

Outward FDI by Singapore: a different animal?*

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Singapore's outward foreign direct investment is unique in important respects, even though it shares some characteristics with foreign direct investment undertaken by traditional investor countries. The focus of this investment on manufacturing in lower-income Asian host countries suggests that the motivations and trade repercussions of Singapore's foreign direct investment differ from those of such investment undertaken by major industrialized countries. We apply basic gravity models in order to investigate the relationship between Singapore's outward foreign direct investment and trade and, thereby, to assess whether the concern that outward foreign direct investment has adverse labour market implications are economically founded. We do not find that Singapore's foreign direct investment has replaced exports, but the balance-of-payments effects differ considerably across manufacturing industries.

Keywords: vertical and horizontal FDI, trade effects, labour market implications, gravity model

JEL classification: F21, F23, F14

1. Introduction

The fear that outward foreign direct investment (OFDI) has adverse labour market repercussions for the home economy is widely shared in advanced economies, even though public

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concerns are not necessarily grounded on rigorous empirical research. J. P. Agarwal (1997) pointed out that such worries existed in countries such as France, Germany, Japan, and the United States in the mid-1990s and earlier. In the United States, FDI flows to Mexico following the creation of the North American Free Trade Agreement (NAFTA) were supposed to represent a “giant sucking sound” of jobs in the United States. S. Brainard and D. Riker (1997a) as well as M. J. Slaughter (2000) found little evidence to this effect, whereas M. Blomström et al. (1997) as well as R. C. Feenstra and G. H. Hanson (1996) argued that the employment and earning opportunities of less qualified workers are negatively affected by the FDI-induced relocation of production and outsourcing of labour intensive stages of the value chain. In European home countries, the accession of Central and East European countries to the European Union (EU) has fuelled public concerns about the labour market implications of outward FDI. Again, the evidence is mixed. J. Konings and A. Murphy (2001) rejected the hypothesis that the emergence of Central and Eastern Europe as an attractive production location has resulted in an exodus of jobs from European home countries. D. Marin (2004) even found positive employment effects in German parent companies. In contrast, the results reported by S. O. Becker et al. (2005) suggest that cost-oriented German FDI in Central and Eastern Europe substitutes, at least partly, for employment at home.

Against this backdrop, one can reasonably expect that labour market concerns may also arise in major investor countries in the developing world. T.-Y. Chen and Y.-P. Chen (1995) for example, pointed to the risk of de-industrialization in their short account of FDI from Taiwan Province of China. The share of developing economies in the world’s outward FDI stocks is still modest (11% in 2003). However, FDI stocks held by developing economies abroad soared from less than \$130 billion in 1990 to almost \$860 billion in 2003 (UNCTAD 2004; annex table B.4).

This article considers the case of outward FDI from Singapore and assesses its impact on the home country labour

market by analysing the relationship between OFDI and foreign trade. It is for two reasons that this study focuses on the case of Singapore. First, Singapore is one of the most important outward investors in the developing world. Second, its FDI stock is concentrated in lower-income host countries. The debate in advanced economies suggests that this may result in de-industrialization and the outsourcing of jobs by replacing exports and increasing imports.

The rest of this article is organized as follows. The development of Singapore's OFDI and important FDI characteristics are described in section 2. It is shown that the Government's FDI policy forms an important part of its efforts to support the international competitiveness of Singapore. In section 3, we summarize the recent literature on the relationship between FDI, trade and domestic labour markets. A review of the literature suggests that trade effects as well as labour market implications depend on the type of FDI involved. In addition, we briefly present empirical findings for more advanced investor countries. Section 4 introduces the gravity model, which draws on previous studies analysing the possibility of negative effects of OFDI on a home country's balance of payments and its labour market. The critical question is whether OFDI and trade are complements or substitutes. We are particularly interested in finding out whether the complementary relationship between FDI and trade shown in several studies for advanced economies also holds for developing countries such as Singapore, where outward FDI is a more recent phenomenon. Furthermore, we analyse whether the FDI-trade relationship differs across manufacturing industries in order to account for the heterogeneous nature of FDI. Empirical results are presented in section 5. In section 6, we conclude that OFDI by Singapore has not replaced exports. While labour market concerns seem to be unfounded for the Singaporean economy as a whole, the balance-of-payments effects of Singapore's FDI differ considerably across manufacturing industries. Moreover, the case of Singapore is shown to be unique in several respects, even though it shares important characteristics with FDI undertaken by major industrialized countries.

2. Singapore's OFDI: stylized facts and the role of government policy

Developing economies hosted 28% of worldwide inward FDI stocks in 2003 (UNCTAD 2004, annex table B.3). Their share in the world's OFDI stock continues to be comparatively small. However, the increase in outward FDI from developing economies has outpaced the world average since 1990 (table 1). In particular, some developing economies in Asia have emerged as important direct investors. While Hong Kong (China) was clearly in the lead among them, Singapore ranked second, followed by Taiwan Province of China, China and the Republic of Korea in 2003. In terms of cumulative FDI flows during the period 1995-2001, Singapore ranked second among all source countries in Malaysia and Myanmar, and third in Brunei Darussalam, the Philippines, Thailand and Viet Nam (ASEAN Secretariat 2002).

Table 1. Outward FDI stock of developing economies, 1990 and 2003

(Per cent of worldwide stock)

Year	Developing economies						
	All	in Asia	Hong Kong (China)	Singapore	Taiwan Province of China	China	Republic of Korea
1990	7.3	2.8	0.7	0.4	0.7	0.1	0.1
2003	10.5	7.8	4.1	1.1	0.8	0.5	0.4

Source: UNCTAD (2004).

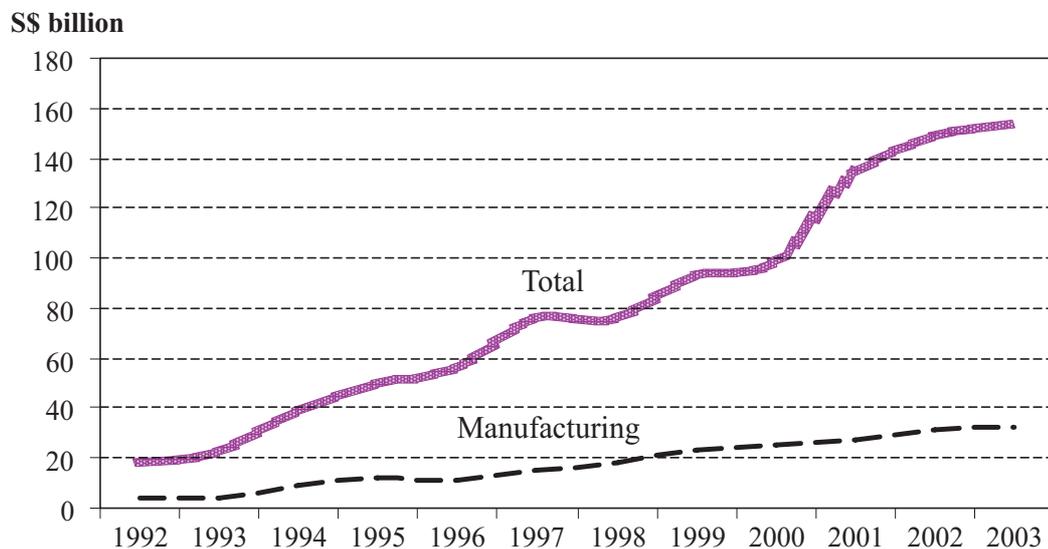
Singapore's total OFDI stock rose almost ninefold in the period 1992–2003 (figure 1). This development was supported by the Government, which encouraged OFDI and assisted direct investors in various ways, in order to promote the country's global reach. The Government began to pay explicit attention to OFDI after the recession in the mid-1980s. The International Direct Investment Programme was approved in 1988. Direct investors were offered tax incentives and financial support for evaluating FDI opportunities (Okposin 1999). The Committee to Promote Enterprise Overseas was set up in 1993; this

Committee made various suggestions aimed at facilitating overseas ventures (Tan 1995/96).

The Government considered OFDI an essential means to preserve international competitiveness through structural change and industrial upgrading (Aggarwal and Agmon 1990, p. 167; Lecraw 1985; Sithathan 2002). This meant that lower-end industrial activities were supposed to move to locations with lower labour and land costs, while more human capital-intensive and technology-intensive stages of the production process were to be retained in Singapore. Therefore, vertical (or efficiency-seeking) FDI, which tends to be motivated by cost considerations and is characterized by fragmented value chains, can be expected to constitute at least part of total OFDI.¹

Lower-income countries in Asia, especially China, India and various South-East Asian countries, were emphasized as

Figure 1. Singapore's FDI stock abroad, 1992–2003
(Billion, Singaporean dollars)



Source: Singapore, Dept. of Statistics (var. iss.).

¹ In contrast, so-called horizontal (or market-seeking) FDI is motivated by considerations of access to local markets. However, the analytical differentiation between different types of FDI is often blurred. For example, FDI undertaken in developing economies offering attractive markets may be motivated by both cost and market considerations. China represents an obvious case in point.

major target countries. For example, in the context of the Government's regionalization strategy, Singaporean investors are granted preferential treatment, and the Government is heavily involved in setting up industrial parks and infrastructure projects in China, India, Indonesia, and Viet Nam.² At the same time, the Government encouraged FDI in advanced industrialized countries to facilitate the acquisition of new technology. Government-linked companies were occasionally used as spearheads in this process.

The financial industry accounts for more than half of Singapore's overall OFDI stock (figure 2). Other services contributed another 17% in 2003. As we show in section 5 below, the gravity-model results depend on whether financial and other services are included in the estimation. One might suspect that the prominence of FDI in services limits adverse labour market repercussions of Singapore's OFDI. FDI in the services sector has traditionally been considered market-seeking, and the non-tradability of many services precludes the replacement of exports by FDI.³ However, the recent experience of advanced economies suggests that outsourcing has gained momentum in services industries, too, especially in banking.⁴ It should also be noted that a sizeable part of Singapore's OFDI is accounted for by holding companies. Holding companies may be engaged in manufacturing activities, but it is unknown to what extent this is the case.

Singapore's OFDI stock in the manufacturing sector, which is the focus of our empirical analysis in sections 4 and 5 below, increased by roughly the same proportion as its total FDI stock (figure 1). Excluding financial services, FDI in manufacturing figured most prominently, with 47% of the remaining FDI stock in 2003. In Asian host countries, the corresponding share of the manufacturing sector was 53%. Again, government policy is a major factor in explaining Singaporean FDI in manufacturing.

² See, for example, Yeung (1999).

³ See, for example, UNCTAD (1998, p. 113).

⁴ A disaggregated analysis of whether Singapore's balance of payments and its labour markets were affected by OFDI in the services sector is not possible because of the lack of data on trade in services.

2001). However, cost considerations turned out to be of greater importance for FDI in neighbouring Asian host countries, compared to FDI in economically advanced host countries in Europe and North America.⁵

The regional and industrial composition of OFDI may provide first clues as to whether Singapore's FDI differs from that of major investor countries, such as the United States, Japan, Germany, and the United Kingdom (table 2). As noted before, the structure of Singapore's FDI differs from others in that the financial sector plays a dominant role. Taking financial and other services together, however, the share of the services sector in Singapore's OFDI is similar to that of Germany and the United States. It is only in the total FDI stock held by the United Kingdom that the share of manufacturing is substantially higher than it is for Singapore (32% versus 21%).

In several respects, the regional structure of the FDI stock reveals striking differences between Singapore and major investor countries:

- The concentration of Singapore's FDI in Asia is almost as pronounced as the concentration of German and British FDI in Europe. This contrasts sharply with Japanese FDI, for which the Asian region is of minor importance.
- The focus on Asia is even stronger for FDI in the manufacturing sector. More than 90% of Singapore's FDI stock in manufacturing was located within Asia in 2003 (Singapore Department of Statistics, var. iss., 2003).
- In contrast to the European pattern, the focus of Singapore's FDI on Asia cannot largely be attributed to institutionalized regional integration. Member countries of the Association of Southeast Asian Nations (ASEAN) hosted just about one fifth of Singapore's total FDI stock, or less than half of the stock accounted for by all Asian

⁵ Moreover, cost considerations may be understated in the survey results presented by Yeung (2001). Labour-intensive manufacturers appear to be under-represented in the sample. The sample consists mainly of technologically advanced manufacturers and service providers for whom labour costs constituted a relatively small fraction of total operational costs.

countries. For FDI in manufacturing, there has been a considerable shift from ASEAN host countries to other Asian countries since 1992. This was mainly because of the declining importance of Malaysia. Though still the second largest recipient of manufacturing FDI from Singapore (behind China), Malaysia's share in total FDI stock in this sector dropped from 51% in 1992 to 16% in 2003. ASEAN countries together accounted for 38% of the FDI stock in manufacturing in 2003, compared to 53% for other Asian countries (Singapore, Dept. of Statistics, var. iss., 2003).

- Most importantly, developing economies, which are economically less advanced than Singapore, host more than 80% of Singapore's FDI stock, compared to less than

Table 2. Structure of OFDI stock: Singapore compared to major home countries, recent years
(Per cent of total stock)

Item	Singapore ^a	Japan ^b	Germany ^c	United Kingdom ^c	United States ^b
Sector structure					
Manufacturing	20.8	n.a.	19.4	31.7	25.8
Financial activities	55.8	n.a.	17.0	13.9	19.6
Other ^d	23.4	n.a.	62.9	54.4	54.6
Regional structure					
Region of home country ^e	49.3	19.1	55.7	60.2	20.3 ^h
Regional integration scheme ^f	22.0	n.a.	47.5	54.2	13.8
Developing economies ^g	82.3	26.5	13.7	12.6	31.7

Source: OECD (2003); Singapore, Dept. of Statistics (var. iss., 2003).

^a 2003.

^b 2002.

^c 2001.

^d Including other services, real estate, primary sector and unspecified.

^e Asia for Singapore and Japan; Europe for Germany and the United Kingdom; The Americas for the United States.

^f ASEAN for Singapore; EU for Germany and the United Kingdom; NAFTA for the United States.

^g Non-OECD countries plus Czech Rep., Hungary, Rep. of Korea, Mexico, Poland and Slovak Rep. for all home countries except Singapore; for Singapore: Asia (except Japan), European countries other than EU and Switzerland, Latin America and the Caribbean and unspecified.

^h Note that 19% of FDI stocks are "unallocated", a significant proportion of which is likely to be located in Latin America, especially the Caribbean.

one-third in the case of United States FDI. The difference is even larger when comparing Singapore to major European investor countries.

The structural characteristics of Singapore's OFDI can be attributed, at least partly, to the unique combination of the country's well-known openness to foreign trade and FDI inflows on the one hand, and the strong guidance by the Government with regard to OFDI on the other. Most of the FDI undertaken by industrialized countries in other industrialized countries seems to be of the horizontal type, whereas the regional structure of Singapore's FDI supports the proposition that vertical FDI is more prominent.⁶ Cost considerations tend to be more important when undertaking FDI in lower-income countries. As a result, market-related determinants of FDI, such as population size and per-capita income in host countries, may have less impact on Singapore's FDI than on FDI by major industrialized countries. Another difference concerns the role of institutionalized regional integration, which, in contrast to FDI by European investor countries, does not appear to have stimulated Singapore's FDI.⁷

Thus, Singapore's FDI has several unique characteristics that may have an impact on the trade implications of OFDI. The Government supported OFDI, and government-linked companies played an important role in that regard. While this seems to be similar to what can be observed for OFDI by countries like China, governments in various (developing and industrialized) countries tend to discourage outward FDI.⁸ The ownership structure of Singapore's OFDI also differs from that of FDI by other home countries in that a large proportion of Singapore's FDI originates from companies in which foreign-

⁶ Markusen and Venables (1998, p. 184) noted that "a large proportion of direct investment is two-way investment among similar developed economies". According to Carr et al. (2001, p. 693), horizontal firms seem to be more prevalent in the world. The review by these authors of various studies reveals strong support for the theoretical prediction of models of horizontal FDI, according to which FDI is concentrated among countries that are similar in size and per-capita income.

⁷ See Buch et al. (2003) for the role of regional integration with regard to FDI within the EU.

based TNCs have major stakes (Ramstetter 1996). According to Singapore, Dept. of Statistics (var. iss.), foreign affiliates accounted for almost half of Singapore's total OFDI in 1998; their share declined to 35% in 2003.

The literature on OFDI by developing economies says little on trade and labour market implications in developing home countries at different stages of development.⁹ Earlier studies such as Sanjaya Lall (1983) focus on the propensity and motives for investing abroad, the patterns and characteristics of outward FDI, and the competitive edge of transnational corporations (TNCs) based in several developing economies, whereas home-country effects are hardly addressed. Likewise, home-country effects do not receive much attention among the issues discussed by K. M. Khan (1986, pp. 11-12) and K. Kumar (1981, p. XVI). Lall (1998) provides a short account of the possible benefits developing economies may derive from outward FDI, but does not provide empirical evidence. UNCTAD's review of the home-country impact of outward FDI almost exclusively draws on evidence from industrialized countries, as "the developing-country experience has not yet received proper research scrutiny" (UNCTAD 1993, p. 77). For trade and balance-of-payments effects, J. P. Agarwal (1986) and Donald T. Lecraw (1981) represent notable exceptions:

- Agarwal's study on India concluded that the contribution of TNCs based in India to its exports and balance of payments was positive, even though about half of the product categories analysed provided evidence of export replacement.

⁸ With regard to developing economies, UNCTAD (1993, p. 82) observed that inward-oriented countries imposed tighter controls and approval requirements on outward investors than outward-oriented countries. For example, Indian regulations prohibited outward FDI in the form of cash, rather than transfers of capital goods or know-how (Agarwal 1986, p. 192). See also Lipsey (2002, p. 7) on regulations applied by the United States until the mid-1970s, specifically aimed at reducing the outflow of capital for United States direct investment.

⁹ See also UNCTAD (1993, chapter III), according to which the impact of outward FDI on the development process of home countries has been largely neglected in the literature.

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- Lecraw (1981) suggested that the impact of TNCs based in developing economies on both home and host economies may differ from the impact of TNCs based in industrialized countries. He found, *inter alia*, that the sample of 23 developing-country firms that had invested in ASEAN countries imported less foreign inputs and exported less of their output than firms from industrialized countries.¹⁰

In the subsequent sections, we follow Lecraw (1981) and address the question of whether the home-country impact of Singapore's OFDI differs from that of FDI by major OECD countries. There are several reasons for taking this approach. As noted before, the empirical evidence on the trade implications of OFDI by developing countries is extremely limited. For Singapore, earlier studies, such as Lecraw (1985, p. 399), could provide only weak evidence due to sparse data on OFDI. Moreover, previous findings may no longer apply. In earlier studies, OFDI by developing economies was typically shown to be low-tech, small-scale, labour intensive, and concentrated in mature markets with standardized, low-quality products and strong price competition (UNCTAD 1993, p. 16). More recently, however, TNCs from developing economies appear to have acquired skills and experience that allow them to compete with TNCs from industrialized countries. Dunning et al. (1996) argued that there has been a fundamental shift in the character and motivation of OFDI from developing economies that have proceeded along their so-called investment development path. UNCTAD (1993, p. 72) noted that "the 'new breed' developing-country TNCs broadly resemble its developed-country counterpart." Such observations would apply to TNCs from Singapore, which is one of the most advanced developing economies.¹¹ Hence, the subsequent analysis of the trade implications of Singapore's OFDI, and the related labour market concerns that may arise, attempts to fill an important gap in the empirical literature on OFDI by developing economies.

¹⁰ In another study on OFDI by Indonesian firms, Lecraw (1993) showed that the performance of foreign investors improved after FDI had been undertaken, e.g. in terms of exports and cost of production.

¹¹ Singapore's per-capita income of \$21,200 in 2003 amounted to 82% of the average per-capita income of high-income OECD countries.

3. Analytical background and previous findings

The recent literature on the motives and consequences of FDI by industrialized home countries offers important insights on possible trade and labour market implications. Theoretical models have been developed for two types of FDI, which are supposed to have different trade and labour market effects in the home country:

- Companies undertaking *horizontal* FDI produce the same goods and services in their home country and in the host countries.¹² This type of FDI is motivated by trade barriers, transportation costs and other transaction costs that discourage exports (Carr et al. 2001). FDI is a means to avoid such costs. Horizontal FDI is driven by market considerations. That is why this type of FDI is also known as market-seeking FDI (UNCTAD 1998, p. 91).
- Companies undertaking *vertical* FDI fragment the production process geographically and locate specific stages of the value chain in countries offering relevant cost advantages.¹³ This type of FDI is motivated by cost considerations. Investors take into account the differences in factor prices across countries (Markusen and Zhang 1999). FDI of this type is also known as efficiency-seeking FDI (UNCTAD 1998, p. 91).

D. Marin et al. (2003) argued that relatively advanced home countries may suffer from adverse effects on the labour market if OFDI is of the vertical type. This is because an investor relocates the relatively labour-intensive stages of production to lower-income countries, thereby reducing the demand for unskilled workers in the home country. In contrast, these authors do not expect horizontal FDI to have effects on wage inequality or employment opportunities in the home country. However, the labour market implications of FDI are not easy to generalize. For instance, the employment effects of vertical FDI depend on

¹² For an early model of horizontal FDI, see Markusen (1984); more recent models include Markusen and Venables (1998, 2000).

¹³ For an early model of vertical FDI, see Helpman (1984); see also Helpman and Krugman (1985).

whether the cost reduction associated with such a strategy results in an overall expansion of the investing company, including complementary operations at home (Becker et al. 2005). On the other hand, FDI that appears to be horizontal may affect employment prospects if foreign production negatively affects the production of the same goods produced at home.¹⁴ In other words, the counterfactual of what would have happened in the absence of OFDI is difficult to establish for both types of FDI.¹⁵

For practical purposes, the composition of sales by the foreign affiliates of TNCs has been suggested as a criterion for distinguishing the type of FDI (Hanson et al. 2001; Marin et al. 2003). FDI is considered horizontal if foreign affiliates sell their output (almost) exclusively in the host country. In contrast, a high share of affiliate sales destined for markets other than the host country is taken as an indication of vertical FDI. Especially if a substantial share of the output of foreign affiliates is exported back to the home country of the investor, the foreign engagement of this investor can be regarded as vertical.

Gravity models are widely used in the literature on the determinants of FDI and trade. As noted by A. Deardorff (1998), this class of models first appeared in the empirical literature on bilateral trade flows without much serious attempt to justify them theoretically. However, Deardorff showed that even simple gravity models can be derived from standard trade theories. Specifications used in the empirical literature vary, but population, per-capita income and geographical distance (hence the allusion to Newton's theory of gravity) are typically included as explanatory variables. The first two variables are representative of market size and effective demand, while distance serves as a proxy for transportation and other trade costs.

Based on a similar line of reasoning, gravity models are also applied to analyse bilateral FDI (Mutti and Grubert 2004).

¹⁴ See Nunnenkamp (2004) on the relocation of German automobile production to Central European countries.

¹⁵ This is also because of indirect effects such as the possible replacement of domestic investment by FDI. Feldstein (1994) found support of this being a one-to-one substitution effect.

This approach, which we follow in section 4 below, clearly has some limitations. Similar to the case of trade, FDI is supposed to be attracted by local market size and effective demand, proxied by population and per-capita income. However, the impact of per-capita income is ambiguous in the case of FDI. While horizontal FDI should be stimulated by higher effective demand in the host country, host countries with lower per-capita income may offer cost advantages and, thus, attract vertical FDI.¹⁶ Likewise, the impact of the distance variable is not as clear-cut as in the case of trade. On the one hand, FDI flows to distant countries may even be encouraged if distance acts as a deterrent to trade in the first place. On the other hand, FDI should decline to the extent that distance is associated with higher costs of coordinating and managing foreign affiliates due to, for example, costs related to language and cultural differences (Mutti and Grubert 2004). Finally, simple gravity models ignore various other factors that may have an impact on FDI decisions, such as taxation, exchange rate volatility, political risk and bilateral investment treaties.¹⁷

The limitations of gravity models in explaining FDI decisions are less serious in the present context, as our focus is on the trade implications of OFDI. We follow Edward M. Graham (1996) as well as M. Kawai and S. Urata (1998), who combine gravity models for trade and FDI. In this way, it can be assessed whether OFDI is complementary to a home country's imports from the respective host country. At the same time, it is possible to evaluate whether OFDI is associated with higher exports of the home country to the host country, or rather

¹⁶ Differences in per-capita income between the home country of foreign investors and the host country tend to be associated with differences in the endowment of skilled labour. A relative abundance of less skilled labour in the host country can be expected to give rise to vertical FDI, as foreign investors outsource relatively unskilled labour intensive parts of the value chain (Carr et al. 2001).

¹⁷ Mutti and Grubert (2004) focus on taxation; they find that United States-owned foreign affiliates are particularly sensitive to host-country taxation if FDI is export oriented. Grosse and Trevino (1996) show, inter alia, that FDI in the United States is negatively affected if the home base of the foreign investor is culturally and geographically distant from the United States, and if the currency of the home country depreciates against the dollar.

replaces exports. The argument that OFDI has adverse labour market repercussions would appear weak if its relationship with the home country's exports was complementary and if a complementary relationship with the home country's imports did not exist. On the other hand, it would appear more likely that OFDI has adverse effects on the labour market if it was associated with both rising imports and declining exports.

Early theoretical models suggested that trade and FDI are perfect substitutes (Mundell 1957). However, more recent studies, such as James R. Markusen (1983), have demonstrated the theoretical possibility that FDI and trade are complements rather than substitutes. Therefore, the relationship between FDI and job opportunities at home is indeed an empirical question. Numerous empirical studies have failed to support R. Mundell's "perfect substitution" theory, pointing instead to a complementary relationship between FDI and trade.¹⁸ Major findings summarized in the remainder of this section provide a useful benchmark against which to compare the case of Singapore.

P. Brenton et al. (1999) explored the deepening economic integration between the EU and Central and Eastern European countries. Their estimations based on aggregate bilateral flows of trade and FDI indicate that the relationship between the two is complementary. M. Kawai and S. Urata (1998) reported similar results for Japan's trade and investment. After finding support for a complementary relationship at the aggregate level, these authors investigated different industries within the manufacturing sector. The relationship between exports and FDI turns out to be complementary in all manufacturing industries except for wood and pulp, for which the relationship is

¹⁸ For a concise review of the literature on OFDI and home-country exports, see Lipsey (2002, pp. 7-14). Well-known studies include Lipsey and Weiss (1981, 1984), who found that exports and foreign production by United States firms were, for the most part, complementary; Lipsey et al. (2000), who show that, in the minority of Japanese industries where any relationship between foreign production and exports could be discerned, the relation was positive.

substitutive.¹⁹ Interestingly, the significance of per-capita income as an explanatory variable also varies considerably between industries, underscoring the need for examining the relationship between specific types of FDI and trade. C.M. Buch et al. (2003) provided further evidence to this effect. Investigating firm-level data of German FDI, they found that the determinants of FDI vary significantly between industries, while the overall relationship between FDI and trade was shown to be complementary.

According to Edward M. Graham (1996), the relationship between FDI and trade is also affected by the host region in question.²⁰ His estimates indicated that United States FDI and trade are complements in Europe and East Asia, but substitutes within the Americas. Graham interpreted this result as being a legacy of Latin American import substitution policies. A similar substitutionary relationship is found for Japan's relations with Indonesia. The importance of location is also emphasized by S. Brainard and D. Riker (1997a, 1997b). These authors estimated the elasticity of substitution between employment in the parent company and their foreign affiliates, as well as that among affiliates. The elasticity of substitution between parent firm and affiliate employment was shown to be very small. While there was a high degree of substitution between affiliates in developing countries, the relationship between employment in industrial-country affiliates and in developing-country affiliates turned out to be complementary. Magnus Blomström et al. (1997) showed that overseas investment in developing countries by United States firms replaced domestic employment, whereas investment in developed countries did not. Replacement effects were limited to production workers. The finding that the employment effects of FDI differ between skill categories of workers implies that

¹⁹ This is in line with Agarwal (1997), who considered it unlikely that employment in the home country is affected equally in every industry by FDI outflows.

²⁰ Graham (1996) also reviewed earlier empirical studies on the trade effects of FDI, almost all of which find that home-country exports tend to increase along with FDI.

FDI has important consequences for income distribution. This was also emphasized by Feenstra and Hanson (1996).²¹

According to Lipsey (2002, p. 12), positive associations are more common in the empirical literature on the effects of OFDI on home-country exports. At the same time, the author stressed “the frequency of results indicating no association in either direction”. This ambiguity is probably because the export effects differ across host countries, industries and the types of OFDI. For instance, Lipsey (2002) supposed export substitution to be more likely for horizontal FDI in the manufacturing sector than for vertical FDI. This view contrasts with D. Marin *et al.* (2003) who, as noted before, argued that home countries may suffer adverse labour market repercussions if OFDI is of the vertical type.

The gravity models applied in many of the above-mentioned studies are similar in that the model specification is rather basic. An extended model is presented by D. L. Carr *et al.* (2001), who argued that the existence of trade costs and different factor intensities call for a model encompassing both horizontal and vertical FDI. The so-called knowledge-capital model incorporates the skill ratios of countries as well as indices of perceived trade and investment costs as additional explanatory variables. Other methodological improvements are suggested by P. Egger and M. Pfaffermayer (2001), C. Carrère (2004) and B. A. Blonigen *et al.* (2004).²²

These recently developed models are more in line with microeconomic theories of the firm; their theoretical foundation is clearly superior to basic gravity models. However, we use

²¹ According to Feenstra and Hanson (1996), United States FDI in Mexico raised the demand for skilled workers in the United States, thus raising the relative wage of skilled labour and worsening income distribution, while the reverse occurred in Mexico.

²² Blonigen *et al.* (2004) employed spatial econometric techniques to analyse the pattern of United States FDI in OECD countries. They take into account the potential interdependence between FDI decisions with respect to alternative host countries. Empirical findings point to an export-platform motivation of United States FDI in Europe.

basic specifications of the gravity model in the subsequent analysis of Singapore's OFDI. This is mainly because the data needed for applying the knowledge-capital model are not readily available for Singapore and the host countries of its FDI. Moreover, most studies based on the knowledge-capital model use aggregate trade and FDI data, while we aim at a disaggregated analysis. Finally, the results of basic gravity models reported above are largely consistent with the results of extended models, thus providing a reasonable benchmark to which we can compare the case of Singapore.

4. Approach and data

In the first step of our analysis, we employ a basic gravity model of FDI. Two different specifications are used, following Kawai and Urata (1998) (equation 1) and Brenton et al. (1999) (equation 2), respectively:

- (1) $\ln(\text{FDI}) = \beta_0 + \beta_1 \ln(\text{population}) + \beta_2 \ln(\text{GDP/cap}) + \beta_3 \ln(\text{distance}) + \beta_4 \ln(\text{FDI}_{(-1)}) + \varepsilon;$
- (2) $\ln(\text{FDI}) = \beta_0 + \beta_1 \ln(\text{population}) + \beta_2 \ln(\text{GDP/cap}) + \beta_3 \ln(\text{distance}) + \varepsilon.$

In the next step, we use the same approaches to estimate whether the relationship between Singapore's FDI and trade is complementary or substitutionary:

- (3) $\ln(\text{trade}) = \beta_0 + \beta_1 \ln(\text{population}) + \beta_2 \ln(\text{GDP/cap}) + \beta_3 \ln(\text{distance}) + \beta_4 \ln(\text{FDI}_{(-1)}) + \varepsilon;$
- (4) $\ln(\text{trade}) = \beta_0 + \beta_1 \ln(\text{population}) + \beta_2 \ln(\text{GDP/cap}) + \beta_3 \ln(\text{distance}) + \beta_4 (\text{residuals FDI}) + \varepsilon.$

In the above equations, "trade" stands for bilateral imports or exports. "Population" refers to the number of inhabitants in Singapore's partner countries, and "GDP/cap" to their per-capita income. "Distance" is measured by the number of kilometres "as the crow flies" between Singapore and the partner country's capital (except for the United States, where Indianapolis, Indiana, is regarded as the economic centre). "FDI₍₋₁₎" represents the lag of Singapore's FDI stock in the partner country. Finally, the variable "residuals FDI" refers to the residuals obtained from

equation (2). According to Graham (1996), the coefficient of “residuals FDI” reflects a causal relationship between FDI and trade flows. A positive coefficient would suggest complementarities in production or distribution, and a negative coefficient substitutability due to, for example, outsourcing and relocation. Similarly, a positive (negative) coefficient of lagged FDI stock would suggest a complementary (substitutionary) relationship.

In additional estimations, we include dummies for ASEAN members and members of the Asia-Pacific Economic Cooperation (APEC) to test for the effect of regional trade and cooperation agreements. We also consider the population share of ethnic Chinese in the host countries of Singapore’s FDI in order to assess the impact of Chinese networks. As shown by J. E. Rauch and V. Trindade (2002), such business networks reduce the psychological distance between countries and may have considerable effects on trade and investment patterns.²³

The two alternative approaches of Kawai and Urata (1998) and Brenton et al. (1999) have different limitations. Hence, both approaches are considered in order to check the robustness of results. The two approaches differ in the way they make use of the available data. Kawai and Urata allow for using an uneven panel of data.²⁴ In contrast, the approach of Brenton et al. is

²³ Furthermore, we ran estimates with an additional dummy for bilateral investment treaties (BITs) concluded between Singapore and various partner countries, based on information provided by UNCTAD (<http://www.unctad.org/fdistatistics>). However, the promotion and protection of investments offered by BITs never turned out to be significantly positive. This may be because the BITs Singapore had agreed to with a highly diverse group of countries differed in terms of qualitative content. Note also that UNCTAD (1998, p. 117) considers it unreasonable to expect a significant impact of BITs on FDI flows. Hence, results of estimates including the dummy for BITs are not reported in the following.

²⁴ This is useful for the case of Singapore. The number of observations available per partner country ranges from two to eleven, which is due to an imperfect overlap between trade and FDI data. Our analysis covers the period 1992-2002. Hence, we have a maximum number of eleven observations for host countries for which statistical authorities in Singapore report both FDI and trade data for each year. The number of observations declines if either FDI data or trade data are missing for a particular year.

based on average values for all available years. This translates into higher significance of the results obtained with the approach of Kawai and Urata. As shown below, however, the results of both approaches are fairly similar.

Trade data are obtained from several editions of the International Trade Centre's PC-TAS CD-Rom. Data on FDI stock are from Singapore's Department of Statistics (DOS var. iss.). Population figures are taken from the United States Census Bureau's International Data Base (<http://www.census.gov/ipc/www/idbnew.html>) and GDP figures from the IMF, except for Brunei in which case the data are taken from UNCTAD. The population share of ethnic Chinese is based on estimates for 2002 by Ohio University (http://www.library.ohiou.edu/subjects/shao/databases_popdis.htm). Not all variables could be obtained for all years. Hence, our estimations are based on an unbalanced panel of 23 economies²⁵ over the period 1992–2002. These countries include all major recipients of Singaporean FDI.

5. Empirical results

First, we apply two simple gravity models to OFDI by Singapore (table 3). Not surprisingly, the model based on Kawai and Urata (1998) reveals that FDI stock is strongly dependent on previous FDI decisions. This holds for both total FDI in all sectors and FDI in manufacturing. The inclusion of lagged FDI considerably reduces the coefficients of other variables. The results of both models are, however, similar in several respects. Larger markets, measured by host-country population, attract more FDI from Singapore. The importance of population size as a driving force of FDI increases if the models are estimated for FDI in manufacturing. The minor relevance of this variable in services industries can, at least partly, be attributed to the strong engagement of Singaporean direct investors in financial

²⁵ These economies are: Australia, Brunei, Cambodia, Canada, China, France, Germany, Hong Kong (China), India, Indonesia, Japan, Malaysia, Myanmar, Netherlands, New Zealand, Philippines, Republic of Korea, Switzerland, Taiwan Province of China, Thailand, United Kingdom, United States and Viet Nam.

and insurance services in small Caribbean economies. Latin America and the Caribbean accounted for 46% of Singapore's OFDI stock in finance and insurance in 2003 (Singapore, Dept. of Statistics, var. iss., 2003).

The strong engagement in the finance and insurance industry of distant countries also helps explain why the coefficient of the distance variable is much higher, in absolute terms, for FDI in manufacturing (columns 5 to 8 in table 3). The discouraging effect of distance is less pronounced for FDI in services as it is mainly for financial transactions that globalization has resulted in sharply declining transaction costs. Compared to finance, distance costs remain relatively high for manufacturing activities.

Table 3. Gravity model results: FDI equation^a

Variable	Total FDI				FDI in manufacturing			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(population)	0.41*	0.09***	0.09***	0.08***	0.76***	0.13***	0.14***	0.13***
	(0.22)	(0.02)	(0.02)	(0.02)	(0.25)	(0.04)	(0.04)	(0.04)
ln(GDP/cap)	0.29	0.04*	0.04*	0.02	0.23	0.01	0.01	-0.07*
	(0.29)	(0.02)	(0.02)	(0.03)	(0.33)	(0.03)	(0.03)	(0.04)
ln(distance)	-0.78*	-0.07***	-0.06**	-0.13***	-1.32**	-0.12**	-0.13**	-0.24***
	(0.43)	(0.03)	(0.03)	(0.04)	(0.48)	(0.06)	(0.07)	(0.08)
ln(FDI lagged)		0.91***	0.90***	0.90***		0.93***	0.90***	0.86***
		(0.03)	(0.03)	(0.03)		(0.03)	(0.03)	(0.05)
Share Chinese			0.16***				0.27***	
			(0.05)				(0.09)	
ASEAN				-0.20*				-0.46***
				(0.11)				(0.18)
APEC				-0.01				0.37**
				(0.08)				(0.15)
Constant	3.78	-0.49	-0.52	0.42	0.73	-0.85	-0.83	1.13
	(4.45)	(0.39)	(0.41)	(0.56)	(4.98)	(0.75)	(0.85)	(0.96)
R ²	0.23	0.94	0.94	0.94	0.53	0.90	0.90	0.91

Source: Authors' calculation.

^a ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively; standard errors in parentheses. The simultaneous inclusion of the variables "share Chinese" and "ASEAN" does not produce significant results, which are thus not reported.

The findings reported so far are largely in line with gravity-model results obtained for FDI by major industrialized countries. This applies especially to the role of market size as a driving force of FDI and the deterrent effects of distance.²⁶ In contrast to the pattern typically observed for industrialized home countries, however, the effect of the host countries' stage of economic development, measured by their per-capita income, on Singapore's OFDI remains insignificant in most estimations.²⁷ This is especially so for FDI in manufacturing. The focus of Singapore's FDI in manufacturing industries of lower-income Asian host countries, mentioned in section 2 above, makes this finding plausible. It supports the proposition that a considerable part of Singapore's FDI in manufacturing is vertical rather than horizontal. This does not imply that market considerations are irrelevant for Singapore's FDI. Rather, the positive coefficient of the population variable in combination with the insignificant coefficient of the per-capita income variable reinforces the point made above that market and cost considerations tend to be interlinked. It is consistent with this reasoning that the per-capita income variable turns out to be significantly positive, though only at the 10% level for FDI in manufacturing, if FDI equations reported in table 3 are estimated for a reduced sample including only developing host countries.²⁸ Yet, the results for Singapore differ from results of earlier studies on the motives of FDI by major home countries, which found

²⁶ Brenton et al. (1999) showed that market size, measured by the log of GNP, is positively related to FDI by all major OECD home countries. At the same time, the coefficient of the distance variable typically turns out to be significantly negative. Similar results for German FDI are reported in Buch et al. (2003). Chakrabarti (2001) argued that the correlation between FDI and market size is robust to changes in the conditioning information set. According to Nunnenkamp and Spatz (2002), the distribution of FDI from all home countries taken together continues to be shaped by market-related determinants in the era of globalization.

²⁷ According to UNCTAD (1998, p. 135), higher-income countries typically attract more FDI. For German FDI, Buch et al. (2005) find that the difference between the per-capita income of Germany and the per-capita income of host countries is positively and significantly related to FDI stocks.

²⁸ These results are not shown, but are available from the authors upon request.

stronger support for the predominance of horizontal FDI (Brainard 1997; Carr et al. 2001; Blonigen et al. 2003). For example, it is in striking contrast to the case of Singapore that the results presented in Buch et al. (2005, p. 74) are “highly supportive of the notion that German multinationals are primarily motivated by a search for market access rather than by a search for lower production costs”. As argued by these authors, the case for horizontal FDI is particularly strong if both population and per-capita income have a positive impact on FDI when considering the whole set of host countries.

The results obtained for the basic specification of the gravity model prove to be fairly robust once additional FDI determinants are taken into account.²⁹ Nevertheless, the extended specifications offer additional insights. Host countries with a higher population share of ethnic Chinese attract significantly more FDI from Singapore. Similar to the trade-promoting effect found by Rauch and Trindade (2002), Chinese networks are relevant for FDI: these networks counteract distance-related transaction costs by providing better information, trust and informal enforcement mechanisms.³⁰ Including dummy variables for membership in ASEAN and APEC somewhat increases the magnitude of the coefficients for geographical distance, while the coefficient for host countries’ per-capita income diminishes further. Most strikingly, however, the ASEAN dummy turns out to be negative. This is in sharp contrast to the positive effect reported for other regional integration agreements, notably the effects of EU membership on intra-regional FDI (Buch et al. 2003). Two factors seem to account for this difference. First, ASEAN has achieved substantially less economic integration among its members, compared to the EU. R. J. Langhammer (2001) noted that free intra-ASEAN investment flows, requiring the freedom of establishment and mobility of investment-related labour, are a

²⁹ Extended specifications are reported only for the model based on Kawai and Urata.

³⁰ See also Lecraw (1985, p. 392), who stresses the role of ethnic ties for Singapore’s FDI.

distant target.³¹ Second, as mentioned in section II, Singaporean direct investors were strongly encouraged by the Government to reach beyond ASEAN, and increasingly shifted their attention to other Asian host countries, particularly to China. It fits into this picture that, in contrast to the ASEAN dummy, the dummy for APEC members turns out to be significantly positive with respect to Singapore's OFDI in manufacturing.

In the next step, we assess the trade implications of Singapore's OFDI. Table 4 reports the results for Singapore's total exports and imports as well as its exports and imports of all manufactures. As before, we draw on two slightly different gravity models. Following Kawai and Urata (1998), lagged FDI is added to the standard list of right-hand variables.³² The second model suggested by Brenton et al. (1999) considers FDI residuals, resulting from the FDI equations reported in columns (1) and (5) in table 3, instead of lagged FDI.

All coefficients of the standard variables "population", "GDP per capita" and "distance" have the expected sign and are highly significant. Both exports and imports are increasing in the partner country's population as well as its per-capita income, and decreasing in distance between Singapore and the partner country. This applies to total trade as well as manufacturing trade. Extending the specification of the Kawai-Urata model by the population share of ethnic Chinese and the ASEAN dummy has little effect on the coefficients of the standard variables, except that the coefficient for geographical distance becomes smaller. The population share of ethnic Chinese has a significantly positive effect on trade, which is in line with the findings by Rauch and Trindade (2002). Moreover, in contrast to the FDI equation reported in table 3, the ASEAN

³¹ See also Hew and Soesastro (2003, p. 295), who concluded that "implementation (of political initiatives) has always been a problem for ASEAN".

³² As before in table 3, we present extended specifications of the Kawai-Urata model by including the population share of ethnic Chinese and the ASEAN dummy. The APEC dummy turned out to be insignificant in the trade equation and, thus, was dropped.

Table 4. Gravity model results: the effect of FDI on exports and imports^a

Variable	Total trade						Manufacturing trade					
	Exports			Imports			Exports			Imports		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ln (population)	0.55*** (0.10)	0.62*** (0.08)	0.59*** (0.08)	0.89*** (0.05)	0.90*** (0.07)	0.93*** (0.03)	0.56*** (0.13)	0.63*** (0.11)	0.60*** (0.10)	1.01*** (0.09)	1.08*** (0.10)	1.06*** (0.07)
ln (GDP per capita)	0.70*** (0.09)	0.78*** (0.11)	0.80*** (0.10)	1.04*** (0.07)	1.12*** (0.09)	1.14*** (0.06)	0.86*** (0.11)	0.85*** (0.14)	0.98*** (0.12)	1.24*** (0.12)	1.40*** (0.13)	1.38*** (0.12)
ln (distance)	-0.88*** (0.16)	-1.08*** (0.16)	-0.57*** (0.17)	-1.21*** (0.08)	-1.31*** (0.13)	-0.90*** (0.10)	-0.82*** (0.19)	-1.06*** (0.21)	-0.42 (0.27)	-1.28*** (0.15)	-1.47*** (0.20)	-0.85*** (0.21)
ln (total FDI lagged)	0.27*** (0.07)		0.27*** (0.06)	0.08* (0.05)	0.09 (0.06)					0.10* (0.06)		0.08 (0.07)
ln (manufacturing FDI lagged)							0.19*** (0.08)		0.20*** (0.08)			
residual total FDI		0.29*** (0.09)			0.17** (0.07)							
residual FDI in manufacturing								0.17 (0.10)			0.16 (0.10)	
Share Chinese			0.62** (0.31)			0.54*** (0.18)			0.66* (0.35)			0.92*** (0.32)
ASEAN			1.01** (0.47)			0.99*** (0.30)			1.28** (0.65)			1.39*** (0.55)
Constant	4.51*** (1.49)	6.03*** (1.67)	-0.16 (2.83)	-0.72 (0.81)	-0.35 (1.32)	-5.30*** (1.58)	3.18* (1.88)	4.81** (2.19)	-2.61 (3.18)	-4.17*** (1.60)	-4.89** (2.03)	-10.46*** (3.00)
R ²	0.84	0.82	0.87	0.92	0.93	0.94	0.79	0.73	0.82	0.86	0.89	0.89

Source: Authors' calculation.

a ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively; standard errors in parentheses.

dummy is significantly positive in the export and import equations for both total and manufacturing trade. This suggests that the integration of trade within ASEAN, at least as far as Singapore's trade is concerned, is more advanced than its integration with regard to FDI.³³

Turning to the FDI variable, which is the principal concern in the context of this article, the models based on Kawai and Urata (1998) and Brenton et al. (1999) point to significant complementarities between total FDI and total trade. The estimates suggest that complementarities are considerably stronger for total exports than for total imports. One might, therefore, conclude from columns (1) to (6) in table 4 that, on balance, Singapore's OFDI has positive balance-of-payments effects and that labour market concerns are not warranted. However, the picture is less clear when it comes to FDI and trade in manufacturing. According to the model based on Kawai and Urata (1998), complementarities are still stronger for exports than for imports, even though complementarities turn out to be weaker for manufactured exports than for total exports. Applying the approach proposed by Brenton et al. (1999) results in both coefficients of the residuals of manufacturing FDI being insignificant. This means that Singapore's trade balance with regard to manufactured goods is hardly affected by OFDI.

The ambiguous relationship between FDI and trade in the manufacturing sector provides a reason for undertaking further analysis with more disaggregated data and evaluating how FDI affected trade in particular manufacturing industries. Indeed, the results reported in table 5 support the view that the results for manufacturing as a whole disguise considerable differences with regard to the trade implications of FDI within the manufacturing sector.

³³ This is so, even though the ASEAN Free Trade Area (AFTA) "is not quite what it is cracked up to be" (*The Economist* 2004, p. 44). Several members refused to lower tariffs on critical products (see also Hew and Soesastro 2003). Carrère (2004) observed that ASEAN members are more outward looking than is typically the case for South-South integration schemes; in contrast to other regional trade agreements, ASEAN does not seem to have resulted in trade-diverting effects.

Positive balance-of-payments effects and, thus, favourable labour market effects are most likely in the chemical industry (SITC 5). On the one hand, the complementarity between Singapore's FDI and its exports of chemicals is most pronounced (rows 1 to 3 in table 5). On the other hand, there is no evidence that FDI has resulted in higher imports of chemicals (rows 4 to 6). These findings may be explained by some characteristics of FDI in the chemical industry. Data on FDI undertaken by the United States in developing countries reveal that FDI in this industry is most human capital-intensive and technology-intensive, while the export orientation of foreign affiliates in this industry is particularly low (Nunnenkamp and Spatz 2004). If similar characteristics applied to Singapore, this would explain the strong complementarity with regard to Singapore's exports and rather weak import pressure.

Indeed, several observations indicate that Singapore possesses competitive advantages vis-à-vis lower-income host countries in which its FDI in the chemical industry is concentrated. Chemicals, including petroleum products, represent one of Singapore's top five export items. The focus of the industry is on R&D and manufacturing of pharmaceuticals, medical devices, biotechnology and agro-biotechnology products. The development of high value-added downstream chemistry chains has been supported by the Government since the mid-1990s. Singapore's Economic Development Board sought to attract investment to establish vertically integrated structures, by helping producers in sourcing inputs and marketing their output (PESA 2000). Moreover, the Government encouraged TNCs to invest in the chemical industry by offering incentives, including seed financing to projects, and providing infrastructure. Pharmaceutical production and life sciences were identified as key areas for new investment. Human capital-intensive chemical production was also supported by on-the-job training of workers and training of students, in which the Institute of Chemical Sciences, established by the National Science and Technology Board, played a major role.

In contrast to chemicals, we observe strong complementarities with regard to both exports and imports in

Table 5. Gravity model results: the effect of manufacturing FDI on trade in SITC categories 5–8^a

Item	In (population)	In (GDP per capita)	In (distance)	In (man. FDI lagged)	residual man. FDI	ASEAN	Share Chinese	Constant	R ²
Chemicals (SITC 5)									
Exports (1)	0.51*** (0.09)	0.60*** (0.11)	-0.69*** (0.17)	0.31*** (0.07)	0.28** (0.11)			2.24 (1.83)	0.76
(2)	0.66*** (0.11)	0.60*** (0.15)	-1.12*** (0.22)					4.65* (2.26)	0.74
(3)	0.56*** (0.07)	0.71*** (0.12)	-0.35 (0.25)	0.30*** (0.07)		1.12* (0.65)	0.72** (0.36)	-2.81 (3.07)	0.78
Imports (4)	1.28*** (0.19)	1.69*** (0.23)	-0.86*** (0.33)	0.11 (0.12)				-19.49*** (3.51)	0.85
(5)	1.38*** (0.16)	1.71*** (0.21)	-1.07*** (0.30)		0.17 (0.15)			-19.12*** (3.15)	0.86
(6)	1.25*** (0.18)	1.61*** (0.24)	-1.14*** (0.45)	0.10 (0.13)		-0.87 (0.89)	-0.40 (0.58)	-15.58*** (4.83)	0.86
Manufactured goods (SITC 6)									
Exports (7)	0.33*** (0.09)	0.46*** (0.07)	-1.02*** (0.15)	0.18** (0.07)				9.37*** (1.64)	0.76
(8)	0.38*** (0.11)	0.42*** (0.15)	-1.27*** (0.21)		0.18 (0.11)			11.78*** (2.22)	0.72
(9)	0.36*** (0.08)	0.49*** (0.10)	-0.95*** (0.20)	0.12* (0.08)		0.27 (0.61)	0.61* (0.34)	8.11*** (2.87)	0.78
Imports (10)	1.05*** (0.10)	1.21*** (0.11)	-0.99*** (0.14)	0.19*** (0.05)				-9.76*** (2.33)	0.88
(11)	1.21*** (0.09)	1.25*** (0.12)	-1.33*** (0.17)		0.27*** (0.08)			-9.22*** (1.78)	0.92
(12)	1.03*** (0.09)	1.10*** (0.14)	-1.37*** (0.23)	0.13** (0.07)		-1.14* (0.69)	-0.08 (0.33)	4.69 (3.98)	0.89
Machinery, transp. equipm. (SITC 7)									
Exports (13)	0.59*** (0.13)	0.93*** (0.12)	-0.80*** (0.19)	0.22*** (0.08)				1.21 (1.83)	0.79
(14)	0.71*** (0.12)	0.95*** (0.15)	-1.07*** (0.23)		0.24** (0.11)			2.32 (2.36)	0.74
(15)	0.64*** (0.11)	1.06*** (0.12)	-0.40 (0.28)	0.23*** (0.08)		1.28** (0.66)	0.59 (0.38)	-4.56 (3.18)	0.81
Imports (16)	1.36*** (0.14)	1.73*** (0.21)	-1.24*** (0.22)	0.40*** (0.12)				-17.44*** (3.86)	0.83
(17)	1.47*** (0.15)	1.76*** (0.20)	-1.64*** (0.30)		0.42*** (0.15)			-14.20*** (3.08)	0.87
(18)	1.41*** (0.14)	1.91*** (0.22)	-0.66 (0.55)	0.44*** (0.16)		1.82 (1.57)	0.66 (0.74)	-25.64*** (7.63)	0.84
Miscellaneous man. articles (SITC 8)									
Exports (19)	0.49*** (0.11)	0.83*** (0.08)	-0.78*** (0.17)	0.14* (0.07)				2.13 (2.10)	0.77
(20)	0.49*** (0.11)	0.78*** (0.14)	-0.91*** (0.21)		0.03 (0.10)			4.45* (2.17)	0.69
(21)	0.52*** (0.09)	0.92*** (0.13)	-0.50* (0.27)	0.17* (0.09)		0.86 (0.81)	0.29 (0.44)	-1.73 (3.72)	0.78
Imports (22)	0.89*** (0.16)	1.07*** (0.16)	-1.37*** (0.23)	-0.04 (0.10)				-1.19 (2.82)	0.75
(23)	0.84*** (0.12)	1.15*** (0.16)	-1.44*** (0.24)		-0.02 (0.12)			-0.62 (2.46)	0.78
(24)	0.95*** (0.14)	1.13*** (0.19)	-1.23*** (0.26)	-0.14** (0.07)		0.57 (0.76)	1.19*** (0.35)	-3.85 (5.37)	0.79

Source: Authors' calculation.

^a ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively; standard errors in parentheses.

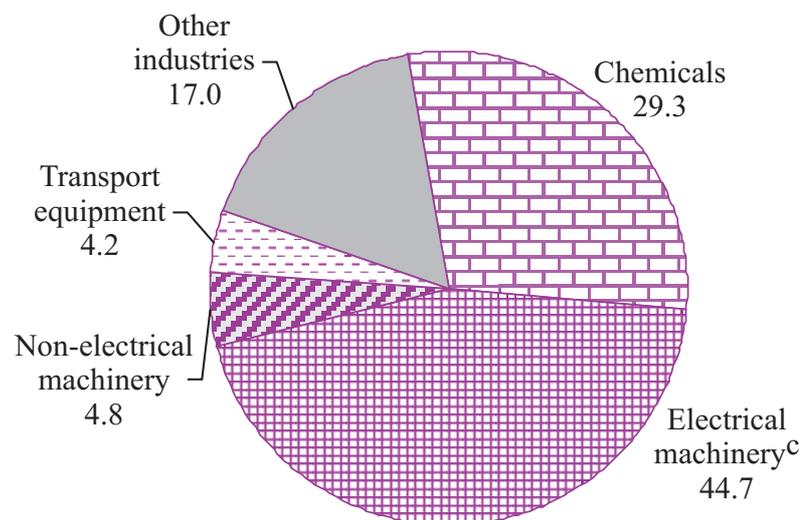
the machinery and transport equipment industry (SITC 7). Furthermore, both models result in coefficients of the FDI variable (FDI residuals and lagged FDI, respectively) that are almost twice as high in the import equation as in the export equation. Negative balance-of-payments effects appear to be most likely in this industry. The structure of Singapore's foreign trade fits into this picture; while electronics, which belongs to SITC 7, represented slightly less than a quarter of its total exports in 2003, machinery and equipment accounted for almost 60% of its total imports. According to United States FDI data, the factor intensities differ considerably across major branches included in SITC 7. However, transport equipment as well as non-electrical and electrical machinery have a common characteristic, namely that foreign affiliates are relatively strongly integrated into trade networks with parent companies. Vertical integration of this sort would explain that outward FDI leads to higher exports as well as higher imports. The particularly pronounced effect on imports may be attributed to the strong export orientation, which foreign affiliates tend to have in (electrical and non-electrical) machinery. Moreover, the high labour intensity (and, correspondingly, the low human capital and technology intensity) of many operations related to electrical and electronic equipment points to comparative advantages of lower-income host countries of Singaporean FDI. The outsourcing of labour-intensive stages of production by Singaporean investors seems to have played an important role in inducing higher imports in this industry.

Even though the share of foreign affiliates in Singapore's OFDI in specific manufacturing industries is not reported by the country's Dept. of Statistics (var. iss.), there are strong indications that the relationship between FDI and trade in the chemical industry and the machinery and transport equipment industry is significantly influenced by the vertically integrated structures of foreign affiliates. Taken together, these two industries accounted for 83% of all manufacturing FDI projects approved in Singapore during the period 1995-2001 (figure 3). At the same time, Singapore's OFDI in the manufacturing sector in lower-income Asian countries is clearly dominated by foreign affiliates. In 2003, these firms accounted for more than two thirds

of manufacturing FDI stock in Asia, which is almost twice their share in Singapore's total FDI stock in all sectors and all host countries (Singapore, Dept. of Statistics, var. iss., 2003). This implies that it is mainly due to the activities of foreign affiliates that an important part of Singapore's OFDI is of the vertical type. More specifically, the aforementioned characteristics of chemical production plus the prominence of FDI approvals in this industry (figure 3) suggest that foreign affiliates have contributed considerably to Singapore's exports of chemicals. On the other hand, it appears to be mainly in electrical machinery that these firms have contributed to negative balance-of-payments effects by giving rise to imports from lower-income Asian host countries. The important role of foreign affiliates may also explain why most coefficients of the population share of ethnic Chinese remain insignificant in the chemical industry and the machinery and transport equipment industry.

The remaining two industries range between the extremes represented by chemicals and machinery and transport equipment. We find only weakly significant results for SITC 8.

Figure 3. Industry structure of approved manufacturing FDI projects in Singapore^a, 1995-2001^b



Source: ASEAN Secretariat (2002, table 6.1.9)

^a Total project cost basis of foreign investment commitments.

^b Cumulative.

^c Including radio, TV and communication equipment.

This is probably because “miscellaneous manufactured articles” comprise a fairly heterogeneous bundle of goods, ranging from clothing and footwear to prefabricated buildings, furniture as well as professional and scientific instruments. This heterogeneity renders it likely that the pattern observed for the whole industry disguises intra-industry differences in the relation between FDI and trade, similar to what we find for overall manufacturing. Likewise, manufactured goods in SITC 6 include widely different items such as non-metallic mineral manufactures, metal products, iron and steel, textile yarn as well as manufactures made from leather, rubber, wood, and paper. Still, there are some, if only weak, indications that FDI may have negative trade implications in this industry. The lagged FDI variable is positively related to both exports (rows 7 and 9 in table 5) and imports (rows 10 and 12) of Singapore in SITC 6; but FDI residuals remain insignificant in the export equation (row 8), while pointing to strong complementarity with imports (row 11).

6. Summary and conclusions

The aim of this article is to investigate the relationship between Singapore’s FDI and trade and, thereby, to assess whether OFDI is likely to have adverse effects on the labour market. The home-country effects of OFDI by developing economies have received little attention in the literature so far, even though “the ‘new breed’ developing-country TNCs” are no longer confined to low-tech, small-scale and labour intensive activities. The analysis of the trade implications of Singapore’s FDI attempts to fill this gap. The case of Singapore offers interesting insights, not least because FDI in the manufacturing sector is strongly concentrated in lower-income Asian countries. The structural characteristics of FDI let us suspect that the motivations and thus the trade repercussions of Singapore’s FDI differ from previous findings on FDI undertaken by major industrialized countries.

Indeed, although Singapore’s FDI is far from being a completely “different animal”, it is unique in several respects. Most strikingly, perhaps, institutionalized regional integration

does not appear to have stimulated FDI by Singapore in its ASEAN partner countries. This is in sharp contrast to the experience of EU integration. ASEAN's insignificant effect on Singapore's FDI also differs from the positive effect ASEAN has had on Singapore's overall exports and imports. Our FDI-related findings tend to support the sceptical assessment of ASEAN's effective degree of integration by Langhammer (2001) as well as D. Hew and H. Soesastro (2003). Singapore's outward FDI has been stimulated by informal business networks, reflected in a high share of ethnic Chinese in the host countries' population, and by incentives the Government of Singapore has offered to investors reaching beyond ASEAN.

Furthermore, in contrast to what is typically observed for industrialized countries, the per-capita income of host countries does not represent an important driving force of Singapore's FDI. This supports the proposition that the share of vertical FDI is higher, and that market-related considerations are less important than in the case of FDI by major industrialized countries.

Labour market concerns appear to be unfounded when considering the trade effects of OFDI in the manufacturing sector as a whole. In particular, we do not find evidence that Singapore's OFDI has replaced exports. In that regard our results are similar to previous studies on the effects of FDI by industrialized home countries. However, the balance-of-payments effects and the labour market implications of Singapore's FDI differ considerably across manufacturing industries. These differences are related to industry characteristics such as factor intensities and the degree of vertical integration between parent companies and their foreign affiliates. In particular, our results indicate that FDI went along with fragmented production of machinery and transport equipment, thereby giving rise to Singaporean exports, but even more so to Singaporean imports of such goods.

Government policy in Singapore suggests that outsourcing and relocation in particular industries are not an unwanted effect of FDI, but rather the result of a deliberate strategy to shift

economic activity towards higher value-added manufacturing as a means to preserve international competitiveness. Even 15 years ago, R. Aggarwal and T. Agmon (1990) concluded that Singapore represents a case of what these authors coin “government directed dynamic comparative advantage”. The promotion of inward FDI constitutes an important element of this concept. By luring foreign TNCs with advanced technological and managerial skills into Singapore, notably in the chemical industry and the machinery and transport equipment industry, the Government facilitated the process of industrial upgrading. As argued by Lall (1998), policymakers should actively support FDI in both directions, in order to boost the level and range of domestic technological capabilities.

In the short run, however, restructuring through the promotion of vertical FDI is likely to give rise to distributional conflicts within specific industries. Low-skilled workers in relatively labour intensive lines of manufacturing are most likely to suffer deteriorating employment and wage prospects. Most importantly, increased educational and training efforts would be required to upgrade the skills of less qualified workers. In other words, forward-looking government policies must not only focus on technological upgrading but also on the employment and wage prospects of workers who are ill-prepared to participate in this process.

Our findings have implications for future research on the trade and labour market implications of OFDI. The conclusion that considerable differences across industries exist warrants further studies based on more disaggregated data. Moreover, Singapore’s FDI may be different not only from FDI by traditional investor countries, but also from FDI by other newly emerging investor countries. This applies especially to FDI undertaken by lower-income countries such as China. Hence, it would be useful to perform similar studies on the links between OFDI, trade and labour market repercussions for other developing economies. Finally, it is obviously desirable to overcome data constraints in order to be able to apply more sophisticated models than the gravity models used here. ■

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