Intra-industry Affiliate Trade of Foreign Owned Companies in Poland 1993-2002[1]

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Abstract

The concept of intra-industry international exchange of goods and assets has attracted a lot of interests within the last 30 years. Concepts like intra-industry trade, intra-industry foreign direct investments, intra-industry affiliate sale, and intra-industry supply have been used in theoretical and empirical research with most emphasis laid on intra-industry trade. What has not been investigated until now is a subgroup within intra-industry trade, namely intra-industry affiliate trade, which is two-way trade from/to foreign owned affiliates in a country.

By use of a unique database containing trade (exports and imports) and industry variables (wages, employment, foreign capital share, investments, sales, etc.) of foreign owned companies in the Polish manufacturing industry for the years 1993-2002, this paper, investigates for the first time intra-industry affiliate trade (IIAT), including its industry determinants. Labour intensive industries and specialised supplier intensive industries are shown to operate at the highest level of IIAT, and generally IIAT is shown to be increasing over time. Wage level, labour intensity and scale economies are in panel estimations shown to be significant and positively associated to IIAT, while the degree of foreign control over affiliates (measured by the foreign capital share in total equity) is insignificant. Our results are shown partly to be in accordance with the knowledge capital model of Markusen (2002). By assuming that industry variables like scale economies and wage levels are proxies for technology flows and IIAT is a measure for its efficient transfer, our results do also indicate (in accordance with international business research (Kogut and Zander, 1993)) that complex technology is transferred to larger affiliates giving higher wages to their employees as an incentive to absorb new technology.

Keywords: Intra-industry affiliate trade; Multinational enterprises; Poland.

[1] Thanks to Herbert Brücker, DIW; Mark C. Casson University of Reading; Peter J. Buckley, University of Leeds and Ivo Zander, Stockholm School of Economics for many helpful comments.

1. Introduction

International intra-industry exchange of goods and assets has attracted a lot of interests within the last 30 years. The concept has, first of all, been useful as an extension to the traditional views of trade and capital movements as "one-ways". And furthermore, by bringing a deeper knowledge of "why" goods and assets move across frontiers, measures for two-way trade in goods and assets have also been used as indicators for the *similarity of development* of countries and thereby also for *globalisation*.[2]

Intra-Industry Trade (IIT) is defined as the international exchange of products belonging to the same industry, while inter-industry trade is the case, when the exchanged products belong to different industries. The literature on intra-industry trade (IIT) has been extensive within the last 30 years, both theoretically and empirically. Intra-industry trade was identified empirically in the late 1960s and early 1970s and was documented more comprehensively by the work of Grubel and Lloyd (1975)[3].

Theoretical, and primarily empirical research, has mainly been based on economic trade models and disjoint from the theory of foreign direct investments (FDI). Recently, integration of FDI's in trade models has however been a hot research topic bringing contribution also to the knowledge of the relation between IIT and FDI (see e.g. Markusen, 2002). But still these economic models have some limitations, e.g. because they typically operate with only single final goods producing firms and only seldom with intermediate goods and multiproduct firms. Besides, they are typically operated in two-country models[4].

The role of FDI in *empirical* IIT research is still in its infancy. In their 1997 paper, "Back to the Future: Taking Stock on Intra-Industry Trade", Greenaway and Torstensson (1997), mention the progress in the *theory* of multinational firms and IIT, but do not mention as an "Unsolved Issues", the lack of real knowledge of IIT for foreign owned companies. Most studies of the relation between IIT and foreign capital involvement use data for FDI financial flows, which are poor measures for the activity levels of MNEs.

Besides empirical IIT-studies - in some cases with FDI financial flows (or stocks) as explanatory variables - there have been few studies measuring *Intra-Industry Foreign Direct Investment* (IIFDI). Dunning (1982) is an example. Besides measuring IIFDI he compares the levels of IIT and IIFDI across a number of countries and finds out the levels to be rather similar, but with IIFDI lagging behind IIT in time. Even though the number of countries and industries are rather small his findings lend some support to the hypothesis that intra-industry trade and FDI are positively related.

Between IIT (for total trade) and IIFDI as extremities, we find in between: Intra-Industry Affiliate Trade (IIAT), Intra-Industry Affiliate Sales (IIAS), Intra-Industry Supply (IIS), see *figure 1*.[5]

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[2] "When both exports *and* imports of both components and end-products comprise a high proportion of overall trade in an industry, it suggest greater global integration", Makhija et al (1997:688).

[3] Greenaway and Torstensson, (1997) take the temperature of the IIT literature before 1996, and Lloyd and Lee (2002) bring an up-to date overview of the state of IIT theory and empirical evidence.

[4] The two-country limitation is partly solved in Ekholm, Forslid and Markusen (2003), and the intermediate good limitation is partly solved in Chapter 9 in Markusen (2002). Finally, the multi-product limitation is partly solved in Baldwin and Ottaviano (2001).

[5] Besides the types of intra-industry international exchanges in figure 1, intra-industry trade in services has been investigated by Lee and Lloyd (2002) and intra-industry trade in assets by Grubel (2002).

Figure 1. *Five types of intra-industry international exchanges*

IIT	***IIAT***	***IIS***	***IIAS***	***IIFDI***
(total trade)	(trade from foreign affiliates)	(total trade plus affiliates production	(sales/production from foreign affiliates)	(total FDI flows)

Intra-industry Affiliate Sales (IIAS) is studied by e.g. Markusen and Maskus (2001). They are basing their empirical investigation on a general equilibrium model for trade and affiliate activity predicting that both IIT and IIAS are related to country characteristics (country sizes and factor endowments) and trade and investment costs. Using data for the sales of affiliates of American MNEs in different countries and the affiliates in the U.S. of MNEs from the same countries (10 countries and 7 manufacturing sectors), they find that intra-industry affiliate sales index rises relative to the intra-industry trade index as countries become richer and more similar in size and in relative endowments.

The concept of *Intra-industry Supply* (or "extended intra-industry trade", IIS) was introduced by Greenaway et al (2001). Their starting point is that globalisation is no longer primarily a question of trade in goods, but at least to the same extent a question of international production. They therefore suggest extending the traditional IIT measure to include besides trade, international production. So IIS is a *combination* of IIT and IIAS. Besides introducing the new concept they find out (using U.S. data) that international production counts for most of the two-way extended supply.

Taking the point of departure in empirical research, we find in figure 1 a huge amount of research to the left (IIT), but very little to the right of IIT. The IIFDI research has been sparse and not very enlightening, because the substance of understanding multinational companies' activities is not related to the financial flows of FDI, but to the 'real' activities (sales, production, employment, trade, etc.) of these companies, which generally is related to the firm specific assets of these companies. Therefore, moving to the left from the right endpoint in figure 1 is more enlightening, because these concepts (i.e. IIAS, IIS and IIAT) are related to production, sales and trade. Using the concepts of IIS and IIAS certainly contribute to the understanding of globalisation and MNE's behaviour. But these concepts do not contribute to the understanding of *international trade from MNE's affiliates* (including trade between foreign affiliates and affiliates and parent companies). This is exactly, where this paper comes in.

The reason why the relation between IIT and foreign ownership empirically has been researched so little is certainly related to the lack of useful data[6]. This problem is partly solved in this paper, where we are basing our results on a unique industry data set on trade, employment, wages, foreign control and sales figures at 3-digit NACE level for foreign owned companies situated in Poland, giving us the possibility of calculating intra-industry affiliates trade (IIAT) from the beginning of the large inflows of FDI in 1993 to 2002, two years before Polish EU membership.

In this paper, besides calculating IIAT - as far as we know - for the first time[7], we particularly want to relate the IIAT to a number of industry determinants for foreign owned companies in Poland. Because of the relative big differences in factor endowments, the motives for doing FDI in transition economies may differ from Western countries' intra-FDI pattern. We expect the investment in transition economies to a larger extent to be based on the motive of using the country as a platform for export to other countries including the investor country. So in contrast to most other empirical intra-industry trade studies, which are based on "new trade theory" our theoretical background is theories that combines trade and FDI like e.g. Markusen (2002). So this

[6] This count for all intra-industry types of measures in figure 1, apart from IIT itself.
[7] However, Nielsen and Pawlik (2004b) calculated IIAT based on CN-8 digit data.

paper is expected to be both a contribution to the general understanding of the relation between IIAT and FDI, and besides, to the specific relation for transition economies.

In section 2 we present briefly the literature on IIT, FDI and transition economies besides our hypotheses. In section 3 an overview of trade and FDI of the Polish economy 1993-2002 is given besides a discussion of the association between IIAT and the export-orientation of foreign affiliates in Poland. Section 4 presents our empirical model, section 5 our results and section 6 concludes.

2. Intra-industry trade, FDI and transition

"Product" or" industry" based IIT

Intra-industry trade research related to *transition economies* has for very obvious reasons increased intensively in recent years, but still without any specific regards of FDI. Because transition economies have a factor endowment somewhat different from the more advanced countries in the EU and the US, we may expect that intra-industry trade in transition economies to a large extent to be *vertical,* and this in a double sense. First of all, because it is based on exchange of *products* of different qualities - so-called vertical intra-industry trade (in contrast to horizontal intra-industry trade, where goods of the same quality are exchanged). And vertical intra-industry trade is according to theory primarily based on differences in factor endowments of countries; see e.g. the seminal paper by Falvey (1981). Secondly, because one of the main motives of multinational companies to invest in transition economies is to exploit differences in factor endowments (cheap, well-educated labour). This type of organisation of MNEs is called vertical integrated MNEs, where different parts of the value chain of the company is placed where factor endowments and technology levels of countries best fit the requirement of the given fragmented production process (Caves, 1971). So, by for example exporting higher technology components from the home basis of the MNE to the transition economy and by giving these intermediates a labour intensive value added there, and then exporting the final goods back to the home country or other higher developed countries, intra-industry trade is created, because the parts and the final goods are produced within the same *industry*[8]. So, this process both involves intra-industry affiliate trade (IIAT) and intra-firm trade, the latter accounting a large share of international trade in goods (for the U.S. one third (OECD, 2002). This is in contrast to horizontal integrated MNEs, where the same good is produced at home and in the host country.

So, intra-industry trade may be related to exchange of *products* belonging to the same product group ("industry") or to exchange of final goods and intermediates (within the same "*industry")*. Because this paper uses industry data and not product based trade data, it is the latter type of IIT that is focused on.

Transition and IIT

According to OECD (2002), the Eastern European transition economies of Czech Republic, Hungary, Poland and Slovakia are the countries with the most rapid increase in intra-industry trade over the 1990s. The OECD ascribes this development in IIT to the high and increasing inflows of FDI over 1990s. And Gabrisch and Werner (1998) compare the IIT level of the transition

[8] This fits the definition given by Grubel and Lloyd (1975) of vertical intra-industry trade as the simultaneous export and import of goods in the same industry, but at different stages of production.

economies to that of Greece, Portugal, and Spain at the time of their EU accession and find IIT of the latter countries at a lower level than the mentioned transition economies.

For Poland - the country investigated in this paper - IIT-studies where also done during the socialistic period. Blaszczuk (1974), Kotynski (1979), Siwinski (1980) and Misala (1985)) are examples. Newer studies of Polish economist are Michalek and Sledziewska-Koledziejska (2000), Misala and Plucinski (2000) and Cieslik (1999). Generally they find an increase in IIT with vertical IIT of importance relative to horizontal, but none of the studies take FDI factors into consideration. The general growth of Polish IIT with emphasis on the vertical part is also confirmed by non-Polish economist like e.g. Gullstrand (2000). Aturupane et al (1997, 1999) found also that vertical intra-industry trade accounted for the highest share of IIT for the Central and Eastern European nations (89% in case of Poland), and what is new in their investigation is that the role of FDI is taken into consideration as an explanatory variable for vertical IIT. The activity of FDI or "multinationality" is measured as the output of affiliates as a share of industry total, which certainly is a better measures than the inward financial flows of foreign companies. A positive and significant relationship between FDI and both vertical and horizontal IIT is found.[9]

Besides the factors mentioned in international trade theory and FDI theory (factor endowments, product differentiation, consumer preferences, scale economies, trade costs, country sizes, etc.) more specific "transition factors" may play a role for the level of IIT, the relation between IIT and FDI and the level of IIAT.

Because changes in specialisation take time, there is certainly a path-dependency in the trade- and IIT pattern of a transition economy. The specialisation pattern inherited from the plan economy period may have some (declining) influences years ahead. Off course it is decisive if the transition model is gradualism or shock-therapy. Under a shock-therapy – which is the model of Poland (Paldam (2002)) – Polish companies have to make a quick reorientation of their trade from the East to the West. To do so, they have to establish linkages to EU companies, leading to a vertical specialisation, which gives increasing IIT, if EU companies export advanced intermediates and capital equipment plus market knowledge, and the Polish companies export the finished products back to the EU. A requirement is the intermediates and finished products are statistically related to the same industry. Later on, the vertical specialisation may be done within the multinational company (Hoekman and Djankov, 1996).

Another transition specific effect that may influence the IIT development of Poland and other transition economies is the *trade policy* these countries are surrounded by. Especially, the policy of the EU granting more liberal access for foreign goods that embody a significant amount of inputs originating from EU firms, may influence IIT. The so-called outward processing traffic, where tariffs on goods that are re-imported after processing are reduced, has created an incentive for placing parts of the value chain in CEEC countries. With the introduction of the Europe Agreements (for Poland in 1992) tariffs on such trade were eliminated altogether for goods satisfying the agreements rules of origin (Brenton and Machin, 2003). Together outward processing and rules of origin may have had a positive effect on the development of IIT by establishing linkages (subcontracting) between EU and CEEC companies. The industries, where outward-processing traffic has been important, are textiles, electronics, machines, shoes, cars and furniture. It is industries, where fragmentation of the value chain seems rational, and it is exactly industries, where we also expect vertical integrated MNEs to be active players and therefore IIAT to be high.

[9] In Nielsen and Pawlik (2004b) a significant positive association is found between IIAT and the stock of FDI in Poland, while no association was found between the stock of FDI and IIT for private and public domestic owned Polish companies.

Hypotheses

Because intra-industry *affiliate* trade is not a well-known concept from the theoretical and empirical literature, no direct support in formulating hypotheses for the level and development of IIAT is found. One possibility is therefore to look for theory on "FDI motives" as found in the international business literature. Here motives are often divided into market seeking, efficiency seeking, resource seeking and strategic asset seeking motives, see Dunning (1994). Or "FDI motives" may be found in the international economics literature as types of organization of foreign production like horizontal integrated MNEs or vertical integrated MNEs. We are primarily using the latter types of theories that combine trade and multinational companies (e.g. Helpman, 1985, and Markusen, 2002), but are also drawing on international business literature (e.g. Kogut and Zander, 1993) supported with empirical results of export behaviour in Poland found in Nielsen and Pawlik (2005).

If a multinational company is fully *horizontally* integrated, with a parallel production plant in the host country, where all local produced production is sold, export from the affiliate is per definition zero and so is IIAT. If a multinational company is *vertically* integrated with different parts of the value chain having different capital (labour) intensities, and with a geographical separation of affiliates according to countries with the same factor intensities, IIAT will typically arise for not too narrow defined industries. The reason is that at the existing levels of disaggregation of empirical data, finished goods and middle products that are used in their production often appear in the same category (Helpman, 1985: 453). For the level of aggregation used in this paper, we expect to find a high level of IIAT for vertical integrated MNEs, which are also companies with an expected high export-orientation *and* a high labour intensity. Thus horizontal integrated MNEs should generally be associated with a modest level of IIAT, while vertical integrated MNEs stimulates two-way cross border trade and a high level of IIAT.

Looking at the *time dimension*, trade costs (for goods as well as assets) between Poland and its trading partners (especially to the West) have fallen over the analysed period 1993-2002. This factor will by itself lead to an increase in vertical integrated MNEs relative to horizontal integrated according to Markusen (2002) and for that reason an increase in IIAT should be expected. But as stated above, because of the outward processing traffic, vertical linkages between domestic or foreign companies or vertical integrated MNEs were created early in the period. The gradual reduction in out-ward processing traffic were overcompensated by the general reductions in trade barriers and therefore we expect IIAT to increase over time. In the opposite direction, the catching-up process of the Polish economy (by the end of the period) or an equalising process of relative factor endowments and market sizes will, according to the knowledge capital model of Markusen (2002), lead to an increase in horizontal integrated MNEs relative to vertical integrated and therefore a fall in IIAT. Since the catching-up process is still modest (2002) we generally expect IIAT to increase over time. This is supported by the fact that the export orientation of foreign companies in Poland has increased as shown in Nielsen and Pawlik (2004a). Therefore our first hypothesis is $\partial IIAT/\partial t>0$ (**H_1**), where t is time.

International sales and sourcing motives (exports and imports) for foreign affiliates in Poland differ across industries classified in factor intensity groups (Nielsen and Pawlik, 2004a). Resource intensive and science based industries are clear locally oriented with respect to both sales and sourcing, while labour intensive industries are clearly export-oriented. Finally scale intensive and specialised supplier industries are in a mid position with an equal large share of sales locally oriented, and changing from local to export orientation over the years 1993-2002. Based on these observations supplied with the argument of Markusen (2002) mentioned above, we make the hypothesis that *labour intensive industries have a high IIAT ratio with scale intensive and specialised supplier industries coming next (**H_2**).*

The unit of analysis in this paper is not firms, but industries (3-digit NACE manufacturing sectors). In each industry there are typically a number of firms, which may have different motives for establishing production in Poland, and some may follow a mixed strategy covering both the local market and exports. But generally, following the knowledge capital model of Markusen (2002), we expect the level of labour intensity (*L/S*) at the industry level to be positively associated to vertical integrated MNEs, and therefore also to the level of IIAT. Therefore $\partial IIAT/\partial(L/S)>0$ ($\boldsymbol{H_3}$), where *L* is labour input and *S* is real sales value.

That intra-industry affiliate trade is related positively to the *foreign capital share* (FCS) in the given industry is based on an assumed relation between FCS and the complexity of technologies transferred from the mother company to the affiliate (Zander, 1991; Kogut and Zander, 1992, 1993)[10]. Firstly, exploitation of knowledge is firm-specific, often tacit and difficult to provide to the receivers. Secondly, Kogut and Zander (1993) show that attributes of technology such as tacitness, codifiability and teachability[11] are decisive for how technology is transferred, through e.g. licensing, to a joint venture or a wholly owned subsidiary. That is, they assume a positive association between control[12] (FCS) and technological complexity.

The knowledge transfer of MNEs (proxied by FCS) as an explanatory variable for intra-industry affiliate trade has not been researched so far in the literature. Based on the technological competence perspective larger tacitness and high complexity of knowledge will take place in foreign affiliates that are highly controlled by MNEs. It is our prediction that it will also lead to high intra-industry affiliate ratio. We assume that a highly complex technology in a transition economy requires foreign sourcing of components and production lines from either the mother company, or in cases where the MNE is not able to provide a complete value chain to its newly established affiliate, from other companies outside the transition country. On the other hand products processed with utilization of complex technology will to a larger extent be exported abroad (Hanson and Slaughter, 2002), because they are part of a vertical production chain benefiting locally from access to cheaper resources as labour or materials. Moreover, knowledge is not only transferred in the form of technological know-how, brand names and managerial skills, but also through access to export networks and as reputation (Meyer and Sinani, 2002). Consequently, larger inflow of knowledge to a fully controlled affiliate enhances its exports abilities that together with increasing sourcing lead to high IIAT. Consequently, we make the hypothesis that $\partial IIAT/\partial FCS>0$ ($\boldsymbol{H_4}$)[13]. What makes this hypothesis uncertain is that in a transition economy the degree of foreign ownership is also a result of the privatisation policy in the given country. In Poland it was, in the

[10] In international business research literature the term "technology" has been applied in a broad sense, from manufacturing hardware to skills that reside in people. Based on Caves (1971), Dunning (1982) and Zander (1991) we consider technology in the broadest sense capturing all forms of knowledge that affect the production function of the user firm, both *embodied* (in the form of physical assets) and *disembodied* (consisting of the information base for tools, contained in manuals or residing in people).

[11] So knowledge is not a pure public good.

[12] And control is related to internalization, that is "motives or reasons why the multinational firm wants to exploit its ownership advantages abroad through an owned subsidiary (and hence FDI) rather than through some arm's-length arrangement such as a licensing agreement. (Markusen, 2002: 287)

[13] Blanes and Martín (2000) presume a positive relation between foreign capital participation and IIT (total, not affiliate) in Spain, but do not give any reasons for the expected positive sign. But their empirical results confirm their hypothesis. Also Greenaway, Milner and Elliott (1999) argue for a positive association between IIT and multinational activity. Using the share of total industry sales accounted for by foreign enterprises the positive role of multinationals in generating UK IIT is confirmed. Andersson and Fredriksson (1996: 255) argues for negative association between the foreign capital share (called "multinationality") and export intensity, because a high degree of foreign control signals horizontal integration rather than vertical integration, since affiliates in the former case substitute for, rather than complement, activities at home.

beginning of the transition process, primarily a question of taking over in joint ventures earlier state owned companies, while later to a higher extent to establish fully owned companies.

Also the *investment activity (I/S)* in foreign owned companies may be an explanatory variable for IIAT. In a vertically integrated company (high IIAT), investments are typically already done (shipping capital equipment from home and all technological improvements are done in the mother-company), while in a horizontally integrated MNE, a parallel plant to that at home has to be built, typically involving a huge investment (fixed costs), so we may argue for a negative association between IIAT and I/S. But this association may be the opposite, if we apply the argumentation used in relation to hypothesis (4) (the importance of the complexity of technologies transferred). The higher expenditures on new machinery and equipment, the more complex the production process is assumed to be. And a complex production process in a transition economy requires transfer of complex technologies and management skills. So, because of these two opposite directed factors, we have no clear indication of the sign of the partial relation between IIAT and investment activity, so $\partial IIAT/\partial(I/S) \approx 0$ (***H*****$_5$**).

As is well-known from the "new trade theory" the degree of *scale economies* may also influence IIT. The scope for horizontal product differentiation may vary with the size of minimum efficient scale and therefore the number of companies and number of varieties. So the bigger the minimum efficient scale is, the smaller the number of companies giving a smaller share of horizontal IIT. For vertical IIT the association is more blurred. According to Falvey (1981) there is no scale economies motive for specialisation and IIT, but according to Shaked and Sutton (1984), IIT is driven by scale economies. So there is no clear recommendation from theory. Because the investigation in this paper is on Polish trade to the world – in practice to higher developed countries – there are reasons to expect Polish intra-industry trade generally to be primarily in vertical differentiated goods, but still theory does no not give any clear indication of the sign. A further problem related to our research is that we look at IIAT and not IIT, and that as mentioned above industry trade data and not product trade data are used. Both facts indicate that the distinction between horizontal and vertical product differentiation has less importance, while exchange of final goods for intermediates is of high importance for IIAT. Based on these arguments from international trade theory no clear indication of the sign of the partial relation between IIAT and scale economies is found. But, claiming that larger plants are more likely to be technology intensive and lead to more complex knowledge transferred, we may use a similar argumentation as for hypothesis 4 and therefore assume a positive association between IIAT and scale economies: $\partial IIAT/\partial SCAL>0$ **(*H*$_6$).**

Even though the labour intensity (*L/S*) and the average wage level (*W/L*) has a negative and significant correlation[14] (-0.525), we expect a positive association between *W/L* in foreign companies and the level of IIAT, $\partial IIAT/\partial(W/L)>0$ **(*H7*)**. This relation may also be based on "the complexity of technology argument" presented above. To transfer successfully complex technology requires absorptive capacity of the receivers including the employees of the companies (Cohen and Levinthal, 1990). The absorptive capacity may be lifted through human capital investments and different wage incentive systems giving larger compensation relative to other companies. Since our wage variable (*W/L*) is an average wage at industry level, higher *W/L* may be explained by higher wages for given skills or by wages related to the different skill levels. The skills may include knowledge of foreign markets, both at the export and import side, so for a given value of *L/S*, industries with a higher *W/L* are supposed to be more international oriented and competitive (higher IIAT), because higher qualified employees have better foreign market knowledge, creates

[14] See the scatter plots in figure A1 in appendix A.

possibility for production of higher quality products which again requires higher quality intermediates.[15]

3. Trade and FDI overview of the Polish Economy 1993-2002

Table 1 gives an overview of the Polish economy with respect to GDP, inflation, international trade (total and for foreign companies) and FDI. A high growth rate (except for 2001 and 2002) and a decreasing inflation rate to the EU level (2002) have been the case. Both factors are supposed to stimulate FDI inflows (market motive and reduced risks). The openness of the Polish economy with respect to trade, measured by the ratio of the total foreign trade turnover in GDP, has only increased slightly following a U-path. But for foreign owned companies this ratio has increased significantly from 7.7% in 1993 to 27.5% in 2002. So, there is a significant relative change in the Polish foreign trade structure from domestic and towards trade from foreign owned companies. The stock of FDI has also increased significantly with an average yearly growth rate of 42% (measured nominally in US$) and an increasing ratio between the stock of FDI and GDP from 2.6% in 1993 to 13.5% in 2002.

Table 1. *Growth, inflation and international openness of the Polish economy 1993-2002*

	1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
GDP (current prices)	120812	185926	308103	387826	472350	553560	615115	715391	750786	777248
Total exports	25757	39246	55515	65744	84463	98647	108757	137908	148114	167338
Total imports	34018	49072	70502	99899	138770	162963	182400	213071	206252	224816
Foreign Trade Turnover	59775	88318	126017	165642	223234	261610	291157	350979	354366	392154
Exports – foreign companies (NACE)	3431	7084	13271	18747	27839	37462	47841	67740	73945	88400
Imports – foreign companies (NACE)	5887	11755	22209	35332	55162	70017	93754	116837	108706	125293
Turnover – foreign companies	9318	18839	35480	54079	83002	107480	141595	184578	182652	213693
FDI stock	3088	6030	10446	19378	34364	54073	67576	84593	90381	104958*
	1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Real GDP growth rate	3.8	5.2	7.0	6.5	6.9	4.8	4.1	4.0	1.0	1.0
Inflation (year to year)	35.3	32.2	27.8	19.9	14.9	11.8	7.3	10.1	5.5	2.1
total exports/GDP	21.3	21.1	18.0	17.0	17.9	17.8	17.7	19.3	19.7	21.5
total imports/GDP	28.2	26.4	22.9	25.8	29.4	29.4	29.7	29.8	27.5	28.9
Foreign Trade Turnover/GDP	49.5	47.5	40.9	42.7	47.3	47.3	47.3	49.1	47.2	50.5
Exports – foreign companies (NACE)/GDP	2.8	3.8	4.3	4.8	5.9	6.8	7.8	9.5	9.8	11.4
Imports – foreign companies (NACE)/GDP	4.9	6.3	7.2	9.1	11.7	12.6	15.2	16.3	14.5	16.1
Foreign trade turnover - foreign companies (NACE)/GDP	7.7	10.1	11.5	13.9	17.6	19.4	23.0	25.8	24.3	27.5
FDI-stock/GDP	2.6	3.2	3.4	5.0	7.3	9.8	11.0	11.8	12.0	13.5*

Notes: All figures in current prices are in millions Polish zloty. All ratios in percentage.
Source: FDI figures: Own calculations based on PAIZ data that only includes medium and large investors (above 1 million USD). Converted from UDS to Polish zloty by exchange rates conversions keys from the Polish National Bank. * The 2002 FDI figures are from June 2003.

Overview of IIT – domestic versus foreign companies

[15] A number of studies have shown for many countries a rising within-affiliate relative employment of more-skilled workers over time (e.g. Berman et al, 1998, Haskel and Slaughter, 2002, Berman and Machin, 2001). These observations seem also to be in line with the statement that multinational affiliates raise demand for more-skilled workers when they utilize firm-specific (knowledge) assets.

To get an overview of the intra-industry trade development in Poland over the analysed period, we have in *table 2* calculated the aggregated Grubel-Lloyd index (GL)[16] for the foreign, domestic private and domestic public companies. The calculations are based on the economic activity statistics (NACE) at the 3-digit level. The shown GL-indices are weighted averages from the GL 3-digit NACE levels.

Intra-industry trade for foreign owned companies is slightly increasing from 1993 to 2002, while domestic private companies show a significant growth. Intra-industry trade for public owned companies has, after a fall up to the mid of the period, been reviving. But the level of IIT is, as expected, highest for foreign companies followed closely by domestic privately owned companies. The growth of IIAT is a confirmation of hypothesis 1 (H_1), but if IIT for domestic companies are used as a benchmark, the confirmation is only valid, if the benchmark is public owned companies.

Table 2. *Intra-industry trade in Poland 1993-2002: Foreign, private and public owned companies*

Types of ownership	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Foreign	0.71	0.71	0.73	0.69	0.70	0.72	0.73	0.81	0.75	0.75
number of observations	58	70	73	76	82	75	74	73	84	89
Domestic private	0.60	0.67	0.62	0.64	0.67	0.64	0.64	0.71	0.73	0.73
number of observations	40	62	71	78	87	91	90	90	88	97
Domestic public	0.64	0.45	0.47	0.46	0.36	0.44	0.51	0.51	0.55	0.57
number of observations	38	48	63	69	43	42	45	45	43	41

Notes: IIT: Intra-industry trade are weighted calculations from NACE 3-digit levels.
Number of observations is equal to number of 3-digit NACE industries (exclusive observations that are hidden because of confidentiality reasons).
Source: Own calculations based on data from GUS.

Association between IIAT and export-orientation

To get a preliminary picture of the relation between intra-industry affiliate trade and the export-orientation (*X/S*) of foreign companies ("their motives"), *table 3* divides the IIAT-ratio into "low", "medium" and "high" and brings the corresponding values for number of industries and companies besides the export-orientation and import sourcing for the two years 1993 and 2002.

Table 3 *Distribution of industries, number of companies, export-orientation and sourcing of import according to low, medium and high intra-industry affiliate trade, 1993 and 2002.*

Type of IIAT	Year	Number of NACE 3 digit sections*	Number of companies*	IIAT ratio – weighted average	Export-orientation (X/S) – weighted average	Sourcing of import (M/S) – weighted average
"Low" IIAT (<0.40)	1993	13 (22)	333 (24)	0.18	0.04	0.27
	2002	7 (8)	156 (6)	0.24	0.06	0.30
"Medium" IIAT (0.40-0.60)	1993	12 (21)	257 (18)	0.53	0.25	0.28
	2002	13 (15)	382 (14)	0.55	0.29	0.21
"High" IIAT (>0.60)	1993	33 (57)	816 (58)	0.86	0.33	0.29
	2002	69 (78)	2131 (80)	0.84	0.53	0.45

Notes: *In brackets percentage. IIAT, weighted average of Grubel-Lloyd indices calculated at 3-digit NACE figures.
Source: Own calculations based on data from GUS.

Three main conclusions follow from table 3. The first is that a positive association between intra-industry affiliate trade and export-orientation seems to be the case, both in 1993 and in 2002. The second is that the partial association between IIAT and *X/S* - $\partial(IIAT)/\partial(X/S)$ – is smaller in

[16] See formula (2).

2002 than in 1993. The third is that the IIAT growth from 1993 to 2002 found in table 3 seems primarily to be a consequence of a net-increase in the number of NACE 3-digit industries (and companies), with the new coming foreign owned companies operating in the "high" IIAT group. Companies staying in the "low" and "medium" groups in 1993 as well as 2002 seem on average to keep their IIAT unchanged. *Table B1* in the Appendix shows that there are no extreme jumps of industries from "low" to "high" IIAT or the other way. The main trend is movement from low to medium and from medium to high IIAT. There are two exceptions. Manufacture of furniture and production/preserving of meat have moved from high to medium IIAT. Movements from medium to low IIAT have not been observed in the compared years.

4. Empirical model

The main purpose of this paper is to explain the degree of intra-industry affiliate trade (*IIAT*) in Poland (dependent variable) by five independent variables plus time and factor-intensity dummies explained in the seven hypotheses in section 2. To that purpose we use the following model

$$IIAT_{i,t} = \beta_0 + \underset{+}{\beta_1(L/S)_{it}} + \underset{+}{\beta_2(W/L)_{it}} + \underset{?}{\beta_3(I/S)_{it}} + \underset{+}{\beta_4 FCS_{it}} + \underset{+}{\beta_5 SCALE_{it}} + TD_{it} + FACTD_t + \varepsilon_{i,t} \quad (1)$$

where subscripts *i* and *t* denotes manufacturing industries and time, respectively, and the signs below the coefficients indicate the assumed partial association between *IIAT* and the given independent variable.

Measurement of the dependent variable

The Grubel and Lloyd-index, GL, (Grubel and Lloyd, 1975) is the most commonly used measure for the share of intra-industry trade in total trade. It is formulated as

$$GL_{it} = \frac{(X_{it} + M_{it}) - |X_{it} - M_{it}|}{X_{it} + M_{it}} \quad (2)$$

with X_{it} and M_{it} indicating the value of exports and imports inside industry *i* respectively at time *t* for the chosen level of aggregation, $|X_{it} - M_{it}|$ the net trade and $(X_{it}+M_{it})$ the value of total trade. Accordingly, the part of foreign trade that is characterised by being inter-industry is the residual of equation (2). Therefore, following the Grubel and Lloyd method, a given trade flow between two countries within an industry typically involves *both* inter- *and* intra-industry trade. The usefulness of this measure has been heavily discussed in the literature. Should e.g. the measure be corrected for imbalances in the total trade balance of the investigated country? We follow the main stream of the literature and use the uncorrected GL-index (see Lloyd, 2002).

X_{it} and M_{it} are defined as the *multilateral* export and import values respectively from companies in Poland, where the foreign capital share is above 10%.[17] Because *IIAT* measured bilaterally may differ across countries that Poland trade with, the changes we observe over time may partly be a result of a changing composition of the Polish export-structure (from East to West). If trade to the East is, as expected, more inter-industrial than to the West, the decreasing importance

[17] The reason why we solely use multilateral trade data is that by demanding bilateral trade figures the number of observations would be reduced drastically because of confidentiality rules. Using multilateral trade figures excludes the possibility of using country-specific factors which traditionally in IIT-regressions have outperformed determinants that are industry-specific (Greenaway and Torstensson, 1997).

of the East trade will by it self increase the measured IIT levels. But because we look at trade from foreign owned companies (*IIAT*) with a new market orientation, this "problem" is expected small.

Another important factor with respect to the size of GL_{it} is the used export and import figures are at a rather high level of aggregation (approximately 80 NACE groups), which influences the level of IIT (IIAT). Compared to other studies using data from MNEs, this study is anyhow rather disaggregated.

Independent variables

As indicated in formula (1) we have five explanatory variables plus time and factor intensity dummies. Except time all variables are industry-specific (see footnote 17).

Labour intensity (L/S) is measured by the number of employees per real sales unit. *Wage level* (*W/L*) is measured by the share of real salaries, regardless of type of work in number of employees. *Investment activity* is measured by the investments-to-sales ratio (*I/S*) that is all expenditures on fixed assets (tangible and non-tangible[18]) as a share of revenues on sales. *Foreign control* is measured by the foreign capital share (*FCS*) that is the foreign owner's input of capital as a part of total capital provided for setting up the business entity at the moment of establishing the company. *Scale economies* (*SCALE*) is measured by the average size of establishment (the real sales divided by number of companies). For investment activity no sign is indicated because we are not able to formulate a conclusive hypothesis.

To control for changes in macroeconomic condition, *time* is represented by time-dummies (*TD*) (1994-2002). The groupings of industries in factor-intensities is represented - following the OECD classification shown in table C1 in appendix C, by factor-intensity dummies (*FACTD*) for labour intensive, scale intensive, specialised supplier and science based industries, with resource intensive industries as the base group.

Data

Our data rest on a unique database created in cooperation with the Central Statistical Office of Poland. This database includes information on all foreign companies with a number of employees exceeding 9 persons and with a foreign capital share equal to or greater than 10 percent in total equity. From this database we use export and import data, sales value, wages, number of companies and employees, investment outlays and foreign capital share. Further details are given in appendix A, which also includes the partial correlation between all variables, shown as scatter plots.

Techniques of estimation

Because our data set have both a cross-sectional (approximately 80 industries) and a time series dimension (12 years), to increase the sample size, a pooled cross section analysis over 12 years has been carried out. Panel data analysis has also been done to account for possible heterogeneity across manufacturing industries. This estimation technique assumes that the intercept (β_0) in equation (1) varies across industries and thus can be written as β_{0i}. β_{0i} captures all unobserved, time-constant factors that affect $IIAT_{i,t}$. We estimate (1) using both a fixed and random effect model, where the first assumes β_{0i} to be a fixed parameter and allows for arbitrary correlations between β_{0i} and the independent variables in any time period, while the latter is attractive to use, when we think the unobserved effects is uncorrelated with all explanatory variables (Woolridge, 2003).

Because we have good reasons to expect that β_{0i} is correlated with some of the explanatory variables like e.g. "labour intensity" (*L/S*), we first make fixed effect panel estimation and use an F-test to see if there is a fixed effect (unobserved heterogeneity). Because the unobserved

[18] Non-tangible assets are e.g. software.

heterogeneity as mentioned may also exist in case of random effect, we use the Breusch and Pagan Lagrangian multiplier test (LM) for random effects. If unobserved heterogeneity is observed in both the F-test and the LM-test we use the Hausman test to compare fixed and random effect (null hypothesis that random effect model is valid).

We estimate both log-log models as well as level-log models and because the Grubel-Lloyd index lies between zero and one we also try, as common in IIT-regressions, a logistic variant.

5. Empirical findings

Tables D1-D6 in Appendix D display the results of our different estimations. The pooled (OLS) regressions are rejected in favour of the fixed effects and the random effect regressions[19], so unobserved heterogeneity exists. In cases where fixed and random effects are comparable, according to the Hausman specification test, random effect is not favoured, since some regressors are correlated with the unobserved heterogeneity term. Because the logistic regressions performs equal well or worse than similar log-log or level-log models and the log-log models better than (or equal to) level-log models, we have in *table 4* only presented the log-log fixed effect models and the random effect model with time and factor intensity dummies.

The pattern is rather clear independent of model specifications. The wage variable (*W/L*) is highly significant (0.1% level) in the fixed effect model and with the expected positive sign, but less significant and with a somewhat smaller coefficient in the random effect model. The labour-intensity variable is similar, as expected, positive and highly significant, with the size of the coefficient (elasticity) rather stable around 0.40. The scale variable is also positive and highly significant, with a size in the interval 0.06-0.08. But the investment and the foreign control variables are insignificant, but FCS has the expected positive sign. The inconclusiveness of the investment variable was as hypothesis stated. So, generally we find the wage level and the labour intensity as the industry variables with the main impact on IIAT, with a rather similar elasticity around 0.40 in the different models, but with scale economies contributing relatively little.

Time dummies are all significant since 1997 (but since 1995 at 10% level) and increasing over time. And in the random effect model labour intensive and specialised supplier industries have a significant higher level of IIAT, than the other types of factor intensive industries. Generally, the results are relatively robust to different specifications of the model, while the power of explanation is not impressive (15%), which to a high extent is a result of not using country specific variables, which in earlier studies have been the most contributing variables (see e.g. Greenaway and Torstensson 1997)[20]

[19] With one exceptions, namely the level-log random effect model with time dummies.

[20] The fact that we are using multilateral trade data and therefore not are able to explain differences in IIAT relative to different countries, is maybe not as big a problem as it sounds, because a big share of Polish trade are directed to the EU countries, especially the higher income EU countries, where differences in factor endowments etc. are not so big. So in this respect the Polish trade fits into a "two-country" type of model.

***Table 4**. Estimations results*

	Fixed effect panel estimations								Random effect panel estimations	
	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test
(Constant)	-0.47*	(-2.04)	-0.09	(-0.42)	-0.47*	(-2.05)	-0.22	(-0.85)	-0.18	(-0.75)
ln (W/L)	0.44***	(8.08)	0.47***	(8.92)	0.44***	(8.16)	0.31***	(3.55)	0.19*	(2.21)
ln (L/S)	0.38***	(6.71)	0.32***	(5.93)	0.37***	(6.70)	0.40***	(6.93)	0.41***	(7.83)
ln (I/S)	-0.02	(-0.75)	-0.02	(-0.77)			-0.02	(-0.71)	0.00	(-0.16)
ln (FCS)	0.07	(0.80)	0.10	(1.02)	0.07	(0.76)	0.01	(0.11)	0.03	(0.36)
ln (SCALE)	0.08***	(3.41)			0.08***	(3.42)	0.06**	(2.91)	0.08***	(3.58)
φ LABOUR									0.29*	(2.21)
φ SCALE									-0.04	(-0.30)
φ SPECIALISED									0.30*	(2.08)
φ SCIENCE									-0.18	(-0.97)
σ 1994							0.05	(0.84)	0.02	(0.31)
σ 1995							0.12	(1.83)	0.12	(1.79)
σ 1996							0.12	(1.81)	0.13	(1.89)
σ 1997							0.14*	(2.05)	0.17*	(2.40)
σ 1998							0.21**	(2.98)	0.23**	(3.25)
σ 1999							0.18*	(2.21)	0.24**	(3.00)
σ 2000							0.18*	(2.15)	0.24**	(2.91)
σ 2001							0.19*	(2.09)	0.27**	(3.04)
σ 2002							0.28***	(3.46)	0.34***	(4.29)
R^2 (within)	0.14		0.13		0.14		0.16		0.16	
N	755		755		755		755		755	
F	13.33***		13.75***		13.41***		12.42***			
Hausmam test chi2	27.47***		21.55***		20.34***		44.5***			
Lagrarian Multiplier test chi2	661.44***		693.73***		685.99***		646.06***		512.7***	

Notes: The dependent variable is ln(IIAT).The independent variables are: *W/L*: The wage level. *L/S*: Labour intensity. *I/S*:Investment activity. *FCS*: Foreign control, *SCALE* :Scale economies. *σ 1994, σ 1995* etc. indicates time dummies, and *φ LABOUR*, etc. factor intensity dummies. *N*: Number of observations. *, **, *** significant at 5%, 1%, and 0.1% levels. The Hausman test could not be done for the random effect model with factor intensity dummies, since the fixed effect model cannot be performed in such a case.

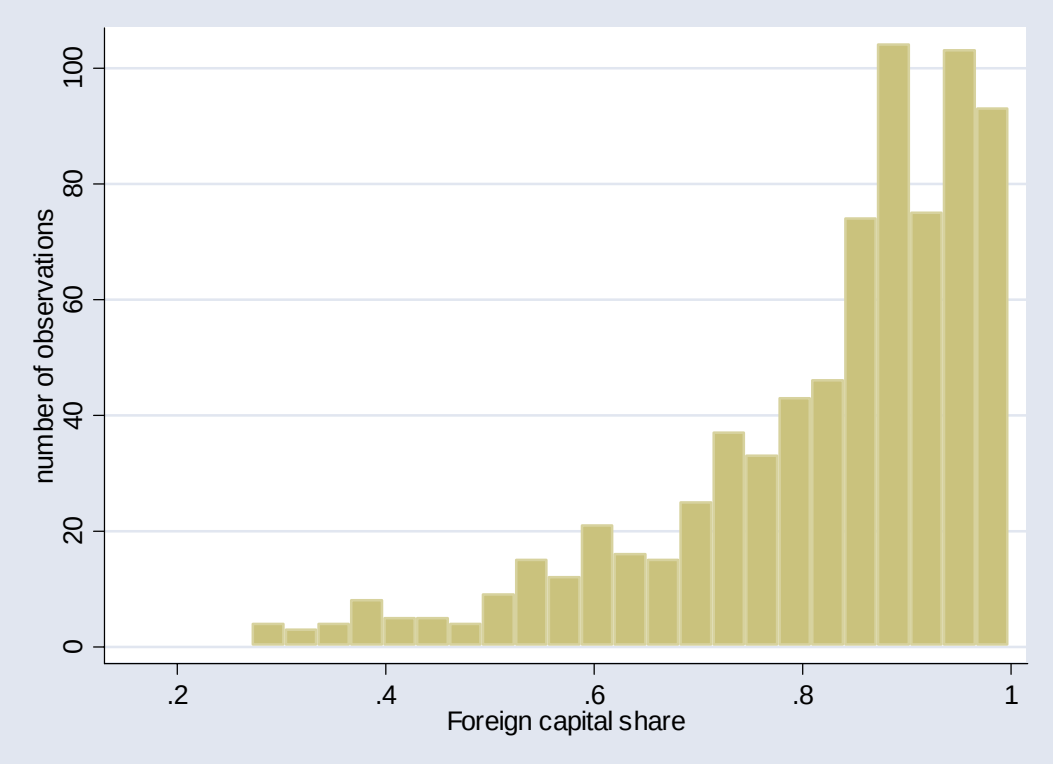
Therefore we may conclude that hypothesis 1 ($\partial IIAT/\partial t>0$) may not be rejected.[21] Hypotheses 2 that labour intensive industries have a higher level of IIAT than scale intensive and specialised supplier may not fully be accepted. Labour and specialised supplier industries have a more or less equal level, but significantly above scale intensive industries. Neither hypothesis 3 ($\partial IIAT/\partial(L/S)>0$), 6 ($\partial IIAT/\partial SCAL>0$) nor 7 ($\partial IIAT/\partial(W/L)>0$) may be rejected, while 4 ($\partial IIAT/\partial FCS>0$) may be. Hypothesis 5 ($\partial IIAT/\partial(I/S) \approx 0$) is confirmed in the sense that the relation between *IIAT* and *I/S* is insignificant.

Figure 2 may give a reason for the rejection of hypothesis 4. According to our data set the value of FCS is minimum 0.10 and maximum 1.00. The distribution across all 755 observations is, as can be seen from the figure, skewed to the right with around 90% of the observations above 50%. If "full control" over a company is defined as a foreign capitals share above 50%, it is obvious that full control is the "norm". So from such a perspective you could argue that the interesting variable is not a continuous FCS-variable like the one used above, but a dichotomous FCS-variable taking e.g. the value of 0 for foreign capital shares below 0.5 or else the value of 1. But because data in

[21] But as shown in section 3, if IIT for private domestic companies are used as a benchmark, this conclusion is not correct.

this study is industry averages, a foreign capital share for a given industry in a given year of e.g. 0.6 may at the firm level consists of e.g. the following FCS's: 0.3; 0.3; 0.9; 0.9 that is two foreign companies with "full" control and two with "less than full control". Therefore the continuous variable approach in this study probably makes sense, but the level of aggregation has probably reduced the variation in the variable. Another problem with the foreign control variable is that the theoretical relation as described in hypothesis 4 - even if it is correct - may not always be able to be carried out in a transition economy, since the actual privatization and restructuring policy may to some extent hinder the optimal choice of entry modes for MNEs entering Poland.

***Figure 2**. Distribution of foreign capital share across NACE 3-digit industries and the years 1993-2002*



The theoretical basis of this paper is primarily models that combine international trade and FDI like e.g. Markusen (2002) supplied with some international business literature and transitionl economics literature.

The results seem to some extent to be a confirmation of Markusen's knowledge capital model, since they are in line with a distinction between v*ertical and horizontal integrated* multinational companies. A *purely* vertical integrated MNE is the case, where the MNE for costs reasons produce a "part" of its value chain in Poland and exports it back to the home country (Ekholm, Forslid and Markusen, 2003). Affiliates of this type of MNEs are to a large extent dependent on imported intermediates and capital goods, so IIAT will be high. And a *purely* horizontal integrated MNE has a market seeking motive to produce in Poland and sell there as its only market, so IIAT will be low (zero), independent of its sourcing behaviour. Between these theoretical extreme cases we may find a case where the affiliate's output is partly sold in Poland and partly in third markets, where third markets primarily may be the surrounding Central and Eastern European countries. The affiliate in Poland is not a pure export-platform because of the size of the Polish market relative to the neighbouring countries to the East and South. But the MNE may

be horizontal in the sense that it has established in Poland a plant "identical" to the one in the native country, but for trade costs reasons the MNE prefer to export a big part of its sales to the *region* from Poland instead of from the native country. Therefore, exports from Poland may be sizeable as well as imports of intermediates and capital goods, so IIAT may be high in case of an export-platform affiliate.

By assuming that industry variables like scale economies and wage levels are proxies for the complexity of technology transfer and IIAT is an indirect measure for its efficient implementation, the results also indicate – in agreement with international business literature – that complex technology is transferred to larger affiliates giving higher wages to their employees as an incentive to absorb new technology. With other words, if MNEs wish to achieve high performance in technology assimilation/management of foreign trade (IIAT), complex knowledge has to be successfully absorbed by their employees. Effective means to that is improvement in skills through training, through hiring new highly skilled staff or through acquiring specific knowledge that is embodied in staff (for instance expatriates). That the investment activity is not positively associated to IIAT may be explained by the fact that technology embodied in physical capital (machines etc.) to a large extent is mature that is, having a low level of complexity.

6. Conclusions

The whole concept of a transition economy (i.e. systemic change) is about ownership, technology and competitive changes. Ownership changes through privatisation processes and high inflow of FDI, with affiliates of foreign companies taking substantial market and foreign trade shares. Transfer of technology through multinational companies contributes to a successful restructuring of companies. Reintegrating to the global economy shows clearly the competitive side of these changes. The success of affiliates of MNEs in foreign markets (export and import) represents an indicator for integration of foreign technology and efficiency in production. The level of intra-industry affiliate trade may therefore be viewed from two angles. Firstly, the traditional one, as an indicator of the degree of participation in the globalization process, because such a type of trade offers a finer division of labour and more benefits than that associated with traditional inter-industry trade. The speed of integration in the world economy is strengthened through the increasing participation of foreign capital, and therefore the intra-industry affiliate trade becomes particular important as an analytical concept in transition economies and catching-up economies in general. And secondly, the unconventional one, as an indicator for successful integration of knowledge in the affiliates.

The contribution of this paper is to use for the first time the concept of intra-industry trade to foreign owned affiliates in a transition economy (Poland) and show how the level and development of intra-industry affiliate trade may be explained by industry factors like labour intensity, wage level, scale economies. Furthermore the results of our paper are shown to be both in accordance to the knowledge capital model of Markusen and (to a lesser extent) the complex technology view of Kogut and Zander. The paper in this way fruitfully combines contributions from both international trade theory and international business theory by going behind the assumption in international trade and FDI theory that knowledge is a "pure" public good.

The paper also opens up for further research. The in-significance of the foreign capital share (FCS) in the regression model could be reasoned by too little variation in this variable. A distinction between entry modes (joint ventures, or fully owned MNE) may improve the results. Information on the country of destination and origin for export and imports combined by factor endowments

information would certainly also improve the results of the model and open up for a specific analysis of the export platform concept. At the moment confidentiality reasons prevent access to information of this type.

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Appendix A

Data description

The Central Statistical Office (GUS), the National Bank of Poland and the Polish Agency for Foreign Investments are the main providers of data on foreign companies in Poland. The methodologies employed by these institutions reveal many differences, which are to a major extent a result of different objectives, sources and legal frameworks. As described in Pawlik (2004) data collected according to the GUS's legal foundation is informative, reflective and reliable in relation to research of foreign companies operating in Poland. This paper is therefore based on a database created in cooperation with GUS.

Foreign companies in our dataset are all companies established according commercial law in Poland with a number of employees exceeding 9 persons and with a foreign capital share equal to or greater than 10 percent in total equity (basic capital)[22]. The minimal foreign capital share comes from the OECD definition, which says that foreign investor holds at least 10% of the ordinary shares or voting rights in the firm in which the investment takes place.[23]

Balance sheet records and single act documents

There are two sources to our data, balance sheet reports (BS) and single act documents (SAD). Balance sheet report delivers figures on sales, investments, wages, number of employees, number of companies and foreign capital share. The single act documents are filled out by the companies aiming on informing customs about exports and imports. The used export and import data are *multilateral* values. According to the law, if there are less than 3 units in the aggregation (sales, exports etc.) figures cannot be disseminated. So our results may be biased in the sense that information on larger foreign companies to a higher extent are hidden, but we have no a-priori information to assume that IIAT differs for large and small subsidiaries.

Due to the above limitations of data on foreign companies, it has been decided only to acquire the dataset with the 3-digit NACE level (groups) as the most detailed one. Looking only at manufacturing, at this level of aggregation, starting from codes 150 to 372, there are 103 groups in the NACE classification, which are potential for observation. Over the years the number of observations available for different estimations differs, see *table A1*.[24]

[22] GUS specifies that foreign capital is the basic capital (equity) provided by the foreign investors that are: (1) private persons whose place of living is located abroad, (2) legal entities with foreign headquarter, (3) legal entities of the company whose private or legal personality was set up abroad according to the legal framework of the foreign countries, (4) legal entities whose headquarter is located in the Republic of Poland dependent on other foreign entity.

[23] For definition visit http://www.oecd.org

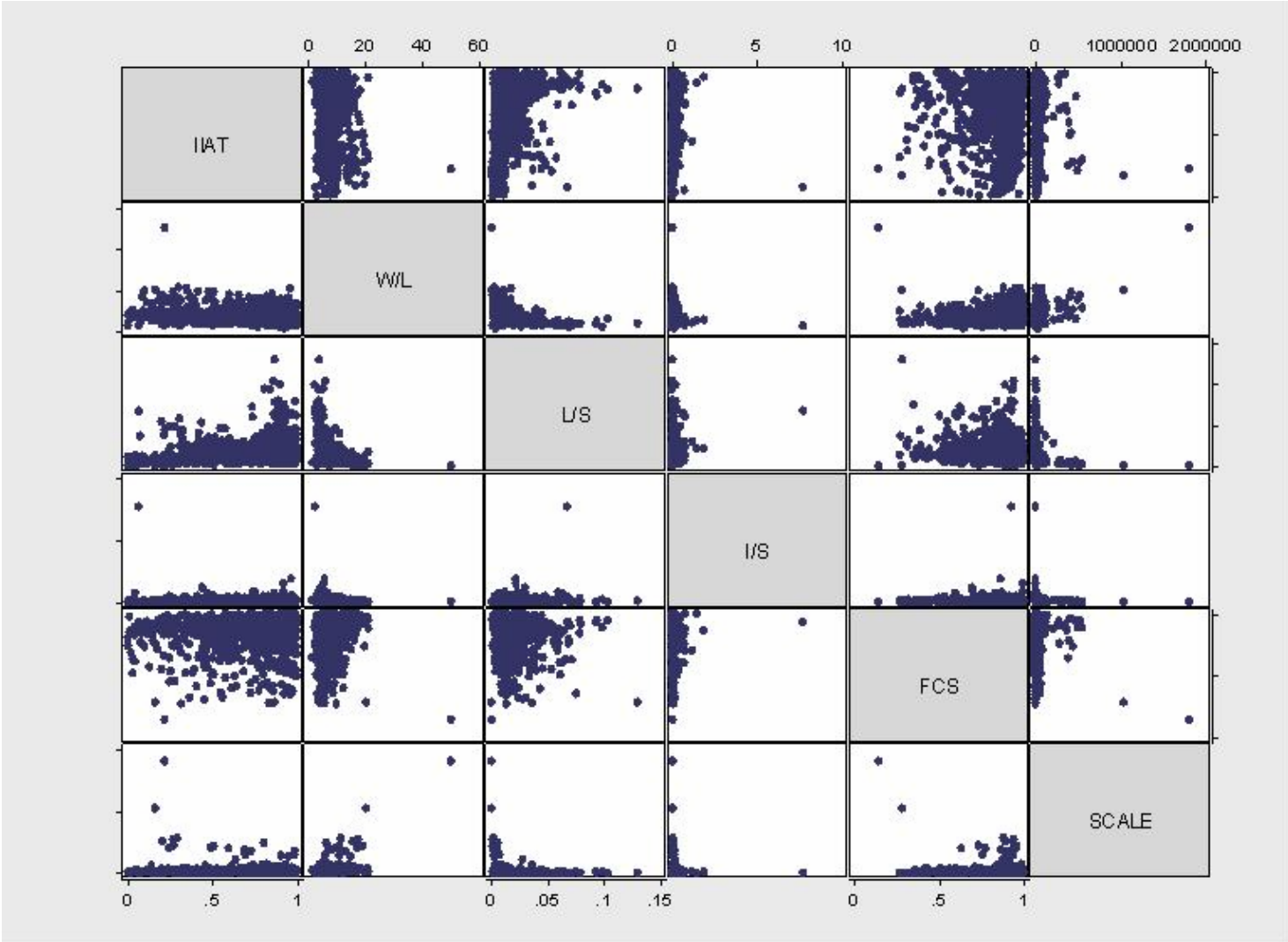
[24] In our paper on motives of foreign companies in Poland we excluded manufacture of refined products (NACE 232) from our dataset (Nielsen and Pawlik (2004a)). The reason was that is discussable if the dominating company in this industry, PKN Orlen S.A, should be viewed as a "foreign owned company". According to our definition of foreign ownership in this paper (capital share >10%) it is. This company has deposited its shares in foreign financial institutions as so-called "Global Deposit Receipts", but so far the role of foreign shareholders has been gradually marginalized by the Polish state. From the research perspective of this paper we decided to keep this observation due to the fact the main objective is to find an association between IIAT and and a number of industry variables. Inclusion of NACE 232 is not expected to bias our results.

Table A1. *Number of potential observations for different datasets and analytical purposes*

Number of cases at the NACE 3-digit:	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Manufacturing total	103									
Observations available on sales from balance sheets (BS)	78	83	87	85	87	81	86	84	99	95
Observations available on exports from single act documents (SAD)	60	71	73	78	84	77	77	74	93	90
Observations available on imports from single act documents (SAD)	66	77	85	82	84	77	76	77	86	90
Available observations for calculations using all variables in the given year	58	70	73	76	82	75	74	73	84	89

Source: Own calculations based on GUS dataset.

Figure A1. *Scatter plots of the variables*



Appendix B

Table B1. *Examples of Industries across different IIAT levels.*

Type of IIAT	Year	Example of Industries – 3-digit NACE:	
		Code	Description
Low IIAT (<0.40)	1993	158-159	Manufacture of beverages and other foodstuffs
		201; 205; 221	Sawmilling and planning of wood; Manufacture of cork, straw etc; Publishing
		244-245	Manufacture of pharmaceuticals, soap and detergents
		300; 322	Manufacture of office machinery and computers
		332-333	Manufacture of instruments for measuring, testing and industrial control
	2002	160; 205	Manufacture of tobacco products; Manufacture of articles of cork, straw etc.
		221, 232	Publishing; Manufacture of refined petroleum
		244; 275; 371	Manufacture of pharmaceuticals; Casting metals; Recycling of metals
Medium IIAT (0.40-0.60)	1993	175; 177	Manufacture of knitted, crocheted articles and other textiles
		203-204	Manufacture builders' carpentry and wooden containers
		265, 268	Manufacture of cement, lime and plaster and other non metallic minerals
		334	Manufacture of optical instruments and photographic equipment
		342-343	Manufacture of bodies, parts and accessories for motor vehicles
		351	Building and repairing of ships and boats
	2002	151; 159; 172	Production and preserving of meat; Manufacture of beverages; Textile weaving
		201; 204	Sawmilling and planning of wood; manufacture of wooden containers
		243	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
		264-265	Manufacture of bricks, construction products, cement, lime and plaster
		271	Manufacture of basic iron and steel
		322	Manufacture of television and radio transmitters
		332	Manufacture of instruments and appliances for measuring, checking, testing,
		353; 361	Manufacture of aircraft and spacecraft; Manufacture of Furniture
High IIAT (>0.60)	1993	151-155	Production and preserving of: meat, fish, fruit and its products manufacture of diary products
		181-193	Manufacture of leather and footwear
		281-287	Manufacture of fabricated metal products, except machinery and equipment
		291-295	Manufacture of machinery and equipment
		311-315	Manufacture of electrical machinery and apparatus
		341	Manufacture of motor vehicles
		361; 366	Manufacture of Furniture; miscellaneous manufacturing
	2002	152-158	Production and preserving of: fish, fruit and its products manufacture of diary, grain mill products and prepared animal feeds
		171-193 excl. 172	Manufacture of textiles, leather and footwear
		202-203	Manufacture of veneer sheets and builders' carpentry
		211-212; 222	Manufacture of pulp and paper and paperboard and its articles
		241-247 excl.243-244	Manufacture of basic chemicals, soap and detergents and other chemicals
		251-252	Manufacture of rubber and plastics
		261-268 excl. 264-265	Manufacture of other non-metallic mineral products
		272-274	Manufacture of tubes and basic precious metals
		281-287	Manufacture of fabricated metal products, except machinery and equipment
		291-297	Manufacture of machinery and equipment
		300	Manufacture of office machinery and computers;
		311-316	Manufacture of electrical machinery and apparatus
		321; 323	Manufacture of electronic valves and tubes; Manufacture of television and radio receivers
		331; 333	Manufacture of medical equipment and industrial process control equipment
		341-354 excl. 353	Manufacture of all transports equipment
		366; 372	Miscellaneous manufacturing; Recycling of non-metal waste scrap

Source: Own calculations based on data from GUS.

Appendix C

Table C1. *Classification of NACE 3-digit groups into factor intensity product groups*

Description	NACE codes
Science-based	
Manufacture of pharmaceuticals, medicinal chemicals and botanical products	244
Manufacture of office machinery and computers	30
Manufacture of medical, precision and optical instruments, watches and clocks	33
Manufacture of aircraft and spacecraft	353
Specialised supplier	
Manufacture of machinery and equipment n.e.c.	29
Manufacture of electrical machinery and apparatus n.e.c.	31
Manufacture of radio, television and communication equipment and apparatus	32
Scale-intensive	
Manufacture of pulp, paper and paper products	21
Publishing, printing and reproduction of recorded media	22
Manufacture of chemicals and chemical products	24 (less 244)
Manufacture of rubber and plastic products	25
Manufacture of basic iron and steel and of Ferro-alloys (ECSC)	271
Manufacture of tubes	272
Other first processing of iron and steel and production of non-ECSC Ferro-alloys	273
Manufacture of motor vehicles, trailers and semi-trailers	34
Manufacture of other transport equipment	35 (less 353)
Labour-intensive	
Manufacture of textiles	17
Manufacture of wearing apparel; dressing and dyeing of fur	18
Manufacture of leather and leather products	19
Manufacture of fabricated metal products, except machinery and equipment	28
Manufacture of furniture; manufacturing n.e.c.	36 (less 361)
Resource-intensive	
Manufacture of food products and beverages	15
Manufacture of tobacco products	16
Manufacture of wood and of products of wood and cork	20
Manufacture of coke, refined petroleum products and nuclear fuel	23
Manufacture of other non-metallic mineral products	26
Manufacture of basic precious and non-ferrous metals	274
Casting of metals	275
Manufacture of furniture	361

Note: A 2-digit code implies that the lower level of aggregation (i.e. 3-digit) belongs fully to the given intensity group, unless exceptions are indicated in the brackets.
Source: Structural Adjustment and Economic Performance", OECD, 1987.

Appendix D

Table D1. *Pooled regression for Intra-industry Affiliate Trade 1993-2002.*

	LN IIT		IIT		LN IIT		IIT		LN IIT		IIT		LN IIT		IIT		LN IIT		IIT	
	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test
CONSTANT	0.30	(1.62)	1.04***	(14.00)	0.81***	(4.43)	1.22***	(19.50)	0.21	(1.35)	1.01***	(15.28)	0.37	(1.51)	1.08***	(12.01)	-0.01	(-0.03)	0.86***	(9.22)
ln (W/L)	0.18	(1.68)	0.03	(1.00)	0.24*	(2.08)	0.05	(1.69)	0.17	(1.60)	0.03	(0.93)	-0.19	(-1.25)	-0.12**	(-3.15)	-0.21	(-1.28)	-0.14***	(-3.40)
ln (L/S)	0.51***	(5.99)	0.18***	(9.00)	0.38***	(5.17)	0.14***	(7.47)	0.51***	(5.94)	0.19***	(8.94)	0.40***	(4.35)	0.14***	(6.75)	0.32**	(3.28)	0.09***	(4.17)
ln (I/S)	0.04	(1.23)	0.01	(0.94)	0.05	(1.55)	0.02	(1.29)					0.06	(1.64)	0.02	(1.63)	0.09*	(2.39)	0.04**	(2.99)
ln (FCS)	0.15	(1.75)	0.07	(1.79)	0.16*	(1.99)	0.07*	(1.97)	0.16	(1.93)	0.07	(1.90)	0.02	(0.26)	0.02	(0.43)	-0.01	(-0.14)	-0.01	(-0.24)
ln (SCALE)	0.12***	(4.68)	0.04***	(4.61)					0.13***	(4.70)	0.05***	(4.67)	0.12***	(4.65)	0.04***	(4.56)	0.12***	(4.36)	0.04***	(4.58)
φ LABOUR																	0.32***	(6.11)	0.19***	(8.16)
φ SCALE																	0.12	(1.59)	0.11***	(4.40)
φ SPECIALISED																	0.35***	(6.40)	0.20***	(8.70)
φ SCIENCE																	-0.07	(-0.85)	-0.03	(-0.98)
σ 1994													-0.05	(-0.36)	-0.01	(-0.23)	-0.09	(-0.59)	-0.03	(-0.68)
σ 1995													0.11	(0.80)	0.02	(0.47)	0.08	(0.67)	0.01	(0.25)
σ 1996													0.13	(0.96)	0.04	(0.80)	0.10	(0.79)	0.02	(0.55)
σ 1997													0.23	(1.74)	0.07	(1.56)	0.19	(1.52)	0.05	(1.27)
σ 1998													0.27*	(2.10)	0.08	(1.82)	0.24	(1.92)	0.07	(1.59)
σ 1999													0.43**	(3.15)	0.16***	(3.36)	0.41**	(3.02)	0.15***	(3.36)
σ 2000													0.43**	(3.10)	0.16**	(3.25)	0.39**	(2.91)	0.14**	(3.18)
σ 2001													0.50**	(3.26)	0.20***	(4.14)	0.48**	(3.12)	0.20***	(4.31)
σ 2002													0.52***	(3.87)	0.21***	(4.54)	0.50***	(3.79)	0.20***	(4.80)
R^2	0.16		0.15		0.13		0.12		0.16		0.15		0.21		0.20		0.27		0.32	
N	755		755		755		755		755		755		755		755		755		755	
F	14.76***		23.40***		16.04***		22.94***		17.55***		28.72***		7.65***		12.30***		12.62***		24.00***	
VIF average	1.71		1.71		1.46		1.46		1.86		1.86		2.28		2.28		2.15		2.15	

Notes: *IIAT (ln(IIAT)):* Intra-industry affiliate trade is the dependent variable. *W/L*: The wage level. *L/S*: labour-intensity . *I/S*:investment activity. *FCS*: foreign control, *SCALE* :Scale economies. *, **, *** significant at 5, 1, 0.1% levels respectively. *σ 1994, σ 1995* etc. indicates time dummies, and *φ LABOUR*, etc. factor intensity dummies. *N*: Number of observations. *VIF*: Variance inflation factor. Robust standard errors used.

Table D2. *Fixed effect panel estimation for Intra-industry Affiliate Trade 1993-2002.*

	LN IIT		IIT		LN IIT		IIT		LN IIT		IIT		LN IIT		IIT	
	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test
CONSTANT	-0.47*	(-2.04)	0.67***	(7.16)	-0.09	(-0.42)	0.77***	(9.30)	-0.47*	(-2.05)	0.67***	(7.15)	-0.22	(-0.85)	0.84***	(8.07)
ln (W/L)	0.44***	(8.08)	0.10***	(4.69)	0.47***	(8.92)	0.11***	(5.21)	0.44***	(8.16)	0.11***	(4.79)	0.31***	(3.55)	0.00	(0.08)
ln (L/S)	0.38***	(6.71)	0.09***	(3.75)	0.32***	(5.93)	0.07***	(3.32)	0.37***	(6.70)	0.08***	(3.61)	0.40***	(6.93)	0.09***	(3.76)
ln (I/S)	-0.02	(-0.75)	-0.01	(-1.07)	-0.02	(-0.77)	-0.01	(-1.08)					-0.02	(-0.71)	-0.01	(-0.66)
ln (FCS)	0.07	(0.80)	0.06	(1.55)	0.10	(1.02)	0.06	(1.69)	0.07	(0.76)	0.06	(1.49)	0.01	(0.11)	0.02	(0.64)
ln (SCALE)	0.08***	(3.41)	0.02*	(1.98)					0.08***	(3.42)	0.02*	(1.98)	0.06**	(2.91)	0.01	(1.63)
σ 1994													0.05	(0.84)	0.01	(0.36)
σ 1995													0.12	(1.83)	0.03	(0.96)
σ 1996													0.12	(1.81)	0.03	(1.23)
σ 1997													0.14*	(2.05)	0.05	(1.70)
σ 1998													0.21**	(2.98)	0.07*	(2.29)
σ 1999													0.18*	(2.21)	0.09**	(2.73)
σ 2000													0.18*	(2.15)	0.09**	(2.67)
σ 2001													0.19*	(2.09)	0.12**	(3.16)
σ 2002													0.28***	(3.46)	0.13***	(4.00)
R^2 (overall)	0.09		0.05		0.07		0.04		0.09		0.05		0.15		0.16	
R^2 (between)	0.06		0.07		0.04		0.05		0.06		0.05		0.15		0.25	
R^2 (within)	0.14		0.06		0.13		0.06		0.14		0.06		0.16		0.09	
N	755		755		755		755		755		755		755		755	
F	13.33***		12.16***		13.75***		12.66***		13.41***		12.18***		12.42***		11.44***	

Notes: *IIAT (ln(IIAT)):* Intra-industry affiliate trade is the dependent variable. *W/L*: The wage level. *L/S*: labour-intensity . *I/S*:investment activity. *FCS*: foreign control, *SCALE* :Scale economies. *, **, *** significant at 5, 1, 0.1% levels respectively. *σ 1994, σ 1995* etc. indicates time dummies, and *φ LABOUR*, etc. factor intensity dummies. *N*: Number of observations

Table D3. *Random effect panel estimation for Intra-industry Affiliate Trade 1993-2002.*

	LN IIT		IIT		LN IIT		IIT		LN IIT		IIT		LN IIT		IIT		LN IIT		IIT	
	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test
CONSTANT	-0.26	(-1.26)	0.83***	(10.35)	0.11	(0.61)	0.92***	(13.08)	-0.26	(-1.22)	0.84***	(10.49)	0.06	(0.28)	0.98***	(11.50)	-0.18	(-0.75)	0.83***	(8.94)
ln (W/L)	0.41***	(7.79)	0.10***	(4.42)	0.45***	(8.71)	0.11***	(5.00)	0.42***	(7.90)	0.10***	(4.53)	0.18*	(2.10)	-0.03	(-1.04)	0.19*	(2.21)	-0.03	(-0.95)
ln (L/S)	0.44***	(8.57)	0.13***	(6.32)	0.37***	(7.61)	0.11***	(5.78)	0.43***	(8.53)	0.12***	(6.17)	0.44***	(8.53)	0.11***	(5.55)	0.41***	(7.83)	0.10***	(4.86)
ln (I/S)	-0.02	(-0.86)	-0.01	(-1.31)	-0.02	(-0.82)	-0.01	(-1.27)					-0.01	(-0.61)	-0.01	(-0.68)	0.00	(-0.16)	0.00	(-0.01)
ln (FCS)	0.12	(1.38)	0.08*	(2.38)	0.14	(1.55)	0.09*	(2.47)	0.12	(1.33)	0.08*	(2.32)	0.03	(0.39)	0.04	(1.06)	0.03	(0.36)	0.03	(0.88)
ln (SCALE)	0.08***	(3.83)	0.02*	(2.39)					0.08***	(3.82)	0.02*	(2.37)	0.07***	(3.44)	0.02*	(2.08)	0.08***	(3.58)	0.02*	(2.35)
φ LABOUR																	0.29*	(2.21)	0.17***	(3.74)
φ SCALE																	-0.04	(-0.30)	0.07	(1.45)
φ SPECIALISED																	0.30*	(2.08)	0.19***	(3.65)
φ SCIENCE																	-0.18	(-0.97)	-0.07	(-0.99)
σ 1994													0.03	(0.41)	0.00	(0.18)	0.02	(0.31)	0.00	(0.02)
σ 1995													0.13	(1.92)	0.03	(1.06)	0.12	(1.79)	0.02	(0.89)
σ 1996													0.14*	(2.08)	0.04	(1.51)	0.13	(1.89)	0.04	(1.29)
σ 1997													0.19**	(2.70)	0.06*	(2.33)	0.17*	(2.40)	0.06*	(1.99)
σ 1998													0.25***	(3.53)	0.08**	(2.81)	0.23**	(3.25)	0.07*	(2.50)
σ 1999													0.27***	(3.30)	0.12***	(3.66)	0.24**	(3.00)	0.11***	(3.36)
σ 2000													0.26**	(3.24)	0.12***	(3.60)	0.24**	(2.91)	0.11**	(3.26)
σ 2001													0.30***	(3.35)	0.15***	(4.28)	0.27**	(3.04)	0.14***	(3.99)
σ 2002													0.36***	(4.56)	0.16***	(4.99)	0.34***	(4.29)	0.15***	(4.74)
R^2 (overall)	0.12		0.10		0.09		0.09		0.12		0.12		0.18		0.18		0.22		0.28	
R^2 (between)	0.11		0.18		0.07		0.15		0.11		0.18		0.21		0.28		0.27		0.39	
R^2 (within)	0.14		0.06		0.13		0.05		0.14		0.05		0.16		0.09		0.16		0.09	
N	755		755		755		755		755		755		755		755		755		755	
Hausman test chi2	27.47***		41.43***		21.55***		35.62***		20.34***		31.04***		44.50***		14.20					
Lagrarian Multiplier test chi2	661.44***		867.19***		693.73***		927.36***		685.99***		887.58***		646.06***		878.90***		512.70***		577.96***	

Notes: IIAT (ln(IIAT)): Intra-industry affiliate trade is the dependent variable. *W/L*: The wage level. *L/S*: labour-intensity . *I/S*:investment activity. *FCS*: foreign control, *SCALE* :Scale economies. *, **, *** significant at 5, 1, 0.1% levels respectively. *σ 1994, σ 1995* etc. indicates time dummies, and *φ LABOUR*, etc. factor intensity dummies. *N*: Number of observations

Table D4. *Logistic pooled OLS regression for Intra-industry Affiliate Trade 1993-2002.*

	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
CONSTANT	-0.61	(-1.57)	-0.60	(-1.56)	-0.60	(-1.54)	-3.48***	(-6.14)	-2.28***	(-3.83)
W/L	0.04	(1.92)	0.04**	(2.59)	0.04	(1.79)	0.58*	(2.08)	0.71*	(2.39)
L/S	-22.25***	(-4.90)	-22.20***	(-4.92)	-21.02***	(-4.52)	-0.92***	(-5.89)	-0.63***	(-3.73)
I/S	0.52***	(3.38)	0.53***	(3.39)			-0.08	(-0.90)	-0.17*	(-2.09)
FCS	-0.60	(-1.47)	-0.62	(-1.60)	-0.53	(-1.30)	-0.05	(-0.21)	0.11	(0.44)
SCALE	0.00	(0.33)			0.00	(0.40)	-0.26***	(-4.14)	-0.25***	(-3.91)
φ LABOUR									-1.10***	(-7.12)
φ SCALE									-0.65***	(-3.66)
φ SPECIALISED									-1.28***	(-7.44)
φ SCIENCE									0.12	(0.57)
σ 1994							0.03	(0.09)	0.15	(0.45)
σ 1995							0.02	(0.08)	0.09	(0.30)
σ 1996							-0.21	(-0.63)	-0.13	(-0.43)
σ 1997							-0.54	(-1.59)	-0.43	(-1.37)
σ 1998							-0.38	(-1.19)	-0.29	(-0.97)
σ 1999							-0.68*	(-2.11)	-0.63*	(-2.05)
σ 2000							-0.73*	(-2.21)	-0.66*	(-2.09)
σ 2001							-0.99**	(-2.84)	-0.99**	(-2.91)
σ 2002							-1.01**	(-3.12)	-1.00**	(-3.24)
R^2	0.07		0.07		0.06		0.15		0.24	
N	755		755		755		755		755	
F	14.07***		16.74***		14.31***		9.33***		17.02***	
VIF average	1.32		1.20		1.35		2.04		1.94	

Notes: *ln(1/IIAT -1)*is the dependent variable. *W/L*: The wage level. *L/S*: labour-intensity . *I/S*:investment activity. *FCS*: foreign control, *SCALE* :Scale economies. *, **, *** significant at 5, 1, 0.1% levels respectively. *σ 1994, σ 1995* etc. indicates time dummies, and *φ LABOUR*, etc. factor intensity dummies. *N*: Number of observations. *VIF*: Variance inflation factor. Robust standard errors used.

Table D5. *Logistic fixed effect panel estimation for Intra-industry Affiliate Trade 1993-2002.*

	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
CONSTANT	-0.14	(-0.37)	-0.15	(-0.38)	-0.27	(-0.70)	-0.01	(-0.01)
W/L	-0.09***	(-4.78)	-0.08***	(-4.43)	-0.09***	(-4.90)	-0.10***	(-3.39)
L/S	-18.14**	(-2.80)	-17.76**	(-2.73)	-11.57	(-1.85)	-20.66**	(-3.09)
I/S	0.53***	(3.40)	0.54***	(3.41)			0.53***	(3.33)
FCS	-0.11	(-0.26)	-0.14	(-0.33)	0.00	(-0.01)	-0.09	(-0.20)
SCALE	0.01	(1.81)			0.01	(1.82)	0.00*	(2.06)
σ 1994							-0.06	(-0.30)
σ 1995							0.10	(0.48)
σ 1996							-0.09	(-0.44)
σ 1997							-0.19	(-0.93)
σ 1998							-0.13	(-0.63)
σ 1999							0.08	(0.35)
σ 2000							0.05	(0.21)
σ 2001							0.06	(0.21)
σ 2002							-0.20	(-0.84)
R^2 (overall)	0.01		0.02		0.00		0.01	
R^2 (between)	0.01		0.00		0.00		0.09	
R^2 (within)	0.06		0.05		0.04		0.07	
N	755		755		755		755	
F	9.49***		9.42***		9.37***		8.78***	

Notes: *ln(1/IIAT -1)* Intra-industry affiliate trade is the dependent variable. *W/L*: The wage level. *L/S*: labour-intensity . *I/S* :investment activity. *FCS*: foreign control, *SCALE* :Scale economies. *, **, *** significant at 5, 1, 0.1% levels respectively. *σ 1994, σ 1995* etc. indicates time dummies, and *φ LABOUR*, etc. factor intensity dummies. *N*: Number of observations

Table D6. *Logistic random effect panel estimation for Intra-industry Affiliate Trade 1993-2002.*

	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
CONSTANT	0.00	(0.01)	0.09	(0.23)	-0.08	(-0.20)	-0.17	(-0.41)	0.15	(0.35)
W/L	-0.07***	(-3.72)	-0.05**	(-2.85)	-0.07***	(-3.83)	-0.03	(-1.19)	-0.03	(-1.09)
L/S	-23.12***	(-4.22)	-22.98***	(-4.17)	-18.35***	(-3.43)	-25.33***	(-4.61)	-20.54***	(-3.68)
I/S	0.58***	(3.74)	0.59***	(3.81)			0.55***	(3.55)	0.49**	(3.11)
FCS	-0.35	(-0.87)	-0.56	(-1.42)	-0.27	(-0.66)	-0.14	(-0.34)	-0.09	(-0.23)
SCALE	0.00**	(2.70)			0.00**	(2.80)	0.00*	(2.09)	0.00	(1.81)
Φ LABOUR									-1.01***	(-3.29)
Φ SCALE									-0.31	(-0.99)
Φ SPECIALISED									-1.19***	(-3.59)
Φ SCIENCE									0.59	(1.32)
σ 1994							0.01	(0.04)	0.03	(0.12)
σ 1995							0.07	(0.35)	0.08	(0.38)
σ 1996							-0.13	(-0.63)	-0.12	(-0.57)
σ 1997							-0.32	(-1.52)	-0.30	(-1.40)
σ 1998							-0.24	(-1.14)	-0.23	(-1.04)
σ 1999							-0.20	(-0.85)	-0.19	(-0.80)
σ 2000							-0.24	(-1.00)	-0.22	(-0.91)
σ 2001							-0.36	(-1.36)	-0.34	(-1.30)
σ 2002							-0.50*	(-2.11)	-0.48*	(-2.01)
R^2 (overall)	0.03		0.02		0.02		0.05		0.17	
R^2 (between)	0.05		0.03		0.03		0.10		0.26	
R^2 (within)	0.05		0.05		0.03		0.05		0.07	
N	755		755		755		755		755	
Hausman test chi2	28.29***		27.38***		37.39***		26.54***			
Lagrarian Multiplier test chi2	621.51***		617.46***		600.42***		572.99***		382.48***	

Notes:*: ln(1/IIAT -1)* is the dependent variable. *W/L*: The wage level. *L/S*: labour-intensity . *I/S*: investment activity. *FCS*: foreign control, *SCALE* :Scale economies. *, **, *** significant at 5, 1, 0.1% levels respectively. *σ 1994, σ 1995* etc. indicates time dummies, and *φ LABOUR*, etc. factor intensity dummies. *N*: Number of observations