WP

Konrad Pawlik

Export performance of MNE affiliates in Polish manu-facturing: 1993-2002. A study of knowledge mandate, transfer and absorption

International Business Section

Export performance of MNE affiliates in Polish Manufacturing: 1993-2002
A study on knowledge mandate, transfer and absorption[1]

Konrad Pawlik
Department of Management and International Business
Aarhus School of Business
Haslegaardsvej 10-12
Aarhus, Denmark
Phone: +45 8948 6862
Fax: +45 8948 6348
e-mail: kpa@asb.dk

Abstract:
Using a unique database containing trade (export and import) and industry variables (wages, employment, foreign capital share, investments, sales, etc.) of foreign affiliates in the Polish manufacturing industry for the years 1993-2002, this paper analyses the determinants of the export performance of the foreign affiliates. The results from panel estimations show that the export intensity of the affiliates has increased every year since 1994. The lowest level of export performance was recorded in science-based industries. Import intensity, labour intensity, wage level, scale economies and foreign control are significant and positively associated to export performance, while investment activity is negatively related to the export performance of the affiliates. On the assumption that some industry variables are proxies for technology transfer, the results show that the increasing export orientation of foreign affiliates is the result of increasing international sourcing, implying that the foreign affiliates hold an advanced role in MNEs, which translates its "knowledge mandate" into more trade (imports and exports) in interdependence with other foreign affiliates. High wages to foreign affiliate employees (indicating improvements in absorptive capacity) are related to high export performance. Besides, given international business research (Kogut and Zander, 1993), the positive association between foreign ownership and export intensity suggests that transfer of tacit knowledge is positively related to affiliate production in exports. Results for investments activity (as an indicator for investments production technology) indicate that the high level of export performance of foreign affiliates in a transition economy does not reflect a large flow of technologies embodied in machinery and software.

Keywords: the determinants of export behaviour; foreign sourcing; foreign capital share; MNE affiliates

---

1. Introduction

In the vast literature on export performance, the research focus has mostly been on export intensity, regardless of the type of company, while only a few separate studies have investigated the export behaviour of foreign affiliates. This is surprising because the affiliates of Multinational Enterprises (MNEs) account for an large share of world exports – 51 % of world exports in 2000 (UNCTAD, 2001). Much of the research has implicitly assumed that the export performance of foreign affiliates may be explained in the same way as that of other firms, and various authors have attempted to investigate external and internal factors as determinants of export performance. The external factors considered are typically related to the general environment, in particular, the socio-cultural and political surroundings of the exporting firm (Baldauf et al, 2000). The internal factors are ones related to the characteristics of the firm, its business strategies, etc. A large group of studies has focused on the relationship between firm size and export intensity (for a review, see Bonaccorsi, 1992) finding both positive and negative relationships (Czinkota and Johnston, 1983). The aspects of business strategy which are related to a differentiation strategy show a positive association with export orientation (Baldauf et al, 2000).

The few studies made on the export performance of foreign affiliates (Authokorala et al, 1995; Tavares and Young, 2001; Aggarwal, 2002; Siddharthan and Nollen, 2004) seem to suggest that the determinants of export behaviour vary and that they are very often due to the specificities of foreign companies or their advantages over the domestic ones. Tavares and Young (2001) identified the link between the strategic roles and characteristics of MNE affiliates on the one hand and their export patterns on the other. Their paper confirms that export intensity is related to the affiliate mandate: it is high in rationalized manufacturers and product mandate affiliates and low in "miniature replica" affiliates. Moreover, they established the existence of a negative relationship between value-added scope (measured in terms of autonomy and specialized capabilities) and export intensity. Furthermore, their results showed that affiliates which are (a) large, (b) more recently established, and (c) located in smaller markets are also more export-oriented. The study by Siddharthan and Nollen (2004) showed that the volume of exports of MNE affiliates is positively related to the foreign equity stakes in the companies that transfer tacit knowledge and complementary FDI advantages

and to their imports of explicit technology from the purchase of licenses. These results are precursory for the research on knowledge transfer to and the export behaviour of foreign affiliates but, unfortunately, they have only been confirmed for specific a sector in a developing country, namely, Information Technology in India.

In this paper, the relation between knowledge transfer and the export performance of foreign affiliates is of central importance. The reason for this is that, in International Business (IB), knowledge strategies in MNE affiliates and their impact on the export performance affiliates are entirely unexplored fields of research. In addition, FDI, trade and technology transfer are of particular research interest in connection with transition economies, which were opened only a decade and a half ago. The large inflow of Foreign Direct Investments (FDI) into these countries and, specifically into Poland (PAIZ, 2002), has, in recent years, led to growth in the export performance of foreign affiliates (OECD, 2002). This paper attempts to analyse how the export performance of foreign affiliates has changed within the Polish manufacturing sector since the moment when the first foreign investors entered the market.[2] Furthermore, the paper investigates how knowledge transfer, specifically, attributes of knowledge (tacitness versus explicitness), mandates and absorption determine the export performance of foreign affiliates in the manufacturing sector as a whole.

The paper is organised as follows. The next section presents a brief overview of the literature on Export performance and MNE strategy in relation to knowledge transfer, absorption and affiliate mandate, formulating four main hypotheses and five "control" hypotheses. The third section presents the data and the empirical model used in this study. Section four presents the empirical findings while the last section concludes.

---

[2]The stock of FDI reached USD1bn in 1993.

2. Export performance and transition

Strategies of MNE affiliates in relation to export orientation and sourcing

There is a vast international business, management and economics literature on the organization (motivation, production, strategy) of MNEs. Whether directly or indirectly, all of it treats the imports and exports of affiliates. The literature on international economics categorises the international production of MNE affiliates into three types (Caves, 1971; Baldwin and Ottaviano, 1994): the horizontally integrated MNE (production operation like that of the parent company, with production orientation towards the local market and with minimal inter-affiliate trade), the multi-product MNE (horizontally integrated firms producing different imperfect substitutable varieties in different countries), the vertically integrated MNE (firms with different parts of the production value chain in different countries). The IB literature based on Dunning's (1993) categorisation of investment motivation/strategy identifies four different types of FDI: market-seeking, resource-seeking, efficiency-seeking and strategy asset-seeking FDIs. The last two motives, in particular, are trade-creating ones (Cantwell and Bellak, 2000), while resource-seeking FDIs may be more export-oriented, i.e., not import-oriented as the resources are available in the market (Nielsen and Pawlik, 2004a).

International management literature perspective is based on aspects of MNE strategy, which involves several types of MNE organization and affiliate mandates. The transnational solution of Bartlett and Ghoshal (1989) distinguishes four types of MNE organisational models: multinational, international, global, and transnational organisation. Apart from the *multinational* model, which represents so-called stand-alone affiliates producing and selling their products on the domestic market, the other types of organisation emphasize the importance of trade orientation with balanced or unbalanced import-export volumes at affiliate level. The *international model* is characterized by regionally integrated affiliates specialized in a certain level of exchange of components/products in the vertical process of production or for final distribution. The *global* MNE is characterized by standard products produced in a few places in the world and shipped to the affiliates. This type of organization serves local markets, sometimes providing additional services such as packing and product adaptation. Unless the affiliate is a production site for global products -

in which case the affiliate has a large volume of imports and exports – affiliate trade is characterized by imports only. The *transnational* solution is related to the growth of both imports and exports at affiliate level. Such affiliates are characterized by large flows of components, products, resources and (dis)embodied knowledge. The motive for the affiliate is that of meeting efficiency demands related to global integration and to local responsiveness to the market (Bartlett and Ghoshal, 1989). Since knowledge on the specific trade flows produced by the different types of foreign affiliate is limited, it is important to investigate this increasingly important field of research on MNE affiliates (Egelhoff et al, 2000). As parts of the differentiated corporate network of the MNE, foreign affiliates have distinct strategic roles and scopes. They may be active in both export and import operations, in both internal markets within the MNE itself and in external markets. On the basis of a few other studies (White and Poynter, 1984) and their own investigation, Birkinshaw and Morrison (1995) reviewed various affiliate typologies, making a distinction depending on the strategic roles and scopes of foreign affiliates. Like Tavares and Young (2001), this study makes use of a revised typology of White and Poynter (1984) and Birkinshaw and Morrison (1995), categorising affiliates into three different types: the miniature replica, the specialized contributor and the world product mandate. Miniature replicas are local market-oriented affiliates producing for sale in the host country. The specialized contributor affiliate has certain specific functions or activities, characterized by a narrow set of value activities and high levels of interdependence with other affiliates (White and Poynter 1984): it specializes in the manufacture of part of the product range or in a production stage for regional or global markets. The world mandate affiliate has worldwide or regional responsibility for a product line or an entire business; it typically has unconstrained product scope and broad value-added scope (White and Poynter 1984); it operates in a strategically important market; and it has large amounts of resources and high levels of expertise. On the basis of the above discussion, export intensity is expected to be positively associated with specialized contributors and world product mandates and negatively with miniature replicas (Tavares and Young, 2001). In the case of import intensity, however, the above discussion only allows us to assume that import intensity will have a definite positive association with specialized contributors. The two other types of affiliate mandates will have different relationships.

During the intensive integration process of Central and Eastern European countries into the economic region of the EU, MNE affiliates in these countries have gradually become integrated into international production. The case studies undertaken by Kochaniec (2002) indicate that, in the initial stage of economic transition, the dominant MNE strategy in Poland was that of the multinational model with miniature replica affiliate mandates. Since the first years of the transition period and particularly with Poland's joining WTO, OECD and with its preparations for EU membership, MNE strategy in Poland changed substantially and foreign affiliates in that country became part of international, global strategy models (with global products being produced in Poland) (Zorska, 2002). In brief, the affiliate mandates were no longer those of miniature replicas but of specialized contributors. This suggests that affiliates with high levels of imports are likely to tend to have high levels of export intensity.

> **Hypothesis 1:** In a transition economy, the import intensity of the foreign affiliates in a given industry is positively related to their export performance.

Knowledge transfer and the complexity of this

There is a vast International Business literature on ownership structure in foreign affiliates. The MNE goes abroad to reap the profits from its store of knowledge, and the creation and exploitation of that knowledge are the main reasons for the success and growth of the multinational over time (Dunning, 1988). This focus on knowledge has led to the emergence of three perspectives describing how knowledge determines the expansion tendencies of firms: the *public goods*, *internalization* and *technological competence* perspectives (Eden et al 1997). The argument underlying the Eclectic Paradigm (Dunning 1993) is that location, internalisation and ownership advantages shape the actions of MNEs and FDI patterns. The *public goods* perspective underlines ownership advantages stemming from the possession of intangible assets such as knowledge. The publicness of knowledge suggests that knowledge is easy to transfer but hard to protect and that transfer through the external market is difficult to price due to high levels of opportunistic behaviour. Consequently, the public goods perspective provides the rationale for MNE preferences for wholly owned subsidiaries as the vehicle for transferring technology.

The *internalization perspective*, on the other hand, concentrates on aspects that affect the transfer of knowledge as such (Buckley and Casson, 1976). On this view, "it is not the possession of knowledge as such which gives the firm its advantage. Rather it is the process of internalizing that asset as opposed to selling it to the foreign producer which gives the MNE its unique advantage" (Hood and Young, 1979). Thus, internalization decisions rely on the relative weights of bureaucratic and transaction costs. If market failure occurs in the trade of the knowledge of a firm, advantages accrue to the firm which internalizes the transfer of this knowledge (Buckley and Casson 1976, Hennart 1982).

The *technological competence* perspective is based on the knowledge competence which is unique to each firm. Being tacit, it is largely incomprehensible to competitors. It resides in the shared norms and routines of the employees of the firm (Nelson and Winter, 1982) and in the ability of the employees to reconfigure the routines (Kogut and Zander, 1993) to produce novel knowledge. The development of tacit knowledge is viewed as a function of the evolutionary development of the firm. Kogut and Zander (1993) claim that the central issue in FDI is the notion of ownership advantages. The quintessence of the advantage of the investing firm is its knowledge and the transfer of that knowledge to the host country. Conceptualized in this way, knowledge is an intangible asset which comprises (a) the organization of work, (b) non-codifiable knowledge, (c) marketing and finance know-how, and (d) product innovation. The exploitation of knowledge is firm-specific, often tacit and difficult to transfer to the receivers. Moreover, Kogut and Zander (1993) show that such attributes of technology as tacitness, codifiability and teachability are decisive for how technology is transferred; for example, through licensing to a wholly owned subsidiary or a joint venture. Consequently, such knowledge can not be perceived as a purely public good.

The above argumentation concerning knowledge attributes is especially valid in transition economies. In Central and Eastern Europe, the transfer of managerial knowledge preceded the transfer of technology (Meyer, 2000). The former type of knowledge has been absolutely critical to the organizational change of the inherited, centrally planned structures within the companies newly acquired by foreign investors (Newman and Nollen, 2002). As a first step, foreign companies have to engage in the training (or retraining) of management, making it familiar with modern leadership (Child and Czegledy, 1996), and in the implementation of new knowledge in such a fields as marketing, accounting, logistics, etc. The successful

firms are those which strengthened their marketing functions, reorganised their decision-making and information systems, invested in human resources and created effective mechanisms of corporate governance (Brada, 2003). Such a process may be expected to have led to large flows of knowledge (Kogut, 1996).

Hypothesis 2: In a transition economy, a high level of foreign control over a company is associated with a high level of export performance.

Following the above argumentation, the implementation of complex technology embodied in production lines and equipment may not necessarily translate into a high level of export performance. Case studies of foreign affiliates in transition economies (for instance, Czegledy, 1996) show that, as presented in the international product cycle theory of Vernon (1966), newly acquired/established companies which received mature technology became more export-oriented than the relative competitors to which more advanced knowledge was transferred. According to case studies made by Brada (2003) on the Czech Republic, Poland and Hungary, large investments in capital and technology were less important features of the successful restructuring of newly acquired companies. As was mentioned above, the successful firms are those which, at first, strengthened their marketing functions, reorganised their decision-making and information systems, invested in human resources and created effective mechanisms of corporate governance (Brada, 2003). "As a second to modern managerial skills comes technology transfer embodied in machines and equipment" (Meyer, 2002). The argumentation is rooted in the premise that these companies have to be reorganised into well functioning enterprises capable of cooperating with the rest of the MNE network. Only then are MNE affiliates in a transition country able to absorb advanced production technology, the output of which may subsequently be coherently distributed within the MNE.

Hypothesis 3: In a transition economy, the investment activity in foreign affiliates is negatively associated with export performance.

Knowledge absorption

Since the seminal work of Cohen and Levinthal (1990), the concept of absorptive capacity has been the main framework for understanding the conditions required for effective knowledge transfer. Cohen and Levinthal (1990) assumed the existence of a current knowledge base to be a necessary but not sufficient condition for the ability of a firm to absorb new knowledge. Companies (affiliates) have to develop capabilities which

allow them to transfer and apply new knowledge effectively on a systematic basis (Cohen and Levinthal, 1990, Levitt and March, 1998). The issue is further complicated by the addition of the aspects involved in a transition economy, in which firms have to improve their fundamental capabilities. In the transition countries, the technological skills were at a reasonably high level while the managerial and social skills were deficient due to the immense institutional transition from a central planned to a market economy (Meyer, 2001). MNE knowledge transfer to affiliates required improvements in the absorptive capacity of the firms, thus enhancing the demand for skilled workers, which, in turn, led affiliates to pay higher wages than were paid before. Such interplay between wage level and absorptive capacity occurs in three cases, namely, when it leads to (a) improvement in the skills or performance of existing employees; or (b) sourcing of highly skilled employees through international transfers (that is, within the MNE in the form of expatriates); or (c) external absorption (for instance, from other local firms). Discussions on the issue of absorptive capacity versus level of compensation may be found in the literature on Human Resource Management and International Economics. Labour compensation is one of the tool-expanding absorptive capacities. An example of the first type of study is illustrated in Minbaeva et al. (2004), which is based on MNE affiliates in Russia[3], where the absorptive capacity increases when combined with higher rates of different wage incentive systems, thus increasing compensation relative to that of other employees for skills or performance improvements. The second type of study discusses international transfers of "person-embodied" technology. Bringing specialists (expatriates) to the newly established or acquired affiliates is a tool which immediately improves absorptive capacity (Harzing, 1999). It also increases affiliate wage levels as the result of the higher wage level of this new highly skilled personnel. The third and final means of improving absorptive capacity has mostly been studied in the field of International Economics in investigations of spillovers, where affiliates owned by MNEs have been found to pay higher wages than domestically owned companies (for UK: Wang et el 2002; for Russia: Yudaeva K., Kozlov K., Melentieva N., 2000; for Poland: Pawlik, 2005a), even when the findings were controlled for such characteristics as industry, region, and overall size (Aitken et al, 1996). The reason for this is that, as they transfer and utilise more complex firm-specific knowledge, MNE affiliates raise demand for more highly skilled workers.

---

[3]Other countries were also included but they were in the process of transition.

Increases in absorptive capacity improve the basis for knowledge transfer of any type. As a result, they lead to increases in the value added by the company, thus improving the production process as well as the organization and sales and, in turn, business performance with respect to exports. This leads to the following hypothesis:

Hypothesis 4: In a transition economy, high wage levels in the foreign affiliates are positively associated with export performance.

2.3. Control variables

There are at least two streams of research which offer important literature on firm size and export performance in the MNE affiliates. In the International Economics literature, results have been published which relate export performance to firm size, size being indicative of economies of scale at plant level and associated with international production specialization (Andersson and Fredriksson, 1996); other results such as those of Egelhoff et al. (2000) link increasing size to the geographical dispersion of sales. In this case, the assumption was that the larger the MNE affiliate the broader the market scope required, which may extend to regional or global markets. The new trade theory posits that economies of scale have a positive impact on market size. It argues that such economies provide cost advantages in production, R&D and marketing efforts (Kumar and Siddharthan 1994).

Although it is mainly concerned with domestic enterprises, the relatively vast literature on export marketing is also of interest. The results of this strand of research suggest that large firms have sufficient resources to gain information on foreign markets and sufficient experience to cope with all related uncertainties (Wakelin 1997). Managerial and financial resources, production capacity, and scale economies appear to be responsible for the positive relationship between firm size and performance (Bonaccorsi, 1992). Moreover, large firms may have more unused resources ('slack' resources) and would, therefore, be better able to focus more efforts on their export activities than would smaller firms. Besides these arguments, some research which assumes a strong association between export performance and firm size at the moment when the export activity begins has suggested a positive relationship between firm size and export performance with regard to timing (Wheeler and Ibeh, 2001).

Hypothesis 5:   Large foreign affiliates will achieve high export performance in transition economies.

Not surprisingly, neither capital nor skilled labour is an abundant factor in transition countries and the companies in these countries benefit from labour intensity. This is confirmed in numerous studies of developing countries, where capital intensity has been shown to have negative effects on the export performance of firms (Lall, 1986, Willmore, 1992). This yields the following hypothesis:

Hypothesis 6: Labour intensity in foreign affiliates in transition economies is positively associated with export performance.

As regards the time dimension, trade costs between Poland and its main trading partners (especially in the West) have decreased over the period analysed, 1993-2002. This factor will, in itself, lead to the evolution of, in International Management terms, MNE strategies (from multinational to international or global) or, in International Economics terms, to MNE organization of production (from vertically integrated MNEs to horizontally integrated ones) and, for this reason, an increase in export intensity is expected.

Hypothesis 7: The export orientation of foreign affiliates in transition economies will have increased over the period analysed.

In their paper on sourcing motives and export orientation, Nielsen and Pawlik (2004a) found that the difference across industries matched factor intensity groups. According to their analysis, resource-intensive and science-based industries are clearly 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 equally large share of sales locally oriented and changing from local to export orientation over the years of 1993-2002.

Hypothesis 8: In transition economies, export intensity will be higher for labour-intensive sectors than for science-based ones.

3. Data and research methodology

3.1. Data

The database used for the present study was created in cooperation with the Central Statistical Office (GUS) of Poland. It is unique in that it includes information on all foreign companies with more than nine employees and with a foreign capital share of total equity equal to or greater than 10 per cent. The database includes sales, wages, number of companies and employees, exports, 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.

The three-digit NACE classification is obviously not a perfect industry description because it conceals differences between a number of sub-segments within some industries. Thus the figures are averages of all measures for a given industry. Consequently, the variables are standard industry characteristics from the industrial economics literature and have also been used in empirical studies of International Business (IB) and International Management (IM).

3.2. Variables

Six explanatory variables have been included plus time and factor intensity dummies. Excepting the time variable, all variables are industry-specific. The literature does not offer one commonly accepted conceptualization of export performance, which has typically been found with a single measure such as export sales, export sales growth or export intensity (Cavusgil and Zou, 1994; Piercy et al., 1997; Zou and Stan, 1998). For the purposes of this paper, Export Intensity (X/S) measured as the ratio between the value of exports and of sales is used as a dependent variable.

Explanatory variables consist of three main and three control variables. The main variables are:

- Import intensity (M/S), which is measured by the imports-to-sales ratio,
- Foreign control, which is measured by the foreign capital share (FCS), that is, the foreign owner's capital input when the company was established as part of total capital provided for setting up the business entity.

- Investment activity, which is measured by the investments-to-sales ratio (I/S), that is, total expenditure on fixed assets (tangible and non-tangible[4]) as a share of revenue on sales,

- Wage level (W/L), which is measured by the share of real salaries, regardless of type of work to number of employees. Since the W/L is an average wage at industry level, a higher W/L may be explained by higher wages paid for given skills or by wages related to the different levels of skills.

Two control variables have also been included:

- Scale economies (SCALE), which are measured by the average size of establishments (real sales divided by number of companies).

- Labour intensity (L/S), which is the ratio between number of employees and sales.

Following the OECD classification shown in table C1 in appendix C, the groupings of industries in factor intensities are represented by factor-intensity dummies (FACTD) for labour-intensive, scale-intensive, specialised-supplier and science-based industries, with resource-intensive industries serving as the base group. Finally, time is represented by time dummies (TD) covering the years 1994-2002.

3.4. Regression Model

This paper tries to explain the export performance (X/S) of MNE affiliates in Poland, using six independent variables identified:

$$(X/S)_{i,t} = \beta_0 + \beta_1(M/S)_{it} + \beta_2(L/S)_{it} + \beta_3(W/L)_{it} + \beta_4(I/S)_{it} + \beta_5 FCS_{it} + \beta_6 SCALE_{it} + TD + FACTD + \varepsilon_{i,t} \quad (1)$$

$$+ \qquad + \qquad + \qquad - \qquad + \qquad + \qquad +$$

The subscripts i and t denote manufacturing industries and time, respectively, and the signs below the coefficients indicate the partial association assumed between X/S and the independent variable given.

Techniques of estimation

The data set has both a cross-sectional (covering approximately 80 industries) and a time series dimension (ten years). In order to increase the sample size, a pooled cross section analysis is carried out. The estimations were followed, using panel data analysis so as to account for possible heterogeneity across manufacturing industries. This estimation technique assumes that the intercept (β_0) varies across industries

---

[4] Non-tangible assets include software, for example.

and thus can be written as β_{0i}, capturing all unobserved, time-constant factors which affect $(X/S)_{i,t}$. The model specified above was tested, 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 useful if the unobserved effects are uncorrelated with all explanatory variables (Wooldridge, 2003).

Assuming the possibility of β_{0i} being correlated with some of the explanatory variables, the fixed effect panel estimation should be made first, using an F-test to see if there is unobserved heterogeneity. Because unobserved heterogeneity (fixed effects) may also exist in the case of random effects, the Breusch and Pagan Lagrangian multiplier test (LM) for random effects is applied. If unobserved heterogeneity is observed in both the F-test and the LM-test, the solution is to use the Hausman test for comparing fixed and random effects (the null hypothesis being that the random effect model is valid). This paper includes both types of estimations: log-log models as well as semi-log models.

4. Empirical findings

Using OECD (1987) classifications into resource-based, labour-based, scale-based, specialised supplier-based, and science-based factor intensity, observation of the differences across industries shows the relative importance of factor intensity groups with respect to number of companies, employees, sales, exports, imports, investments, wages and foreign capital share.

Table 1. The relative importance of foreign owned companies in Poland 1993-2002 according to factor intensities (percentage)

	Number of companies	Number of employees	Sales	Investments	Wages	Foreign capital share	Exports	Imports
Resource intensive	33	38	39	40	36	87	22	21
Labour intensive	27	16	7	6	10	84	15	12
Scale intensive	25	28	38	42	33	89	40	46
Specialised supplier	12	15	13	10	16	89	21	17
Science based	4	3	3	3	4	88	2	4

Notes: NACE 232 excluded.
Source: Own calculations based on data from GUS.

As regards size (number of employees or sales) and international trade, resource and scale intensive industries are the dominant industries with foreign capital, while science-based industries are of only marginal importance. The exclusion of NACE 232 from our data set influences only the relative distribution of sales figures, reducing the share of resource-intensive industries from 51% to 39% and increasing that of scale-intensive industries from 31% to 38% so that the two industries are of equal importance. Investments outlays and wages are similarly distributed to sales with equally large expenditures in resource and scale intensive industries - around 40% in investments and 35% in wages. The only difference is the specialised supplier share of the investments and wages distribution: 10% and 16%, respectively. All intensity groups have similar foreign capital shares but, in labour intensive industries, it is 84% while, in other intensity groupings, it is 3-5% larger on average. Table 2 gives an impression of the size of export and import intensities across factor intensity industries.

To some extent, an analysis of export and import intensities in foreign affiliates already confirms the expectations formulated in hypothesis 1. In almost all intensity groupings, import intensity has been relatively high since 1993.

Table 2. *Export and import intensity ratios for foreign capital in Poland, 1993-2002, across factor intensity industries*

Description / Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Export intensity for Total Economy	**0.15**	**0.19**	**0.20**	**0.16**	**0.17**	**0.16**	**0.16**	**0.18**	**0.19**	**0.21**
Export-intensity: Total including confidential data	**0.23**	**0.30**	**0.32**	**0.25**	**0.26**	**0.28**	**0.26**	**0.32**	**0.35**	**0.39**
Export-intensity: Total 3-digit NACE	**0.24**	**0.31**	**0.32**	**0.25**	**0.26**	**0.28**	**0.30**	**0.38**	**0.35**	**0.39**
Resource intensive	0.22	0.25	0.25	0.17	0.18	0.18	0.18	0.17	0.18	0.18
Labour intensive	0.82	0.81	0.88	0.77	0.71	0.72	0.75	0.74	0.78	0.78
Scale intensive	0.11	0.25	0.27	0.21	0.22	0.24	0.29	0.46	0.53	0.53
Specialised supplier	0.34	0.33	0.39	0.40	0.46	0.50	0.50	0.60	0.63	0.63
Science based	0.05	0.07	0.10	0.14	0.10	0.12	0.12	0.15	0.29	0.29
Import intensity for Total Economy	**0.26**	**0.31**	**0.34**	**0.31**	**0.33**	**0.30**	**0.31**	**0.32**	**0.30**	**0.29**
Import intensity: Total including confidential	**0.28**	**0.36**	**0.38**	**0.35**	**0.37**	**0.36**	**0.36**	**0.40**	**0.37**	**0.38**
Import-intensity: Total 3-digit NACE	**0.28**	**0.37**	**0.38**	**0.34**	**0.37**	**0.36**	**0.36**	**0.39**	**0.37**	**0.38**
Resource intensive	0.23	0.25	0.27	0.21	0.21	0.21	0.20	0.23	0.23	0.23
Labour intensive	0.75	0.65	0.74	0.68	0.69	0.65	0.67	0.62	0.64	0.64
Scale intensive	0.19	0.40	0.41	0.39	0.45	0.42	0.46	0.46	0.47	0.47
Specialised supplier	0.39	0.44	0.47	0.48	0.47	0.45	0.46	0.49	0.50	0.50
Science based	0.38	0.39	0.30	0.43	0.42	0.46	0.47	0.52	0.55	0.55

Source: Own calculations based on data from GUS.

Only in the case of resource intensive industries is the sourcing ratio low. The reason for this is that such industries mostly source technology from abroad while most of the production components are available from the local market (resource-oriented FDI). In labour-intensive industries, the export intensity is high and, in the last few years investigated, this has also been the case in scale-intensive and specialized-supplier industries. This development may be due to a changing mandate for MNE affiliates in Poland. At first, they may have served as merely local implementers responsible for such production activities as packaging, adaptation and assembly but have then become more specialized in the production value chain, their role changing to that of a specialized contributor which, apart from producing for the local market, is responsible for parts of the value-added scope which are important to the production by the whole MNE network. In the science-based sector, export orientation is also emerging; and the resource-intensive industries are rather market oriented.

Table 3 and figure A1 in the appendix present the correlations between the variables. There seems to be a high positive correlation between dependent variable X/S relative to two explanatory variables: M/S and L/S, suggesting that the primary forces explaining increasing export orientation are an increase in foreign sourcing (need for components, affiliate specialisation in a certain fragment of the value chain) and labour intensity in production (the MNE exploits the main factor endowment of the transition economy, i.e., cheap labour). The one major result emerging from the correlation between the explanatory forces is that there is moderate correlation of labour intensity: it is positive with import intensity and negative with wage level. These results of low/medium correlation between the variables imply that the proposed model has low multicollinearity.

Table 3. *Correlation Matrix 1993-2002.*

Variables	X/S	M/S	W/L	L/S	I/S	FCS	SCALE
X/S	1						
M/S	0.8605	1					
W/L	-0.2834	-0.2032	1				
L/S	0.5753	0.4603	-0.5089	1			
IS	0.0096	0.3102	-0.1026	0.1357	1		
FCS	0.0998	0.1141	0.1558	-0.1376	0.0331	1	
SNOC	-0.1106	-0.0712	0.4887	-0.2061	-0.0367	-0.103	1

Source: Own Calculation.

The results of pooled regression and panel estimations including necessary tests are presented in section D of the appendix. The pooled (OLS) regressions and fixed effect panel estimations are rejected in favour of the random effect regressions. In all the cases, random effect was favoured by Hausman specification tests, meaning that some regressors are uncorrelated with the unobserved heterogeneity term. The results for the equation without time and factor dummies show high positive association between all explanatory variables and export intensity (Table 4). The only exception is the case of investment intensity, which is significant and, as stated in the hypothesis, negatively related to export performance. Positive association between X/S and M/S has been strongly confirmed across all types of estimation and model selection tests. This fully supports the assumption made in hypothesis 1.

Table 4. Estimation results - Random effect panel estimations

	β	t-test	β	t-test	β	t-test
(Constant)	0.53	(1.88)	1.29***	(4.47)	1.11***	(3.35)
ln (M/S)	0.60***	(13.00)	0.52***	(11.47)	0.51***	(11.11)
ln (W/L)	0.59***	(8.76)	0.04	(0.38)	0.07	(0.65)
ln (L/NE)	0.79***	(11.77)	0.78***	(11.85)	0.76***	(11.33)
ln (I/S)	-0.14***	(-4.68)	-0.10***	(-3.44)	-0.10**	(-3.11)
ln (FCS)	0.38***	(3.36)	0.22	(1.92)	0.22	(1.95)
ln (SCALE)	0.07**	(2.72)	0.05*	(2.01)	0.06*	(2.05)
Φ LABOR					0.32	(1.46)
Φ SCALE					-0.21	(-0.95)
Φ SPECIALIZED					0.27	(1.11)
Φ SCIENCE					-0.58**	(-2.81)
Σ 1994			0.13	(1.58)	0.13	(1.57)
Σ 1995			0.26**	(3.19)	0.26**	(3.11)
Σ 1996			0.28***	(3.39)	0.27**	(3.26)
Σ 1997			0.39***	(4.54)	0.37***	(4.30)
Σ 1998			0.43***	(4.84)	0.41***	(4.64)
Σ 1999			0.55***	(5.45)	0.52***	(5.16)
Σ 2000			0.60***	(5.91)	0.57***	(5.60)
Σ 2001			0.73***	(6.53)	0.70***	(6.21)
Σ 2002			0.80***	(7.94)	0.78***	(7.68)
R^2 (within)	0.32		0.37		0.37	
N	755		755		755	
Hausmam χ^2-test	0.63		44.5***		▮▮▮	
Lagrarian multiplier χ^2-test	1029.86***		646.06***		512.7***	

Notes: The dependent variable is *X/S*. The independent variables (all in natural logs) are: *M/S*: import intensity. *W/L*: 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 as the fixed effect model cannot be performed in such cases.

The results for the foreign capital share, however, exceed the limit of significance, which was set at 5%, but this level is surpassed with extremely minimal value (the t-values are: 1.92 and 1.95, while the level is 1.97).

Consequently, the hypothesis 2 assumption of a positive impact of foreign control on export performance should be accepted. Hypothesis 3 is fully supported. In the models with factor intensity and time dummies, the results for industry variables are insignificant for the wage level. As a result, the argument that wage level has a positive impact on absorptive capacity, leading to export performance, has not been robustly confirmed; but hypothesis 4 cannot be fully rejected. Labour intensive industries (measured by L/S) have high export intensities, which confirms hypothesis 5. The assumption regarding company size as a determinant for exports is supported (hypothesis 6). Among factor intensity dummies, the results are only for science-based sectors, which show the lowest level of export performance in these industry groupings. This argument only partially supports hypothesis 7 and rejects the results of Tavares and Young (2000), who found that high-intensive affiliates have high levels of trade with parent affiliates. The time dummies show a strong tendency towards export performance growth over all of the years analysed, thus confirming hypothesis 8.

In order to counter any argument for including short-time effects, the model was also tested using 1-year time lags for all independent variables and the results are similar to the ones presented above.

In sum, the results from panel estimations show an increase in the export intensity of the affiliates in all the years since 1994. The analysis of industry specificities shows that the lowest level of export performance is in science-based sectors. Industry determinants such as import intensity, labour intensity, wage level, scale economies and foreign capital share are significant and positively associated to export performance while investment activity is negatively related to the export performance of the affiliates.

4. Conclusions

The analysis of a database containing trade and industry variables of the foreign affiliates in Polish manufacturing and covering the years 1993-2002 has brought new insights to research on the export performance of foreign affiliates and its industry determinants. The results illustrate a certain pattern. During the ten years considered, the export performance of foreign affiliates in Poland was determined by firm

characteristics such as size (scale), the transfer of tacit knowledge, higher utilization of labour than of physical capital and a high level of international sourcing of components, materials and technology.

These results are in line with International Business Research, which underlies the hypotheses presented in this paper. Growing export orientation is an effect of MNE strategy with regard to knowledge: mandate, transfer and absorption. Affiliates become ever more specialized and increases in imports boost their export orientation, leading the firms to become more advanced and specialised in their scope value adding activities. This process of change could be called the evolution of the "knowledge" mandate of the affiliate (the production process becoming increasingly advanced/specialised). Knowledge transfer to affiliates with increasing export orientation is tacit in form (disembodied), strengthening affiliate marketing functions, reorganization of decision-making and information systems, investments in human resources, and creation of effective mechanisms of corporate governance. This type of knowledge is a prerequisite for improvements in the export orientation of foreign affiliates in transition countries.

References

Andersson, T., Fredriksson, T. (1996), International organization of production and variation in exports from affiliates. Journal of International Business Studies 27(2): 249-63.

Bartlett, Ch. A., Ghoshal S. (1989), Managing Across Borders: TheTransnational Solution. Boston (MA): Harvard Business School Press.

Birkinshaw, J., Morrison, A. J., (1995), Configurations of Strategy and Structure in Subsidiaries of Multinational Corporations. Journal of International Business Studies, 26(4): 729-53.

Brada, J. C. (2003), Chapter 5: Privatization, restructuring, corporate governance and the behaviour of firms in transition economies / ed.by Heinz-Jürgen Stüting et al. Basingstoke: Palgrave Macmillan,.

Bonaccorsi, A. (1992), On the relationship between firm size and Export Intensity, Journal of International Business Studies, Vol. 23, No 4 (4th Quarter), pp. 605-35.

Buckley, P.J., Casson, M., (1976), The Future of the Multinational Enterprise, London: Macmillan

Cantwell, J. A., Bellak Ch. (2000), The Impact of Foreign Direct Investment on International Trade. Journal of International Relations and Development, 3(2): 120-27.

Cavusgil, S. T., Zou, S. (1994). Marketing strategy-performance relationship: An investigation of the empirical link in export market ventures. Journal of Marketing, 58(1): 1–21.

Caves, R. (1971), International Corporations: The Industrial Economics of Foreign Investment, Economica, February, p: 1-27.

Child, J., Czegledy, A.P. (1996), Managerial learning in the transformation of Eastern Europe: some key issues, Organization Studies 17(2): 167–179

Cohen, W., Levinthal, D. (1990). Absorptive capacity: A new perspective on learning and innovation. Administrative Science Quarterly, 35(1):128.

Czegledy, A. P. (1996), New Directions for Organizational Learning in Eastern Europe, in Organization Studies 17/2, 327-342

Dunning, J. (1988), The eclectic paradigm of international production: A restatement and some possible extensions. Journal of International Business Studies, 19: 1-31.

Dunning, J.H. (1993), Multinational Enterprises and the Global Economy, Wokingham, UK:Addison-Wesley.

Eden, L., Levitas E., Martinez R.J., (1997), The production, transfer and spillover of technology: comparing large and small multinationals as technology producers, Small Business Economics, 9, 53-66.

Egelhoff, W. G., Liam G., McCormick, S. (2000) How FDI Patterns Influence Subsidiary Trade Patterns: The Case of Ireland. Management International Review, 40(3): 203-230.

Gupta, A.K., Govindarajan, V. (2000), Knowledge Flows within Multinational Corporations, Strategic Management Journal, 21: 473-96.

Harzing, A.-W.K. (1997), Response Rates in International Mail Surveys: Results of a 22 Country Study, International Business Review, 6(6), 641-65.

Hennart, J.-F. (1982), A theory of multinational enterprise, Ann Arbor: University of Michigan Press.

Hood, N. and Young, S. (1979), The Economics of Multinational Enterprise, London: Longman.

Kogut, B. Zander U., (1993), Knowledge of the firm and the evolutionary theory of the multinational corporation, Journal of International Business Studies, 24, 625- 645

Kogut, Bruce (1996), Direct Investment, Experimentation, and Corporate Governance in Transition Economies, in: R.Frydman, C. W. Gray and A. Rapaczynski (eds.): Corporate Governance in Central Europe and Russia, vol. 1, London and Budapest: Central European University Press, p. 293-332

Lall, S.(1985), Multinationals, technology and exports. St. Martins Press, NY.

Lane, P. J, Salk, J. E., Lyles, M. (2001), Absorptive capacity, learning and performance in international joint ventures, Strategic Management Journal. 22(12):1139-1162.

Leavitt, B., March, J. (1988), Organizational Learning, Annual Review of Sociology, vol. 14: pp. 319-340

Markusen, J. R. (2002), Multinational Firms and the Theory of International Trade. The MIT Press.

Meyer, K., Sinani, E. (2002), Identyfing Spillovers of Technology Transfer from FDI: the case of Estonia, Working paper. Centre for East European Studies. Copenhagen Business School.

Meyer, K., (2001), Institutions, transaction costs and entry mode choice in Eastern Europe,Journal of International Business Studies, Vol. 31, Iss. 2, pp 257-367.

Meyer, K. E. (1998), Direct Investment in Transition Economies, Cheltenham: Elgar, forthcoming.

Minbaeva, D., Petersen T., I. Bjorkman, Fey, C.F., Park, H.J., (2003) MNC knowledge transfer, subsidiary absorptive capacity, and HRM, Journal of International Business Studies, Vol 34, 6, 586-599

Nelson J., Winter P. (1982), An Evolutionary Theory if Economic Change, Boston: Harvard University Press.

Newman, K.L., Nollen, S., (1998), Managing radical organizational change. Thousand Oaks, Calif.: Sage Publications.

Nielsen, J. Pawlik, K. (2004). Locally- versus Export Oriented International Production. An analysis of foreign capital in Poland 1993-2001. Working Paper. 04-04. Department of International Business. Aarhus School of Business. Denmark.

PAIZ (2003), The list of the largest foreign Investors in Poland, PAIZ, Warsaw.

Pawlik, K. (2004), Dataset on foreign affiliates in Poland 1993-2002, Working Paper, 04-11. Department of International Business. Aarhus School of Business. Denmark.

Pawlik, K. (2005a), Increasing role of foreign capital in Poland since 1993, Working Paper, 05-01. Department of International Business. Aarhus School of Business. Denmark.

Piercy, N. F., Katsikeas, C. S., Cravens, D. W. (1997). Examining the role of buyer-seller relationships in export performance. Journal of World Business, 32(1): 73–86.

Porter, M. E. (1986), Competition in global industries: A conceptual framework. In M. Porter, ed, Competition in global industries. Boston: Harvard Business School Press.

Schumpter, J. (1934), The Theory of Economic Development. Cambridge, Mass.: Harvard University Press.

Shoham, A. (1998), Export performance: A conceptualization and empirical assessment. Journal of International Marketing, 6(3): 59–81.

Styles, C., Ambler, T. (1994), Successful export practice: The UK experience. International Marketing Review, 11(6): 23–47.

Swaan W., (1997), Knowledge, Transaction Cost and the Creation of Markets in Post-Socialist Economies, in P.G. Hare and J. Davis (eds.), Transition to the Market Economy, vol. II, London: Routledge, 53-76

Szulanski, G. (1996), Exploring internal stickiness: Impediments to the transfer of best practice within the firm. Strategic Management Journal, 17(Winter Special Issue): 27-43

Tavares, A. T., Young, S., (2002), Explaining the export intensity of multinational subsidiaries: an EU-based empirical study. SIBU Working Paper. Strathclyde International Business Unit. Working Paper 2002/02.

Tung, R. (1994), Human resource issues and technology transfer. International Journal of Human Resource Management, 35(6), 807-826.

UNCTAD (2002), Trade and Development Report 2002, New York and Geneva: United Nations.

Vernon, R. (1966), International Investment and International Trade in the Product Cycle, Quarterly Journal of Economics, 80 (May), pp. 190-207.

Wheeler, C., Ibeh K.I.N. (2001), UK Export Performance Research 1990-2000: Review and Theoretical Framework, mimeo, Glasgow: University of Strathclyde.

White, R., Poynter, T. (1984), Strategies for Foreign-Owned Subsidiaries in Canada, Business Quarterly, Summer: 59-69.

Wooldridge J.M., (2002), Introductory econometrics: A modern approach, Thomson Learning 2003

Zou, S., Stan, S. (1998), The determinants of export performance: A review of the empirical literature between 1987 and 1997. International Marketing Review, 15(5): 333–356.

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 largely the result of different objectives, sources and legal frameworks. As described in Pawlik (2004), data collected in accordance with the legal foundation of GUS is informative, reflective and reliable in relation to research on foreign companies operating in Poland. For this reason, the study reported on in this paper is based on a database created in cooperation with GUS.

In our dataset, foreign companies include any company established under the commercial law of Poland and having a minimum of nine employees and a foreign capital share equal to or greater than ten percent of total equity (basic capital)[5]. The minimum foreign capital share requirement is from the OECD definition, which says that a foreign investor holds at least 10% of the ordinary shares or voting rights in the firm in which the investment takes place.[6]

Balance sheet records versus single act documents

Our data has two sources: balance sheet reports (BS) and single act documents (SAD). Balance sheet reports, which are completed annually, give aggregate figures on sales, investments, exports, the number of employees and companies, and on equity provided by foreign investors and total equity. Balance sheet reports do not contain figures on imports but merely on tariffs, etc., paid due to import activities. Imports cannot be estimated on the basis of BS because tariff rates differ across products and because companies sometimes exploit tariff exemptions. Single act documents, however, are completed and submitted by the companies in order to inform customs authorities about exports and imports.

In a number of industries, exports from SAD exceed the value of sales. These somewhat dubious cases are observed in the manufacturing of textiles, leather products, electronic valves, motorcycles and bicycles. The number of industries with dubious cases and their share in total exports has, however, been decreasing over time.

Neither GUS, the Ministry of Finance (which formally supervisese the customs authorities) nor the Ministry of Economy has been able to give us a complete explanation for these dubious cases. Undoubtedly, either exports in SAD or sales in BS are overestimated or underestimated. One possible explanation may be illustrated by the case of textile and leather manufacturing. Affiliates in these industries often serve as simple workrooms. They receive complete sets of materials from abroad and return them without valuing the

---

[5] GUS specifies that foreign capital is the basic capital (equity) provided by foreign investors. These are: (1) private persons whose place of living is located abroad, (2) legal entities with foreign headquarters, (3) legal entities of a company which was established as a private or legal person abroad under the legal framework of a foreign country, (4) legal entities whose headquarters is located in the Republic of Poland but is dependent on a foreign entity.

[6] The definition is available at: http://www.oecd.org

products but merely charging for sewing services. Likewise, there are manufacturing affiliates which provide the services of washing, ironing and "alterating" "second hand" textiles. The difference between border declarations and accounting records will be obvious in these cases.[7]

In spite of these problems, SAD data are our source for exports and imports. Although sometimes there may be products or technology solutions which originate from other industries, all final products and intermediates exported or imported (sourced) by a given company necessarily show up at industry level.

Confidentiality

According to Polish law, figures cannot be published if there are less than three companies in the aggregation as it might enable identification of individual economic units. For data built on SAD, the number of hidden observations (NACE industries) was not insignificant at the beginning of the period but by the end only six observations in exports and 13 in imports were hidden (see table A3 in the appendix). In the period 1993-1998, around 2-5% of the total volume of sales, exports and imports was hidden (NACE sections D) while, in 1999 and 2000, these figures rose to 10-15% for sales and 15-20% for imports but did not change for exports. In 2001 and 2002, no observations relating to sales were hidden.[8] The reason for the sudden increase in hidden sales and import values in 1999 and 2000 may be the (greenfield) establishment or acquisition of large companies which were not especially export-oriented. In the case of BS data (sales and exports), there are no confidentiality problems relatning to exports and, as regards sales, the problem is more or less constant over time except for 2001 - 2002, when it disappears (see footnote 18 and table A4). In general, we do not find the potential bias relating to confidentiality rules to be of such size that it affects the analyses made and conclusions drawn in what follows.

Classification

Due to the limitations of data on foreign companies, the decision was made to only acquire the dataset with the three-digit NACE level (groups) as this is the most detailed one. At this level of aggregation - if manufacturing alone is considered – then, from codes 150 to 372, the NACE classification includes 103 groups which may potentially be observed. We have decided to exclude "manufacture of coke, refined petroleum products and nuclear fuel" (NACE 232) from our data set. This NACE group includes seven companies, among them PKN Orlen S.A. – a huge monopoly in the manufacturing of refined petroleum products. Whether PKN Orlen S.A. should be viewed as a "foreign owned" company is open to discussion,; but, by the definition of foreign ownership provided in this paper (capital share >10%), it is one. The company has deposited its shares in foreign financial institutions as so-called "Global Deposit Receipts", but the role of foreign shareholders has been gradually marginalized by the Polish state.

---

[7] In cases in which the export-to-sales ratio is larger than 1, the import-to sales ratio is also larger than 1 and of a similar size. The correlation coefficient between the export-to-sales and import-to-sales ratios is 0.94. This almost perfect correlation indicates that these companies bring large amounts of imported inputs to Poland and export them back after some (low) value adding. As explained above, the sales figures may have been underestimated.

For the years considered, the number of observations available for different estimations differs, see *table 1*.

Table A1. *Number of 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 about sales from balance sheets (BS)	78	83	87	85	87	81	86	84	99	95
Observations available about exports from single act documents (SAD)	60	71	73	78	84	77	77	74	93	90
Observations available about 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.

---

[8] The reason for there being no hidden observations in 2001 is that GUS delivered data without hidden observations.

Figure B1. *Scatter plots of the variables.*
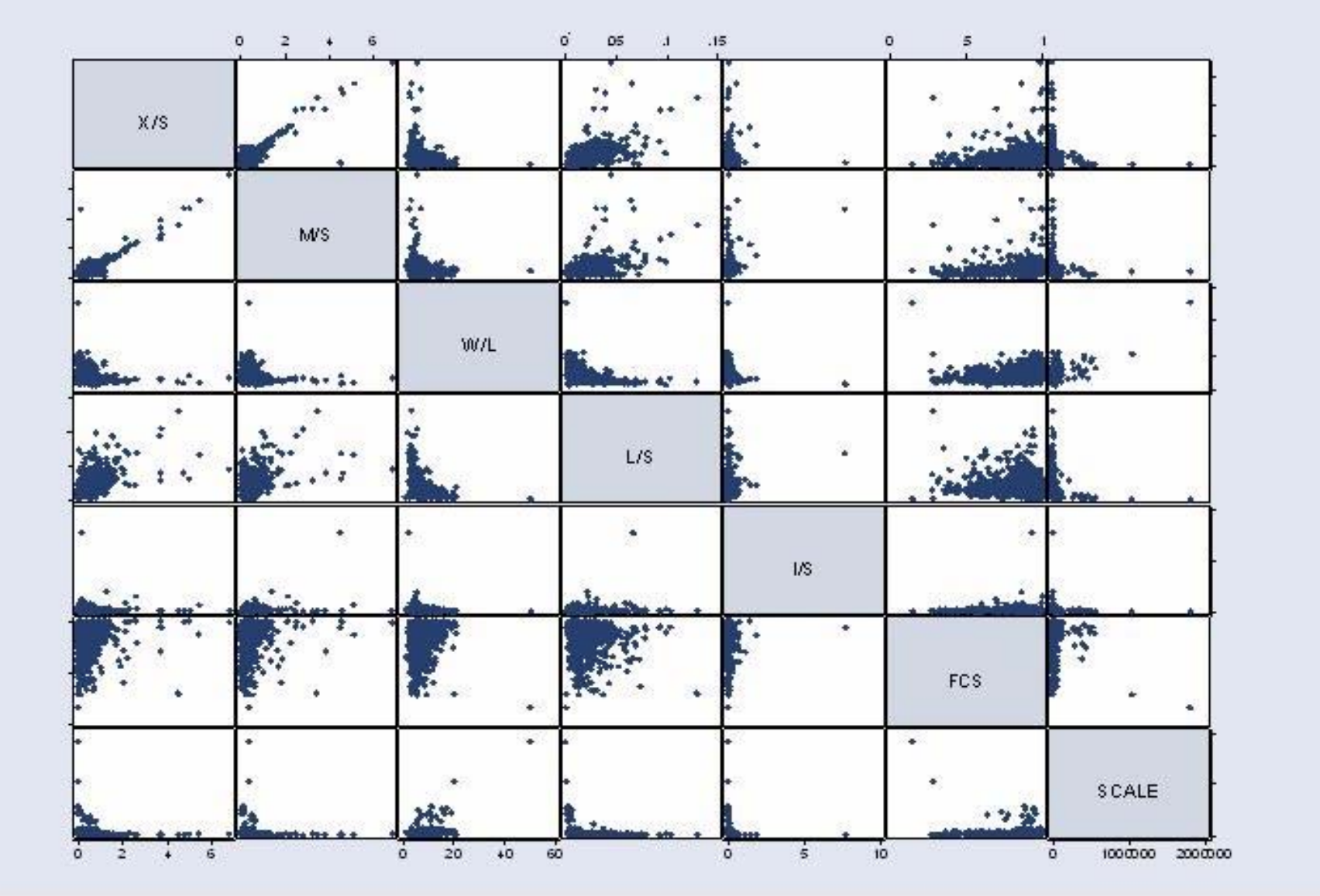
Appendix C

Table C1. *Classification of NACE three-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 two-digit code implies that the lower level of aggregation (i.e., the three-digit level) is fully within the given intensity group unless exceptions are indicated in brackets.
Source: Structural Adjustment and Economic Performance", OECD, 1987.

Table D1. *Pooled OLS regression for Export Intensity 1993-2002.*

	ln X/S		X/S		ln X/S		X/S		ln X/S		X/S	
	β	*t-test*	*β*	*t-test*	*β*	*t-test*	*B*	*t-test*	*β*	*t-test*	*β*	*t-test*
CONSTANT	2.17***	(8.28)	1.87***	(12.58)	2.27***	(7.38)	1.88***	(13.54)	2.06***	(6.23)	1.92***	(9.81)
ln M/S	0.55***	(11.32)	0.41***	(7.61)	0.50***	(10.11)	0.40***	(17.88)	0.49***	(7.61)	0.47***	(7.16)
ln W/L	0.18	(1.27)	0.04	(0.79)	-0.62**	(-3.26)	-0.13	(-1.88)	-0.55**	(-2.67)	0.03	(0.37)
ln L/S	1.07***	(9.87)	0.37***	(9.67)	0.87***	(7.58)	0.32***	(8.58)	0.80***	(6.78)	0.34***	(8.20)
ln I/S	-0.15***	(-3.53)	-0.11***	(-4.07)	-0.11*	(-2.34)	-0.09***	(-1.52)	-0.11*	(-2.27)	-0.13***	(-4.21)
ln FCS	0.55***	(3.97)	0.13	(1.41)	0.32*	(2.23)	0.08	(1.12)	0.32*	(2.37)	0.10	(1.12)
ln SCALE	0.11**	(3.01)	0.03*	(2.01)	0.11**	(3.00)	0.03	(1.78)	0.09*	(2.35)	0.02	(1.41)
φ LABOR									0.17	(1.48)	-0.13	(-1.92)
φ SCALE									0.01	(0.09)	-0.16***	(-3.33)
φ SPECIALIZED									0.25**	(2.62)	-0.21***	(-3.42)
φ SCIENCE									-0.54***	(-4.47)	-0.49***	(-6.53)
σ 1994					0.07	(0.33)	0.09	(1.13)	0.03	(0.16)	0.08	(1.01)
σ 1995					0.24	(1.36)	0.14	(1.81)	0.20	(1.20)	0.11	(1.18)
σ 1996					0.35*	(1.98)	0.07	(0.98)	0.32	(1.86)	0.05	(0.74)
σ 1997					0.56**	(3.27)	0.10	(1.30)	0.51**	(3.08)	0.06	(0.89)
σ 1998					0.62***	(3.62)	0.11	(1.40)	0.57***	(3.39)	0.06	(0.98)
σ 1999					0.97***	(5.28)	0.18*	(2.13)	0.90***	(4.93)	0.09	(1.23)
σ 2000					1.01***	(5.22)	0.20*	(2.47)	0.92***	(4.75)	0.11	(1.54)
σ 2001					1.18***	(5.81)	0.31***	(3.55)	1.09***	(5.22)	0.17*	(2.02)
σ 2002					1.14***	(6.24)	0.31***	(3.83)	1.07***	(5.71)	0.19*	(2.41)
R^2	0.51		0.49		0.55		0.52		0.58		0.55	
N	755		755		755		755		755		755	
F	36.26***		111.88***		49.33***		19.42***		57.75***		22.34***	
VIF average	1.65		1.65		2.22		2.22		2.21		2.21	

Notes: The dependent variables are *X/S and ln X/S, respectively.* The independent variables (all in natural logs) are: *M/S*: import intensity. *W/L*: 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., indicate time dummies, and φ LABOR, etc., factor intensity dummies. Robust standard errors used.

Table D2 . Fixed effect panel estimation for Export Intensity 1993-2002.

	ln X/S		X/S		ln X/S		X/S	
	β	t-test	β	t-test	β	t-test	β	t-test
CONSTANT	0.8	(0.62)	1.51***	(7.77)	0.88**	(2.79)	1.65***	(7.61)
ln M/S	0.58***	(11.80)	0.46***	(13.97)	0.50***	(10.30)	0.44***	(12.98)
ln W/L	0.61***	(9.02)	0.13**	(2.79)	0.18	(1.69)	0.00	(0.06)
ln L/S	0.69***	(9.63)	0.29***	(6.00)	0.71***	(9.93)	0.27***	(5.63)
ln I/S	-0.12***	(-3.93)	-0.08***	(-3.87)	-0.09**	(-2.76)	-0.05*	(-2.49)
ln FCS	0.33**	(2.76)	0.16*	(1.97)	0.19	(1.68)	0.12	(1.54)
ln SCALE	0.07*	(2.47)	0.03	(1.57)	0.05	(1.73)	0.03	(1.45)
σ 1994					0.15	(1.87)	0.07	(1.29)
σ 1995					0.25**	(3.12)	0.10	(1.83)
σ 1996					0.25**	(3.06)	0.06	(1.02)
σ 1997					0.33***	(3.83)	0.05	(0.84)
σ 1998					0.37***	(4.20)	0.05	(0.79)
σ 1999					0.45***	(4.38)	0.09	(1.24)
σ 2000					0.50***	(4.84)	0.12	(1.67)
σ 2001					0.61***	(5.31)	0.19*	(2.45)
σ 2002					0.70***	(6.88)	0.22**	(3.14)
R^2 *(within)*	0.32		0.28		0.37		0.30	
N	755		755		755		755	
F	22.80***		9.00***		20.68***		8.85***	

Notes: The dependent variables are *X/S and ln X/S, respectively.* The independent variables (all in natural logs) are: *M/S*: import intensity. *W/L*: 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., indicate time dummies, and φ LABOR, etc., factor intensity dummies.

Table D3. Random effect panel estimation for Export Intensity 1993-2002.

	ln X/S		X/S		ln X/S		X/S		ln X/S		X/S	
	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test	β	t-test
CONSTANT	0.53	(1.88)	1.68***	(10.28)	1.29***	(4.47)	1.80***	(10.20)	1.11***	(3.35)	1.85***	(9.39)
ln M/S	0.60***	(13.00)	0.47***	(16.66)	0.52***	(11.47)	0.45***	(15.57)	0.51***	(11.11)	0.46***	(15.58)
ln W/L	0.59***	(8.76)	0.12**	(2.78)	0.04	(0.38)	-0.02	(-0.30)	0.07	(0.65)	0.01	(0.15)
ln L/S	0.79***	(11.77)	0.33***	(8.03)	0.78***	(11.85)	0.30***	(7.27)	0.76***	(11.33)	0.31***	(7.19)
ln I/S	-0.14***	(-4.68)	-0.09***	(-4.97)	-0.10***	(-3.44)	-0.07***	(-3.48)	-0.10**	(-3.11)	-0.07***	(-3.60)
ln FCS	0.38***	(3.36)	0.16*	(2.23)	0.22	(1.92)	0.12	(1.65)	0.22	(1.95)	0.13	(1.73)
ln SCALE	0.07**	(2.72)	0.03	(1.68)	0.05*	(2.01)	0.03	(1.54)	0.06*	(2.05)	0.03	(1.58)
φ LABOUR									0.32	(1.46)	-0.02	(-0.23)
φ SCALE									-0.21	(-0.95)	-0.16	(-1.46)
φ SPECIALISED									0.27	(1.11)	-0.18	(-1.52)
φ SCIENCE									-0.58**	(-2.81)	-0.42**	(-2.72)
σ 1994					0.13	(1.58)	0.07	(1.29)	0.13	(1.57)	0.07	(1.28)
σ 1995					0.26**	(3.19)	0.11	(1.93)	0.26**	(3.11)	0.10	(1.80)
σ 1996					0.28***	(3.39)	0.06	(1.14)	0.27**	(3.26)	0.06	(0.99)
σ 1997					0.39***	(4.54)	0.07	(1.15)	0.37***	(4.30)	0.05	(0.92)
σ 1998					0.43***	(4.84)	0.06	(1.07)	0.41***	(4.64)	0.05	(0.84)
σ 1999					0.55***	(5.45)	0.11	(1.65)	0.52***	(5.16)	0.09	(1.30)
σ 2000					0.60***	(5.91)	0.14*	(2.09)	0.57***	(5.60)	0.12	(1.71)
σ 2001					0.73***	(6.53)	0.22**	(2.99)	0.70***	(6.21)	0.19*	(2.55)
σ 2002					0.80***	(7.94)	0.24***	(3.62)	0.78***	(7.68)	0.21**	(3.22)
R²(within)	0.32		0.28		0.37		0.30		0.37		0.30	
N	755		755		755		755		755		755	
Hausman test chi2	0.63		5.40		-62.32 failed		4.59		■■■		■■■	
Lagrarian Multiplier test chi2	1029.86***		456.20***		1047.15***		445.53***		990.02***		387.30***	

Notes: The dependent variables are X/S and ln X/S, respectively. The independent variables (in level and logs) are: *M/S*: import intensity. *W/L*: wage level. *L/S*: labour intensity. *I/S*: investment activity. *FCS*: foreign capital share, *SCALE*: scale economies.*, **, *** significant at 5, 1, 0.1% levels, respectively. σ 1994, σ 1995, etc., indicate time dummies, and φ LABOR, etc., factor intensity dummies.

WP