What drives foreign direct investment in Southeast Asia? A dynamic panel approach

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Abstract

This study analyses the determinants of foreign direct investment (FDI) for a panel of countries in South, East and Southeast Asia within the framework of a partial stock adjustment model. I find that most of the determinants as proposed by the new trade theory show expected and significant effects, while the direction and level of impact may well vary across sectors of industry. Moreover, I show that FDI has a positive and significant effect on both exports and imports and that cross-industry spill-overs contributed to the increase in trade flows in Southeast Asia.

Keywords: FDI, partial stock adjustment model, dynamic panel.
JEL-classification: F21, F23, O53.

1 Motivation

Foreign direct investment (FDI) has played an important role in the economic development of Southeast Asia over the last two decades as a major source of capital and technological know-how. It has largely contributed to the tremendous growth performance of most countries in the region by establishing trade linkages between foreign subsidiaries, local regional suppliers and parent companies by the means of an efficient international division of labour. The dynamic change in country- and industry-specific determinants of FDI over time and across countries, however, has not left unchanged

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the regional pattern of trade and investment flows and reinforced the shift of resources according to the new comparative or absolute advantages and competitiveness. Outward investment facilitates the structural adjustment in the capital-source country by transferring abroad the industries in which the economy is losing its comparative advantage. Major former recipients of FDI have become large suppliers of capital, labour and foreign exchange or have emerged as a powerful force of demand for less capital-intensive goods when their economies have succeeded in the specialization of more sophisticated or differentiated products. In particular, the appearance of fast and persistently growing China on the economic landscape has attracted large FDI inflows of Western industrialized countries, mainly on the cost of other labour-abundant countries in the region, and has henceforth significantly reshaped the trade-FDI nexus in Southeast Asia.

The tremendous magnitude and rapid growth of direct investment inflows experienced by all countries in this region since the early 1980s, and particularly in China in the 1990s, makes it an important case to study the driving factors of FDI and to identify the impact on other international transactions, namely trade. China's repercussion on the global economy as the world's assembling factory and second largest trading nation is not negligible anymore. Strong demand and supply effects may be easier than ever carried over to European consumers and suppliers through the rise in the international synchronization of business cycles[1]. More traditionally, trade in goods and services, as well as international portfolio flows in financial assets accounted for the most prominent channels for the growing co-movements of business cycles. The increasing integration of corporate production networks, following the global liberalization process in both trade and investment in the 1980s and 90s, has established another dimension for the transmission of economic trends across countries. Multinational enterprises (MNEs) engaging in FDI turn the host and source economies more sensitive to economic disturbances from abroad, either directly through production decisions of parent companies or indirectly via trade in intermediate or final goods. As a consequence, only the sum of or inter-relationship between international trade and foreign direct investment can fully capture the significance of today's globalisation process, its impact on the synchronization of international business cycles, and thus our understanding of the global economy.

In fact, much of the international flow of goods is accounted for by multinational corporations in the form of intra-firm trade between parent company and affiliates (UNCTAD, 1996 and 2002). In the United States, for example, Filipe et. al (2002) show that as much as 40% of total exports and imports during the 1990s was accounted for by US and foreign-owned

[1] In 2001, the difference in cross-country growth rates of industrialised economies even fell to its lowest level since more than 30 years (Jansen and Stokman, 2004).

multinationals.[2] Comprehending the role of MNEs plays therefore a dominant role in disentangling the relationship between FDI and trade and is essential for policy-makers to grasp the potential balance-of-payments effects. Imports of intermediate goods by foreign affiliates in the short-term together with the repatriation of profits in the medium-to long-term may give rise to the impression of a net negative impact, but doing so ignores the potential counter-balancing effects of a subsidiary importing capital in the form of financial assets, generating exports and producing import substitutes. In addition, intra-firm trade prevailing amongst MNEs' affiliates is likely to behave differently to key economic variables such as income or exchange rates with respect to conventional trade. Multinationals make their decisions under exchange rate uncertainty and their responsiveness to changes in the level of exchange rates will substantially influence overall economic activity.

This paper will link several, mostly independent, strands of the literature on foreign direct investment in order to encompass the elements outlined above and to enrich our understanding of the determinants and consequences of the trade-FDI relationship. Based on the work by Helpman (1984, 1985), Markusen (1985, 2000) and Markusen and Venables (1998) in the context of the new trade theory, a model is developed that addresses the determinants of foreign direct investment on the substance of the underlying theory and, in addition, controls for a set of variables, which have either been left unspecified or tested separately in previous empirical work. The approach of this paper is a two-step procedure that first aims at disentangling the determinants of foreign direct investment in Southeast Asia in the period from 1981 to 2002, and secondly, tries to measure the impact of FDI on the trade flows of the sample countries in this region. The first part of this study uses a modified gravity equation within the framework of a partial stock adjustment model, which employs the standard gravity-type variables along with different moments of FDI-weighted effective exchange rates, factor-endowment proxies and source-countries' equity indices as a measure of firm-specific intangibel assets and the degree of business-cycle transmission. In addition, with the inclusion of the lagged stock of FDI as an explanatory variable the model incorporates the dynamics of adjustment over time and hence allows for the effects of agglomeration and external economies of scale. The second part is devoted to determine the impact of direct investment on trade using a similar gravity-type model that deliberately incorporates FDI as a regressor.

Both types of analysis are carried out at the disaggregated industry level for a sample of ten countries (China, Hong Kong, Indonesia, Japan, Repub-

[2]The OECD (Organisation for Economic Co-Operation and Development) Economic Outlook (2002) reports similar figures for the United States and somewhat lower shares for Japan (31% of exports and 24% of imports in 1999).

lic of Korea, Malaysia, Philippines, Singapore, Thailand and Taiwan)[3] and ten industries at the two-digit ISIC Rev. 3 level and for the aggregates of the primary, secondary and tertiary sectors for the period from 1981 to 2002. Given that no data at the bilateral sector-level for FDI is available, the dataset is further refined by calculating the relative share of each source country from the aggregate geographical distribution of FDI inflows and applying those weights to relevant potential determinants of direct investment at the industry-breakdown. This approach is unique to the best of my knowledge and allows employing country-specific parameters at the industry level, which in turn provides the necessary filter to disentangle the eventual counterbalancing effects at an aggregate level.

The remainder of this paper is structured as follows. Section 2 briefly offers a description of the main trends in foreign direct investment and trade over the past two decades in Southeast Asia. Section 3 reviews the current literature on the theory of the multinational enterprise and the channels through which direct investment might be determined and impact the cross-border trade flows of the recipient countries. Section 4 develops the model and introduces the reader to the econometric methodology and data specifications. Section 5 presents the results and evaluates those against the background of the theory introduced before. Section 6 summarises the main findings and draws some policy conclusions.

2 Empirical background

2.1 Developments in foreign direct investment

The developments in world foreign direct investment since the beginning of the 1980s have substantially contributed to the increased integration of the global economy and the perceived degree of globalisation. In fact, direct investment figures reported by the United Nations Conference on Trade and Development (UNCTAD database, 2004) suggest that world FDI has grown considerably in both the 1980s and 1990s at average annual rates of growth of 17.5% and 20.9% respectively.[4] In comparison, the increase in world total trade over the same two periods amounted to 5.8% and 6.7% respectively, underlining the relative importance of FDI in establishing new links between national economies. Nevertheless, direct investment continues to be a very volatile phenomenon with large annual fluctuations, including

[3] In what follows and for the ease of illustration, I refer to this group of countries as Southeast Asia, unless otherwise indicated, although I note that this is geographically not strictly correct.

[4] Direct investment in 2001 and 2002 experienced a global downturn from the peak levels registered in 2000, with two-digit negative rates of growth in the vast majority of countries. This section of the study is more concerned about the rise in FDI and its consequences up to 2000, while the analytical part below encompasses the most recent years as well.

negative rates of growth, reflecting the up- and downturns in the global economy and eventually further strengthening the degree of business cycle transmission across countries.[5] World FDI inflows amounted to USD 651.2 billion in 2002 or 12.2% of global gross fixed capital formation. The stock of inward direct investment world-wide grew almost continuously from 6.7% of global gross domestic product (GDP) in 1980 to 22.3% in 2002.

[Table 1 about here]

Table 1 reveals the relative importance of FDI in most of the economies in Southeast Asia. In the vast majority of countries, the average annual rates of growth in both the 1980s and 1990s have significantly outpaced the global developments with growth rates partially averaging three-digit levels. Over time, Southeast Asia became gradually an attractive host to world FDI flows, doubling its share in global direct investment during the 1990s with respect to the previous decade (from 9.1% to 18.2%). This tremendous development is mostly accounted for by China, which succeeded in increasing its share from a low of 1.5% to 7.7% of world FDI in the 1990s. Together with Japan, Southeast Asia attracted nearly as much of global foreign direct investment as the United States over the same period, suggesting a small shift of world FDI flows from industrial economies to countries in means of development (the share of developed countries decreased from 74.4% to 65.5%). In particular, direct investment growth rates in Japan reflect the large volatility of FDI inflows and are largely explained by base-effects, while the nominal value of FDI inflows is comparatively stable and low. The outbreak of the East Asian financial crises in 1997 had no significant impact on FDI flows into the region, with the only exception being Indonesia, which reported net outflows since the outburst and up to 2002.

More specifically, for Southeast Asia as a whole, direct investment has turned into a crucial source of capital, accounting for 10.3% of gross fixed capital formation as at the end of 2001, compared to only 5.0% eleven years earlier. For small open economies like Hong Kong and Singapore these ratios account for an overwhelming share of total capital formation, but the overall importance of FDI as a fund of capital during the 1990s turned out to be a global phenomenon. However, the financial crises in 1997 had a major impact on the form of capital formation, leading to a reduction in foreign greenfield investments (i.e. the raise of new capital) and a marked increase in mergers and acquisitions (M&A).[6] This development was mostly due to the uncertainty foreign investors were facing after the crises and the

[5] Interestingly, in the years 1982, 1991 and 2001, which were deemed to be global recessions or downturns, world foreign direct investment recorded negative rates of growth, with the latest one being the most pronounced.

[6] Data reported by the Thomson Financial database reveals that the volume of M&A deals in all countries in Southeast Asia, besides Hong Kong and Indonesia, rose sharply

subsequent relaxation of restrictions on equity participation in most of the countries. Nevertheless, after two decades of sustained net inflows, the share of foreign direct investment in total economic activity reveals the significance of FDI in Southeast Asia relative to other regions in the world. The inward stock of direct investment as a share of GDP increased from an already high level of 20.9% in 1990 to 38% in 2002, which is more than twice as high as for the industrial economies as a whole (18.7%). In particular, for the above mentioned economies of Hong Kong and Singapore the FDI stocks have already exceeded the value of gross domestic product, but even for relatively large countries like Indonesia, China or Malaysia foreign direct investment plays a substantial role in the overall economic activities with 32.2%, 36.2% and 59.4% of GDP respectively.

[Table 2 about here]

Looking at the geographical breakdown of FDI inflows into Southeast Asia, table 2 shows the importance of Western industrialised economies as a source of foreign capital in the region. In the five-year-period from 1995 to 1999, the United States accounted on average for more than 20% of direct investment inflows in six out of ten countries, with the Netherlands and the United Kingdom following closely behind. Germany, France and, to a lesser extent, Switzerland were still fairly broadly investing in most of the countries of Southeast Asia. Large direct investment inflows originating from offshore financial centres like the Bermudas, the British Virgin Islands and the Cayman Islands are likely to reflect the place of capital procurement and stock listing rather than the investing economy, indicating the increasing degree of global capital diversion. A similar observation relates to the case of China and Hong Kong, where Chinese investors are thought of as transferring capital offshore to Hong Kong in order to revert it back to China disguised as foreign direct investment.[7] More interestingly, with the increased regional integration efforts and the emergence of the Newly Industrialising Countries (NICs) as sources of capital for other less-developed economies in the region, intra-Southeast Asian FDI has significantly gained in importance over time.[8] While Japan is still the second biggest investor in Southeast Asia after the United States, Taiwanese and especially Singaporean companies are gradually shifting more-labour intensive parts of their value-added chains to subsidiaries in comparatively advantaged neighbouring economies. Indeed, Japanese and Singaporean shares in direct investment inflows in Indonesia, Malaysia and Thailand were among the highest in these countries.

after 1997. Of course, this period coincides with the global boom in mergers and acquisitions.

[7] This phenomenon is also known as 'round-tripping' and has received some attention in the literature (see Xiao, 2003 and World Bank, 2002).

[8] The NICs comprise Hong Kong, Singapore, Taiwan and the Republic of Korea.

[Table 3 about here]

For the former first two economies this can also be seen by the relatively large average share of FDI inflows into the more labour-intensive manufacturing sector (see table 3). Unfortunately, Indonesia does not report individual figures on investment into the petroleum sector, which presumably accounts for a similar or higher share as in Malaysia (22.4%), given that both countries are the largest holders of proved oil reserves in the region. China's wave of global direct investment inflows in the 1990s has predominately targeted the manufacturing sector, accounting for the highest share of secondary investment in the region and reflecting the factor-reward driven FDI into the country. More surprisingly, other Southeast Asian economies with a relatively low capital-labour ratio like the Philippines and Thailand attracted large amounts of direct investment in the tertiary sector over the period from 1990 to 1999, with nearly 50% and 66.5% respectively. These investments were primarily concentrated in the finance sector and, with respect to Thailand only, in the trade and real estate industry (together 30.5%). Among the group of NICs, sectoral data on FDI confirm the increased development and relative importance of the tertiary industry, which accounts for the overwhelming share in total direct investment inflows in Hong Kong (92.8%) and Singapore (73.4%). Instead, in Korea and Taiwan the manufacturing sector still attracts slightly more than half of all FDI inflows, but with the majority being invested in high-tech industries such as electronic equipment and chemical products. In Japan, direct investment was mainly in the service industry (60.5%) and in the machinery-manufacturing sector (23.9%).

2.2 Patterns in trade flows

The developments in trade flows in Southeast Asia followed closely the dynamics in foreign direct investment, albeit to a lesser extent and somewhat more moderate. Annual average rates of growth in the period from 1990 to 1999 ranged from 4.3% in Japan to 15.7% in China, with the average rate across all countries in the region amounting to 10.3%. Exports and imports evolved thereby almost symmetrically within each economy, with the only major exception being China, where exports were on average growing by 4% faster than imports. Overall, this fast increase in the volume of international transactions during the 1990s resulted in a sharp rise in the share of exports and imports in total economic activity in the majority of countries. The Philippines recorded the highest increase in the relative weight of trade in GDP from 59.4% in 1990 to 123.6% in 2000, while in China, Indonesia and Thailand the share of trade in GDP almost doubled over the same period. In contrast, Singapore even experienced a pronounced decline by 43.8% in

its portion of exports and imports in total domestic activity, but trade nevertheless still accounted for a tremendous 244.2% of GDP in 2000. Malaysia evolved as the second most open economy in the region, followed by Thailand and the Philippines with a trade to GDP ratio of 223.2%, 123.7% and 123.6% respectively.

[Table 4 about here]

The geographical pattern of export flows is strikingly homogenous across countries in the period from 1990 to 1999, reflecting the high degree of intra-Southeast Asian trade dependence and indicating the existence of regional production networks. Table 4 reveals that out of the ten most important export trading partners of all economies in the region only six countries are non-Asian countries, which can essentially be reduced to four countries when ignoring the minor share of Canada and the former USSR in the bilateral export shares to Hong Kong and China respectively. Most of this intra-regional share is still accounted for by Japan, which remains a major export destination specifically for less-developed Southeast Asian economies. Yet, the Newly Industrialising Countries also contributed to the rise in intra-regional trade with non-redundant shares in the vast majority of countries. However, the United States accounted for a significant share of exports in all Southeast Asian economies, evolved as the most important export partner for six countries in the region and absorbed on average up to 35% of all Philippine exports. Similar to the developments in foreign direct investment, Germany, the United Kingdom and the Netherlands emerged as the most significant export destinations in Western Europe.

The picture of import flows[9] is less homogeneous and is characterised by a much larger number of import partners and of higher geographical diversity, including countries from Africa and the Middle East. The latter regions are likely to reflect the growing need for raw materials, which arose when Southeast Asian economies succeeded in specialising in manufacturing industries. Important to note is that market proximity seems to matter more than for exports, with the shares of the United States being almost exceptionally lower than for exports, while the reverse is true for Japan. In addition, besides Germany no other Western European economy seemed to have established strong export linkages to Southeast Asian economies in the period from 1990 to 1999. In fact, the relative proximity of Australia seemed to have provided a comparative advantage over other more advanced economies resulting in cross-country import shares of nearly 3% to up to 5.5%.

[9]The statistical discrepancy between bilateral exports and imports is also visible at the data at hand. This is why it makes sense to report separately on the developments of each category. In tendency, world exports are under-reported, resulting in a global current account deficit, as reported by the IMF (various years).

[Table 5 about here]

Table 5 emphasises the relative importance of the manufacturing sector for the rise in overall trade in Southeast Asia. Surprisingly, even in more advanced countries like Hong Kong, Korea or Taiwan the share of secondary industries in total trade is overwhelmingly high, accounting for 87.3%, 83% and 82.6% respectively. The specialisation in consumer electronic products, telecommunication and electrical equipment is revealing and largely dominates total trade in all Southeast Asian economies except for Indonesia. Instead, the shares of less skilled-labour-intensive industries like textiles and clothing are comparatively high in the latter and China, probably reflecting the relative factor endowments in these countries. Interestingly, the Philippines and Thailand, which attracted large FDI inflows in the tertiary industry (see sub-section 2.1 above), were also the countries with the highest portions of trade in services with 23.8% and 22.5% respectively.

3 Literature Review

Traditionally, theories about foreign direct investment have been elaborated separately and classified as by-products of the classical models on the determinants of trade. Factors of production were assumed to be internationally immobile in well-established trade theories like in Ricardo or Heckscher-Ohlin, trying to explain the existence of trade in goods in the absence of cross-border labour and capital mobility. Capital flows in general and direct investment in particular arose on the basis of trade impediments and comparative costs, specifically when trade did not succeed in equalising factor prices. The logical consequence of these findings resulted in the basic notion that movements in factors can substitute for trade in the presence of trade barriers. The first formal prove of this relationship is credited to Mundell (1957), who demonstrated within the framework of a standard Heckscher-Ohlin model and in the presence of tariff barriers that if trade was to be stimulated by unequal factor endowments, movements in factors can substitute for trade in commodities.[10] The tendency of factor movements to equalise differences in initial endowments and thus in factor prices would hence revoke the factor proportion basis for trade. Mundell's conclusions have later been challenged by a number of authors, mainly Schmitz and Helmberger (1970), Purvis (1972), Flatters (1972) and Koijima (1978). These authors were, among others, able to demonstrate a complementary relationship between factor movements and trade by relaxing some of the assumption of the original Heckscher-Ohlin model.[11] Markusen (1983) was the

[10] The terms 'goods' and 'commodities' are used fairly interchangable in the trade literature.

[11] Flatters' model allows for mobility of both factors of production (i.e. capital and labour), while Mundell assumed only capital to be mobile across borders. This extended

first to present a comprehensive set of models aside the background of the standard factor proportion theory, each of which introduced an alternative non-factor-endowment basis for trade, contrary to what has been originally assumed by Mundell. With similar relative endowments and unequal factor prices in the initial equilibrium in trade, factor mobility will distort the original balance in endowments and hence increase the volume of exports and imports by adding a factor proportion basis for trade. This leaves countries relatively well endowed with the factor used extensively in the production of the exported good. While this is the consequence of trade in commodities in the Heckscher-Ohlin model, Markusen instead suggests that it is the result of movements in factors.

The assumptions of the neoclassical theories of trade, however, revealed some shortcomings in providing efficient explanations for the global pattern of trade flows and foreign direct investment. Indeed, relatively capital-scarce countries should have been among the main recipients of comparatively well-endowed capital source countries, since the law of diminishing returns implies that the marginal product of capital is higher in the former. Conventional comparative-advantage theories hence imply that direct investment and trade in goods is most likely to occur between dissimilar economies. In reality, developed and relatively capital-rich countries not only account for the vast majority of direct investment outflows, but also attract the overwhelming portion of FDI inflows (UNCTAD database, 2004) [12]. This paradox between the law of comparative-advantage and empirical findings has, among others, led to the emergence of the industrial organisation approach to trade, the so-called new trade theory (Krugman, 1979; Helpman, 1981; Ethier, 1982; Helpman and Krugman, 1985). The fundamental notion of this theoretical concept stems from the insight that mutual gains from trade can arise independently of any form of comparative advantage, based on firms pursuing product differentiation and exploiting increasing returns to scale in international markets that are not assumed to be perfectly competitive. These new elements have greatly enriched the understanding of trade and, more importantly, seemed to be consistent with the empirical finding that the share of world trade is the highest among industrial countries with similar economies and endowments. Though firms instead of countries were

version of the model demonstrates that trade in commodities and factor movements both succeed in identical equalisation of factor prices and product prices respectively. Similarly, Koijima relaxed the assumption of identical production technologies across countries, concluding that direct investment is to increase the volume of trade only if FDI flows from the source country's comparatively disadvantaged industry to the recipient country's relatively advantaged industry. The contributions of Schmitz and Helmberger and Purvis are discussed at other length in section 4.

[12] This periodical observation holds true since direct investment flows are reported. Lucas (1990) interpreted this paradox in his seminal paper "Why doesn't capital flow from rich to poor countries?" as a human capital externality that provides a Hicks-neutral productivity advantage for capital-rich countries over poor countries.

introduced as trading partners in the industrial organisation approach, the treatment of the firm was still limited, in the sense that it was understood as a single-plant, national entity producing one good in one location. The firm's profits were identical to the national income of the host country, excluding the possibility of foreign ownership of domestic production facilities. In fact, the industries with significant economies of scale were largely dominated by multinational corporations, which penetrate international markets in the form of subsidiaries or simple production facilities. The new trade theory had thus to be combined with a theory of the multinational enterprise in order to take account of the real developments and to encompass the endogenous choice between foreign production and exporting.

3.1 The theory of the multinational firm

The theoretical construct of the multinational firm has largely been developed apart from the traditional trade theory. The assumption of perfectly competitive markets and constant-returns-to-scale in the neoclassical notion of trade has generally constrained the inclusion of the multinational firm by definition.[13] The literature distinguishes between two different types of multinational corporations based on the nature of the strategic purpose of the direct investment. Horizontal companies aim at replicating a firm's core activities in foreign markets, while vertical firms divide the production process along the value-added chain across several geographical allocations. A typical point of departure for explaining the emergence of both forms of MNEs arose from the logical premise that a multinational corporation must possess some tangible or intangible assets, which offset the disadvantages of higher costs and business barriers relative to domestic firms.[14] Hymer (1976, 1979) was one of the firsts to establish an arbitrage condition between direct investment and exporting by referring to competitive advantages in the form of scale economies, product differentiation and superior technology among others. The most comprehensive framework, however, has been developed by Dunning (1977, 1981) in what is said to be 'the eclectic paradigm of international business'. The core elements of Dunning's ideas have been successively incorporated and further expanded in the theory of the multinational firm.

Dunning points to the existence of three conditions, which increase the likelihood of a firm becoming a multinational corporation. The presence of these circumstances compensates for the diseconomies of establishing a

[13] With constant-returns to scale direct investment cannot be distinguished from portfolio investment, since there is no room for a firm as itself.

[14] Penetrating foreign markets is associated with higher costs, including transport and communication costs, higher compensating wages for staff sent abroad, and local impediments such as language, cultural differences and lack of information with respect to administrative rules and government procedures.

business abroad and can be summarised as OLI, the advantages of Ownership, Location and Internalisation. Firms may acquire or possess ownership advantages through the adoption and use of exclusive rights, in the form of patents, blueprints, copyrights or trademarks, on a product or production process. Other advantages mainly refer to intangible assets (Caves, 1980) such as knowledge (human capital), technical know-how, managerial experience or simply the reputation of the enterprise. These elements together are also summarised as 'knowledge capital' (Markusen, 2000), and turned out to be the most prominent channel of contributions to the formal theory of the MNE. Markusen essentially associates the existence of multinational corporations with the stylised fact that MNEs are intensive in the use of knowledge capital rather than physical capital, providing three explanations that support the empirical finding. First, knowledge capital can be transferred easily and at low or zero cost to a subsidiary abroad and, secondly, has the property of being relatively skilled-labour intensive, which explains why skilled-labour abundant countries are major exporters of foreign direct investment. Third, knowledge capital serves the firm as a public good, a fact that has also become known as 'multi-plant economies of scale' and is discussed in further detail below. Overall, ownership advantages must be large enough in order to offset the disadvantages of doing business abroad.

Location advantages stem from market conditions abroad that make it profitable to shift the production of the good to the foreign country rather than simply exporting it. Customer proximity, provision of complementary duties or on-site supply of services as well as cheap input factor prices in production or large foreign market size may account for such advantages. In addition, the circumvention of trade impediments, such as tariffs, import quotas or high transportation costs may also be of benefit to the firm when investing abroad. In a sense, location advantages are not uniformly applicable to both forms of multinational firms. While trade costs seem to be a necessary condition for horizontal direct investment to occur, vertically integrated firms that engage in intra-firm trade in intermediate inputs or final goods are discouraged by transportation costs or trade impediments.[15]

Finally, the internalisation advantage provides the condition of why an enterprise prefers to produce in a foreign country instead of licensing its product to a local-market-based firm. Even in the presence of both ownership and location advantages, a firm could still prevent the risk and set-up costs associated with foreign direct investment and exploit potential profits by contracting a host-country firm. One of the reasons may be seen in the public good property of firm-specific intangible assets, which could easily be assimilated and implemented independently by licensees. Other forms

[15] In the absence of trade costs, horizontal firms would have no incentive to produce the same goods or services abroad. They would simply serve the foreign market by exporting. In contrast, horizontal investment is attracted by demand-side factors such as market size.

of knowledge capital such as brand names or reputation could simply exert greater benefits if they are exploited internally.

Dunning's concept of three necessary conditions for direct investment to occur, formed the basis of the theory of the multinational enterprise. A number of authors connected and extended these ideas within the framework of the new trade theory to formally construct general equilibrium models, in which MNEs may arise endogenously and, at the same time, determine the volume of trade. Helpman (1984) introduces the property of firm-specific assets, or headquarters services, into the standard theory of monopolistic competition in differentiated products, a feature that enables firms to use the same input in geographically separated locations. He explains the emergence of MNEs on the factor proportion basis of trade, more concretely, cost-minimising location choices of firms in a differentiated product sector allow that differences in relative factor rewards lead to a shift in production activities to the cheapest location. Theoretically, this is achieved by choosing specific subsets of initial factor endowment allocations between countries, which cannot result in factor price equalisation when firms have to employ their inputs in a single country. By relaxing the latter assumption, i.e. with corporations not being restricted to employ all factors of production in one country, factor price equalisation can be obtained with firms being allowed to engage in foreign direct investment and exploiting the country differences in factor rewards. Multinationals engage in intra-industry as well as in intra-firm trade, which consists in the exchange of the headquarters services, and the pattern of trade depends on the world's distribution of factors of production and on the relative country size, measured as gross national product.[16] All of this, however, holds only true if the set of endowment allocations differs from the standard Heckscher-Ohlin model, in which case there is no incentive to open a production facility abroad and the pattern of trade is similar to those in models of the new trade theory: inter-industry trade emerges as a consequence of differences in relative factor endowments, while intra-industry trade is explained by Chamberlinian-type monopolistic competition in differentiated products.

As opposed to the approach of Helpman, Markusen (1984) demonstrates the emergence of a multinational firm in the absence of Ricardian- or Heckscher-Ohlin-type bases of trade. The rationale for opening a subsidiary in a foreign market is described by the so-called 'multi-plant economies of scale', the ability of replicating a company's input factor in different locations without reducing the marginal productivity of the same factor in plants in which it

[16] In the absence of tariffs and transportation costs the MNE has no incentive to open more than one production facility abroad. In an extension of his work, Helpman (1985) accounts for this fact by incorporating a middle product, namely an intermediate input, into the model, which results in the emergence of MNEs in more than one country. Intra-firm trade occurs not only in headquarter services, but also in intermediate inputs, while the pattern of trade still depends on the relative factor endowments and country size.

has already been employed. Put differently, economies of multi-plant corporations mainly refer to cost efficiencies that a single two-plant firm enjoys over two independent single-plant firms. Such advantages may arise from the public-good character of firm-specific assets of the kind of Dunning, which once established can be implemented at zero costs in an arbitrary amount of production facilities as a joint input. In contrast, increasing economies of scale at the plant-level would rather induce the tendency towards centralisation than to spread production geographically. The efficiency advantage over a single-plant firm is easily modelled by the ability of the MNE to allocate labour more optimally across production facilities, since the share of labour necessary to create the firm-specific asset is only required at one location and can hence be reallocated in all remaining plants. The multinational corporation arises therefore as a horizontally integrated one, producing in both countries, while at the same time increasing the volume of world production of the product, which has the firm-specific asset as input. Furthermore, Markusen assumes that all labour devoted to the 'production' of the joint input factor is centralised in one country, so that the intra-labour allocations and factor rewards across countries cannot be identical. The factor used intensively in each country's predominant activity has a relatively high price, hence if factors of production are allowed to move across borders, a factor proportion basis of trade is added and the volume of trade would increase in the presence of multinational firms. Even if factors are not permitted to move, the difference in intra-labour allocations results in countries with identical factor endowments specialising in the production of different goods and thus in an international division of labour and inter-sectoral trade. Horstmann and Markusen (1987) extend the paper of Markusen by adding export costs to the model, which together with plant-level increasing returns in production counterbalance the MNE-inducing multi-plant economies of scale. They find that multinational firms prevail in knowledge-capital-intensive industries with low firm-level costs relative to plant-level increasing returns.

A similar approach has also been taken upon by Markusen and Venables (1998). By incorporating trade impediments like tariffs and transportation costs, they focus on the key arbitrage condition of whether to serve a foreign market by exports or direct investment (see also Brainard, 1993 and Horstmann and Markusen, 1992). The decision is essentially determined by outweighing the additional fixed costs from establishing a second plant against the trade costs of exporting the product to the foreign market. In addition, the outcome is made dependent on the well-established multi-plant economies of scale and relative country characteristics. When countries are assumed to be identical, a ceteris paribus increase in trade costs or market size raises the likelihood of an equilibrium with multinational firms. Instead, the case with differences in relative country characteristics is what has become known as the 'convergence hypothesis': with countries becoming more

similar in income levels, relative factor endowments, and production technologies, trade is gradually substituted by multinational corporations.[17] Intuitively, this can only be true for a horizontally integrated firm, for which the primary objective is not described by exploiting differences in cross-country factor rewards. Thus, foreign direct investment originating from a relatively large, well-endowed or technically efficient country is inferior to exporting to the foreign market. Domestic national firms therefore (a) dominate when countries are relatively different, (b) loose in importance but coexist when economies converge in terms of size, endowment and technology, and (c) may even be displaced by multinationals in situations described by large transport costs and high degree of convergence.

An extension of the work of Markusen and Venables (1998) is presented by Markusen (2000) who incorporates the emergence of vertically integrated firms in the same general equilibrium approach of horizontal direct investment. Multi-plant economies of scale and concentration of headquarters activities, which require skilled labour as an input factor, are described as in Markusen (1984). The main predictions of the convergence hypothesis remain valid regardless of the presence of vertical firms. When countries are relatively similar in both size or factor endowments, horizontal direct investment continues to dominate, since vertically integrated corporations lack the economic incentive to exploit differences in factor rewards. However, Markusen finds that with countries being similar in size but very different in relative endowments, vertical foreign direct investment will be the only type prevalent in equilibrium. This is also and especially true in the case of low or zero trade costs, in which case horizontal firms, given economies of scale at the plant-level, have no motive to enter. The impact on the pattern and volume of trade is, similar to the reasoning behind the emergence of multinational corporations, determined by the interaction of two sources of comparative advantage, namely relative factor endowments and plant-level economies of scale. Indeed, multinational firms substitute for trade in the majority of factor endowment allocations, but may increase the volume of trade if the small country is also the skilled-labour abundant country.

To summarise, the theory of the multinational firm has succeeded in providing formal support to empirically stylised facts. The theory is capable to capture the economic incentives of different types of direct investment and to qualify the impact of transportation costs and asymmetries between countries on the behaviour of the multinational firm. Vertical direct investment is encouraged by low trade costs and cross-country differences in factor rewards, separating the production process into stages of different factor intensity and allocating each of it in accordance to the law of com-

[17] It should be mentioned that FDI is not truly substituting for trade, because trade would vanish even in the absence of direct investment as countries converge (Markusen, 1995).

parative advantage. Horizontal firms aim at avoiding transportation costs and trade barriers by penetrating the foreign market with a similar bundle of goods or services as produced domestically and are attracted by a relatively large customer base. Both types of firms share the property of relying rather intensively on the firm-specific intangible ownership advantage, which is 'produced' at the headquarters and exported to the production facilities abroad. The type of firm that will prevail in equilibrium is ultimately determined by the degree of asymmetry in relative factor endowments, country size and technical efficiency.

The studies that have been briefly sketched above have combined elements of both ownership and location advantages, generally ignoring the question of internalisation. There is a small literature that discusses the question of whether direct investment should be preferred to licensing, based on general aspects of the agency theory and the consequences of informational asymmetries and moral hazard in particular. None of these factors are of peculiar interest for the objective of this paper, wherefore the reader is referred to Markusen (1995) for an excellent review of the problematic of internalisation. However, another shortcoming of the theory of the MNE is of concern to this study, namely the exposure of the multinational firm to exchange rate risk. The latter arises, for example, because of the time lag between investment and the realisation of profits. Yet, if exchange rate movements are considered as a random walk, claims to a future stream of income in a foreign currency are converted back at the same prevailing exchange rate level, thereby leaving unchanged the present discounted value of the investment (McCulloch, 1989). Given this interpretation, the standard view of exchange rate expectations denies any impact of the exchange rate on direct investment. In addition, from the perspective of the theory of international capital markets (Mundell, 1968), perfect capital mobility prevents any investor from retrieving a systematic cost advantage due to exchange rate movements, given that all market participants enjoy the same unrestricted access to global capital markets. To emphasise, a depreciation of a host country's currency will decrease production costs in this country for any firm, because the opportunity cost for a foreign versus a domestic investor continues to be the same. Together, these traditional views of exchange rate expectations (random walk) and capital market assumptions dismiss the relationship between foreign direct investment and exchange rates, but in what follows, a number of channels are presented, which are able to establish the factual impact of currency movements on FDI.

3.2 Direct investment and exchange rates

The theory of the multinational firm was able to deliver formal results that explain the geographical and, to a lesser extent, industrial pattern of direct investment in the world. In short, intangible assets and differences in fac-

tor rewards could give reasonable explanations of why firms may decide to become multinational corporations. The approach was rather comparative-static, allowing MNEs to arise endogenously in equilibrium as compared to a world with national firms only. Doing so, however, ignores the empirical finding that direct investment flows in the short-run exhibit a very strong volatility, a fact which can hardly be explained by changes in comparative costs or in the value of intangible assets. For example, annual FDI inflows in Japan from 1985 to 2002 showed only three times the same sign as in the previous year (UNCTAD database, 2004). While these swings may be due to a number of market imperfections in the short-run, one potential factor that might account for the excess volatility are movements in the exchange rate. Truly, if purchasing power parity (PPP) is assumed to hold at any time, exchange rate fluctuations are exactly offset by changes in the relative prices across countries, keeping profits in the investor's country's currency constant and hence no relationship between FDI and exchange rates could be established. Considering exchange rate levels in models of foreign direct investment therefore implies taking into account long-run deviations from PPP, while establishing a link between exchange rate changes and FDI reflects the belief of short-run adjustments from PPP (Itagaki, 1981; Dewenter, 1995; Blonigen, 1997). Therefore, deviations from PPP may provide additional insight into the large fluctuations of direct investment flows and, to some extent, also reflect changes in the expectations of future changes in the level of PPP. A number of authors have included exchange rate movements in empirical studies (Caves, 1989; Ray, 1989; Martin, 1991; Stevens, 1992; Swenson, 1994, and Xing, 2002), but there is only a small theoretical literature that describes the impact of both exchange rate levels and changes on FDI.

Itagaki (1981) assumes a two-goods, two-country-specific-intermediate-goods model in which the multinational firm maximises the expected utility of net global profits denominated in the currency of the headquarters' country. The exposure to exchange risk may either be positive or negative, arising because the MNE's intra-firm imports to the headquarters as well as the subsidiary's profits abroad are denominated in the foreign currency. The MNE operating under perfect foresight could in the long-run process (1) both intermediate goods at home, (2) both in the foreign country or (3) each in a different country. In the former two cases the firm will engage in intra-firm trade, exporting the final good to the country in which no production took place, while no trade will occur if the inputs are processed in the country of sale. Introducing uncertainty into the model under some restrictive assumptions will result in all cases, contrary to what is expected, in an increase of direct investment abroad in order to reduce a firm's exposure to risk, which may arise from increased costs of foreign production. Moreover, the expectation of depreciation of the home country's currency forces a multinational firm to shift part of its home sale in final goods to the foreign country and,

at the same time, to diminish the amount of imported intermediate goods from abroad.[18] To be precise, in the presence of multinational firms and exchange rate uncertainty, the incentives for direct investment increase and the volume of trade in intermediate-goods is predicted to fall when the home country's currency depreciates.

Cushman (1985) presents a series of two-period, two-country models in which a multinational firm under different domestic and foreign production schemes invests in the first period, given exchange and inflation rate uncertainty, in order to realise profits in the second period. He examines four scenarios of production activities in which the MNE (1) processes foreign inputs and sells output abroad with capital either financed at home or abroad, (2) produces and sells in the foreign market and exports an intermediate good to the foreign subsidiary, (3) is vertically integrated, importing the intermediate good from abroad, and (4) is horizontally integrated, but chooses between purchasing the capital at home or abroad. The models predict that the risk-adjusted direct effect of an expected real foreign currency appreciation increases the volume of direct investment by lowering the foreign capital cost.[19] In cases (3) and (4), however, the real appreciation may turn foreign labour costs prohibitively expansive or change foreign output prices in such a fashion that direct investment will ultimately decrease in both cases.

Froot and Stein (1991) focus in their model on an important component of FDI, namely mergers and acquisition. They establish a link between FDI and exchange rates by relaxing the assumption of perfect capital markets. This should not be understood as if capital is not perfectly mobile anymore, but rather as an informational asymmetry between asset owners and credit suppliers. The return on the acquisition of a domestic asset can only be observed ex-post, but while this is free of any costs only to the asset's owner, external creditors must bear additional monitoring costs, the source of imperfection in capital markets.[20] Investors are thought of as competing for the acquisition of a domestic asset with their reservation bid price being constrained by the investor's wealth and the external financing. Assuming that both entrepreneurs are credit-rationed, the one with the higher domestic-currency value of wealth will win the auction. The main intuition is now straightforward: if the foreign currency is to appreciate relative to the domestic one, investors from abroad experience an increase in their relative

[18] In this context, the MNE is assumed to import one of the intermediate inputs from its production facility abroad and is not engaged in intra-firm trade in final goods.

[19] Risk-adjusted refers to the fact that the firm can only estimate the expected value of the future changes in the real exchange rate. These estimates may be adjusted each time period.

[20] Froot and Stein point out that these costs only occur for information-intensive investments. Given the costs and barriers for doing business abroad, direct investment as opposed to portfolio investment can be classified as being rather information-sensitive.

wealth position and hence outpace their domestic counterparts. This effect will be stronger, the higher the monitoring costs are. In short, changes in the exchange rate can increase the volume of foreign direct investment in a world with imperfect capital markets.

The model of Blonigen (1997) is possibly the most interesting and useful approach for the objective of identifying an overarching model of the determinants of FDI. It establishes the link to the theory of the multinational firm by explicitly incorporating the same firm-specific assets that at least partially explained the emergence of MNEs in the above-discussed models of Helpman (1984) and Markusen (1984). The formal set-up is similar to the approach of Froot and Stein, assuming a foreign and domestic firm that both compete in an auction for the acquisition of another domestic corporation. The latter, however, possesses a firm-specific asset that, after acquisition, can be used as a joint input factor in an arbitrary amount of plants without reducing its marginal productivity in any of the existing facilities. Clearly, this public-good property can be exploited without any foreign currency transaction, since the firm-specific asset can be transferred at zero cost to the subsidiary abroad.[21] More precisely, while the acquisition of a firm-specific asset is dealt with in the currency of the target company's country, the nominal return may result in a number of foreign currencies. This relationship determines the impact of an exchange rate movement on the reservation price of a foreign corporation. An appreciation of the foreign currency results in an increase in the domestic-currency denominated reservation price of the foreign corporation, since the return of the firm-specific asset is expected to occur in the foreign currency. Hence, similar to the result of Froot and Stein, the foreign firm wins the auction due to the relative increase in its reservation price and the volume of direct investment rises. [22] However, this result can only hold if markets are segmented to some extent, implying that the domestic competing firm has limited or no access to the foreign market. If domestic firms could engage in two-way direct investment, they would experience a similar increase in expected returns, offsetting the exchange rate advantage of the local foreign-market based corporation. To summarise, Blonigen's results are strikingly similar to the ones of Froot and Stein, but while the latter assume capital market imperfections, the former finds that exchange rate changes can affect FDI via good markets imperfections.

Finally, Chakrabarti and Scholnick (2001) discuss the potential link between exchange rates and direct investment from a different angle, examining the formation of expectations about future changes in the level of the

[21] To recall, firm-specific assets are assumed to be of the knowledge-capital type, such as research and development, as opposed to physical capital.

[22] This is of course only possible if short-run deviations from PPP are allowed. The foreign firm's returns must be realised before the exchange rate adjusts to its original level.

exchange rate. In the context of long-term binding investments such as FDI, expectations about key economic variables are likely to be of major importance in the decision-making process of any investor. Exchange rates are usually understood as following no systematic pattern, characterised by the assumption of random walk. In this case, the expectation about the future level of the exchange rate is simply determined by its present rate and shocks are instantaneously and fully translated into the future expected value. However, Chackrabarti and Scholnick suggest, for example, that investors are more likely to expect a currency to appreciate if it had suffered from a relatively large depreciation before. This element of mean-reversion is similar to the idea of exchange rate overshooting (Dornbusch, 1976) and may induce companies to invest after a large shock when the foreign currency is temporarily considered as undervalued. Thus, when the currency adjusts to its long-run level, the future stream of income is expected to be higher in the domestic country's currency, creating a strong incentive for companies to engage in direct investment shortly after a relatively large depreciation of the foreign currency. One possible interpretation of mean-reversion expectations is therefore to consider not only the changes in exchange rates per se, but also the relative size of the shocks on the direct investment behaviour of multinational firms.

4 The Model

The advantage of the theory of the multinational firm is that it provides clear testable hypothesis and is a valuable guide for empirical research. In addition, a satisfactory model should be able to offset some of the shortcomings of the theory and ought to explain the temporal fluctuations and geographical diversity of foreign direct investment in Southeast Asia. Spatial variance across countries may, among others, arise because of the potential channels of exchange rate uncertainty on international investment decisions of MNEs, which have been briefly sketched above. However, much of the literature focused on a simple comparative-static approach when demonstrating the emergence of multinational corporations, ignoring the temporal effects of externalities that arise because of geographical proximity (Krugman, 1991a, 1991b). Industries tend to cluster in specific locations in order to exploit external economies of scale, which may emanate from technological spill-overs, backward and forward linkages or the existence of a trained labour-pool. These agglomeration effects can spur subsequent investments without any changes in other locational determinants and found some empirical confirmation in previous studies of foreign direct investment (Wheeler and Mody, 1992; Head et. al, 1994; Smith and Florida, 1994; Cheng and Kwan, 2000). To capture these effects, this study follows the approach by Nerlove (1967), Barrel and Pain (1996), and Cheng and Kwan (2000) and

applies a modified version of the partial stock adjustment model, which is standard in the investment literature. It assumes that the current stock of FDI in a given industry grows in the absence of any exogenous variations and will gradually adjust to an equilibrium level, in which the agglomeration-externalities cease to influence the level of direct investment. The equilibrium level or optimal stock of FDI itself is assumed to be entirely determined by exogenously given variables, which can change over time and hence alter the steady-state level continuously. The dataset at hand allows to test for the presence of industry-specific agglomeration effects and may hence provide a more detailed insight of the strength of these externalities in the secondary and tertiary industries in Southeast Asia.

Let Y_{it} denote the stock of foreign direct investment in country i and period t and Y_{it}^{*} the corresponding equilibrium level or optimal stock, then

$$\Delta \ln Y_{it} = \xi \left(\ln Y_{it}^{*} - \ln Y \right) \qquad i = 1, 2, ..., N; \quad t = 1, 2, ..., T. \tag{1}$$

where ξ, such that $0<\xi<1$, is known as the coefficient of adjustment. Equation (1) shows that the actual change in the stock of FDI in any given time period t is some fraction ξ of the gap between the equilibrium level and the actual stock. Since it is assumed that Y_{it}^{*} is not a function of Y_{it}, i.e. the equilibrium level is determined exogenously only, (1) assures stability in the model by diminishing the effects of agglomeration when the actual stock approximates its equilibrium level. Hence, the observed stock of FDI will gradually adjust to the optimal level via the self-reinforcing effect. Collecting terms and rearranging results in

$$y_{it} = (1 - \xi) y_{it-1} + \xi y_{it}^{*} \tag{2}$$

where lower case letters denote the natural logarithms. Equation (2) says that the observed stock of FDI at time t is a weighted average of the stock in the previous period and the desired or optimal stock at that time. It implies that FDI attracts further FDI, while the steady-state level is determined by a vector of independent variables, which will be discussed in further detail below. That is,

$$y_{it}^{*} = \vartheta \chi_{it}^{'} + \lambda_i + \varpi_t + \nu_{it} \tag{3}$$

where ϑ is a $K \times 1$ vector and $\chi_{it}^{'}$ is the itth observation on K explanatory variables. λ_i is a standard unobserved time-invariant country-specific fixed effect, ϖ_t a time-specific but country-invariant effect and ν_{it} an uncorrelated stochastic error term over all i and t. Substituting (3) into (2) yields,

$$y_{it} = \theta y_{it-1} + \beta \chi_{it} + \varepsilon_{it} \tag{4}$$

$$\varepsilon_{it} = \eta_i + \gamma_t + u_{it} \tag{5}$$

where $\theta = (1 - \xi)$, $\beta = \xi\vartheta$, $\eta_i = \xi\lambda_i$, $\gamma_t = \xi\varpi_t$ and $u_{it} = \xi\nu_{it}$. Equation (4) is a dynamic model with a lagged dependent variable, which explains the actual stock of foreign direct investment in country i at period t with the stock in the previous period and a set of other explanatory variables. In the following, I will discuss the assumed determinants of direct investment and its expected impact on the dependent variable, before proceeding in estimating the model empirically.

4.1 Data and specification of variables

The panel comprises ten countries in Southeast Asia, namely China, Hong Kong, Indonesia, Japan, Republic of Korea, Malaysia, Philippines, Singapore, Thailand and Taiwan, and is estimated for 10 industries at the two-digit ISIC Rev. 3 level and for the aggregates of the primary, secondary and tertiary sectors for the period from 1981 to 2002 (see Appendix A for details). Several data sources are used to construct the panel. To correct for inflationary differences across countries, all variables are transformed into real 1995 prices by using the GDP deflator.[23] The dependent variable is the natural logarithm of the real annual industry-specific stock of foreign direct investment in millions of US dollars, drawn from the database of the United Nations Conference on Trade and Development (UNCTAD, 2004). The disaggregation by sector of industry is of interest for several reasons: first, country-specific parameters may vary substantially in their force of gravity for FDI across industries; second, concerning the second part of this study, direct investment could influence the pattern of trade differently depending on industry technologies and structure (Schmitz and Helmberger, 1970)[24]; and third, because the theory of the multinational firm indeed recognises the importance of intangible, firm-specific knowledge-capital, but also notes that these assets may be significant in both manufacturing and service industries (Markusen, 1995 and 2000). This study contributes by disentangling the eventual offsetting or misleading effects on an aggregate level and by testing the predictions of theory for each individual industry. Furthermore, stocks rather than flows are considered for each industry, essentially because this study assumes that FDI has accumulated effects (agglomeration-externalities) and since the return on investment depends on the stock of

[23] The GDP deflator is a more generic and comprehensive measure of inflation than the CPI-Index. By definition, it accounts for changes in consumption patterns or the introduction of new goods and services, while the CPI-deflator assumes a fixed basket of products.

[24] At a time when the neo-classical theory of trade still provided the framework to analyse the relationship between trade and FDI, Schmitz and Helmberger criticised Mundell's (1957) paper for not distinguishing between classifications of industries. They argued that the primary industry could not be assumed to have similar production technologies across countries, and hence proved Mundell wrong in showing that trade and FDI in industries with different technologies are complements and not substitutes.

capital, which is generally described by decreasing marginal productivity (diminishing returns on capital). Moreover, for the analysis on trade and direct investment, stocks amount to the only accurate measure to test the impact on exports and imports, since they reflect part of the production capacity of an economy, which ultimately matters for the volume of trade.

The assumptions and predictions of the theory of the MNE give rise to a simple econometric specification, namely a gravity model, around which the explanatory variables are build. In short, the gravity model states that bilateral trade flows depend inversely on the distance between two countries and proportionally on their absolute weight or size, generally measured as the two countries' GDP (Krugman, 1980; Frankel et al., 1995; Fontagne and Pajot, 2000). More recently, Portes and Rey (1999) and Mody et. al (2003) also employed the gravity model to explain cross-border equity flows and direct investment respectively. For the purpose of this study, the gravity model nicely combines the key elements of the theory of the multinational firm by modelling the impact of transport costs, which in practise is generally proxied by distance, and economic size on the emergence of MNEs in equilibrium. Therefore, a modified gravity model seems consistent with the idea to estimate the equilibrium level of foreign direct investment on the basis of theoretical guidelines and is recognised as a transaction cost model. However, the spirit of the gravity model relies on bilateral country pair observations and has been extensively used to explain the geographical pattern of trade or, more recently, investment flows, rather than to eludicate the industrial decomposition of FDI.

Given that no data at the bilateral sector-level for FDI is available, one of the challenges lies in combining standard country-pair specific variables of the gravity model with the analysis at the industry level. This is achieved in a consistent way over all relevant explanatory variables. First, the aggregate geographical breakdown of FDI inflows into each country in the panel is split into three identical five-year time periods: 1985 to 1989, 1990-1994 and 1995 to 1999. Within each of these periods the largest ten foreign investors are identified and their relative shares in total FDI normalised to 100.[25] This method implies moving country weights and aims at taking into account shifts in the geographical pattern of FDI inflows over time. These country weights are then applied to the relevant real independent variables of each of the FDI source countries, following the geometric weighting principle. More formally,

$$\chi_{jt} = \prod_{i=1}^{M} \left(\frac{\psi_{it}}{d_{it}} \right)^{w_{t\tau}} \tag{6}$$

[25] In the vast majority of countries and time periods the aggregate share of the top ten investors amounted to over 90% of total FDI and is hence a very good proxy for the geographical representation of FDI inflows. The lowest aggregate share accounted for 79.1% in Japan during the years 1985 to 1989.

where M denotes the number of FDI source countries and $M = 10$ for all countries and time periods in the panel. Clearly, the amount of partner countries remains constant over the three time periods, but they may vary in their composition. ψ_{it} is equivalent to the unweighted explanatory variable of source country i at time period t, the number of years within each time period, and d_{it} denotes the GDP deflator.[26] $w_{i\tau}$ stands for the relative weight of each source country during the time periods τ as specified above ($\tau = 3$) and χ_{jt} corresponds to the weighted explanatory variable for panel country j at year t. Finally, the three time-series are chain-linked and to neutralise the effect of the weight changes on the temporal evolution of the variables in concern, time-series with $\tau \geq 2$ are re-indexed to their first values and multiplied by the last value of the previous series. To keep the distortion of the latter operation as small as possible, monthly data of all variables are taken first, which are then converted back into annual time-series. Overall, this weighing method allows to combine the benefits of an analysis at the industry level with multilateral country-pair specific determinants and, at the same time, takes into account the dynamics in the geographical pattern of direct investment inflows.[27]

This study uses four categories of independent variables: (1) a set of factors commonly used in gravity models; (2) different moments of effective exchange rates; (3) a measure of business cycle transmission and intangible assets and (4) relative production costs.

The class of gravity variables comprises the natural logarithm of the real GDP of each panel country and is taken as a measure of market size or market demand. Larger markets are characterised by (neo)-classical economies of scale in production, lowering the costs of output if the market coincides with the place of sales, i.e. in the case of horizontal foreign direct investment. Shifting production abroad can be more costly in smaller markets with relatively higher factor rewards and hence a positive correlation between GDP and direct investment is expected.
Real GDP per capita is generally taken as a proxy for the stage of development or a country's endowment respectively (Chunlai, 1997; Otsubo and Umemura, 1998; Cheng and Kwan, 2000). I believe that relative factor endowments are better represented by a country's capital-labour ratio, where capital is the cumulated sum of real gross fixed capital formation at each t in the sample period and labour is the total labour force.[28] Both indicators are downloaded from the World Economic Outlook (WEO) database of

[26] Because no reliable geographical breakdown is available before 1985, the weights of the first time period are applied back to 1970. This is not of a major concern, since FDI flows were still relatively subdued in the 1970s. Weights of the period from 1995 to 1999 are applied up to 2002 in order to ensure consistency across countries due to data availability.

[27] Moreover, it turned out to create a salient feature for the panel analysis to follow.

[28] The domestic capital stock is only available for a few industrialised economies. The cumulated sum of gross fixed capital formation seems the best proxy for capital.

the International Monetary Fund (IMF). Following equation (6) a weighted capital-labour ratio for the ten largest foreign investors of each panel country is created to approximate the criterion of the 'convergence hypothesis' (Markusen and Venables, 1995), which predicts that as countries become more similar in relative endowments, foreign direct investment is to rise. Taking the absolute value of the natural log of the capital-labour ratio between panel country j and its respective foreign investors implies that a decrease in the ratio coincides with an increase in similarity and therefore I expect a negative sign for the relative factor endowment variable.

The relative distance between source and host countries qualifies as another gravity factor and proxies for transaction costs, such as transportation, information and communication costs, as well as cultural barriers. The 'Centre D'Etudes Prospectives et D'Informations Internationales' (CEPII) has made available the 'greater circle distances' in kilometres for 225 countries in the world, using the longitude and latitudes of the most important cities in terms of population. Here, the weighted geometric average is calculated using the undeflated equation (6) and a five-year moving average is constructed to smooth the series, but to still keep track of the potential changes in the relative distances of each panel country to its foreign investors over time. That is, opposite to other gravity models, distance in this model is not time-invariant since it represents the average FDI-weighted distance to a sample of the ten largest partner countries at different points in time. Hence, if the geographical composition of partner countries is to change over time, the measure of relative distance used here is able to capture this effect. The expected sign for the relative distance is ambiguous and depends on whether direct investment is of the horizontal or vertical type. For the former, some transaction costs seem indispensable since a MNE would not consider serving the foreign market by FDI if exporting would be free of any costs. Therefore, increasing trade costs may stimulate foreign direct investment of the horizontal type, while for a vertically integrated firm, which aims at exploiting factor-reward differences between countries, a rise in trade costs would turn intra-firm trade in intermediate or final goods more expansive and hence reduce the volume of FDI.

In addition to the distance variable the model includes the annual average tariff rates in percentage points of each panel country as provided by the World Bank. Adding it as an individual variable has the advantage of testing explicitly the hypothesis of 'tariff-jumping', which is sometimes referred to as the effect of an increase in FDI due to high trade costs in the form of tariffs (Blonigen et. al, 2002). Since the latter is just another form of trade impediment, the expected sign depends on the same argumentation as for the relative distance. Finally, the last variable commonly used in gravity models is a measure of infrastructure, which allows the MNE to operate effectively in the host market. In this study it is proxied by the telephone density in the host country, measured as telephone main lines in use per 100

inhabitants, and provided by the International Telecommunications Union (ITU). The infrastructure variable is expected to enter the equation with a positive sign.

The second category of explanatory variables relates to the effect of exchange rate movements on foreign direct investment and its factual use is justified by the theories presented in sub-section 3.2. The objective within the context of the partial stock adjustment model is to identify the variables, which might explain the steady-state or equilibrium level of FDI and hence, by including the exchange rate level as an independent variable, it is assumed that there are long-run deviations from PPP.[29] Applying a slightly amplified version of equation (6) to the nominal annual bilateral exchange rates between each panel country and its partners results in a real effective exchange rate based on FDI weights.[30] The latter is generally used as a country's measure of international price and cost competitiveness and reflects within the context of this study a summary indicator of the real external value of a panel country's currency against the currencies of its most important foreign investors. The nominal data are taken from the International Financial Statistics (IFS) database of the International Monetary Fund (IMF) and are denoted in units of foreign currency against one unit of domestic currency. Hence, an increase in the real effective exchange rate corresponds to an appreciation of the domestic currency. The theory presented above identified several channels through which movements in the exchange rate may affect FDI. The models of both Froot and Stein (1991) and Blonigen (1997) predict that through imperfections in the capital and good markets respectively a depreciation of the domestic currency may result in an increase in inward foreign direct investment. Under certain behavioural assumptions, Cushman (1985) shows that a domestic currency depreciation may lower factor costs for foreign producers and hence also increase inward FDI. Finally, Chackrabarti and Scholnick (2002) argue that a rise in direct investment inflows is consistent with the hypothesis that investors expect

[29] In fact there are many reasons to believe that PPP does not hold in the long-run. The 'Balassa-Samuelson effect' and the 'Dutch disease' phenomenon are probably the most prominent channels. For an excellent review of PPP see Neary (2004).

[30] Following Buldorini et. al (2002), the real effective exchange rate is calculated by deflating the nominal effective rate with the relative prices. Hence, equation (6) includes the deflator of the panel country as well, that is:

$$ee^r_{jt} = \prod_{i=1}^{N} \left(\frac{e^n_{ijt} d_{jt}}{d_{it}} \right)^{w_{t\tau}}$$

where e^n_{ijt} is the nominal spot exchange rate between country i and j at period t. d_{it} and d_{jt} are the corresponding GDP deflators for each country and ee^r_{ijt} stands for the real effective exchange rate of country j at period t. Moreover, nominal annual exchange rates are calculated as the average over the period. The choice of average against end-of-period rates is based on the idea that the mean is more likely to reflect the relative currency strength for investment decisions than the level at the end of a year.

mean reversion in the future exchange rate after a depreciation of the domestic currency. It is therefore expected that the exchange rate level is negatively correlated with the stock of foreign direct investment. Given the long-run nature of FDI, the model considers the one-year lagged exchange rate level, which reflects the belief that firms cannot react immediately and instantaneously to changes in the exchange rate.

Moreover, the models of Itagaki (1981), Goldberg and Kolstad (1985) and Cushman (1985) point to the fact that MNEs make their decisions under exchange rate uncertainty. Including the exchange rate volatility as an explanatory variable allows to control for the risk aversion of multinational firms under uncertainty. Volatility is calculated as the annualised standard deviation of the monthly log change of the real effective exchange rate. Higher volatility is understood as an increase in risk, reducing the trade activity of a multinational firm and hence induces a compensating rise in more secure foreign direct investment (Cushman, 1985). The literature indicates a more immediate impact of exchange rate volatility on FDI as compared to the long-run movements in levels and is therefore included as a contemporaneous variable with an expected positive sign.

The variable of the third category denotes the crucial proxy for the knowledge-capital or intangible assets emphasised in the theory of the MNE. As compared to the broad-based definition of Dunning (1977) and the argumentation of Markusen (2000), this study considers a more differentiated approach through which ownership advantages are transmitted. Following the approach by De Santis et. al (2004), stock market indices are used to represent the source countries' Tobin's Q. The latter implies the existence of intangible assets if a firm's market value is greater than its book value, which stimulates investments and thus may ultimately increase foreign direct investment. Stock markets can therefore serve as a good proxy for the knowledge-capital of multinational firms, but also represent, at least partially, the funding source of FDI. Bullish stock markets may increase the investment possibilities of firms and generally coincide with periods of global economic booms. International investment activities can therefore correlate with business cycles and serve as a transmission channel of up- and downturns of general economic activity (Jansen and Stokman, 2004). Major national stock market indices of direct investment source countries are taken from the database of Global Financial Data, Inc. as the closing value at the end-of-the-period and are GDP deflated and FDI weighted following the principle of equation (6). Taking the natural log, weighted stock market indices are expected to enter the equation with a positive sign.

The last explanatory variable is straightforward and reflects the level of production costs of each panel country relative to its foreign investors. This is done by constructing a ratio between the real wages of each host country and the real weighted wages of its partner countries, applying again equation (6) to the nominal wages in manufacturing (ISIC 2) as provided by the

Explanatory variable	Abbreviation	Expected sign
Lagged stock of FDI	FDI(-1)	+
GDP	GDP	+
Capital-labour ratio	CAP_LAB	-
Distance	DIST	+/-
Annual average tariff rate	TARIFF	+/-
Telephone lines per 100 inhabitants	TELE	+
Lagged effective exchange rate	FX(-1)	-
Exchange rate volatility	FX_VOL	+
Stock market indices	STOCKS	+
Wage ratio	WAGE	-

Table 1: Explanatory variables and expected sign

International Labour Organisation (ILO).[31] Relative production costs are specifically important for vertically integrated firms since by definition they aim at exploiting factor-reward differences. Nevertheless, direct investment of the horizontal type also maintains production facilities abroad and is therefore likewise expected to be stimulated by relatively lower wages in the foreign market. Labour-intensive industries may thereby be more affected by the relative wage levels as compared to industries of the tertiary sector. Unfortunately, only wages for the manufacturing sector are available and must therefore serve as a proxy for monthly earnings in the service industry. Taking the natural logarithm, the real wage ratio is expected to have a negative sign, since a rise in the relative domestic labour costs should reduce inward direct investment.

4.2 Econometric methodology

Table 6 reports a summary of the variables discussed above. Recalling equation (4) in scalar terms and substituting (5) into (4), yields

$$y_{it} = \theta y_{i,t-1} + \sum_{k=1}^{K} \beta_k x_{ikt} + \eta_i + \gamma_t + u_{it} \quad i = 1, 2, ..., N; \quad t = 1, 2, ..., T. \quad (7)$$

where $k = 1, 2, ..., K$ and $\theta < 1$. Equation (7) describes a dynamic panel model with a two-way error component structure and a remainder stochastic disturbance term with $u_{it} \sim \text{IID}(0, \sigma_u^2)$. The parameter θ describes the adjustment process towards steady-state as presented in the model outline above. The η_i and γ_t are assumed to be fixed parameters, which account

[31] Wages across countries are reported for a number of diverging time units, but have all been converted into hourly wages. For countries that only reported weekly or monthly data, the hourly wage rate was calculated by dividing it by the total weekly or monthly hours worked. The latter indicator is also provided by the ILO.

for structural determinants other than those identified as explanatory variables. The country-specific effect η_i may capture factors such as national treatment of FDI, restrictions on investment, political stability, tax system or other more institutional factors, while the inclusion of the time-specific effect γ_t controls for common shocks across countries, such as the East Asian financial crises in 1997 or the global downturn in direct investment in 2001 and 2002. Overall, the panel data specification has desirable properties for studying the dynamics of adjustment. The time-series aspect integrates the agglomeration externalities into the model, while the cross-sectional dimension controls for heterogeneity across countries. Here, the spatial dimension of the panel represents the countries in Southeast Asia as specified above ($N = 10$), each being characterised by 10 explanatory variables ($K = 10$) over 22 periodical observations ($T = 22$), which results in a data matrix of dimension 10 x 22. Since some of the data are not available for all countries and years, an unbalanced panel is estimated.

Panel data analysis generally distinguishes between fixed effects and random effects models. The latter is usually applied for studies in which the unobserved heterogeneity between cross-sectional units could either be because of factors, which are constant over time, but vary between units or, conversely, for variables that vary over time, but are assumed to be similar across sections. The specifications of the random effects model are therefore appropriate for relatively large N and where these units are drawn randomly from a large population (Baltagi, 2001 and 2002; Hsiao, 2002; Arellano, 2003). In contrast, fixed effects models aim at explaining cross-sectional heterogeneity due to omitted or unobserved variables, which are assumed to be constant over time. Against this background, the choice for a fixed-effects model seems appropriate given the fact that a relatively small and homogenous N is employed and the primary objective lies in estimating y_{it} on an identified group of common indicators in the absence of more country-specific variables. Fixed effects models are estimated by including a matrix of individual cross-sectional dummies in the regression and applying standard ordinary least squares (OLS), which results in unbiased and efficient estimates.

The inclusion of a lagged dependent variable renders several severe implications for an appropriate estimation technique in the context of a fixed-effects model. First, since equation (7) defines y_{it} as a function of the fixed parameter η_i, it immediately follows that $y_{i,t-1}$ is also a function of η_i. Recalling from equation (5) that η_i is a component of ε_{it}, it subsequently implies that the right-hand regressor $y_{i,t-1}$ is correlated with the error term and hence renders OLS estimators biased and inconsistent (Anderson and Hsiao, 1981 and 1982; Baltagi, 2001). [32] Furthermore, the LSDV estimator

[32] This hold even true if the remainder disturbance term uit does not suffer from serial correlation.

suffers from inconsistent estimates in the presence of a lagged dependent variable if T is small, although the fixed effects are differenced out when taking the deviations from their mean (the sum of all η_i is zero). However, as can be seen in (7), y_{it} is also a function of the remainder disturbance term u_{it}, which is not cancelled out by the least squares dummy variable estimator (LSDV) estimation and hence implies that the lagged dependent variable is still correlated with the mean of the error term. This is so because the latter average comprises $u_{i,t-1}$, which is correlated with $y_{i,t-1}$ even if the u_{it} are not serially correlated (Nickell, 1981). The latter effect tends to be stronger the smaller T is and only if $T \to \infty$ will the LSDV estimator be consistent in a dynamic error component model. Anderson and Hsiao (1981) suggest to use first differences in the equation to eliminate the residual component based on fixed effects, which are time-invariant by definition, and to employ $y_{i,t-2}$ as an instrument for $\Delta y_{i,t-1}$.

$$y_{it} - y_{i,t-1} = \theta(y_{i,t-1} - y_{i,t-2}) + \sum_{k=1}^{K} \beta_k (x_{ikt} - x_{ik,t-1}) + u_{it} - u_{i,t-1} \quad (8)$$

The intuition behind this operation is straightforward: $y_{i,t-2}$ is highly correlated with the first differenced lagged dependent variable, but not with $\Delta u_{it} = u_{it} - u_{i,t-1}$ and therefore serves as a valid error- term-uncorrelated instrument for $\Delta y_{i,t-1}$.[33] This method leads to consistent but possibly inefficient estimations since not all moment conditions are exploited and it ignores the first-order moving average MA(1) disturbances with unit root serial correlation (Ahn and Schmidt, 1993).[34] In fact, Amemiya and MaCurdy (1986), Breusch et. al (1989) and Arellano and Bond (1991) note, among others, that all $y_{i,t-2-j}$ with $j = 0, 1, ..., M$ satisfy the moment restrictions $E[y_{i,t-2-j}(y_{i,t-1} - y_{i,t-2})] \neq 0$ and $E[y_{i,t-2-j}(u_{it} - u_{i,t-1})] = 0$ and therefore serve as valid, legitimate instruments for $\Delta y_{i,t-1}$. Estimators that are based on these additional moment conditions increase the efficiency of the IV estimator and eliminate the correlation between the lagged dependent variable and the disturbance term. I follow the approach by Holtz-Eakin et. al (1988), Arellano and Bond (1991), Arellano and Bover (1995) and Ahn and Schmidt (1995) by using the generalized method of moments (GMM) estimator to exploit these conditions and to obtain a parameter-defining mapping of the model.

[33] More formally, a n-dimensional space can be divided into two orthogonal subspaces, $S(W)$ and $S^{\perp}(W)$, where W is a matrix of instrumental variables, which are either exogenous and/ or predetermined. OLS minimises the distance between the single point y and $S(X)$, the matrix of explanatory variables, which leads to inconsistent results because the disturbance term is correlated with X. Instrumental variables (IV) only minimise the part of the former distance that lies in $S(W)$, while the IV residuals lie in $S^{\perp}(W)$.

[34] Moment conditions are often referred to as the zero expectation of a random quantity, which for the IV estimator is reduced to $E[y_{i,t-2}(y_{i,t-1} - y_{i,t-2})] \neq 0$ and $E[y_{i,t-2}(u_{it} - u_{i,t-1})] = 0$ (see also Davidson and MacKinnon (1993).

For ease of illustration, I denote the $T-2$ equations in (8) ($t=3$ is the first time period for which (8) is observed) in vector notation, resulting in

$$\Delta y = \Delta y_{-1}\theta + \Delta X\beta + \Delta u \tag{9}$$

where Δy_i, $\Delta y_{i,-1}$ and Δu_i are $N(T-2)$ x 1 vectors of the form $(y_3 - y_2, ..., y_T - y_{T-1})'$, $(y_2 - y_1, ..., y_{T-1} - y_{T-2})'$ and $(u_3 - u_2, ..., u_T - u_{T-1})'$ respectively. ΔX is a $N(T-2)\times K$ matrix of $(x_3 - x_2, ..., x_T - x_{T-1})'$. Efficient GMM estimation will implement different numbers of instruments for each variable, depending on the degree of exogeneity of the variable in concern (Arellano and Bond, 1991; Baltagi, 2001). Consider first the strictly exogenous variables with the orthogonality (moment) restriction $E(x_{it}u_{is}) = 0$ for all $t, s = 1, 2, ..., T$. Since by definition all x_{it} are assumed to be uncorrelated with the error term, the observations for all periods are valid instruments for the first-differenced equation (9). Together with the above described moment conditions for $\Delta y_{i,t-1}$, a preliminary matrix of instruments for each i is given by

$$W_i = \begin{bmatrix} [y_{i1}, x_{i1}^{'}, ..., x_{iT}^{'}] & & & 0 \\ & [y_{i1}, y_{i2}, x_{i1}^{'}, ..., x_{iT}^{'}] & & \\ & & \ddots & \\ 0 & & & [y_{i1}, ..., y_{iT-2}, x_{i1}^{'}, ..., x_{iT}^{'}] \end{bmatrix}. \tag{10}$$

However, if there are reasons to believe that variables are only weakly exogenous or predetermined with $E(x_{it}u_{is}) \neq 0$ for $s < t$ and zero otherwise, then only $[x_{i1}^{'}, x_{i2}^{'}, ..., x_{i,s-1}^{'}]$ are legitimate instruments for the first-differenced equation (9) at period s and W_i has to be adjusted accordingly. Multiplying (9) with a suitable matrix of instruments yields in

$$Z^{'}\Delta y = Z^{'}(\Delta y_{-1})\theta + Z^{'}(\Delta \mathbf{X})\beta + Z^{'}\Delta u \tag{11}$$

where Z is a $N(T-2)\times K$ matrix containing a mixture of strictly exogenous and predetermined instruments. Note from above that Δu is a MA(1) with unit root and $u_{it} \sim$ IID(0,σ_u^2), hence

$$E(\Delta u_i \Delta u_i^{'}) = \sigma_u^2(I_N \otimes G) \tag{12}$$

where σ_u^2 denotes the variance of u_i, I_N is an identity matrix of size N and $\otimes$ indicates the Kronecker operator. Due to the first-order moving average, G is defined as

$$G = \begin{bmatrix} 2 & -1 & 0 & ... & 0 & 0 & 0 \\ -1 & 2 & -1 & ... & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & ... & -1 & 2 & -1 \\ 0 & 0 & 0 & ... & 0 & -1 & 2 \end{bmatrix}. \tag{13}$$

with dimension $(T-2)\times(T-2)$, reflecting the non-serial correlation at higher orders of u_i (Baltagi, 2001). The optimal weighting matrix is therefore given by

$$H_1 = [Z^{'}(I_N \otimes G)Z]^{-1} \tag{14}$$

where Z is the matrix of instruments as defined above and H_1 is similar to the one used in the one-step GMM estimator of Arellano and Bond (1991). Based on estimates of the disturbance term of the one-step method I use a multiple n-step estimator, which employs in n iterative sequences the differenced residuals obtained from the $n-1$ estimation, resulting in

$$H_n = [Z^{'}\Delta u \Delta u^{'} Z]^{-1} \qquad n = 2, 3, ..., 500 \tag{15}$$

and the optimal GMM estimators are then given by applying the generalised least square (GLS) estimator with the above defined matrices by

$$\begin{pmatrix} \widehat{\theta} \\ \widehat{\beta} \end{pmatrix} \left[(\Delta y_{-1}, \Delta X)' Z \widehat{H}_N^{-1} Z' (\Delta y_{-1}, \Delta X)\right]^{-1} \left[\Delta y_{-1}, \Delta X)' Z \widehat{H}_N^{-1} Z' \Delta y\right] \tag{16}$$

5 Estimation results

Table 7 provides a summary overview over the estimated coefficients. Overall, the regressions performed very well, confirming the strong backward and forward linkages of foreign direct investment and underlining the importance of most of the variables proposed by the literature. Moreover, the estimations by sector of industry reveal new and more detailed information about the statistical significance and direction of impact of each of the variable in concern and highlight the difference between multinational firms engaged in the secondary or tertiary industry respectively.[35] The functional form of the model is a standard log-linear equation, so that coefficients can be interpreted as constant elasticities.

[Table 7 about here]

As a first step I assess the validity of the imposed moment conditions by computing the Sargan test of overidentifying restrictions. The null of strict

[35] Due to data availability not all industries described in section 2 were estimated, since the number of instruments would have surpassed the number of observations in a GMM estimation. Moreover, for the interpretation of results, it is important to note, that the aggregate primary, secondary and tertiary industries do not correspond to the sum of the sub-industries, but are taken from the UNCTAD database without adjustment in order to reflect the true level of sectoral totals.

exogeneity of all variables could not be rejected for any industry at any conventional significance level and implies that the model is correctly specified when using the instruments as specified in (10). That is, the J-Statistics reported under 'Sargan test' in table 7 is asymptotically distributed as a chi-square with as many degrees of freedom as overidentyfing restrictions (Arellano and Bond, 1991). Moreover, the assumption of no serial correlation of the stochastic error term u_{it} is essential for the consistency of the GMM estimator. I test for second-order serial correlation by regressing the first-differenced residuals on their second-order lagged value and computing a formal Wald test under the null of no serial correlation following a chi-square distribution. The null could not be rejected at the 1% significance level for all industries, thereby justifying the use of y_{it} as valid instruments with a two-period lag. For five industries the null was rejected at the 5% level and in order to account for the potential inconsistency in the estimator, I implemented higher-order lags of instruments, which were proved to solve the serial correlation in these sectors by subsequent Wald tests.

The results in table 7 demonstrate the striking importance of lagged foreign direct investment as an explanatory variable. The coefficient is highly statistically significant and stable for all industries, ranging from a low of 0.60 in the electrical manufacturing industry to a high of 0.82 in the aggregate tertiary industry and confirms the evident proximity externalities arising from past FDI. While these coefficients determine the short-run impact on the stock of FDI, the adjustment rate to equilibrium is given by $\xi = 1 - \theta$ and lies hence between 0.28 and 0.40 in the first period. These results for Southeast Asia are consistent with the findings of Wheeler and Mody (1992), Head et. al (1995) and Cheng and Kwan (2000) for FDI in the United States and China respectively.

The class of gravity variables reveals interesting results on the type of direct investment prevailing across industries. Overall, market size as measured by GDP turned out to be highly significant for FDI as a whole as well as for the aggregate primary and tertiary industries. In contrast, GDP for the total secondary sector had no impact on FDI, though all selected sub-industries registered positive and significant coefficients.[36] These findings gain further momentum when looking at the sign of the capital-labour ratio between the secondary and tertiary sector. For the latter, the negative sign in all but one industry confirms, at least partially, the predictions of the theory of the MNE that FDI is to rise when countries become more similar in relative factor endowments. [37] Together with the positive influence of

[36] The sub-industries were chosen depending on data availability for all countries. The results on GDP may seem akward in the beginning, but total secondary FDI consists of the sum of the reported sectors plus a residual 'other manufacturing', which is substantial in some of the countries.

[37] Recall from above, that the capital-labour vector is constructed such that a negative sign always indicates an increase in similarity.

market size on FDI, direct investment in the more skilled-labour intensive tertiary industry can be assumed to be of the horizontal type as shown in the models of Markusen (1984), Markusen and Venables (1995) and Markusen (2000). However, the predominant positive sign in the majority of manufacturing industries rather points to the importance of vertically integrated multinational firms (Helpman, 1984) in the secondary industry, aiming at exploiting differences in factor rewards across countries. Changes in the capital-labour ratio towards less similarity potentially influence returns on the factors of production and may hence stimulate vertical foreign direct investment.

This hypothesis is substantially supported when looking at the overall importance of the wage-ratio between the recipient and source country. As expected, a decline in the wage-ratio triggers further direct investment into the countries of Southeast Asia and is particularly pronounced in more labour-intensive industries such as in the primary sector or the heavy metal manufacturing industry. The overall significance of the wage-ratio across sectors is consistent with both vertical and horizontal FDI, since both maintain production facilities in the host country. In contrast, the majority of distance coefficients clearly point to the dominance of horizontal direct investment, since a rise in distance or transport costs tend to increase FDI in the panel with the MNE substituting exports for investment. Interestingly, as opposed to the manufacturing sector, distance was not statistically significant in a number of tertiary industries, which are generally characterised by non-tradeable goods for which a multinational firm has no choice of whether to serve the foreign market via exports or FDI and hence distance or transport costs may not be of relevance for the decision of a MNE in these sectors.

The impact of distance on FDI is also in line with the results obtained for the tariff variable, emphasising the fact that rising transaction or transport costs may substitute trade for FDI. The 'tariff-jumping' hypothesis (Blonigen et. al, 2002) is supported by the predominantly positive and significant coefficients across most industries, indicating that a rise in trade tariffs increased foreign direct investment. However, a look at the magnitude of the impact reveals that tariffs play a statistically non-negligible, albeit limited role in attracting FDI in Southeast Asia with most of the coefficients being close to zero. This also true for the infrastructure variable, namely telephone lines per 100 inhabitants, which overall performed poorly. Some industries show counterintuitive negative numbers, but in most sectors it turned out to be not significant at all. These estimates confirm the ambiguous results of infrastructure variables in models of FDI, being likewise negative and/ or not significant in the studies of Cheng and Kwan (2000) and Kinoshita and Campos (2003).

Turning to the crucial factor of direct investment in the theory of the MNE, stock markets as a proxy for Tobin's Q and intangible assets emerged

as a powerful source for explaining FDI. The coefficients of weighted stock markets of direct investment source countries are highly significant, positive and large in all but two industries. The less significant and negative impact in the primary sector is not surprising given the relatively low knowledge-capital and skilled-labour intensity in production. However, the important role of intangible assets in the secondary and tertiary industries is well documented by the estimation results and fully underlines the predictions and stylised facts of the theory of the MNE (see also Markusen, 2000). Hence, a 10% rise in the foreign stock markets increases total foreign direct investment in Southeast Asia by 9%. These relatively large and highly significant coefficients also translate the risk for and exposure of host countries to cyclical developments abroad. Global booms and recessions are generally well captured in the movements of stock markets and may hence serve as a strong channel of business cycle transmission via direct investment.

The results for the effect of exchange rate levels on FDI are ambiguous, but reveal an interesting industrial pattern. As expected, a depreciation of the real effective exchange rate induces an increase in direct investment in all but one manufacturing industries via the channels proposed in the literature (Cushman, 1985; Froot and Stein, 1991; Blonigen, 1997; Chackrabarti and Scholnick, 2002). However, FDI in the primary and tertiary sectors seems to react differently to changes in the exchange rate level, leading to a reduction of direct investment inflows when the host country's effective exchange rate depreciates. This effect may have several reasons: firstly, it is worth mentioning that an increase in the real effective exchange rate does not imply that the host country's currency appreciated bilaterally against all partner countries. It may well be that some of the ten largest investors experienced an appreciation against the recipient country, which were more than counterbalanced in aggregated terms. The real effective exchange rate is a summary measure of the real value of a currency against a basket of partner currencies, which seems specifically important for export-orientated foreign direct investment and less significant for industries of non-tradeable goods. The manufacturing industries in less developed economies in Southeast Asia are often used as a location for final assembling and as an export-platform to third markets by more advanced countries such as Japan, Korea or Taiwan. In contrast, tertiary industries amount largely to non-tradeable goods and may be less concerned with the real external value of a country's currency. Secondly, direct investment in service industries is somehow horizontal by definition, focusing on the market potential and efficient provision of services to the local customer base and cancelling out the possibility of exports. However, services may still have significant backward linkages in the form of imported goods, which will become cheaper if the host country's currency appreciates and hence reduces the costs of the multinational

firm.[38] An appreciation of the recipient country's currency may therefore exert a similar cost advantage channel as proposed by Cushman (1985) for import-intensive tertiary industries. A third channel was suggested by Goldberg and Klein (1995) and relates to the previous idea. They note that the import-inducing appreciation of the currency increases protectionary pressures on the host country's government. Foreign direct investment is then undertaken in anticipation of the future implementation of trade barriers.

Finally, exchange rate volatility turned out to be statistically insignificant in the majority of industries with the direction of impact varying across sectors. Total direct investment and the aggregated secondary sector show a positive and significant coefficient, underlining the hypothesis of Cushman (1985) and Goldberg and Kolstad (1985) that FDI is to rise when volatility increases. The striking unimportance of volatility in all tertiary industries is thereby plausible and consistent with the idea of the two former studies. FDI is expected to rise because multinational firms reduce exports to a foreign market in response to the increase in risk. Again, this argument seems only valid if firms indeed have a choice between exporting or direct investment. However, as argued above, tertiary industries are likely to be attached to non-tradeable goods, whose only way of provision rests on local presence in the foreign market. Therefore, with multinationals being unable to choose between exporting or FDI, volatility is expected to have no significant impact on direct investment.

5.1 The impact of foreign direct investment on trade flows

FDI may vary in its effects on exports and imports depending on the type of and motivation behind the investment. On the one hand, multinational firms that aim at shifting parts of their value-added chains to countries which are relatively abundant in the factor used intensively in one stage of production give direct rise to trade because the outsourced segments have to be put together at the final stage of assembling. Similarly, direct investment which is driven by exploiting natural resource endowments or raw materials are generally export-orientated, increasing the volume of trade by serving third markets from the resource-abundant host country. In the same way, multinationals may tend to import raw materials or intermediate goods from the headquarters country if the objective is to serve the foreign market, but required inputs are not accessible or available locally. On the other hand, foreign direct investment may influence the level of trade through indirect effects on the micro- and macroeconomic structure of the recipient country. More precisely, FDI in general, and the agglomeration or clustering of multi-

[38] To see this, the provision of transport or telecommunication services may well need specialised and high-tech material from a multinational country's home market. Transport equipment such as buses, trains or cars may be produced in the more skilled-labour or capital abundant country and exported to the host country.

national firms in particular, are likely to affect the structural competitiveness of domestic firms via technological spill-overs, changes in the relative factor endowments or market structure and may ultimately influence the national competitiveness as a whole. FDI-induced increases in productivity or efficiency can give rise to new absolute or comparative advantages and hence alter the volume of trade. Furthermore, direct investment generally impacts the level of domestic employment, national income and prices. Thus, with imports being a function of income, FDI may increase the volume of imports through an indirect consumption effect. A similar supply side effect can arise if domestic production is skewed towards the export-orientated sector. Finally, direct investment may simply substitute for trade if the multinational firm is of the market-seeking type and has chosen FDI as its preferred mode of serving the foreign customer base without having to import specific inputs from abroad.

The impact of foreign direct investment on trade is tested separately for exports and imports in each industry and is estimated using a simple gravity model as discussed above. It is worth mentioning that the objective lies not in constructing an overarching model for trade flows in Southeast Asia, but rather to identify the relative importance of FDI in explaining changes in the volume and direction of trade at a sectoral level. The gravity model is specified as a one-way error component model with

$$trd_{it} = \beta\Omega_i + \iota_i + \upsilon_{it} \quad i = 1, 2, ..., N; \quad t = 1, 2, ..., T; \quad k = 1, 2, ..., K \quad (17)$$

where ι_i are similar time-invariant country-specific effects as η_i and υ_{it} is a stochastic error term with $\upsilon_{it} \sim \text{IID}(0, \sigma_u^2)$. trd_{it} refers to the GDP-deflated industry-specific exports or imports of panel country i and Ω_i includes the sum of the real GDP of the panel country and the weighted real GDP of its partner countries, weighted distance and the real industry-specific inward stock of foreign direct investment.[39] That is, I explicitly add FDI as a regressor in the standard gravity model of trade. Exports and imports are taken from the CHELEM database (or Harmonized Accounts on Trade and the World Economy) provided by CEPII, which is a unique database that allows for comparisons between investment and trade flows.[40] All variables are in natural logarithms. The model is estimated using the least squares dummy variable (LSDV) estimator discussed above,

[39] To pin down the effect of FDI on trade I use the same index for distance as in the model for FDI. Trade is hence explained by the distance to the ten largest foreign investors.

[40] Common data providers report international trade flows in SITC (Standard International Trade Classification) nomenclature, while direct investment figures are published using ISIC (International Standard Industrial Classification), two classifications which are not linked with each other in any consistent form. CHELEM allows to filter trade flows from SITC to ISIC, so that both FDI and trade flows are expressed in similar industrial classifications.

which amounts to an unbiased and efficient estimator for the given specification. GLS weights are chosen to account for the presence of cross-section heteroskedasticity and standard errors are robust to cross-equation (contemporaneous) correlation as well as different error variance in each unit (White-type robust standard errors).

[Table 8 about here]

Table 8 shows the results of the estimations for both exports and imports.[41] Overall, the regressions unambiguously confirm the expected importance of FDI on trade flows in Southeast Asia with all coefficients being highly significant and positive except for one industry in each section. For the secondary sector in particular, FDI increases the volume of trade in a similar magnitude for both exports and imports, amounting to an elasticity of around 0.3. The labour-intensive textile and clothing industry showed relatively large coefficients for exports and imports, indicating the potential presence of mostly vertically integrated multinational firms. The impact of FDI on exports is somewhat smaller in most of the other secondary industries for which a 10% increase in FDI results in a 1% rise in exports. Moreover, the estimations clearly reject the hypothesis of market-seeking FDI acting as an import-substitute, demonstrated at least partially by the high and significant coefficient for the tertiary sector as a whole. One possible explanation could lie in the above described consumption effect, which may have increased the average propensity to import services, given the simultaneous rise in GDP in most of the countries in the panel (see also Shan et. al 1997 for a Granger causality test on GDP and FDI in China). GDP as an independent regressor was highly significant for all but one industry and confirmed the positive influence on the volume of trade. Distance proved to be insignificant for the tertiary sector as a whole and for a number of secondary industries on the export side. These findings are consistent with the results for FDI.

In addition to the intra-industry relationship between trade and direct investment I performed a number of regressions testing for spill-overs from FDI to other industries. The results are promising and indicate that the stock of direct investment in the tertiary industry is to increase both exports and imports in the secondary sector by around 2.5% if FDI in services was to rise by 10%. Similarly, foreign direct investment in the secondary industry is positive and highly significant for imports and exports in the tertiary sector, underlining the indirect effects of FDI on trade via competitiveness, employment and income.

[41] Since equation (17) was estimated using the fixed effects estimator, more industries could be tested as compared to the model on FDI. For the latter, the number of instruments (moment conditions) were not sufficient for some industries.

The overall findings for the linkages between trade and FDI are difficult to compare with previous studies, which usually focused on a single country rather than a panel and rarely on the industrial decomposition. However, most of the studies showed ambiguous results for the impact of FDI on trade. Bayoumi and Lipworth (1997) were not able to prove that FDI stocks exert any impact on both exports and imports in Japan. Lee (2002) used a similar gravity model as this study does and concluded that direct investment from Korea increased the volumes of exports and overall trade, while imports tended to be statistically insignificant. Yong (2003) found that inward FDI has a larger effect on imports than on exports in China, which matches the results for the panel of Southeast Asian countries. Rothmuller (2003) performed a similar exercise for trade and FDI flows by industry in Brazil, again showing that FDI had a larger impact on imports than on exports, but with FDI being insignificant in the majority of industries. A number of other studies using more disaggregated firm-level data also showed that trade was to rise with increased FDI (Lipsey and Weiss, 1984; Blomstroem et. al, 1988; Head and Ries, 2001), while Frank and Freeman (1978) and Cushman (1988) found that FDI may substitute for trade. In general, more empirical evidence indicates to a complementarity relationship between trade and direct investment, which is underlined by the results presented above.

6 Conclusions

This study attempts to find further empirical evidence on the choice of location of foreign direct investment and its impact on the volume and direction of trade. It aims at better understanding the determinants behind Southeast Asia's wave of foreign direct investment inflows over the past two decades. Southeast Asia is a very interesting and important case in the analysis of FDI due to its vibrant dynamics and sheer magnitude of direct investment inflows into the region since the beginning of the 1980s. The geographical distribution of international production and service networks by multinational firms has significantly promoted the specialisation in the region based on comparative advantages and the self-reinforcing clustering of industries.

To take account of these developments, a model is estimated that incorporates the agglomeration dynamics of FDI by including the lagged stock of direct investment as an additional regressor. Other potential explanatory variables are specified in accordance to the predictions of the theory of the multinational firm. In addition, the model embodies a second, mostly independent strand of literature on the relationship between exchange rate movements and FDI by controlling for the level and volatility of the real effective exchange rate.

The model is estimated for a number of industries and the strong self-reinforcing effect found for all sectors confirms the evident externalities aris-

ing from direct investment. This may, at least partially, explain the pronounced specialisation of production in Southeast Asia. Moreover, for the primary and the main secondary and tertiary sectors, market size is found to be of high statistical importance for FDI inflows in the region, reflecting the increasing degree of intra-Southeast Asian cross-border investment activity and the penetration of neighbouring markets. Nevertheless, relative low wages are similarly or even more significant than market size in the majority of industries, indicating to some extent the operation of vertically integrated multinationals in the region, which locate parts of their production process into countries where that particular process may be performed more inexpensively or efficiently. The importance of cost-considerations for the secondary manufacturing industries is emphasised by the negative and robust coefficient of the real effective exchange rate, while FDI inflows in the service industries tend to increase when the effective exchange rate appreciates. Exchange rate volatility is found to be significant only in industries in which a multinational firm has a choice between exporting or investing abroad. Most industries that are characterised by non-tradeable goods are neither affected by increased exchange rate volatility nor by the distance to the foreign market. The positive and significant impact of distance on the majority of secondary sectors and the rise in FDI in a number of tertiary sectors when countries become more similar in relative factor endowments further accentuates the increasing importance of horizontal direct investment in Southeast Asia. Tariffs and the local infrastructure as measured by telephone lines per 100 inhabitants turned out be of no or minor statistical significance.

One of the main findings, however, relates to the role of foreign stock market indices as a proxy for intangible assets and source of funds. In almost all industries the coefficient was positive, large and highly significant. These results confirm the relative importance of intangible assets attached to in the literature and underline the developments in direct investment inflows in Southeast Asia. In fact, a rising share of FDI in the 1990s was into the knowledge-capital intensive tertiary sector, accounting for half or more of total direct investment inflows even in less developed economies like the Philippines or Thailand. These findings are also consistent with the results of De Santis et. al (2004) for euro area FDI into the United States.

The impact of foreign direct investment on overall trade flows in Southeast Asia is robust and positive for all industries. This indicates that FDI did not substitute for trade in any sector in the region, but rather increased both export and imports with a more pronounced rise in the latter. This is especially true for imports in the tertiary sector and is consistent with the findings on the determinants of FDI in the service industries. Market-seeking horizontal direct investment is attracted by rising income in the host country and is less concerned with exporting, but is likely to import highly specialised inputs or services from its headquarters abroad. More-

over, cross-sector spill-overs of foreign direct investment are found to be highly statistically significant with FDI in both the secondary and tertiary industry increasing the volume of trade in the other sector. To some extent, these results highlight the potential indirect effects of FDI on trade via competitiveness, income and transfer of technological know-how.

Overall, the findings of this study also bear some potentially dangerous implications of direct investment on the recipient country. The *ceteris paribus* rise in imports through increased FDI, specifically in the tertiary industry, is well documented by the negative trade balance on services for the vast majority of countries in Southeast Asia over the past two decades. With direct investment being increasingly intensive in industries with significant levels of knowledge-capital, less developed recipient economies may eventually suffer from a negative net effect of FDI on the balance-of-payments. If multinational firms find it interesting to invest abroad because of rising market size and in order to exploit their intangible assets, but inputs are not available locally, the share of imports will further increase. In particular, China is still enjoying a large surplus from its trade activities largely as a result of direct investment, but with the combination of a relatively large customer base and sizeable differences in the relative factor endowments with respect to its main foreign investors, imports may sooner or later outpace exports and drive down export-led growth.

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	FDI inflows								FDI inward stocks	
	in USD billions average		rates of growth in % average		as % of world total average		as % of GFCF as at the end of		as % of GDP as at the end of	
	1980s	1990s	1980s	1990s	1980s	1990s	1990	2001	1990	2002
World	***97.9***	***398.2***	***17.5***	***20.9***	***100.0***	***100.0***	***4.5***	***12.8***	***9.3***	***22.3***
Developed countries	75.4	266.5	18.5	22.0	74.4	65.5	4.8	12.7	8.2	18.7
European Union	29.5	147.6	22.4	25.3	28.7	37.1	6.7	24.5	10.9	31.4
United States	35.5	89.1	27.4	28.2	34.7	20.2	5.7	8.8	6.9	12.9
Japan	0.2	2.6	733.8	314.7	0.4	0.6	0.2	0.6	0.3	1.5
Southeast Asia	***9.3***	***65.4***	***25.3***	***22.0***	***9.1***	***18.2***	***5.0***	***10.3***	***20.9***	***38.0***
China	1.7	28.5	76.2	37.2	1.5	7.7	3.5	10.5	7.0	36.2
Hong Kong, China	2.3	9.0	110.3	51.6	2.1	2.2	16.3	54.2	269.7	265.7
Taiwan	0.5	1.5	36.1	118.3	0.4	0.5	3.7	7.8	6.1	11.9
Indonesia	0.3	2.1	21.0	-52.1	0.4	0.8	3.4	-10.8	34.0	32.2
Korea, Republic of	0.4	2.6	216.2	33.6	0.3	0.6	0.8	3.1	2.1	9.2
Malaysia	1.0	4.8	16.2	15.6	1.3	1.7	18.0	2.5	23.4	59.4
Philippines	0.2	1.3	215.0	14.3	0.2	0.4	5.4	8.0	7.4	15.0
Singapore	2.0	8.1	14.9	31.2	2.1	2.3	46.8	43.8	83.1	142.7
Thailand	0.5	3.2	48.1	19.4	0.5	0.9	7.5	14.4	9.6	23.9
Other	13.2	66.2	28.2	28.4	16.5	16.4	n/a	n/a	n/a	n/a

Source: UNCTAD. Notes: GFCF denotes Gross fixed capital formation.

Table 1: Summary statistics of developments in foreign direct investment

Host / *Source*	China [1]	Hong Kong	Indonesia	Japan	Malaysia	Philippines	Korea	Singapore	Taiwan	Thailand
Australia			7.0%						3.8%	
Bermuda		14.7%				4.2%		5.1%		
British Virgin Islands	5.3%	25.5%				5.7%			17.9%	
Canada				3.8%				7.0%	1.4%	
Cayman Islands		2.1%		6.9%						
China		18.9%				3.1%				
France	1.3%			17.0%			4.6%	3.0%		3.8%
Germany	2.0%		6.3%	4.2%	4.3%	3.0%	6.3%			3.4%
Hong Kong, China	44.7%		3.8%	1.6%		6.7%	2.4%	2.2%	6.2%	10.1%
Ireland							2.7%			
Japan	8.1%	3.6%	19.2%		21.1%	24.4%	8.7%	17.4%	17.2%	27.6%
Korea, Republic of	3.8%	2.2%	3.8%		3.9%					
Malaysia			6.0%				10.0%	3.0%		
Netherlands		12.4%		18.6%	2.1%	9.7%	16.0%	9.1%	3.0%	7.4%
Pakistan					1.4%					
Philippines									3.1%	
Singapore	5.5%	2.2%	9.2%	4.5%	16.3%	4.1%	4.8%		7.5%	11.4%
Switzerland				2.6%	5.3%	12.9%				2.1%
Taiwan	7.3%		6.3%		8.5%			2.4%		3.8%
United Kingdom	2.4%	3.5%	20.9%	4.7%	2.4%		2.6%	17.1%	3.1%	3.4%
United States	8.8%	7.9%	5.3%	33.4%	28.8%	12.9%	31.3%	21.7%	24.9%	21.5%
Country total [2]	89.1%	92.8%	87.9%	97.4%	94.0%	86.6%	89.6%	87.9%	87.9%	94.4%

Source: UNCTAD. Note: Figures for Indonesia, Malaysia and Thailand are pre-normalised due to an unspecified share in the geographical breakdown.

1) Average over the period from 1994 to 2001.

2) Corresponds to the sum of the shares of the ten largest investors in each country.

Table 2: Foreign direct investment inflows by country of origin

(10 largest investors; average over the period from 1995 to 1999, unless otherwise indicated)

Host / *Industry*	China [1]	Hong Kong [2]	Indonesia	Japan	Malaysia [3]	Philippines	Korea	Singapore [4]	Taiwan	Thailand
Primary	**2.3%**		**5.6%**			**4.3%**	**1.0%**		**0.0%**	**1.8%**
Secondary	**68.6%**	**3.9%**	**64.0%**	**39.5%**	**100.0%**	**45.7%**	**57.5%**	**26.6%**	**52.3%**	**31.7%**
Food, beverages and tobacco			3.0%	0.8%	2.2%	12.0%	6.6%	0.4%	2.4%	2.3%
Textiles, clothing and leather			2.5%	0.2%	4.6%	0.9%	1.1%	0.0%	2.2%	1.5%
Coke, petroleum products and nuclear fuel				1.2%	22.4%	9.1%	5.2%	3.6%		0.0%
Chemicals and chemical products			32.3%	9.1%	10.9%	3.9%	11.7%	8.2%	8.0%	4.2%
Metallic and non-metallic products			11.9%	3.0%	20.3%	5.1%	2.4%	1.6%	7.4%	4.5%
Machinery and equipment				23.9%	2.6%	5.9%	7.1%	0.7%	2.9%	6.3%
Electrical and electronic equipment					27.4%		13.4%	10.7%	25.6%	9.3%
Motor vehicles and other transport equipment			0.9%		2.2%	2.7%	3.9%	0.4%	2.5%	
Other manufacturing			13.4%	1.4%	7.5%	5.9%	6.1%	0.9%	1.3%	3.6%
Tertiary	**29.1%**	**92.8%**	**30.5%**	**60.5%**		**49.1%**	**41.4%**	**73.4%**	**42.8%**	**66.5%**
Construction	2.6%	1.6%	1.1%	0.1%		3.7%	0.3%		0.7%	4.4%
Trade	2.8%	15.1%	0.7%	18.4%		4.1%	4.7%		13.9%	18.2%
Real Estate and business activities	16.8%	55.0%	10.6%	17.2%		4.0%	2.8%		0.7%	12.3%
Transport, storage and communications	2.5%	4.5%	6.9%	5.3%		8.5%			2.6%	1.8%
Finance		16.6%		18.7%		17.5%	12.8%		15.7%	23.5%
Other services	4.4%		11.1%	0.8%		11.5%	20.9%		9.3%	6.3%
Unspecified	0.0%	3.3%	0.0%	0.0%	0.0%	0.8%	0.0%	0.0%	4.9%	0.0%

Source: UNCTAD. Figures for China, Indonesia, Japan, Malaysia and Taiwan are on approval basis.

1) Average over the period from 1995 to 2002 due to data availability.

2) Average over the period from 1998 to 2002. Hong Kong provides a breakdown by tertiary activities only from 1998 onwards, while at the same time the split for secondary direct investment ceased. The choice for the latter period reflects the importance of tertiary direct investment in Hong Kong.

3) A detailed breakdown is only available for secondary industries. Stock data up to 1995 reveal that tertiary FDI amounts to around 35% of the inward stock.

4) Average over the period from 1990 to 1998. In 1999, Singapore recorded a large share of unspecified secondary direct investment.

Table 3: Foreign direct investment inflows by sector of industry
(average over the period from 1990 to 1999, unless otherwise indicated)

Destination [Origin] *Partner*	China	Hong Kong	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Thailand
Africa n.e.s.			4.7						
Australia			5.5	4.7	4.0	2.7	2.6		
Canada		[2]							
China		37.6 [27.1]	[3.9]	10.2 [4.5]	5.6 [7.2]			3.7	3.2 [2.5]
Germany	5.6 [4]	2.3 [14.2]	12.3 [3]	8.2 [9.7]	4.5 [6.6]	4.3 [3.3]	3.3 [4.4]	3.5 [3.5]	5.2 [6]
Channel Islands	2.9								
Heard McDonald Isles					4.6			8.4	
Hong Kong	9.6 [26.2]		[3.1]	[5.9]	[7.6]	[4.7]	4.2 [4.7]	[8.4]	[5.2]
Indonesia				4.6					
Italy		1.7							
Japan	20.2 [17.1]	14.3 [4.7]	20.8 [27.1]		22.3 [13]	24.4 [12.7]	19.9 [15.9]	19.4 [7.6]	28.2 [16.1]
Malaysia		1.9			[2.3]		[2.8]	15.4 [16.6]	4.5 [3.2]
Netherlands	[2.2]	[2.2]	[3.2]			[3.3]	[6]	[2.8]	[3.6]
Republic of Korea	7.7 [3.9]	4.9	6.0 [6.1]	4.8 [5.9]		4.3 [3.1]	5.5	[2.7]	3.7
San Marino					3.2				
Saudi Arabia					4.3		3.8	3.9	
Singapore	[2.4]	4.6 [4.2]	7.1 [9.6]	[4.4]	[4.1]	14.0 [20]	5.1 [5.5]		6.2 [10.8]
Southern Africa n.e.s.				3.5					
St.Helena					4.2				
Taiwan	10.8 [1.7]	8.1 [3]	[3.6]	4.0 [6.3]	[3.5]	5.2 [3.7]	5.4 [4.8]	4.1 [4.4]	4.9
Thailand				[3.4]		3.1 [3.6]	[2.7]	4.6 [5.3]	
Tonga						3.1	31.9	9.8	
United Arab Emirates				3.5	7.3				
United Kingdom	[2]	2.3 [5.3]	[2.4]	[3.4]	[2.6]	3.0 [3.8]	[4.9]	[3.1]	[3.4]
United States	11.7 [17.2]	7.7 [27.5]	12.3 [13.7]	22.8 [29.3]	21.9 [20.4]	16.8 [19.9]	18.6 [34.9]	16.4 [19.3]	12.3 [20.6]
US Virgin Islands	7.2		4.3						
USSR (Former)	3.6 [1.6]								

Source: UNCTAD. Notes: For Taiwan no figures were available separately. N.E.S. stands for 'not elsewhere specified'.

Table 4: Imports and exports by country of origin and destination

(10 largest trading partners; in percentage points; exports in square brackets; average over the period from 1990 to 1999)

Host / *Industry*	China	Hong Kong	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
Secondary	**86.6%**	**87.3%**	**81.8%**	**78.5%**	**83.0%**	**82.5%**	**75.5%**	**78.1%**	**82.6%**	**76.6%**
Food, beverages and tobacco	3.5%	4.3%	4.6%	3.8%	2.2%	4.4%	4.7%	1.5%	2.4%	6.6%
Textiles, clothing and leather	19.4%	17.9%	10.6%	3.9%	9.9%	3.5%	6.6%	2.3%	8.7%	6.9%
Coke, petroleum products and nuclear fuel	1.1%	2.1%	3.0%	1.1%	2.6%	1.5%	0.9%	6.6%	1.0%	1.4%
Chemicals and chemical products	4.7%	2.7%	4.8%	4.2%	4.8%	3.3%	3.0%	3.9%	4.9%	3.9%
Metallic and metal products	6.8%	4.9%	5.1%	5.9%	7.7%	4.6%	4.1%	3.9%	9.1%	6.2%
Machinery and equipment	6.8%	4.5%	6.9%	9.3%	7.6%	5.6%	4.9%	5.3%	7.4%	7.0%
Electrical and electronic equipment	18.0%	25.9%	8.0%	19.9%	20.8%	38.4%	32.2%	37.3%	27.5%	20.7%
Motor vehicles and other transport equipment	3.3%	3.8%	3.1%	12.5%	7.8%	3.3%	3.3%	3.6%	4.3%	4.8%
Other manufacturing	7.9%	9.7%	4.3%	4.6%	4.4%	3.7%	3.8%	4.9%	5.0%	6.3%
Tertiary	**12.3%**	**11.8%**	**17.5%**	**20.7%**	**16.3%**	**16.8%**	**23.8%**	**21.2%**	**16.6%**	**22.5%**
Construction	1.1%	0.9%	0.7%	0.8%	0.7%	0.8%	0.6%	0.7%	0.9%	0.9%
Transport	3.3%	3.3%	4.5%	5.8%	6.3%	4.9%	3.6%	5.3%	4.2%	6.8%

Source: CHELEM database. Trade for services are taken from the online database of the World Trade Organisation (WTO).
Note: Figures do not sum up to 100 due to the use of different data sources. Secondary industries are chosen to match ISIC Rev. 3 FDI categories and the sum does hence not correspond to the secondary total.

Table 5: Total trade by sector of industry
(average over the period from 1990 to 1999)

Variable / *Industry*	FDI(-1)	GDP	CAP_LAB	WAGE	STOCKS	FX(-1)	FX_VOL	DIST	TARIFF	TELE	Sargan test	Wald test
Total	0.710***	0.211***	-0.056**	-0.263***	0.902***	0.183***	0.025***	0.153***	0.002**	0.001	118.107	2.634
	(55.356)	(5.173)	(-2.035)	(-11.990)	(32.655)	(10.674)	(5.373)	(11.016)	(2.348)	(0.619)	(0.849)	(0.105)
Primary	0.684***	0.470***	-0.075	-0.753***	-0.106*	0.775***	-0.031***	0.362***	0.013***	0.011***	69.855	5.362
	(59.554)	(3.855)	(-1.378)	(-7.486)	(-1.793)	(9.657)	(-3.608)	(6.783)	(6.929)	(7.731)	(0.923)	(0.021)
Secondary	0.780***	0.055	-0.056**	-0.088***	0.392***	-0.063***	0.025***	0.115***	0.002**	-0.001	125.631	2.327
	(62.093)	(1.105)	(-2.540)	(-2.879)	(12.995)	(-2.675)	(6.176)	(3.881)	(2.396)	(-0.982)	(0.568)	(0.127)
Food, beverages and tobacco	0.682***	0.133***	-0.135***	-0.302***	0.647***	0.429***	-0.007	0.269***	-0.005***	-0.002	117.778	5.002
	(30.306)	(2.743)	(-3.731)	(-5.506)	(18.895)	(9.016)	(-1.025)	(5.506)	(-3.012)	(-1.235)	(0.411)	(0.025)
Textiles, clothing and leather	0.705***	0.265***	0.134***	-0.237***	0.742***	-0.370***	0.033***	-0.010	0.003*	0.012***	111.814	1.699
	(38.251)	(3.263)	(3.373)	(-4.333)	(17.244)	(-10.057)	(3.794)	(-0.147)	(1.843)	(6.7823)	(0.567)	(0.102)
Chemicals and chemical products	0.676***	0.465***	0.174***	-0.101*	0.551***	-0.197***	0.006	0.273***	0.001	-0.008***	116.019	0.0325
	(53.935)	(7.691)	(5.736)	(-1.973)	(12.326)	(-4.323)	(0.695)	(5.861)	(0.689)	(-3.620)	(0.456)	(0.857)
Metal and metal products	0.682***	0.693***	0.057**	-0.567***	0.751***	-0.178***	-0.012*	0.202***	0.002*	-0.001	115.884	0.051
	(27.972)	(9.586)	(2.096)	(-13.169)	(15.910)	(-3.709)	(-1.772)	(5.227)	(1.949)	(-0.565)	(0.459)	(0.822)
Electrical and electronic equipment	0.596***	0.566***	0.270***	-0.049	0.799***	-0.531***	-0.003	0.416***	0.008***	-0.010***	79.944	4.088
	(21.156)	(5.004)	(6.298)	(-0.836)	(20.037)	(-7.880)	(-0.594)	(5.199)	(10.136)	(-4.486)	(0.195)	(0.043)
Tertiary	0.817***	0.149**	-0.042	-0.204***	0.380***	0.212***	-0.005	0.039**	0.004***	0.002	133.248	0.126
	(50.093)	(2.317)	(-1.293)	(-5.572)	(9.887)	(8.055)	(-0.762)	(2.160)	(4.001)	(1.569)	(0.358)	(0.722)
Construction	0.701***	0.184*	-0.093	-0.313***	-0.087**	0.005	0.015*	-0.451***	0.011***	0.003	117.659	0.011
	(24.711)	(1.751)	(-1.494)	(-4.303)	(-2.044)	(0.105)	(1.731)	(-5.918)	(6.651)	(1.297)	(0.466)	(0.918)
Trade	0.642***	0.035	-0.156***	-0.255***	0.329***	0.530***	0.005	0.254***	-0.004***	0.021***	92.684	0.445
	(43.718)	(0.531)	(-4.730)	(-3.810)	(9.557)	(7.943)	(0.607)	(4.544)	(-2.657)	(9.780)	(0.374)	(0.505)
Transport, storage and communications	0.662***	1.033***	0.715***	-0.241	1.404***	0.358*	-0.019	-0.404*	-0.019***	0.004	53.671	4.554
	(11.902)	(3.2823)	(4.193)	(-1.160)	(8.634)	(1.796)	(-0.469)	(-1.960)	(-3.265)	(0.601)	(0.841)	(0.033)
Finance	0.812***	0.231**	-0.035	-0.358***	0.493***	-0.188***	0.006	-0.053	0.001	0.011***	111.426	1.399
	(76.437)	(2.341)	(-0.689)	(-8.563)	(9.778)	(-4.236)	(1.090)	(-1.281)	(0.943)	(6.866)	(0.292)	(0.237)
Real Estate and business activities	0.654***	0.438***	-0.449***	-0.950***	1.361***	0.933***	0.017	0.008	0.013***	-0.024***	77.343	5.716
	(37.681)	(4.270)	(-5.535)	(-19.651)	(13.951)	(13.487)	(1.4652)	(0.107)	(8.212)	(-5.834)	(0.710)	(0.017)

*Notes: t-statistics in parenthesis. *,** and *** indicate statistical significance at the 10, 5, and 1 percent level respectively. FDI(-1) refers to the lagged stock of FDI in each industry.*

Table 7: Estimation results for industry-specific stock of FDI as dependant variable

Variable	Exports			Imports		
Industry	FDI	SUM_GDP	DIST	FDI	SUM_GDP	DIST
Total	0.159***	0.589***	0.001	0.297***	0.487***	-0.455***
	(4.568)	(12.567)	(0.021)	(7.078)	(9.729)	(-7.558)
Secondary	0.295***	0.286***	-0.119	0.287***	0.404***	-0.427***
	(5.764)	(3.448)	(-1.276)	(7.313)	(5.719)	(-5.764)
Food, beverages and tobacco	0.022	0.170**	-0.266***	0.383***	0.141	-0.193*
	(0.702)	(2.031)	(-3.368)	(8.037)	(1.522)	(-1.961)
Textiles, clothing and leather	0.344***	0.108*	-0.711***	0.321***	0.518***	-1.002***
	(15.135)	(1.610)	(-6.996)	(6.704)	(3.682)	(-8.457)
Chemicals and chemical products	0.081	0.852***	0.597***	0.128***	0.436***	-0.175***
	(1.310)	(6.678)	(5.7512)	(3.189)	(4.199)	(-3.442)
Metal and metal products	0.095***	0.564***	0.0216	0.214***	0.484***	-0.569***
	(3.434)	(7.998)	(0.253)	(5.770)	(4.273)	(-5.178)
Machinery and equipment	0.097***	0.968***	0.762***	0.047***	0.733***	-0.348***
	(8.499)	(12.838)	(8.048)	(4.536)	(10.048)	(-2.619)
Electrical and electronic equipment	0.098***	1.247***	0.149	0.009	1.292***	0.168**
	(2.686)	(13.330)	(1.192)	(0.254)	(12.654)	(2.319)
Motor vehicles and other transport equipment	0.326***	0.476***	0.252**	0.179**	0.516***	-1.158***
	(5.992)	(5.289)	(2.398)	(2.365)	(3.808)	(-5.941)
Tertiary	0.225***	0.485***	-0.026	0.457***	0.219***	-0.104
	(5.259)	(9.680)	(-0.261)	(14.414)	(5.001)	(-1.153)
Construction	0.215***	0.404***	-0.447***	0.152***	0.778***	-0.506***
	(3.521)	(4.879)	(-3.724)	(4.124)	(9.299)	(-3.838)
Transport, storage and communications	0.057***	0.639***	-0.720***	0.068***	0.485***	-1.181***
	(4.076)	(7.460)	(-4.002)	(7.635)	(8.826)	(-6.060)

*Notes: t-statistics in parenthesis. *,** and *** indicate statistical significance at the 10, 5, and 1 percent level respectively.*

Table 8: Estimation results for industry-specific exports and imports as dependant variables