaple 2005; Todo 2006; Haskel et al. 2007). Finally, another important factor explaining the technology diffusion is firm specific assets (Kiyota 2006; Todo 2006; Murakami 2007), measured as the value of intangible fixed assets RD_{it} from domestic firms. Veugelers and Cassiman (2004) point out that such specific assets allow firms not only to scan and screen the external technology but also to increase the absorptive capacity of the organisation and internalise external knowledge with their own innovative projects. We expect all $\hat{\delta} > 0$ based on the literature review in section 2. Time dummies are also included to allow for period specific effects on the productivity shock that is common to all firms but not attributable to explanatory variables in the equation.

In addition to the baseline specification (4.10), we also augment the model by including the cross product terms between spillover variables and the presence of keiretsu. As defined in chapter 3, vertical keiretsu refer to the supply chain operations that cluster around their downstream parent manufacturers. They consist of subsidiaries or affiliations, which mainly function as suppliers and distributions involved in the parents industry. Typical examples are Toyota, Nissan, Toshiba, Panasonic, and so forth. Horizontal keiretsu consist of member firms operating in unrelated sectors centred on

large financial institutions. We explore whether vertically and horizontally linked keiretsu networks moderate the effect of transactional linkages on the productivity of domestically owned Japanese manufacturing firms. We assume that a certain level of keiretsu networking facilitates the assimilation of new (foreign) technology. Using a dynamic factor demand model with R&D externalities, Suzuki (1993), for example, analyses the effects of knowledge spillovers by vertical keiretsu group in the Japanese electrical machinery industry. The results indicate that the technological diffusions take place between the core firms and their subcontracting firms within keiretsu as well as the outside keiretsu firms. Similarly, Branstetter (2000) provides supporting empirical evidence that vertical keiretsu affiliation can effectively promote knowledge spillovers and innovative activities of Japanese manufacturing industries. Such externalities are generated for not only keiretsu-affiliated firms but also unaffiliated firms. Knowledge spillovers, most importantly those associated with the product innovations, take place the outside of vertical keiretsu relationships. Consequently, the relationships between main assemblers and their suppliers in the manufacturing sector facilitate the essential knowledge sharing in the Japanese economy (Matsuura et al. 2003). Underlying the characteristic of keiretsu is the mechanism that can facilitate the interchange and the flow of information between firms. We expect that horizontally linked keiretsu affects technology diffusions from FDI since it possesses equally prevalent features of information sharing and networking ability. Existing literature to date has largely ignored linking inward FDI

spillovers and the role played by keiretsu. From a broader perspective, the inter-firm keiretsu affiliation, partly share common features with the Porterian cluster[37] in terms of networking. Clustering is more likely to foster the rapid diffusion of knowledge and skills since the cohesive linkages and externalities boost absorptive capacity between firms (Porter 1998; Porter 2000). Literature on industrial clusters suggests that foreign MNEs participate in and are involve in various localised knowledge clusters to augment their abilities through strategic asset seeking FDI (Gugler and Brunner 2007). Furthermore, highly dynamic clusters generally gain productivity spillovers from inward FDI (ibid). To take account Japanese specific institutional clusters, an interaction term is included in the specifications whether the conditional relationship exists between technological spillovers from foreign multinationals and the presence of keiretsu with their effects on the productivity level of Japanese manufacturing firms.

When estimating the production function in the first stage of the 'two step' method, several methodological issues need to be discussed in the spillover equation (4.10) under the fixed effects framework. An advantage of using firm level data with fixed effects is that the model can be estimated on a sample of only domestic firms (defined as those with less than 33.4 % foreign equity). This helps us to alleviate the possible bias of reverse causality that successful

[37] Clusters are defined as "concentrations of highly specialized skills and knowledge, institutions, rivals, related businesses, and sophisticated customers in a particular nation or region (Porter 2000, p32). Proximity in geographic, cultural, and institutional terms allows special access, special relationships, better information, powerful incentives, and other advantages in productivity and productivity growth (ibid).

domestic firms with high productivity levels attract more foreign investment. The difficulty in establishing the direction of causality in sectoral level studies is already well understood. Furthermore, in order to mitigate the possibility of endogeneity or simultaneous bias, all knowledge spillover variables from foreign invested firms are lagged by one period, assuming that the lagged variables are uncorrelated with the error terms in the regression models. The use of lags is appropriate relative to contemporaneous variables when a lagged foreign presence is predetermined with the comparison to the current plant productivity and when spillovers take time to materialise (Haskel et al. 2007).

4.4. Data and Variables

The empirical analysis in this chapter is based on an unbalanced panel data set covering Japanese firms active in the two-digit manufacturing sectors (NACE Rev. 1.1 Classification Codes 15 to 36) during the period of 1997-2003. The consensus by now is that the firm or the plant level panel data are prerequisites for the productivity spillover analysis to obtain robust empirical evidence (Gorg and Greenaway 2004; Crespo and Fontoura 2007). The source of firm level information is drawn from the commercial database from ORBIS compiled by Bureau van Dijk, which provides necessary financial information to construct the production function. The database contains information on the volume of gross revenue, the number of employees, the cost of intermediate inputs, the value of tangible and intangible fixed assets. We have excluded inactive firms and firms with missing observations. All nominal monetary

values are deflated using the relevant price indices at the two-digit industry level obtained from SNA (see Appendix C).

A foreign presence within sectors (horizontal spillovers) is measured as the proportion of sales share accounted for by foreign entities (that is where foreign firms hold more than 33.4%[38] of the equity in a firm) below:

$$INTRA\_FDI_{jt} = \frac{Y_{jt}^{F}}{Y_{jt}^{D+F}} \tag{4.11}$$

As explained in chapter 3 (see Table 3-3), the degree of foreign involvement in terms of employment share in some sectors, for example petroleum refining, electronics, and motor vehicles, is likely to underestimate the actual role of invested firms in the host economy when compared with sales share. Wei and Liu (2006) postulate that different measures of foreign ownership capture different aspects and channels of productivity spillovers. For example, employment is closely related with spillover effects on work mobility or job turnover whilst sales are associated with the diffusion of superior products and marketing knowledge. We argue that sales penetration is a better proxy to capture the effects of externality in the Japanese context since the labour turnover from foreign multinational firms to local firms may not be as high as in other industrialised countries[39].

To construct backward and forward linkages between foreign invested

[38] As discussed in Chapter 3, the survey from METI (Ministry of Economy, Trade, and Industry) defines above this cut-off point as foreign affiliated firms.

[39] The corporate lifetime employment, one of conventional Japanese human resource policies, may not hold any longer, but Blinder and Krueger (1996) find that the rate of labour turnover in Japan is still less than half of the US level. This implies that the flow or the exchange of skilled personal across firms whether foreign or domestically owned can be limited in the Japanese context.

firms and indigenous firms in upstream and downstream sectors, the annual extended Input-Output (I-O) matrices at the two-digit level are used. Our prime interest is to examine the possible different transactional linkage effects of a foreign presence across different sectors. One effect is backward linkages where domestic firms supply the intermediate inputs used by foreign invested firms in downstream industries. Another is forward linkages where domestic firms purchase the intermediate inputs from foreign firms in upstream industries. To obtain these coefficients for transactional linkages, sectoral sales/purchase to each sector is divided by the total intermediate inputs sold/purchased in the domestic market in row/column vectors of "Use" and "Make" matrices.

These linkage coefficients are then multiplied by foreign presence vectors derived from (4.11) to get backward and forward spillover variables.

$$INTER\_BACK_{jt} = \sum_{k, j \neq k} \alpha_{jk} * INTRA\_FDI_{kt} \qquad (4.12)$$

where α_{jk} is the proportion of sector j's outputs supplied to the sector k. The proportion of α_{jk} is calculated only inputs supplied locally, that is the products supplied for the final consumption and the imported intermediate inputs are excluded. The inputs supplied within sectors are excluded in order to isolate the effects of vertical spillovers (INTRA_FDI).

$$INTER\_FORWARD_{jt} = \sum_{k, j \neq k} \beta_{jk} * INTRA\_FDI_{kt} \qquad (4.13)$$

where β_{jk} is the proportion of material inputs purchased by the sector j from the sector k. Equally, the inputs purchased within sectors are excluded,

since this effect is already captured by the INTRA_FDI variable. The greater the value of these coefficients indicates the greater the proportion of outputs supplied to/by foreign sectors. Hence the positive coefficients signify the presence of knowledge spillovers between foreign multinationals and locally owned firms in terms of supplier-buyer linkages. The symmetrical transaction matrix distinguishes between the intra-industry transactions as the leading diagonal and the inter-industry transactions as the off-diagonal measure of FDI intensities. The details of construction of the linkage variables are found in Driffield et al, (2002, p351) and among others (Javorcik 2004; Jabbour and Mucchielli 2007). Table 4-1 provides the definitions and summary statistics for the variables employed and Appendix C supplements information on the construction of variables and the dataset used in our analysis.

Table 4-1: Variable definitions and Summary Statistics

Variable	Definitions	Mean	S. D.	Max.	Min.
TFP	Firm productivity	0.203	0.714	4.266	-3.768
INTER_BACK	Inter-industry (Vertical) spillovers from a foreign presence in backward linkages	0.054	0.037	0.156	0.000
INTER_FOR	Inter-industry (Vertical) spillovers from a foreign presence in forward linkages	0.051	0.055	0.156	0.000
INTRA_FDI	Intra-industry (Horizontal) spillovers from a foreign presence	0.063	0.072	0.032	0.000
MS	Market share in terms of firms' revenue	-5.935	1.723	-0.677	-11.870
RD	Real value of intangible fixed assets	5.220	2.131	13.974	0.000
VK	Top 8-Firm concentration ratio measured by the sales of vertical keiretsu in Electronics and Transport sectors	0.807	1.628	4.352	0.000
HK	Sales share of Horizontal keiretsu firms that belong to President Clubs from Big Six corporate groups	0.219	0.213	0.633	0.000

Note: All variables are expressed in natural logarithms. All variables except TFP are logged after adding '1' to avoid taking the log of zero.

4.5. Results

Effects on Overall Manufacturing Firms

Table 4-2: Fixed Effects with Lagged Spillover Variables: Full Samples
Dependent Variable:
TFP

	Full Samples			
	(1)	(2)	(3)	(4)
Constant	2.57***	4.90***	4.78***	2.90***
	(0.27)	(0.32)	(0.33)	(0.27)
INTER_BACK	0.68	1.47***	0.26	-0.63
	(0.49)	(0.47)	(0.44)	(0.66)
INTER_FOR	0.89***	0.73**	0.90***	0.99***
	(0.27)	(0.27)	(0.27)	(0.28)
INTRA_FDI	-0.29*	0.02	0.30**	-0.10
	(0.15)	(0.14)	(0.14)	(0.15)
MS	0.43***	0.45***	0.45***	0.45***
	(0.04)	(0.04)	(0.04)	(0.05)
RD	0.03***	0.01***	0.01*	0.03***
	(0.01)	(0.01)	(0.01)	(0.01)
VK		-2.53***	-2.53***	
		(0.23)	(0.22)	
HK		-0.16	0.26*	-0.78***
		(0.12)	(0.13)	(0.15)
INTER_BACK*VK			1.26***	
			(0.35)	
INTER_FOR*VK			2.91**	
			(1.42)	
INTRA_FDI*VK			-0.45***	
			(0.09)	
INTER_BACK*HK				4.31**
				(2.09)
# of Obs.	4047	4047	4047	4047
R-Sq.	0.13	0.20	0.22	0.15

Note: Standard errors in parentheses using White consistent covariance matrix estimator. ***, **, and * indicate that the coefficient is significantly different from zero at the 1%, 5%, and 10% respectively. The models are estimated with the correction of heteroscedasticity and autocorrelation, and with the inclusion of time dummies. All variables are expressed in natural logarithms and spillover variables (INTER_BACK, INTER_FOR, INTRA_FDI) are lagged by one year.

Table 4-2 sets out the result of estimations described in an equation (4.10) based on fixed effects with lagged spillover regressors using full samples. Columns (1) and (2-4) provide the baseline specification and augmented

specifications that include interaction terms with a keiretsu presence respectively. Over all, our estimation results are largely in line with the prior theoretical expectations. Market share (MS) and firm specific assets (RD) are, in general, important factors determining the productivity of indigenous Japanese firms irrespective of different model estimations.

In column (1), all coefficients are statistically different from zero, except the coefficient on the backward linkages across different sectors (INTER_BACK). Inward FDI within sectors (INTRA_FDI) is negatively correlated with the productivity of Japanese firms (at the 10 percent significance). During the sample period, a 1 percent increase in the share of foreign participation *within* sectors reduces the level of firm productivity in the Japanese manufacturing sector by 0.3%. The negative effects of aggregated horizontal spillovers are consistent with the recent result obtained by Murakami (2007). An increase in foreign share in a sector reduces the output of individual domestically owned establishments from the overcapacity, which consequently reduces the productivity performance of domestic firms in the short run. This is in line with the findings of Aitken and Harrison (1999), who suggest that the competition effect outweighs any positive technological effects. Foreign invested firms are able to draw demand away from their indigenous counterparts through the introduction of new innovative products. As a result, a foreign presence pushes up the domestic firms' average cost curve by the crowding-out effect (ibid). The increasing efficiency associated with rises in the foreign ownership negatively affects the least efficient domestic firms who

are most vulnerable to competition. Moreover, the market stealing effect may also occur when domestic firms develop valuable technology and brands, but a foreign investor acquires these assets and thus no longer generates the value to the domestic-owned sector. The coefficients on forward linkages across different sectors (INTER_FOR) are statistically significant with a positive sign. In terms of the magnitude on the elasticity, foreign involvement across upstream industries appears to play an important role improving the productivity of domestic firms: a 1 percent increase in a foreign presence raises the level of domestic firms' TFP by around 0.9 per cent. The result indicates that domestic firms who purchase high quality intermediate inputs from foreign upstream sectors substantially benefits from positive externalities in the Japanese manufacturing sector. In other words, domestic firms are capable of fully utilising new and improved quality inputs supplied from foreign multinationals, and as a result become productive. The proprietary knowledge embodied in innovative products and technologies will spillover to domestic producers through supply chains, contributing to the development of local distribution channels and sales network. Similarly, forward linkages boost 'the local production of more specialised inputs which allows the production of more complex goods at competitive costs' (Rodriguez-Clare 1996, p853). The empirical evidence to date on positive forward linkages in downstream sectors is rather limited, but confirmed with studies for industrialised (Driffield et al. 2002; Jabbour and Mucchielli 2007; Girma et al. 2008) and transitional economies (Schoors and Van Der Tol 2002; Liu 2008). The coefficient on

inter-industry spillovers in backward linkages (INTER_BACK) is not statistically significant. The possible explanation for the absence of any significant results on this variable might be that foreign multinationals are "cherry picking" among Japanese suppliers. This means that domestic firms in upstream sectors may not experience any productivity improvement when foreign multinational firms source inputs only from productive local firms (Javorcik and Spatareanu 2005). In such scenario, the externality will be absent since foreign invested firms award contracts to the most reliable suppliers that already possess the required level of sophistication in the recipient country and purchase an increasing amount of intermediate inputs from them (ibid).

The augmented regression results reported in columns (2)-(4) in Table 4-2 are mostly identical to the baseline model (1). The coefficient on (INTER_BACK) becomes positive and statistically significant when keiretsu presences are jointly controlled. This indicates that local Japanese suppliers benefit from their linkages with foreign invested firms in downstream sectors. There is now considerable empirical evidence showing that inter-industry (vertical) spillovers from FDI are more likely to occur than intra-industry (horizontal) spillovers. This is because foreign investors tend to prevent the leakage of knowledge to potential competitors in the same industry but are often willing to transfer the technology to their suppliers to benefit from the improved performance of intermediate products and services (Blalock and Gertler 2004; Javorcik 2004; Kugler 2006). Foreign invested firms may provide explicit technical assistance to potential local suppliers to upgrade their

production techniques and management practices to meet acceptable standards of cost and reliability (Javorcik and Spatareanu 2005). The coefficient on the vertical keiretsu (VK) is negatively correlated with the performance of domestic firms, suggesting that there is an adverse effect from the networking activity of keiretsu affiliations. This is contradictory to the earlier results obtained from Branstetter (2000) who finds the positive impact of knowledge spillovers from vertical keiretsu in Japanese manufacturing firms. The negative impact might occur when local Japanese firms who are the outside of keiretsu members fiercely compete with the affiliated members and are forced to reduce their output as well as their own demand for the intermediate and the final goods. If such competition effect outweighs the demand effect, then the net effect becomes negative. It is also possible that keiretsu affiliated firms are exceedingly defensive about protecting themselves from severe competition in order to retain their market power. Previous empirical evidence (Javorcik and Spatareanu 2008) suggests that such market power is inversely related to the productivity growth of the domestic economy. The distinctive institutional system of Japan's inter-firm networks once played a significant role in the technological development and the innovative strength of Japanese firms, but is perhaps now undergoing much challenge in the face of deregulation, globalisation, and financial disintermediation. It is increasingly difficult for Japanese firms to sustain their traditional inter-corporate (keiretsu) relationships in an environment where modern innovation requires growing flexibility (Matsuura et al. 2003). Internationalisation is gradually forcing the

opening of the supply chains to foreign competition.

The independent variables in which we are particularly interested in are interaction terms between FDI spillovers and a keiretsu presence. The coefficient on vertical keiretsu (VK) is individually negative and significant, and horizontal keiretsu (HK) shows no effect on the productivity performance of Japanese firms (see column 2). However, as reported in columns (3) and (4), inter-industry spillovers through both backward and forward linkages in keiretsu intensive sectors (INTER_BACK*VK, INTER_FOR*VK, and INTER_BACK*HK) are positively correlated with the domestic productivity[40]. Spillovers from backward linkage are not determined by a foreign presence alone, but rather by the simultaneous interactions between foreign and keiretsu firms. This is reinforced by the regressions (3) and (4). The results suggest that domestic firms in vertical keiretsu intensive sectors gain from productivity externalities through a foreign presence in both downstream and upstream sectors. Equally, local suppliers in horizontal keiretsu sectors benefit from downstream FDI. Productivity spillovers from backward linkages are likely to occur through several channels (Alfaro and Rodriguez-Clare 2004). First, domestic suppliers benefit from direct knowledge transfers by foreign customers. Second, foreign multinationals impose higher requirements for product quality and rigid time delivery, which become a greater incentive for domestic suppliers to upgrade their technology and management practices. Third, foreign entries increase the demand for intermediate products by

[40] Other cross product terms we have explored did not produce significant results, therefore are not reported.

introducing new and specialised input varieties, which allows local suppliers to benefits from economies of scale. These arguments are in line with the recent vertical linkage literature (Javorcik 2004; Bwalya 2006; Kugler 2006; Halpern and Muraközy 2007). Moreover, local firms in vertical and horizontal keiretsu dominated sectors are likely to enhance the integration and the coordination of foreign technologies along their supply chains and distribution networks, affecting the overall performance of domestic firms. A point worth stressing is that positive productivity externalities are generated when domestic firms in sectors dominated by keiretsu supply/purchase their outputs/inputs to/from foreign firms. Despite anecdotal evidence on the negative impact of keiretsu on foreign entry, our empirical results in the preceding chapter suggest that the keiretsu networking does not deter foreign penetration in the Japanese manufacturing sector in most of the cases. Instead, many sectoral attributes interacted by keiretsu presences encourage foreign participation. This is perhaps due to positive productivity spillovers generated from inward FDI. The positive aspect of networking by local clusters is, for example, demonstrated through the likelihood of reducing transaction costs and promoting inter-firm learning, innovation, and knowledge spillovers (Veloso 2006). The existing empirical study (De Propris et al. 2005) demonstrates that the local industrial system characterised by a cluster of highly specialised domestic firms that possess competitive advantages induces FDI into both high and low tech-manufacturing industries in Italy. Furthermore, the recent empirical evidence (De Propris and Driffield 2006) shows that domestic firms in the UK

that belong to the clusters significantly increase the beneficial effects of a foreign presence, whilst firms outside clusters do not. This illustrates that the local welfare returns from FDI are greater if foreign firms enter the pre-existing clusters. Luo et al (2002) also demonstrate that the local networking, in the forms of linkages that foreign invested firms establish with domestic firms in the local market, greatly mitigate the liability of foreignness in China. The cluster participation reduces the relative unfamiliarity of foreign owned establishments operating in the foreign market by the formal or informal knowledge exchange and transfer. The cluster is therefore likely to facilitate spillovers of tacit knowledge.

In a similar vein, keiretsu firms that possess distinctive information sharing and networking ability are able to not only react more efficiently to FDI but also promptly recognise the benefits of FDI, hence capture positive spillovers. Such positive productivity shocks to work with multinationals are generated through the domestic firm's own effort to access complementary knowledge from foreign firms or simply by the firm's motivation for the prospect of new business relationships and global learning with foreign invested firms. In general, domestic firms in keiretsu intensive sectors are in a better position to assimilate foreign knowledge with their own economic activities through transactional linkages given their higher absorptive capacities. Backward and forward linkages are regarded as essential channels through which interactive learning, information and technology can be exchanged or jointly exploited for the purpose of productive activities. This implies that interactions between

keiretsu and foreign affiliated firms are likely to stimulate the process of positive spillover occurrences. The indigenous firms embedded in such a mechanism would thus benefit the exploitation of knowledge spillovers, and the accumulation of capability through learning from demonstration effects.

In contrast, (INTRA_FDI*VK) in column (3) is statistically significant but with a negative coefficient, indicating that the productivity of domestic firms in sectors dominated by vertical keiretsu is adversely affected by inward FDI within sectors. As already discussed, such negative spillovers are the results of crowding-out and competition effects and may offset any positive externality for those local firms who are not efficient enough to compete with foreign firms. Foreign competition would therefore deteriorate the local firms' productivity through the reduced margins. The vertically linked keiretsu presence further intensifies such negative effects as foreign and indigenous firms are competing for the same customers and resources responding from market pressures and opportunities, particularly when the investment is undertaken to serve the local market within the same sector. In sum, it seems reasonable to suggest that FDI across sectors dominated by keiretsu generate knowledge more effectively than FDI within keiretsu intensive sectors. We further investigate the importance of absorptive capacities in details below.

The Role of Absorptive Capacity

Having investigated the linkage effects on overall manufacturing firms, we now examine whether spillover effects vary with different absorptive capacity

of firms. The absorptive capacity is the ability not only to scan and monitor the relevant technological and economic information but also to adjust the firm's system of coordination and control to match the new technological opportunities (Mudambi 2002). It is also a capability to acquire knowledge, information, and skills needed to develop their own technology. In order to identify the differences in the firms' productivity performance, the full samples are split into the sub-groups of domestic firms in accordance with the level of their absorptive capacity. We use the innovative capabilities (intangible asset intensity) and the revealed comparative advantages (RCA) as the proxies for the absorptive capacity (see Appendix C for the measurements of these proxies). These are presented in Table 4-3 and 4-4. Appendix D provides the NACE (rev. 1.1) industry classification used for the estimations.

Table 4-3: Fixed Effects with Lagged Spillover Variables: High and Low Tech Sectors

Dependent Variable: TFP

	High Tech									Low Tech					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Constant	3.16***	7.42***	7.49***	6.89***	7.16***	6.54***	6.55***	3.84***	3.82***	2.22***	2.80***	3.26***	2.82***	2.83***	2.12***
	(0.42)	(0.53)	(0.53)	(0.55)	(0.53)	(0.55)	(0.55)	(0.43)	(0.44)	(0.32)	(0.35)	(0.39)	(0.35)	(0.35)	(0.33)
INTER_BACK	2.32***	1.99***	2.01***	1.69***	3.13***	2.88***	2.42***	0.73	1.91***	-1.60**	-0.40	-3.27***	-2.28**	-1.78**	-1.42*
	(0.62)	(0.52)	(0.49)	(0.52)	(0.52)	(0.51)	(0.48)	(0.64)	(0.56)	(0.77)	(0.87)	(0.82)	(0.85)	(0.73)	(0.79)
INTER_FOR	0.86**	0.55	0.54	0.44	0.58	0.46	0.47	0.41	0.84**	1.54***	1.33***	1.91***	1.69***	1.56***	2.60***
	(0.43)	(0.38)	(0.38)	(0.37)	(0.38)	(0.37)	(0.37)	(0.39)	(0.42)	(0.43)	(0.44)	(0.44)	(0.44)	(0.43)	(0.48)
INTRA_FDI	-0.46***	-0.01	-0.08	-0.08	0.46***	0.45***	0.43***	-0.02	-0.72***	0.64	0.64	-0.14	0.08	-0.14	0.80
	(0.15)	(0.13)	(0.14)	(0.13)	(0.12)	(0.12)	(0.12)	(0.15)	(0.25)	(0.53)	(0.52)	(0.49)	(0.51)	(0.54)	(0.51)
MS	0.53***	0.55***	0.54***	0.55***	0.56***	0.56***	0.56***	0.59***	0.58***	0.37***	0.37***	0.37***	0.37***	0.37***	0.37***
	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
RD	0.06***	0.03***	0.03***	0.03**	0.02**	0.03***	0.03***	0.04**	0.04**	0.01	0.00	0.00	0.00	0.00	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
VK		-3.07***	-3.24***	-2.80***	-2.92***	-2.55***	-2.56***				-1.38***	-2.14***	-1.21***	-1.23***	
		(0.31)	(0.28)	(0.32)	(0.29)	(0.32)	(0.32)				(0.32)	(0.43)	(0.31)	(0.31)	
HK		-0.18				0.14	0.19	-1.13***	-0.93***		0.64**				0.71**
		(0.13)				(0.15)	(0.16)	(0.17)	(0.16)		(0.24)				(0.26)
INTER_BACK*VK			0.02				0.68					1.80***			
			(0.36)				(0.46)					(0.42)			
INTER_FOR*VK				3.17**		3.44**	2.92*						7.87***		
				(1.35)		(1.42)	(1.54)						(2.06)		
INTRA_FDI*VK					-0.38***	-0.41***	-0.48***							0.64**	
					(0.08)	(0.08)	(0.10)							(0.28)	
INTER_FOR*HK								18.71***							-12.43*
								(5.25)							(6.60)
INTRA_FDI*HK									-1.67**						
									(0.60)						
# of Obs.	1851	1851	1851	1851	1851	1851	1851	1851	1851	2196	2196	2196	2196	2196	2196
R-Sq.	0.20	0.34	0.34	0.35	0.35	0.36	0.36	0.25	0.25	0.10	0.11	0.12	0.12	0.11	0.12

Note: Standard errors in parentheses using White consistent covariance matrix estimator. ***, **, and * indicate that the coefficient is significantly different from zero at the 1%, 5%, and 10% respectively. The models are estimated with the correction of heteroscedasticity and autocorrelation, and with the inclusion of time dummies. All variables are expressed in natural logarithms and spillover variables (INTER_BACK, INTER_FOR, INTRA_FDI) are lagged by one year. Interaction terms for Eq.(12)-(14) for low tech sectors are individually insignificant when jointly specified.

First, our sample is divided into the two subgroups of domestic firms to see whether the degree of horizontal and vertical spillovers changes with the technological nature of sectors. Columns (1)-(9) and (10)-(15) in Table 4-3 compare the productivity differences between high and low technological intensities of local firms. The baseline result presented from column (1) indicates that all coefficients are statistically significant with positive signs, with the exception of the coefficient on (INTRA_FDI). This indicates that innovative and technologically sophisticated domestic firms can benefit from backward and forward linkages in upstream and downstream sectors from a foreign presence. The market stealing and competition effects become much more apparent and severe for high tech domestic firms when FDI takes place within the same sector. Another noticeable difference in the results between columns (1) and (10) is the coefficients on inter-industry spillovers through backward linkages (INTER_BACK). In column (10) for low-tech sectors, this coefficient becomes negative. This suggests that a foreign presence across downstream sectors adversely affects technologically lagged domestics firms provided that those local firms themselves possess the insufficient innovative capabilities. Technologically advanced firms are able to facilitate innovation and raise the quality of their intermediate inputs and services through a presence of foreign multinationals, whilst technologically lagged ones lack such ability. The possible explanation is that multinationals do not only create new linkages but also displace the pre-existing linkages between local firms and suppliers, or choose to source the intermediate inputs from their

headquarters (Rodriguez-Clare 1996) given the lack of business sophistication in domestic firms. Besides negative competition effects identified by Markusen and Venables (1999), Lin and Saggi (2007) also argue that a foreign presence can reduce the number of suppliers available to local producers under the exclusivity conditions where multinationals preclude their suppliers to serve other local rivals. As a result, the intermediate good market through backward linkages becomes less competitive and can cause local welfare decline due to multinational entry.

Columns (2) and (11) are the baseline estimations with the inclusions of keiretsu variables. The results indicate that the determinants of FDI spillovers appear to be different depending on the technological capabilities of domestic firms. Each variable of backward or forward linkages is individually an important channel of productivity externalities from a foreign presence for high-tech or low-tech sectors, respectively.

Columns (3)-(9) and (12)-(15) report the augmented regression results that include interaction terms[41] between spillovers and keiretsu variables. The results for high and low tech firms are qualitatively identical with ones reported in Table 4-2 for full samples. The coefficients on (INTER_FOR*VK) are statistically significant with positive signs irrespective of technological sophistication of domestic firms. This implies that domestic firms in sectors dominated by keiretsu are in a strong position to appropriate operational and managerial resources adopted from foreign technology (Driffield et al. 2002).

[41] In Table 4-3, we report the coefficients on interaction terms that generated only significant results.

The effects of such forward linkages seem to be further enhanced by the role of the vertical keiretsu network. This suggests that the introduction of large variety of intermediate inputs from foreign suppliers lowers the production cost of certain goods, making their operations profitable and allowing their production of more sophisticated final goods for downstream manufacturers. Japanese producers have begun to re-examine the traditional keiretsu (inter corporate firms and buyer-supplier) relationships and to look for ways to bring high quality and the cost competitive components as well as the materials from overseas suppliers. Similarly, forward linkages in horizontal keiretsu dominated sectors (INTER_FOR*HK) in column (8) are also positively associated with the performance of knowledge intensive domestic firms. Innovative local firms that are able to establish the linkages with foreign firms can, for example, improve the distribution channels and marketing techniques used by foreign multinationals on the domestic and international market. In contrast, this coefficient in column (15) is marginally significant but with a negative sign, suggesting that technologically laggards are not able to benefit from foreign suppliers through forward linkages given the insufficient absorptive capacity. The coefficient on (INTER_BACK*VK) is positive and significant only for low-tech sectors (see column 12). This indicates that less knowledge intensive indigenous firms in keiretsu dominated sectors benefit from the increased efficiencies when they supply their intermediate inputs to foreign firms across different downstream sectors. As a result, the increased demand and competition for intermediate products allow technologically

lagged local suppliers to reap the benefits of scale economies depending on the response of keiretsu network. There is also a pressing need for technologically lagging firms to advance existing knowledge and develop global learning by creating new business relationships with foreign owned firms. The motivation of low-tech firms to catch up the advanced technology appears to be much stronger than that of technologically leading firms. The results in columns (5-7) and (9) demonstrate that FDI within sectors dominated by both vertical and horizontal keiretsu networks (INTRA_FDI*VK and INTRA_FDI*HK) is negatively correlated with the productivity of knowledge intensive domestic firms. This is attributed to adverse competition effects in the short run as found in Murakami (2007) and crowding out effects discussed earlier. Severe competition induced by foreign participation within the same industry restricts the market powers and draws demand away from the domestic counterparts (Aitken and Harrison 1999). Such negative effects are pronounced particularly for those high-tech firms as a result of competitive pressure from the foreign entry, causing them to reduce their output and productivity. On the other hand, productivity externalities are generated for low-tech domestic firms in vertical keiretsu intensive sectors through the positive competition effect (column 14). Competition forces inefficient and technologically lagged firms to exit from the market, as a result the level of the domestic firms' productivity in a sector will increase on average.

Table 4-4: Fixed Effects with Lagged Spillover Variables: High and Low RCA (Revealed Comparative Advantages) Sectors

Dependent Variable: TFP

	High RCA					Low RCA	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	2.72***	5.73***	5.54***	3.20***	3.24***	1.95***	1.89***
	(0.31)	(0.39)	(0.40)	(0.33)	(0.33)	(0.42)	(0.42)
INTER_BACK	0.92*	1.95***	0.68	-0.47	0.42	-1.37	-0.49
	(0.55)	(0.52)	(0.51)	(0.78)	(0.52)	(1.43)	(1.57)
INTER_FOR	0.55	0.06	0.42	0.77**	-0.27	1.05**	1.07*
	(0.33)	(0.34)	(0.34)	(0.35)	(0.45)	(0.45)	(0.45)
INTRA_FDI	-0.23	0.14	0.52***	0.05	0.13	-1.37**	-1.33**
	(0.16)	(0.14)	(0.14)	(0.15)	(0.15)	(0.58)	(0.58)
MS	0.45***	0.48***	0.48***	0.48***	0.49***	0.33***	0.33***
	(0.05)	(0.05)	(0.01)	(0.05)	(0.05)	(0.09)	(0.09)
RD	0.03***	0.01	0.01	0.02**	0.02**	0.03	0.03
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
VK		-2.53***	-2.52***				
		(0.23)	(0.26)				
HK		-0.27**	0.19	-0.92***	-0.98***		0.52*
		(0.13)	(0.15)	(0.16)	(0.15)		(0.28)
INTER_BACK*VK			1.17***				
			(0.35)				
INTER_FOR*VK			2.97**				
			(1.42)				
INTRA_FDI*VK			-0.49**				
			(0.09)				
INTER_BACK*HK				4.28**			
				(2.19)			
INTER_FOR*HK					9.73***		
					(3.07)		
# of Obs.	3212	3212	3212	3212	3212	835	835
R-Sq.	0.14	0.24	0.26	0.17	0.17	0.10	0.10

Note: Standard errors in parentheses using White consistent covariance matrix estimator. ***, **, and * indicate that the coefficient is significantly different from zero at the 1%, 5%, and 10% respectively. The models are estimated with the correction of heteroscedasticity and autocorrelation, and with the inclusion of time dummies. All variables are expressed in natural logarithms and spillover variables (INTER_BACK, INTER_FOR, INTRA_FDI) are lagged by one year. In low RCA sectors, there is no a vertical keiretsu presence and none of the interaction terms for horizontal keiretsu is significant.

Finally, Table 4-4 provides the estimation results according to the level of Japan's revealed industry comparative advantages (RCA), measured as international trade performance. The country has a relative efficiency advantage in certain products that make intensive use of resources that are

relatively abundant within the country. Domestic firms directly facing foreign competition through international trade are more likely to cope with competition and eventually benefit from the positive externality arising form a foreign presence. In comparison with the estimation results from high and low-tech sectors, the grouping of RCA sectors appears to add little to the explanation of externality. Thus, the international trade performance may not adequately capture the spillover effect. The exception is the augmented regressions with interaction terms, which reinforce the results obtained from full samples and high/low tech sectors. As presented in columns (1-2) and (6-7), the beneficial effects from inward FDI are limited to the backward linkages for domestic suppliers in high RCA sectors and the forward linkages for domestic buyers in low RCA sectors. These are the only channels to boost the productivity level of domestic firms. This indicates that industry leaders who supply intermediate goods and services to foreign producers are better positioned to gain from FDI in downstream sectors. Moreover, industry laggards who purchase intermediate inputs from foreign supplier also benefit from an upstream foreign presence. Nevertheless, as shown in columns (6) and (7), domestic firms with insufficient absorptive capacities are the least efficient in adapting the frontier technology by foreign owned establishments and the most vulnerable to competition, reducing the likelihood positive externality within sectors. This shows that determinants of productivity spillovers vary depending on the level of RCA. The specifications that include interaction terms are reported in columns (3)-(5) for high RCA sectors. According to our

classifications, vertical keiretsu are present only for high RCA sectors, therefore the models interacted with vertical keiretsu are estimated for only high RCA sectors. The overall results suggest that inter-industry spillovers through both backward and forward linkages in keiretsu intensive sectors (INTER_BACK*VK/HK and INTER_FOR*VK/HK) are positively associated with the productivity level of local firms that posses sufficient revealed comparative advantages. This indicates that the greatest spillovers occur where MNEs purchase/supply intermediate inputs from/to those downstream/upstream sectors dominated by vertically and horizontally linked keiretsu. These findings are mostly consistent with the earlier results reported in Table 4-2 for full samples and Table 4-3 for high/low tech sectors. Over all, our results indicate that the essential conditional relationships exist between transactional linkages and the greater role played by a keiretsu presence irrespective of the level of absorptive capacity.

4.6. Conclusions

This chapter has analysed the presence of knowledge spillovers from inward FDI through transactional linkages. The empirical analysis is based on firm level panel data for the Japanese manufacturing sector between 1997 and 2003. We specifically attempt to identify externalities generated from backward linkages where domestic firms supply intermediate inputs to foreign invested firms in downstream sectors and forward linkages where domestic firms purchase the intermediate inputs and services from foreign firms in upstream sectors.

Our results suggest that spillover effects largely differ according to the level of technological sophistication and the revealed industry comparative advantage of indigenous firms involved. Disaggregating samples into more homogenous group of firms (i.e. the splitting into high and low tech firms) seems to provide better insight how each linkage affects the productivity of indigenous firms. In general, potential productivity spillovers are generated from forward linkages where Japanese firms purchase the intermediate inputs from foreign firms. High-quality intermediate inputs and services provided from upstream foreign suppliers and the domestic firms' ability to utilise fully such inputs contribute to foster the local distribution and the sales network in the host economy. A presence of keiretsu alone has generally negative effects on the productivity of Japanese manufacturing firms. The traditional inter-corporate relations among production keiretsu and financial centred keiretsu are possibly being undermined by competition for resources,

internationalisation, and external pressures to liberalise the Japanese market. However, there are greater efficiency gains in keiretsu intensive sectors for domestic firms that possess sufficient absorptive capacity from a foreign presence in downstream and upstream sectors. Local suppliers/buyers that are aided by the prevalent role of information sharing and networking from keiretsu are very efficient to assimilate foreign knowledge with their own economic activities. By contrast, intra-industry spillovers from inward FDI in sectors dominated by vertical keiretsu network reduce and deteriorate the productivity level of local firms with high absorptive capacity due to adverse competition and crowding-out effects.

The empirical findings obtained from this study offer some useful insights for policy implications. In general, the Japanese government's recent initiatives to improve the investment climate and to promote foreign investments appear to be the optimal policy prescriptions to boost economic development. We suggest that the policies could be more selective and targeted to specific types of inward FDI. It would be sensible to provide fiscal and financial incentives for foreign entrants located in the intermediate product market since they are expected to generate productivity externalities through transactional linkages. It is, however, important to keep in mind that FDI alone is insufficient. Policy makers should also consider the absorptive capacity of indigenous firms and the role played by the keiretsu networks. Given that presences of keiretsu affiliations in the intermediate product market are a powerful device to upgrade the efficiency of domestic firms. We argue that the existence of keiretsu may

allow local firms to benefit more from FDI spillovers, and thus provide better results in terms of increased productivity. The strong transactional linkages and externalities in keiretsu-dominated sectors efficiently foster the diffusions of skills and expertise. It is, therefore, essential to facilitate the learning and motivation of domestic firms to enhance potential knowledge spillovers from foreign entrants. This can be achieved by developing more flexible forms of purchase-supplier relations involved with keiretsu affiliations. Moreover, the government might at least partially subsidy R&D efforts for technologically less advanced firms to raise their ability to absorb foreign resources, technologies, and skills, and upgrade their competitiveness.

Chapter Five

5. Conclusions

The concluding chapter summarises the key findings from empirical chapters, offers the implications for policy makers, and discusses the limitations of a present study and the directions of future research. The thesis has addressed important research questions related to the study of FDI. As stated in chapter 1, the broad objective of this study is to increase our knowledge on the determinants of inward FDI and of productivity spillover effects from FDI in Japan with a particular emphasis on the role of keiretsu networks. The themes we have pursued are topical and timely. The thesis has substantially increased our understanding of these issues by providing several theoretical and methodological advancements. This is the first comprehensive study of FDI in Japan that provides the analysis of determinants and impacts of inward FDI using panel based techniques. Whilst the detailed contributions and policy implications are clearly stated in each empirical chapter, these are briefly summarised below.

5.1. Overall Conclusions

The results from the determinants of FDI in Japan by source country characteristics are generally less consistent with the previous empirical evidence. This inconsistency appears to be largely attributable to the failure to employ panel data econometrics in previous studies. After controlling unobservable country heterogeneity, our results show that relative exchange rate volatility, a higher borrowing cost in the investing country, and stable home country environments increase the probability of a country investing in Japan. By contrast, the export performance of the source country is negative effects of the size of FDI inflows, indicating that international trade and FDI are substitutes. We emphasise that this is the first empirical application for Japan that links FDI inflows with source country characteristics.

With reference to the findings from the sectoral determinants, our results provide a strong empirical support from hypotheses that R&D intensity and domestic market size stimulate foreign involvement particularly in high tech sectors. This is consistent with existing literature. The evidence of both horizontal and vertical keiretsu impacts on foreign penetration depends on not only different proxy measures used for inward FDI, but also on the level of technological sophistication in given sectors. In general, our results demonstrate that networking and information sharing effects of horizontally linked keiretsu are positively associated with foreign productions in knowledge intensive sectors. By contrast, this effect becomes a significant entry barrier for foreign employment in low-tech sectors. Furthermore, government regulations

and market openness in industrial sectors dominated by horizontal keiretsu positively influence sales activities of foreign firms. There is also evidence that economies of scale and industry performance in vertical keiretsu intensive sectors are likely to induce foreign sales. On the other hand, the advertising intensity with a presence of vertical keiretsu is negatively correlated with foreign sales penetration. This suggests that the marketing knowledge within the keiretsu network in Japan acts as an entry barrier to inward FDI. Finally, the results from the quadratic specifications point to the presence of nonlinear threshold effects. The benefits of foreign penetration are more likely to materialise once greater information sharing effects across the horizontal keiretsu have accumulated. Keiretsu affiliations may initially have pre-empting effects on foreign entrants due to fierce competition. However, after reaching a certain threshold level, keiretsu networking becomes a facilitating device for foreign entry. In summary, the main theoretical contribution is that essential determinants of inter-industry variations of inward FDI are dependent on the moderating effects of dominant roles played by the keiretsu network. Furthermore, our new evidence suggests that the relationship between the keiretsu affiliations and inward FDI are non-linear. These may be the reasons of ambiguous results from previous empirical studies of keiretsu impacts on foreign involvement.

Concerning the impact of inward FDI in Japan, the evidence of productivity spillover effects largely differs according to the level of technological sophistication and the revealed industry comparative advantage of indigenous

firms involved. Our results highlight the importance of absorptive capacity of potential recipients as suggested by existing theory. In general, potential productivity spillovers are generated from forward linkages where Japanese firms purchase the intermediate inputs from foreign firms. This is consistent with received literature on transactional linkages. High quality intermediate inputs and services provided from upstream foreign suppliers and Japanese firms' ability to fully utilise such inputs contribute to foster the local distribution and the sales network in the Japanese economy. A presence of keiretsu alone has generally negative effects on the productivity of Japanese manufacturing firms. This is contradictory to the previous empirical evidence. One possible explanation for this inconsistency is that the sample period of our study was one where Japan was still in recession. Therefore, the traditional inter-corporate relations among production keiretsu and financial centred keiretsu might be undermined by competition for resources, internationalisation, and external pressure to liberalise the Japanese market. However, there are greater efficiency gains in keiretsu intensive sectors for domestic firms that possess sufficient absorptive capacity from a foreign presence in downstream and upstream sectors. Local suppliers/buyers that are facilitated by the prevalent role of information sharing and networking from keiretsu are very efficient to assimilate foreign knowledge with their own economic activities. Japanese firms in keiretsu intensive sectors therefore have the opportunity to benefit from access to technologies, innovations, and expertise that would not otherwise have been available in the domestic arena.

As discussed in chapter 4, keiretsu affiliations partly share similar characteristics with industrial clusters in terms of networking and information sharing. Therefore, the finding of positive spillover effects with a keiretsu presence in this study is broadly linked to the existing literature on cluster networks. This suggests that the presence of cluster networks is likely to increase the local welfare benefit from inward FDI. By contrast, intra industry spillovers from inward FDI in sectors dominated by vertical keiretsu networks reduce and deteriorate the productivity level of local firms with high absorptive capacity due to adverse competition and crowding-out effects. Over all, FDI across sectors dominated by keiretsu contributes to the capabilities and resources of local enterprises more effectively than FDI within keiretsu intensive sectors. The result from our preceding chapter suggests that the presence of keiretsu affiliations is an essential Japanese specific institutional characteristic that determines foreign penetration. However, much of the existing literature has largely ignored linking inward FDI spillovers and the role played by keiretsu affiliations. These have been intensively, but individually investigated. The present study offers substantial contributions by being the first to link these two separate issues. In short, the main theoretical contribution of this study rests in jointly exploring the conditional relationship between technological spillovers from foreign multinationals and the presence of vertical and horizontal keiretsu networks with their effects on the productivity of Japanese manufacturing firms. The findings of this study are particularly important in light of previous research that have been limited to an

assessment of either horizontal spillovers from inward FDI or spillovers from a keiretsu presence. Integrating these coexisting topics substantially advances our scientific knowledge on this subject area.

5.2. Policy Implications

The present study raises important implications for policy makers. Our empirical findings from this study can be useful for designing an appropriate framework to effectively attract inward FDI. In general, the Japanese government's recent initiatives to improve the investment climate and to promote foreign investment appear to be the optimal policy prescriptions to boost economic development. With a declining work force, Japan's per capita growth and competitiveness will depend on higher productivity achieved through the efficient use of resources, advanced technologies, and expertise from abroad. Transfer of high quality technologies and managerial know how is regarded as one of the most important benefits the host country may obtain from receiving FDI, since they play a crucial role in achieving sustainable economic growth. Japan needs to be more integrated with the global economy by accessing foreign markets and by introducing competition from foreign firms to spur improvements in the domestic economy. Globalisation should indeed speed internal reform more efficient since foreign firms serve as a stimulus for an inefficient domestic market, particularly in service sectors. Following the collapse of the bubble economy and the subsequent economic slowdown, a general framework has been developed at the national level to

facilitate the operations of foreign companies in revitalising the Japanese economy and in promoting structural reform. The launch of the new triangular-merger law, namely a cross-border equity swap scheme, which enables foreign firms to use their own shares to buy Japanese firms via local affiliates, should encourage more foreign entrants. Compared with the greenfield investments, the time required to start a business, including obtaining permits and licensing procedures, can be substantially reduced. It will also intensify competition through industrial and corporate reorganisations. Increased M&A deals reflect an increase in selling unprofitable divisions and subsidiaries, the reorganisation, the elimination of cross share holdings (by keiretsu), and the restructuring of operations of troubled companies.

With regards to the findings from the first empirical task, our findings show that the business climate of the investing country is also an essential factor determining FDI flows. Majority of FDI inflows to Japan are currently limited from main industrialised countries. The Japanese government can facilitate the activities of international production more from neighbouring transitional economies such as China, South Korea, Taiwan, Hong Kong, and Singapore. Those economies are sufficiently stable to carry out investment in Japan. This will provide new opportunities for their MNEs, and thus create new business opportunities for both investing and recipient economies. Globalisation is no longer limited to mature and large firms, but small- to medium-sized enterprises will also be able to engage in multi-plant operations. In addition, as most of Japan's current inward FDI is mainly market-seeking to satisfy local

demands with little focus on exports. Import substituting FDI can also be encouraged. In the global economy, the business environment is in continuous change. International trades are no longer the only way for firms to internationalise. Establishing joint ventures with foreign partners as well as cross-border mergers and acquisitions have increasingly become common. Japan should encourage FDI inflows not only in services such as finance but also in high technology sectors where Japanese firms have a relative competitive advantage. One possibility is to develop the formation of regional high technology clusters composed of both Japanese *and* non-Japanese firms.

Japan's investment climate can also be much improved by an increased clarity of administrative policy, and by liberalising and abolishing oligopolies in certain areas, particularly in regards to distribution networks. There is perhaps a need to closely monitor keiretsu activities so that affiliated group firms do not carry out exclusionary transactions or exert monopoly control in the market. The current public impression is that dealing with keiretsu following the entry into the Japanese market is difficult and challenging. Clearly, the Japanese government needs to maximise its efforts to improve the overall image of Japan as a market that remains relatively *closed* to foreign entrants. Effective public relations activities and dedicated policy measures are required to create better perceptions of the investment climate faced by potential foreign investors.

Japan should also have a clearer long-term strategy in relation to FDI. The long-term goal is currently unclear – apart from the short- (or medium) term

goal that Japan attempts to attract foreign investors through investment promotions and increased openness of the economy. The numerical goal has been proposed to increase FDI volume without stating in details what are likely to be the expected welfare effects through incoming FDI. In 2003, the government set a target of doubling inward FDI stock between 2001 and 2006 (JETRO 2007). Now a new target has been set for FDI to reach 5% of GDP by 2010, which is more than twice the 2005 figure. Concluding that an increased investment is always beneficial is inappropriate. Whether FDI is beneficial depends on how local networks interact with international networks, and whether firms cooperate or compete. The emphasis should be placed on the quality of FDI rather than the quantity of FDI. The challenge for the future, therefore, is to successfully attract and foster 'quality' inward FDI – FDI that is most likely to form beneficial linkages with local industry and to understand what barriers to linkage formation, local sourcing, and capability upgrading exist. We suggest that the policies could be more selective and targeted to the specific types of inward FDI. It would be sensible to provide fiscal and financial incentives for foreign entrants located in intermediate product markets since they are expected to generate productivity externalities through transactional linkages. Foreign firms are likely to offer an alternative route for the future development of technologies and access to international expertise and markets. It is, however, important to keep in mind that FDI alone is insufficient. Policy makers should also consider the absorptive capacity of potential recipients and the role played by keiretsu networks. Given that a

presence of keiretsu affiliations in intermediate product markets is a powerful device for upgrading the efficiency of domestic firms. We argue that the existence of keiretsu may allow local firms to benefit more from FDI spillovers, and thus provide better results in terms of increased productivity. The strong transactional linkages and externalities in keiretsu-dominated sectors efficiently foster the diffusion of skills and expertise. It is, therefore, essential to facilitate learning and motivation of domestic firms to enhance potential knowledge spillovers from foreign entrants. This can be achieved by developing more flexible forms of purchase-supplier relations involved with keiretsu affiliations. The joint business relationships with foreign firms offer a way to become part of a global strategy that local players might not be able to achieve on their own. Linking up with foreign firms in many cases will provide Japanese firms with needed expertise in corporate restructuring, technology implementation, and other areas where they have not been able to achieve so far. Moreover, the government might at least partially subsidise R&D efforts for technologically lagging firms to raise their ability to absorb foreign resources, technologies, and skills, and to upgrade their competitiveness.

5.3. Limitations and Future Research

Our empirical results need to be viewed in the context of inherent limitations. In general, data availability is one of the notorious obstacles confronting researchers carrying out international empirical studies on FDI. First, the aggregate FDI data utilised for the study to analyse FDI determinants of source country characteristics is based on notification inflows. Therefore, the data

does not necessarily reflect the realised value as in the case of balance of payment statistics. The results need to be interpreted as an intention or an anticipation of firms to undertake multinational operations in Japan. Another constraint related to the macro analysis of FDI by country origins is to accurately identify the real nationalities of investing countries. Firstly, the considerable proportions of investments from our current data are recorded from offshore sites through subsidiaries of foreign MNEs registered in tax haven countries. Therefore, it is not possible to identify the nationalities of foreign MNEs. Secondly, the additional investments made by foreign firms already established in Japan are also not reflected in our analysis. Given the exclusions of these cases from the sample, our findings might largely underestimate the operations of foreign firms and not fully represent the entire investing economies in Japan.

Concerning the sectoral study of keiretsu impacts on inward FDI, the analysis is limited to manufacturing sectors. As such, the findings are not fully generalisable to non-manufacturing sectors. The research project reported here can be taken forward in several ways. The conditions affecting FDI are expected to change in the future. In fact, the sectoral composition of FDI trends is significantly shifting globally towards more FDI in service sectors. The service sector accounts for almost 70% of GDP and two-thirds of employment in the Japanese economy. Given the increasing importance in service sectors, an interesting avenue for future research is to analyse the impacts of a keiretsu presence in service sectors using the longitudinal data. A longer panel would

also allow us to examine if certain hypotheses predict relatively better during specific stages in the growth of the industry. Another limitation is that the unavailability of keiretsu data from several different data sources has hindered us to carry out a sensitivity analysis to check the robustness of the results on keiretsu effects. Future research might build on the results of this study by collecting data for different sample of keiretsu-affiliated firms and by comparing the effects on both service and manufacturing sectors. Finally, the analysis in this study is carried out based on the theoretical paradigm of FDI that is undertaken principally to exploit firm specific advantages in Japan. Our model does not *explicitly* test for the motives of technology sourcing. Future research can be extended to examine whether or not FDI is undertaken to access unique technological resources and capture externalities created in Japan with a dominant role of keiretsu presences.

With regards to the determinants of productivity spillovers from FDI, our study neither distinguishes the ownership structure (i.e. wholly owned or shared ownership) of foreign firms nor the motives of FDI (i.e. technology exploiting and sourcing). The possible extensions of the results presented here are to investigate the impacts of different ownership structures and the motives on FDI spillovers in Japanese firms. In addition, as suggested earlier, the opening of service sectors to foreign exposure might be a crucial channel through which TFP performance of Japanese firms can be improved. TFP is the most important driver of growth for advanced economies. Given the trends of a declining working population and low returns on capital, the future growth

prospects of the Japanese economy crucially depend on the ability to raise TFP growth (Paprzycki and Fukao 2004). The Japanese government has already started to liberalise the financial and telecommunications sectors by encouraging incoming FDI in the 1990s. The impact of service liberalisation on FDI spillovers in the Japanese manufacturing sector will also provide a promising avenue for theoretical and empirical development.

Appendix A
Measurement and Data Sources

Variables	*Measurement and Data Source*
FDI	Real FDI notification inflows from source countries (JETRO: FDI notification statistics), Japanese GDP deflator (1995=100) (IMF: International Financial Statistics)
GDP	Real GDP of source countries (IMF: International Financial Statistics), GDP deflators of source countries (1995=100) (OECD: Economic Indicators)
EXPO	The ratio of real source country export in Million US$ to real source country import in Million US$ from Japan (IMF: IMF: Direction of Trade Statistics), US GDP deflator (1995=100) (IMF: International Financial Statistics)
EXR	Relative index of real annual average source country exchange rate to Japanese Yen (IMF: International Financial Statistics for Non-European Exchange rate. Board of Governors of the Federal Reserve System for EU countries), CPI of each sample country (1995=100) (IMF: International Financial Statistics)
EXRV	The coefficient of variation of real monthly average exchange rate of source country against Japanese Yen. Coefficient of Variation (CV) is standard deviation divided by mean (3 years moving average of real exchange rate) IMF: International Financial Statistics for Non-European Exchange rate. Board of Governors of the Federal Reserve System for EU countries), CPI of each sample country (1995=100) (IMF: International Financial Statistics)
LR	Real lending rate of source country minus lending rate of Japan (IMF: International Financial Statistics), Lending rate minus inflation (CPI: 1995=100) of each sample country (IMF: International Financial Statistics)
LC	Relative index of nominal compensation costs in US$ for production workers in manufacturing of source countries to nominal Japanese costs (U.S. Department of Labour: Bureau of Labour Statistics), No deflators used. Series indexed with 1990=100
CRSK[42]	Source country credit ratings between 0-100, with 0 least credit

[42] There might be serious drawbacks associated with given arbitrary measures and subjective assessment of indicators. Following Schneider and Frey (1985), Wei and Liu (2001), Carstensen and Toubal (2004), Janicki and Wunnava (2004), political risk in this study is approximated by using investment climate of country credit ratings in which the political component is prominent. The rating reflects the expectations of leading international banks that a sovereign borrower will default on its debts, which manifests inversely related to an observed risk.

worthy country and greatest chance of default with their debt; with 100 most credit worthy country. The rating is evaluated by 75 world-leading bankers. (Institutional Investor: Country Credit Ratings)

SDIST Spatial Distance is measured in kilometres between Tokyo and capital cities (Atlas of the World). Vancouver and Los Angels are used for Canada and the U.S. respectively instead of capital cities.

CDIST The Cultural Distance measure follows Grosse and Trevino (1996), with total cultural distance is measured as the sum of absolute values of the five dimension differences from source country to Japan. Five dimensions are consisted with Power Distance, Uncertainty Avoidance, Individuality, Masculinity, and Long Term Orientation based on the latest study of Hofstede (2001). The missing index for Luxembourg is replaced by Belgium as a proxy.

Sample Descriptive Statistics

	Mean	Median	Max.	Mini.	Std. Dev.
FDI	424.41	67.05	9,511.98	0.01	1,175.39
GDP	997,604.20	347,208.50	9,439,514.00	13,396.00	1,850,832.00
EXPO	13,568.67	5,852.40	132,118.40	25.22	25,999.95
EXR	0.90	0.90	1.23	0.57	0.14
EXRV	9.79	9.35	24.30	3.20	3.47
LR	4.64	4.44	14.29	-0.20	2.33
LC	0.81	0.80	1.65	0.47	0.19
CRSK	82.89	84.60	96.20	53.60	8.45
SDIST	8,273.64	8,913.29	9,855.09	1,154.81	2,110.60
CDIST	167.83	171.00	248.00	102.00	42.51

Appendix B

Variable Name	*Data Sources*
FPEMP, FPSALES, AD, KL, RD, SCALE	*Heisei 9~15 Nen Kigyo Katsudo Kihon Chosa Hokokusyo: Sogo Tokeihyo* (Results of the Basic Survey of Japanese Business Structure and Activities 1998~2004: Volume 1 Summary Report) from Research and Statistics Department, Economic and Industrial Policy Bureau, Ministry of Economy, Trade and Industry (METI)
REG	Indices for 1997~2002 are taken from Japan Industrial Productivity (JIP) Database 2006 from Research Institute of Economy, Trade and Industry, Incorporated Administrative Agency (RIETI). Index for 2003 are constructed similar manner as JIP Database using ' Kisei Kanwa Hakusyo' (White Paer on Public Regulations) from Ministry of Internal Affairs and Communications. Data for value added from I-O Table are used as weight for 2003.
MSIZE	Data for 1997~2002 are taken from Japan Industrial Productivity (JIP) Database 2006 from Research Institute of Economy, Trade and Industry, Incorporated Administrative Agency (RIETI). Gross output for 2003 is taken from Linked Input Output table from METI and Net import for 2003 is from JIP Database.
OPEN, RCA	Trade (export and import) data for 1997~2003 are taken from Japan Industrial Productivity (JIP) Database 2006 from Research Institute of Economy, Trade and Industry, Incorporated Administrative Agency (RIETI). Gross output for 2003 is taken from Linked Input Output table from METI and Net import for 2003 is from JIP Database.
HK	The list of *Shyacho-Kai* (President Club) membership by Big Six financial keiretsu are taken from two sources: *"Kigyo Keiretsu Soran* 1999 and 2000" (Corporate Affiliations) from Toyo Keizai Shinposhya and "*Kigyo Syudan no Jittai ni tsuite - Dai 6~7 ji Cyosa Hokokusyo*" (Research on Industrial Groupings: 6~7-th Survey) from Japan Fair Trade Commission. The members of so-called Big Six are Mitsui, Mitsubishi, Sumitomo, Fuyo, Sanwa, and DKB, which have been merged to Big Four (Mitsubishi, Mitsui-Sumitomo, Mizuho and UFJ) during 1999 to 2002. Sales data of each member firms are collected from "*Yukashoken Hokokusyo*" (Annual Securities Report) using EDINET (Electronic Disclosure for Investors' Network) of Financial Services Agency, The Japanese Government.
VK8, VK4	"*Sales Ranking*" from Money & Market Nikkei Net and *"Nippon no Kigyo Gurupu 2003*" (Corporate Groupings in Japan) from Toyo Keizai Shinposhya. Sales data are also collected and checked from "*Yukashoken Hokokusyo*" (Annual Securities Report) using EDINET (Electronic Disclosure for Investors' Network) of Financial Services Agency, The Japanese Government.
CGPI	Corporate goods price index (2000=100) is taken from Bank of Japan.

Correlation Matrix for Independent Variables

	AD	KL	RD	REG	MSIZE	SCALE	OPEN	RCA	HK	VK4	VK8
AD	1.00										
KL	-0.15	1.00									
RD	0.37	-0.14	1.00								
REG	0.30	0.25	0.22	1.00							
MSIZE	0.17	0.10	0.42	0.25	1.00						
SCALE	-0.23	-0.02	-0.31	-0.21	-0.65	1.00					
OPEN	-0.12	-0.23	0.12	-0.08	0.08	0.22	1.00				
RCA	-0.10	-0.16	0.46	-0.23	0.38	-0.38	0.03	1.00			
HK	-0.07	0.41	0.23	0.23	0.38	-0.22	0.07	0.32	1.00		
VK4	-0.10	-0.12	0.27	0.12	0.39	-0.13	0.23	0.43	0.34	1.00	
VK8	-0.10	-0.13	0.29	0.12	0.40	-0.14	0.24	0.43	0.35	0.99	1.00

High Technology Sectors

1. Chemical fertilizers; Industrial inorganic chemicals; Chemical fibbers; Oils and fat products, soaps, synthetic detergents, surface-active agents and paints, 2. Industrial organic chemicals, 3. Drugs and medicines, 4. Miscellaneous chemical and allied products, 5. Tires and inner tubes; Miscellaneous rubber products, 6. Primary smelting and refining of non-ferrous metals; Secondary smelting and refining of non-ferrous metals, including non-ferrous alloys; Rolling of non-ferrous metals and alloys, including drawing and extruding; Electric wire and cable; Non-ferrous metal, 7. Metal working machinery; Special industry machinery; Office, service industry and household machines, 8. Miscellaneous machinery and machine parts, 9. Electrical generating, transmission, distribution and industrial apparatus; Household electric appliances; Electronic equipment; Communication equipment and related products; Electronic data processing machines, digital and analogue computer, equipment and accessories, 10. Miscellaneous electrical machinery equipment and supplies, 11. Electronic parts and devices, 12. Motor vehicles, parts and accessories, 13. Medical instruments and apparatus; Optical instruments and lenses; Watches, clocks, clockwork-operated devices and parts; Miscellaneous precision instruments, 14. Miscellaneous manufacturing industries

Low Technology Sectors

1. Livestock products; Miscellaneous foods and related products, 2. Seafood products, 3. flour and grain mill products, 4. Soft drinks and carbonated water; Alcoholic beverages; Tea and coffee; Tobacco manufactures, 5. Prepared animal foods and organic fertilizers, 6. Silk reeling plants; Spinning mills, 7. Woven fabric mills; Knit fabric mills, 8. Dyed and finished textiles, 9. Miscellaneous textile mill products, 10.Textile outer garments and shirts, including bonded fabrics and lace, except Japanese style, 11. Other textile apparel and accessories; Miscellaneous fabricated textile products, 12. Sawing, Planning mills and wood products; Millwork, plywood and prefabricated structural wood products, 13. Miscellaneous manufacture of wood products, including bamboo and rattan, 14. Furniture; Miscellaneous furniture and

fixtures, 15. Pulp; Paper, 16. Paper products; Miscellaneous pulp, paper and paper worked products, 17. Printing; Service industries related to printing trade, 18. Petroleum refining; Miscellaneous petroleum and coal products, 19. Plastic plates, bars and rods, pipes and tubes, pipe fittings and profile extrusions; Plastic films, sheets, floor coverings and synthetic leather; Industrial plastic products; Formed and reinforced plastic products; Compounding plastic materials, including reclaimed plastics; Miscellaneous plastic products, 20. Leather tanning and finishing; Fur skins, 21. Glass and its products; Cement and its products; Miscellaneous ceramic, stone and clay products, 22. Iron industries; Steel with rolling facilities; Steel materials except made by smelting furnaces and steel works with rolling facilities except coated steel, 23. Ferrous metal machines parts and tooling products; Miscellaneous iron and steel, 24. Fabricated constructional and architectural metal products, including fabricated plate work and sheet metal work, 25. Miscellaneous fabricated metal products, 26. Miscellaneous transportation equipment

Appendix C

This appendix supplements information on the construction of variables and data sources used in the analysis.

Output (Y) is defined as real total gross revenue (in millions of Japanese yen) deflated by 93SNA (System of National Account) output price deflators. Capital (K) is expressed as real value of tangible fixed assets (in millions of Japanese yen) deflated by 93SNA GDP deflators. Material (M) is the real cost of intermediate input defined as the cost of goods sold (in millions of Japanese yen) deflated by 93SNA input price deflators. Labour (L) inputs are based on man-hour measured as the number of employees multiplied by sectoral working hours. Real value added (VA) is real output less real material. Technology (RD) is expressed as the real value of intangible fixed assets using 93SNA GDP deflators. Alternative proxy for technology that is frequently used in the empirical studies is an input indicator of R&D expenditures. However, given the large missing values on this data in ORBIS, output indicators of intangible fixed assets are used for our analysis. All firm level data are obtained from ORBIS, compiled by Bureau van Dijk. Since working hours for firm level data are not available in ORBIS, instead sectoral working hours at the two-digit level are used to construct labour inputs. All price indices (2000=100) to deflate nominal monetary values and sectoral working hours are taken from SNA, Economic and Social Research Institute (ESRI) from Cabinet office in Japanese government.

Sector specific variables for intra-FDI and inter-FDI spillovers (backward and forward linkages) are constructed using two data sources. The share of a foreign presence is obtained from, *Heisei 9~15 Nen Kigyo Katsudo Kihon Chosa Hokokusyo: Sogo Tokeihyo* (Results of the Basic Survey of Japanese Business Structure and Activities 1998~2004: Volume 1 Summary Report) from Research and Statistics Department, Economic and Industrial Policy Bureau, Ministry of Economy, Trade and Industry (METI) (see Chapter 3 of this thesis). The linkage coefficients at the two-digit level are taken from the extended Input-Output Matrices annually published from Research and Statistics Department, Economic and Industrial Policy Bureau, METI. The three-digit FDI sectors are aggregated to the two-digit level to match the Input-Output Matrices. Finally, information of vertical and horizontal keiretsu are taken from Chapter 3, "*Sales Ranking*" from Money & Market Nikkei Net and *"Nippon no Kigyo Gurupu 2003*" (Corporate Groupings in Japan) from Toyo Keizai Shinposhya. Sales data are also collected and checked from "*Yukashoken Hokokusyo*" (Annual Securities Report) using EDINET (Electronic Disclosure for Investors' Network) of Financial Services Agency, The Japanese Government.

In order to identify the differences in the productivity performance of domestic firms, full samples are split into sub-groups according to the level of absorptive capacity which is proxied as knowledge intensity and revealed comparative advantages (RCA). The former is measured as real value of intangible fixed assets normalised by real total revenues taken from ORBIS,

and the latter is measured as real net export less real net import divided by sum of real trade volume obtained from JIP database 2006, Research Institute of Economy, Trade and Industry (RIETI).

Appendix D

This section provides NACE (rev. 1.1) classification of absorptive capacity according to the level of knowledge intensity and revealed industry comparative advantages (RCA).

High Tech Sectors

(22) Publishing, printing and reproduction of recorded media; (24) Manufacture of chemicals and chemical products; (27) Manufacture of basic metals; (30) Manufacture of office machinery and computers; (31) Manufacture of electrical machinery and apparatus n.e.c.; (32) Manufacture of radio, television and communication equipment and apparatus; (33) Manufacture of medical, precision and optical instruments, watches and clocks; (36) Manufacture of furniture; manufacturing n.e.c.

Low Tech Sectors

(15) Manufacture of food products and beverages; (16) Manufacture of tobacco products; (17) Manufacture of textiles; (18) Manufacture of wearing apparel; dressing and dyeing of fur (19) Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear; (20) Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; (21) Manufacture of pulp, paper and paper products; (23) Manufacture of coke, refined petroleum products and nuclear fuel; (25) Manufacture of rubber and plastic products; (26) Manufacture of other non-metallic mineral products; (28) Manufacture of fabricated metal products, except machinery and equipment; (29) Manufacture of machinery and equipment n.e.c.; (34) Manufacture of motor vehicles, trailers and semi-trailers; (35) Manufacture of other transport equipment

High RCA Sectors

(21) Manufacture of pulp, paper and paper products; (24) Manufacture of chemicals and chemical products; (25) Manufacture of rubber and plastic products; (26) Manufacture of other non-metallic mineral products; (27) Manufacture of basic metals; (28) Manufacture of fabricated metal products, except machinery and equipment; (29) Manufacture of machinery and equipment n.e.c.; (30) Manufacture of office machinery and computers; (31) Manufacture of electrical machinery and apparatus n.e.c.; (32) Manufacture of radio, television and communication equipment and apparatus; (33) Manufacture of medical, precision and optical instruments, watches and clocks; (34) Manufacture of motor vehicles, trailers and semi-trailers; (35) Manufacture of other transport equipment

Low RCA Sectors

(15) Manufacture of food products and beverages; (16) Manufacture of tobacco products; (17) Manufacture of textiles; (18) Manufacture of wearing apparel; dressing and dyeing of fur; (19) Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear; (20) Manufacture of wood and of products of wood and cork, except furniture; manufacture of

articles of straw and plaiting materials; (22) Publishing, printing and reproduction of recorded media; (23) Manufacture of coke, refined petroleum products and nuclear fuel; (36) Manufacture of furniture; manufacturing n.e.c.

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