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## Distinction between Intermediate and Finished Products in Intra-Firm Trade

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## **DISTINCTION BETWEEN INTERMEDIATE AND FINISHED PRODUCTS IN INTRA-FIRM TRADE**

by

Thomas Andersson, Torbjörn Fredriksson  
and Zabrina Leung

March 1993

# **Distinction between Intermediate and Finished Products in Intra-Firm Trade**

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April, 1993

## **Abstract:**

*Using unique data from 1974 to 1990 on Swedish multinationals, this is the first empirical examination of variation in the propensity of manufacturing affiliates to import intermediate and finished products respectively from parent companies. A Tobit model is applied as many observations of the dependent variables are zero. The results show that a decomposition of intra-firm deliveries is indeed necessary. The import behavior of affiliates is affected by firms' international organization of production, and by affiliate- as well as host country-specific characteristics.*

## 1. Introduction<sup>1</sup>

Multinational enterprises (MNEs) have become increasingly important in the global economy. Direct investment flows have grown unprecedentedly in the last decade, with largely indeterminate consequences for both home and host economies. Meanwhile, the nature of international trade has changed considerably, and as much as 25 per cent has been estimated to take place within firms (UN, 1992). Although intra-firm trade has attracted attention, there is still scanty knowledge about its characteristics and composition. It has been noted, however, that internal trade differs from arm's-length transactions and can not be explained by traditional theories such as those of Ricardo or Heckscher-Ohlin. Explanations must incorporate the presence of product differentiation, market imperfections and transaction costs which are factors motivating the existence of MNEs in the first place (Hymer, 1960; Williamson, 1971; Buckley and Casson, 1976; Caves, 1971; Dunning, 1977).

Most previous work on intra-firm trade is based on US data (cf. Lall, 1978; Helleiner, 1979; Goldsborough, 1981; Sleuwaegen, 1985; Cho, 1990)<sup>2</sup>, which only allow for analyses at the industry-level, whereas factors determining intra-firm trade should often be firm-specific in nature. Moreover, from having been the major source country, the US became the largest recipient of direct investment in the 1980s. There is a need for studies of firms based in small industrialized economies, as these account for a growing share of outward foreign investment.<sup>3</sup>

Contrary to what has normally been assumed, intra-firm trade is not homogeneous, but consists of different types of flows. Here, we particularly distinguish between trade in intermediate and finished goods.<sup>4</sup> An intermediate product is defined as an output of one production process and an input to another. If sales and distribution operations are treated as stages in the production process, a finished product exported

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<sup>1</sup> Thanks are due to Roger Svensson for helpful assistance with computer programming. Ari Kokko, Stockholm School of Economics, and colleagues at the Industrial Institute for Economics and Social Research (IUI) have provided many useful comments.

<sup>2</sup> The main sources of data on trade by US MNEs are the two benchmark surveys from 1977 and 1982 (US Department of Commerce, 1981 and 1986), and the survey by the US Tariff Commission (1973).

<sup>3</sup> It has been noted that home market characteristics indeed influence a firm's international involvement, and thus its pattern of trade (cf. UNCTC, 1988; Nankani, 1979; Dunning, 1981).

<sup>4</sup> Intra-firm trade can also consist of capital goods, e.g. machinery and equipment from a parent firm to an affiliate. However, this component is of relatively small importance compared to the other two. See Figure 1.

from a parent to an affiliate can, in a broad sense, also be classified as intermediate. If not, intermediate products comprise raw materials and semi-processed products only. Several researchers have acknowledged that trade in the two categories is likely to be internalized for partly different reasons, and consequently should not be expected to develop in the same way (Stubenitsky, 1970; Lall, 1978; Casson and Associates, 1986). Nevertheless, practically all empirical studies have treated intra-firm shipments as intermediate in the broader sense (cf. Lall, 1978; Helleiner, 1979; Pearce, 1982; Zejan, 1989; Cho, 1990).

The composition of intra-firm trade reveals interesting information regarding the organization of MNE activities. In order to contribute to a better understanding of the relationship between foreign production and intra-firm trade, the present paper undertakes a first examination of variation in the propensity of affiliates to import intermediate and finished products respectively from parents. A Tobit model is applied using detailed firm-level information on Swedish MNEs as a whole as well as on their majority-owned foreign affiliates between 1974 and 1990. The results confirm that internalization of the two categories of products is determined by different factors. Differences as well as similarities in the propensity of affiliates to import intermediate vis-à-vis finished products are shown to relate to firms' organization of international production, and to specific characteristics of individual host countries and affiliates.

The paper is organized as follows. The data base is presented in section 2. Previous theoretical and empirical findings are discussed in section 3, which also presents hypotheses for empirical testing. In section 4, the Tobit model is introduced and our variables defined. Section 5 presents the estimations and results. Section 6 concludes.

## **2. Data on Swedish Multinational Enterprises**

Detailed information on intra-firm trade is available at the Industrial Institute for Economic and Social Research (IUI) for practically all Swedish manufacturing firms with foreign affiliates. The data base covers the consolidated operations of firms as well as each majority-owned manufacturing foreign affiliate for 1965, 1970, 1974, 1978, 1986 and 1990. Throughout, the response frequency has exceeded 90 per cent, with the exception of 1990, for which about 80 per cent of the firms have answered so far. Since some

**Table 1: *Share of affiliates which do not import from the parent company, per cent.***

<u>Mode of establishment</u>	<u>1974</u>	<u>1978</u>	<u>1986</u>	<u>1990</u>
Green-field	18.0	10.8	16.4	14.5
Takeover	27.3	28.0	37.3	43.9

Source: IUI

questions, providing essential information for the study, were not included before 1974, the present paper uses the surveys from 1974 to 1990.

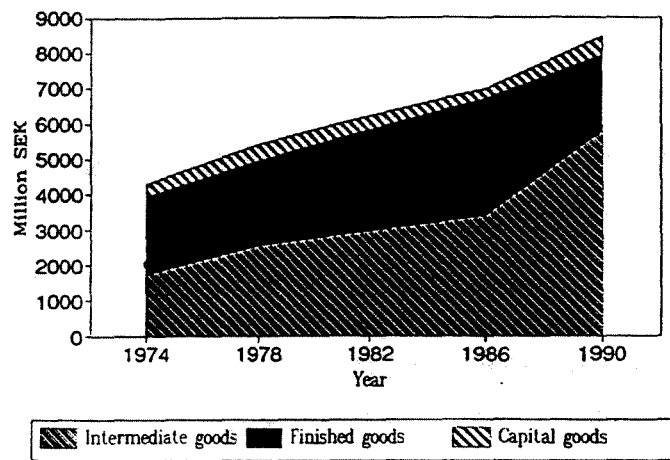
No other economy has a greater number of large MNEs in relation to GNP than Sweden. In 1985, the country had the sixth largest outward stock in the world of foreign direct investment relative to GNP (UNCTC, 1988). The stock has continued to grow mainly through acquisitions of already existing companies in the EC.<sup>5</sup> Swedish MNEs orient their activities primarily towards other developed markets with the bulk of their exports going to the EC. As in many other industrialized countries, intra-firm transactions have become increasingly important. Including deliveries to foreign sales affiliates, the share of intra-firm exports from Swedish parent companies in relation to total exports by MNEs increased from 54 per cent in 1974 to 67 per cent in 1990.<sup>6</sup>

While the share of total exports from the parent companies going to affiliates has increased, the average propensity of manufacturing affiliates to import from parents has fallen. In 1974, imports from parents amounted to about 22 per cent of total sales in affiliates. In 1990, the corresponding figure was only 16 per cent. This decline partly owes to the expansion of mergers and acquisitions, which are substantially less dependent on supplies from the parent firm. As can be seen in Table 1, an increasing share of all takeovers does not import anything from the parent company. In 1990, almost 44 per cent did not import anything from the parent company. Meanwhile, the share of green-field affiliates not importing from the parent has remained small.

<sup>5</sup> About 65 per cent of all affiliates established during the 1980s were acquired, 20 per cent were green-field investments, and the remaining 15 per cent had previously operated as pure sales subsidiaries (Andersson et al., 1992).

<sup>6</sup> A substantial proportion of intra-firm exports consists of exports to sales affiliates. In the analysis, our main concern, however, is how production in foreign subsidiaries affects trade flows, and the import behavior of pure sales affiliates is therefore left out.

**Figure 1:** *Intra-firm exports of intermediate, finished and capital goods to manufacturing affiliates of Swedish MNEs, discrete points in time, identical firms. Fixed prices (base year=1974) in billions SEK.*



Source: IUI

In Figure 1, exports from parents to manufacturing foreign affiliates are broken down into intermediate, finished and capital goods. The latter account for a very small part of total flows and are therefore excluded in the following analysis. Finished goods, on the other hand, make up a substantial proportion of internal deliveries, not least considering that only manufacturing affiliates are included. Between 1986 and 1990, the exports of finished products declined, while a sharp increase was noted in the exports of intermediate products.

There are considerable differences between affiliates with regard to the composition of supplies from parent companies. We have already noted that many acquired affiliates do not import at all from parents. Table 2 further shows that the share of subsidiaries which import both intermediate and finished products has gradually declined. In 1990, about 19 per cent of the subsidiaries imported both categories of goods, 21 per cent imported only intermediate goods, and 20 per cent purchased exclusively finished products from the parent firm. Even within the same multinational firm, affiliates differ markedly in dependence on supplies from the parent company. The disparities between affiliates with regard to the composition of imports make it difficult

**Table 2: *Manufacturing affiliates' dependence on imports from parent company, 1974-1990, per cent.***

<u>Affiliates which import:</u>	<u>1974</u>	<u>1978</u>	<u>1986</u>	<u>1990</u>
Intermediate and finished goods	30.8	27.9	20.7	18.8
Only intermediate goods	28.2	30.5	22.0	21.1
Only finished goods	17.3	18.2	25.7	20.4
Nothing from the parent company	23.7	23.4	31.6	39.7
Total	100.0	100.0	100.0	100.0

Source: IUI

to correctly analyze the impact of foreign production on intra-firm trade without using disaggregated information.

To sum up, the noted increase in intra-firm exports from parent companies is closely interrelated with the expansion of MNE activities. Still, the average propensity to import from parents has fallen, and there are noticeable variations in the pattern of intra-firm trade across multinational firms and across affiliates. Some subsidiaries are highly dependent on supplies from their parent companies, while others do not purchase anything internally. Among those that do import from parents, the composition of the internal deliveries differs considerably. The import behavior of affiliates is affected by several factors, and a set of hypotheses is specified in the next section for empirical examination of the matter.

### 3. Hypotheses

Intra-firm trade takes place because firms perceive a potential gain from integrating separate stages of the production or marketing process internationally. The pattern of trade is determined by the organization of the firms' international activities, and the flow of goods between a parent company and its affiliates depends on how they relate to each other in the value-added chain. Broadly speaking, there are three ways in which an MNE can expand into foreign markets; vertical, horizontal or conglomerate integration (Hymer, 1960; Caves, 1971).

Vertical integration of production is closely interlinked with intra-firm trade in intermediate, but not necessarily finished, products. It means locating separable stages



of the production process in different countries while keeping them under common administrative control. Vertical integration indicates an international specialization of production as activities in different units of the firm complement rather than substitute for each others' production. The transactional explanation emphasizes failures in commodity or information markets which may raise transaction costs associated with arm's-length contracting and enhance vertical integration (Williamson, 1971; Buckley and Casson, 1976). This form of expansion is likely to be most used in firms where different stages of production involve different technologies, and where the intermediate goods are fairly cheap to transport (Casson and Associates, 1986). If plant-economies of scale exist in production, a firm which integrates vertically can be expected to concentrate its operations in a relatively small number of large plants and supply other markets through exports.

Horizontal integration, in contrast, occurs when a firm locates manufacturing of largely the same goods in different countries. The affiliates' production primarily substitutes for the parent's arm's-length exports, without any offsetting increase in internal exports of intermediate goods. However, if the affiliate manufactures only a certain proportion of the parent's full range of products, the parent company might channel complementary supplies of finished products. The rationale for horizontal expansion usually lies in potential gains from internalizing markets for firm-specific assets such as, for example, a patent or a trade mark, superior management techniques, or greater access to financial resources (Caves, 1971). There are not enough economies to scale at plant level or sufficiently low transport costs to motivate a concentration of operations in a limited number of locations. Rather, foreign production is motivated by the need for proximity to the local market, and less emphasis should be expected on production for exports.<sup>7</sup>

Conglomerate expansion, finally, implies manufacturing of an internationally diversified range of products. The motive may be to spread business risks across multiple industries (Caves, 1982). The parent and the affiliate are not operating in the same line of business. In the 1980s, this mode of organization became less significant as firms increasingly focused on their core activities (Porter, 1991). Moreover, the implications for trade from conglomerate integration are less clear, and it will not be explicitly dealt with in the analysis.

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<sup>7</sup> This is verified in Andersson and Fredriksson (1993).

The different modes of integration consequently suggest different connections between foreign production and intra-firm trade in finished and intermediate products. In the following, we examine the variation in affiliates' propensity to import from parent companies. The view taken is that vertical integration primarily is associated with intra-firm trade in intermediate products, and that horizontal integration is connected with less trade on the whole but may enhance complementary supplies of finished products from the parent company. However, it is not straightforward how to classify individual companies in one category or the other since most MNEs use elements of both types of integration. Still, by using factors indicating type of integration, the impact of the organizational mode on trade can be investigated. In addition, there are other determinants of the composition and the magnitude of intra-firm trade. Based on previous theoretical and empirical work, factors which are perceived as most relevant to the study have been classified into three groups labeled: *firm-specific*, *affiliate-specific* and *host country-specific*.<sup>8</sup>

#### *Firm-specific factors*

Firm-specific factors concern features of multinational corporations as a whole. These include: possession of intangible assets in the form of trade marks, experience of international production, marketing or technological know-how; excess capacity or scale economies in production; and organizational structure of international production.

Ownership of intangible assets provides a firm with an advantage relative to domestic competitors, inducing engagement in foreign production as well as in the internalization of trade. Several studies have concluded that a high research and development (R&D) intensity increases the propensity to trade internally (Lall, 1978; Buckley and Pearce, 1979; Zejan, 1989; Cho, 1990). Lall argued that internalization of trade is most likely when finished as well as intermediate goods embody proprietary information. Sleuwaegen (1985) furthermore observed that R&D intensity, although high in both cases, is more strongly correlated with trade in intermediate products than in finished goods, indicating that the two types of goods may be internalized for partly

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<sup>8</sup> The main theoretical work in the field is Coase (1937), Buckley and Casson (1976), Williamson (1979), Casson (1979 and 1982), and Dunning (1979). A summary of previous findings can be found in Cho (1988).

different reasons. Nevertheless, R&D is important for both horizontal and vertical integration, and a positive impact on both categories of goods is expected.

**Hypothesis 1:** High R&D intensity in the parent company is associated with a relatively high propensity of the affiliate to import finished as well as intermediate goods from the parent.

It has been suggested that affiliates which belong to highly internationalized firms enhance trade among each other rather than with the parent. Studying the export behavior of parent companies, Pearce (1982) found an inverse U-shaped relationship between intra-firm exports and degree of multinationality. He suggested that higher levels of multinationality enhance trade between affiliates and the parent up to a point where affiliates would expand trade among each other at the expense of trade with the parent. Analyzing foreign affiliates, Zejan (1989) reached a similar conclusion as he found a negative impact of multinationality of firms on the propensity of affiliates to import from the parent company.

In essence, these conclusions presuppose that highly multinational firms are primarily vertically organized, with affiliates performing specialized activities in separate countries. However, Andersson and Fredriksson (1993) find that multinationality does not exert a positive impact on affiliates' propensity to export, suggesting that a negative impact of multinationality on the propensity to import from the parent company may have alternative explanations. One possibility is that horizontal organization is more conducive to the formation of highly international firms. By definition, a horizontally integrated affiliate substitutes for the parent's activities, reducing the production at home and raising the degree of multinationality for the firm as a whole. Regardless of whether highly multinational firms are biased towards horizontal or vertical integration, however, multinationality can be expected to reduce the propensity of affiliates to import intermediate products. As a high degree of multinationality implies a less pronounced role for the parent company, complementary supplies of finished goods should likewise be less important.

**Hypothesis 2:** A highly multinational firm has a relatively low propensity to import both intermediate and finished products from the parent.

A firm which integrates vertically would be expected to concentrate its operations in a relatively small number of large plants in order to exploit economies of scale. In a horizontally organized firm, production rather occurs within each market, which should account for the establishment of affiliates in a relatively large number of countries.

**Hypothesis 3:** Production in a large number of countries indicates horizontal organization of the MNE, resulting in a relatively small propensity for affiliates to import intermediate products, but a high propensity to import complementary finished goods from the parent company.

Industry characteristics may also play a role for intra-firm trade. Many Swedish multinational enterprises are dependent on access to natural resources, e.g. firms in the paper and pulp or the iron and steel industry. Production which is based on natural resources is normally located close to the source in order to exploit economies of scale and to minimize costs of transportation (Casson and Associates, 1986). When the parent company is located near the resource, the rationale for establishing production abroad should therefore mainly be to integrate forward. Hence, a manufacturing foreign affiliate which belongs to a resource intensive firm should have a high propensity to import intermediate products, and a low propensity to import finished products from the parent company.

**Hypothesis 4:** Affiliates which belong to resource intensive firms should have a relatively high propensity to import intermediate goods internally, and a low propensity to import finished goods from the parent.

#### *Affiliate-specific factors*

Affiliate-specific factors matter because foreign subsidiaries belonging to a certain firm need not behave in the same way, but may play different roles with varying degrees of dependence of the parent. To account for this, we include factors related to the type of integration between the individual affiliate and the parent company, as well as the mode of establishment. These are all likely to exert different effects on intermediate and finished products respectively.

A high propensity to export to third countries implies forward integration, international specialization of production and a high propensity to import intermediate products from the parent company. As such an affiliate would be less oriented towards sales on the local market, there is unlikely to be a well developed distribution network to be utilized for finished goods from the parent firm. Thus, a high export ratio should reduce an affiliate's propensity to import finished products.

**Hypothesis 5:** A high ratio of exports to 'third markets' exerts a positive impact on the propensity to import intermediate products, and a negative impact on the propensity to import finished products from the parent company.

If the affiliate is integrated backwards, i.e., supplies input goods to the parent's production, the propensity to import intermediate products from the parent will depend on its position in the production process. The rationale for backward-integration may be to reduce uncertainty in supply or to exploit low-cost factors of production. If positioned at the beginning of the value-added chain, an affiliate should have a low propensity to import from the parent. In contrast, if it operates at a later stage in the production process and rather exports semi-processed goods to the parent, there should also be a high propensity to import inputs from the parent. It is difficult *a priori* to predict which is the most likely outcome. However, as in the case of forward integration, a backward integrated affiliate is unlikely to emphasize the local market, and should therefore have a relatively lower propensity to import finished products from the parent firm.

**Hypothesis 6:** A high ratio of exports to the parent company is expected to exert a negative impact on the propensity of an affiliate to import finished goods. With regard to the propensity to import intermediate products the effect depends on the stage in the value-added chain at which the affiliate is situated.

The way in which an affiliate was established as a manufacturing outlet of the MNE can be expected to affect its trade with the parent. Broadly speaking there are three modes of establishment. First, a pure sales affiliate can develop manufacturing operations of its own. Having previously focused on the local market, it is likely to become horizontally integrated with the parent company. Lall (1978) argued that complex durable products requiring extensive after-sales services are likely to be traded internally and marketed

abroad through sales affiliates. The same should be true for complementary exports to horizontally integrated affiliates. Ex sales affiliates should therefore be expected to have a high propensity to import finished products.

The other two modes for establishing an affiliate are green-field investment, and takeover of an already existing firm, of which the latter has become more common in recent decades. Analyzing firm-level data, Zejan (1989) confirmed that acquired affiliates have a lower propensity to import from their parents compared to new ventures, but the impact on the composition of intra-firm trade has not been investigated. A green-field affiliate can be organized so as to import both intermediate and finished products from the parent. In contrast, an acquired affiliate brings along another corporate culture and established business relations with local suppliers, etc. Hence, an affiliate established through takeover should have a production apparatus relatively independent of the parent company, accounting for small imports of intermediate goods. However, as discussed in Caves (1982), an important motive for acquiring a domestic firm may be to get access to the affiliate's knowledge about the local market. If the affiliate's distribution network provides the MNE with better opportunities to service the market, a high propensity to import finished products would be expected. This leads us to the following two hypotheses:

**Hypothesis 7:** Ex sales affiliates should primarily become horizontally integrated in production with the parent firm, and are likely to receive complementary supplies from the parent company. Thus, we expect a positive impact on finished goods and the opposite with regard to intermediate products.

**Hypothesis 8:** Affiliates which have been incorporated through takeover should have a relatively lower propensity to import intermediate goods. As access to the affiliate's local distribution network may be an important motive for takeover, we expect an ambiguous influence on imports of finished goods.

### *Host country-specific factors*

Host country-specific factors characterize the recipient economy and how it relates to the home country of the MNE. The category includes production costs, availability of factors

of production, quality of infrastructure, cultural and language barriers, level of current and potential future demand, etc.<sup>9</sup> According to Caves (1971), a high degree of product differentiation and imperfect competition should favor horizontal integration. Moreover, consumers' need for variety and product differentiation has been argued to be greater in high-income economies (Culem and Lundberg, 1986). Thus, the higher the income level in the host country, the higher the propensity of affiliates to import finished products to complement their sales line. More advanced economies should generally have a more developed infrastructure, which would attract specialized production and more imports of intermediate goods as well. However, local supplies of input goods can likewise be expected to be better in such countries, reducing the dependence on supplies of intermediate goods from the parent company. Consequently, we expect an ambiguous effect on affiliates propensity to import intermediate products.

**Hypothesis 9:** The higher the income level in the host country the higher the propensity to import finished goods. With regard to imports of intermediate products, an ambiguous influence is expected.

A large market may favor both vertical and horizontal integration. A greater market enables a firm to meet higher entry costs and exploit economies of scale in local plant production thereby inducing firms to locate highly specialized activities in large markets (Kravis and Lipsey, 1982). This factor should exert a positive impact on the propensity to import intermediate products. Horizontally integrated affiliates, on the other hand, would be able to manufacture a greater proportion of the parent's range of products in a large market, resulting in a smaller need for complementary imports of finished goods. Thus, the level of demand in the host country would, *ceteris paribus*, be associated with smaller imports of finished products from the parent.

**Hypothesis 10:** A large market is expected to exert a positive impact on an affiliate's propensity to import intermediate goods and a negative impact on its propensity to import finished goods.

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<sup>9</sup> In previous work on intra-firm trade by US MNEs, the importance of trade barriers has been emphasized. As Swedish firms' operations abroad are highly concentrated in other developed economies, we have chosen not to include such a variable here.

#### 4. The Tobit Model and Variable Definitions

The following dependent variables are used in three separate estimations: total imports, imports of intermediate products and, imports of finished products by affiliates from parent companies. All are measured in relation to sales of affiliates, and interpreted as propensities. As noted in the previous sections, a large proportion of affiliates does not import anything from the parent company. This means that many observations of the dependent variables will be zero, while the remaining observations are non-negative.<sup>10</sup> This kind of variable is said to be left censored, and a Tobit (censored regression) model has therefore been chosen for the estimations.

The Tobit model, which was first discussed by Tobin (1958) is defined as:

$$\begin{cases} y_i = \beta'x_i + u_i & \text{if } RHS > 0 \\ y_i = 0 & \text{otherwise} \end{cases}$$

where  $y_i$  is the propensity to import,  $x_i$  is a  $k \times 1$  vector of observations of the independent variables,  $\beta$  is a  $k \times 1$  vector of parameters to be estimated, and  $u_i$  are the residuals which are assumed to be independent and normally distributed with zero mean and a common variance.<sup>11</sup> The parameters are estimated by maximizing the log-likelihood function using a ridge-stabilized Newton-Raphson algorithm. The estimates of the standard errors of the parameter estimates are computed from large sample normal approximations using the observed information matrix.

In accordance with the hypotheses, the explanatory variables are divided into firm-specific, affiliate-specific and host country-specific factors. Again, primary attention is paid to differences between effects on imports of intermediate and finished products. The variables are defined below:

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<sup>10</sup> 23 per cent of the observations for the first, 47 per cent for the second and 55 per cent for the third dependent variable are zero.

<sup>11</sup> For a more thorough discussion of the Tobit model, see Maddala (1983).



**Firm-specific variables**

<b>RD;</b>	The parent company's R&D expenditure as a share of its total sales.
<b>MULT;</b>	The degree of multinationality, measured as the ratio of a firm's foreign assets to total assets in book value.
<b>NATION;</b>	Number of countries in which an MNE operates manufacturing activities.
<b>NR;</b>	Dummy variable taking the value 1 if the parent company belongs to the paper and pulp industry or the iron and steel industry, and 0 otherwise.

**Affiliate-specific variables**

<b>FORWARD;</b>	International specialization of production, measured as the ratio of an affiliate's exports, excluding exports back to the parent firm, in relation to its total sales.
<b>BACKWARD;</b>	Backward integration is measured as the proportion of the affiliate's total sales that is exported to the parent.
<b>EXSALES;</b>	This dummy variable takes the value 1 when the affiliate previously has been a sales affiliate, and 0 otherwise.
<b>ACQ;</b>	If the affiliate has been incorporated into the organization through a takeover, the variable takes the value 1, and 0 otherwise. (Both ACQ and EXSALES are thus compared with the case of pure green-field investment).

**Host country-specific variables**

<b>GNPCAP;</b>	The income level in the host country of the affiliate, in logarithmic form.
<b>GNP;</b>	Market size in the host country of the affiliate, in logarithmic form.

In addition to the above mentioned variables, time dummies for 1978, 1986 and 1990 will be included in the estimations to capture possible underlying trends in the propensity to import from the parent. The explanatory variables and their expected signs are summarized in Table 3. As can be seen, there are hypothesized differences regarding intermediate and finished products in each category of explanatory variables.

**Table 3:** *Explanatory variables and expected signs in the hypotheses.*

Hypothesis No	Explanatory Variables	Propensity to Import Intermediate Products	Propensity to Import Finished Products
	<i>Firm-specific variables</i>		
1	RD	+	+
2	MULT	-	-
3	NATION	-	+
4	NR	+	-
	<i>Affiliate-specific variables</i>		
5	FORWARD	+	-
6	BACKWARD	+	+/-
7	EXSALES	-	+
8	ACQ	-	+/-
	<i>Host country-specific variables</i>		
9	GNPCAP	+/-	+
10	GNP	+	-

## 5. Estimations and Results

The estimates are presented in Table 4. All three models produce satisfactory results with high chi-square values.<sup>12</sup> From the correlation matrixes (see appendix) there is no indication of multicollinearity. The results verify that propensities to import intermediate

<sup>12</sup> Concerning the overall explanatory power, we test the hypothesis that all parameters are equal to zero in each of the three regressions, and then use the likelihood ratio test which follows a chi-square distribution.

and finished products are partly differently determined. Seven independent variables have opposite signs in the last two regressions.

Let us first analyze the firm-specific variables. The coefficient of R&D intensity (RD) has the expected positive sign and is significant at the 1% level in all three regressions. This confirms that ownership of intangible assets is a major factor motivating intra-firm trade in both intermediate and finished goods. The degree of multinationality (MULT) exerts a negative effect in all three models, meaning that affiliates in highly multinational firms are less dependent on supplies from the parent company. As previously discussed, there can be several explanations for this. A high degree of multinationality may be associated with trade among affiliates at the expense of trade with the parent company. If a highly multinational firm is horizontally organized, i.e. its affiliates substitute for production in the home country, the relatively lesser weight of the parent accounts for a smaller propensity to import complementary finished products. However, further research is needed to clarify how internationalization affects the organization of firms.

While the results, that far, display expected similarities in the propensity of affiliates to import intermediate and finished products, there are also major dissimilarities. The number of countries in which a firm produces (NATION) has the expected opposite signs in the second and third estimations. The assumption was that production in many countries indicates horizontal expansion, resulting in small imports of intermediate products, but possibly large complementary imports of finished goods. A significant negative effect is noted in the first and second model, while the positive effect in the last regression is not significant at the 10% level, supporting the view that horizontal expansion leads to less trade on the whole but may enhance complementary supplies of finished goods.

The dummy variable for natural resource intensity (NR) affects the two categories of products in opposite ways, but the impact on the propensity to import finished goods is not significant. This observation is in line with the hypothesis that production based on home country-specific resources utilizes economies of scale in the parent firm and favors intra-firm trade in intermediate products and that foreign affiliates of resource intensive parents are mainly vertically integrated. It is worth noting that in the first model, with the overall propensity to import from the parent company as the dependent variable, resource intensity is insignificant.

Table 4: Estimation results of the tobit models

Variables	Total imports from parent	Imports of intermediate products	Imports of finished products
Intercept	-0.064 (0.0655)	0.360* (0.2157)	-1.406*** (0.2495)
RD	0.927*** (0.1220)	1.817*** (0.3959)	1.618*** (0.4299)
MULT	-0.243*** (0.0253)	-0.460*** (0.0847)	-0.511*** (0.0896)
NATION	-0.003*** (0.0008)	-0.009*** (0.0027)	0.004 (0.0028)
NR	0.010 (0.0169)	0.138*** (0.0514)	-0.036 (0.0583)
FORWARD	-0.138*** (0.0229)	0.158*** (0.0583)	-0.277*** (0.0689)
BACKWARD	-0.046 (0.0293)	0.256*** (0.0594)	-0.208*** (0.0757)
EXSALES	0.042*** (0.0145)	-0.034 (0.0478)	0.311*** (0.0450)
ACQ	-0.102*** (0.0117)	-0.228*** (0.0373)	-0.258*** (0.0405)
GNPCAP	0.040*** (0.0073)	-0.037 (0.0244)	0.176*** (0.0275)
GNP	-0.008* (0.0043)	0.033** (0.0140)	-0.029* (0.0149)
T <sub>1</sub>	-0.004 (0.0144)	-0.015 (0.0456)	-0.078 (0.0495)
T <sub>2</sub>	-0.004 (0.0144)	-0.015 (0.0457)	-0.081 (0.0497)
T <sub>3</sub>	-0.010 (0.0153)	-0.090* (0.0497)	-0.110** (0.0532)
Observations:	1721	1577	1577
Noncensored values:	1325	840	712
Left censored values:	396	737	865
Chi-square value:	407.70	200.40	250.00
Prob. > Chi-square:	0.0001	0.0001	0.0001

Standard errors in parenthesis. The asterisks, \*\*\*, \*\* and \*, indicate significance on 1, 5 and 10 per cent level respectively.

Among the affiliate-specific factors, FORWARD, BACKWARD and EXSALES exert opposite effects in the two last models. An affiliate's export ratio was used as a proxy for international specialization of production. The hypotheses are supported by the results as FORWARD exerts a positive impact on the propensity to import intermediate goods and a negative impact with regard to finished goods. In the first regression, the overall propensity to import is reduced by the variable. The coefficients are significant at the 1% level in all regressions.

A high degree backward integration (BACKWARD) affects imports of finished goods from the parent company in a negative way. This confirms the view that such affiliates are unlikely to emphasize the local market. There is a significantly positive effect in the case of imports of intermediate products which indicates that affiliates which supply the parent company with input goods tend not to be situated at the beginning of the value-added chain, but are rather both forward as well as backward integrated with the parent. There is no significant effect on the overall propensity to import.

EXSALES exerts a positive effect on the propensity to import finished products. No significant effect is found with regard to intermediate goods, but the sign is negative. One interpretation would be that ex sales affiliates mainly become horizontally integrated with the parent firm when establishing manufacturing operations of their own, while retaining the role as a sales outlet. A negative impact is noted for ACQ in all three regressions, implying that affiliates incorporated into the firm through a takeover have a generally lower propensity to import both intermediate and finished products from the parent company. Thus, compared with new ventures, ex sales affiliates have a relatively higher propensity to import finished products, while acquired subsidiaries have a relatively lower propensity to import both categories of goods.

Concerning the host country-specific factors, the coefficients in the second and third model have opposite signs. The income level of the host country (GNPCAP) exerts a positive impact in the first regression, while the effect on the propensity to import intermediate is not significant at the 10% level. As expected, a high income level in the host economy is associated with more imports of goods for resale without further processing. A possible explanation is that the need for product differentiation is higher in more advanced countries, as suggested by Culem and Lundberg (1986) and Zejan (1989).

The size of the host country market (GNP) has a positive effect on the propensity to import intermediate goods. The coefficient is significant on the 5% level, indicating

that affiliates located in large markets are more inclined to purchase intermediate goods from the parent company. A negative effect, significant at the 10% level, is observed on imports of finished products. One reason for this could be that manufacturing affiliates on a large market produce a greater proportion of their sales.

Finally, the time dummies for 1978 and 1986 are insignificant in the three estimations. However, on average, observations for 1990 are associated with relatively small propensities to import finished as well as intermediate products. The effect is most significant in the case of finished goods, which is in line with our observations in section 2. Still, when  $T_3$  is regressed on the overall propensity to import from the parent, no significant effect is found.

## 6. Concluding remarks

A growing share of world trade takes place within MNEs, which now expand primarily through acquisition of already existing firms. Using data on Swedish MNEs in manufacturing from 1974 to 1990, this paper has presented the first empirical analysis of intra-firm trade decomposed into intermediate and finished products. A Tobit model was applied since many affiliates, especially those acquired through takeover, have zero imports from the parent company.

A decomposition of internal trade flows in terms of intermediate and finished products is indeed shown to be relevant. Since a substantial part of all intra-firm exports from parent companies to producing affiliates is made up of goods for resale without further processing, it is misleading to treat all intra-firm trade as provisions of intermediate goods in a general sense. Moreover, several characteristics of firms, affiliates and host countries affect the two categories in different ways.

The results support the perspective that vertical integration is associated with intra-firm trade in intermediate products, and that horizontal expansion leads to less trade on the whole but may enhance complementary supplies of finished goods. The affiliates' propensities to import both types of goods are increasing in the research intensity of the parent company, and decreasing in the degree of multinationality of the MNE as well as by takeover as entry mode. A high concentration of foreign operations in a small number of countries, and a high resource dependence in the parent company favor internal supply of intermediate goods but have no significant effects on the

propensity of affiliates to import finished products. A high export-ratio to 'third countries' and exports back to the parent stimulate imports of intermediate goods, while the same factors diminish the propensity to import finished goods. A high GNP per capita increases the propensity to import finished products, which also applies to former sales subsidiaries.

It should be noted that this study has been concerned only with Swedish multinationals. Like MNEs based in other countries, however, Swedish firms have increasingly switched from green-field investment to takeovers in recent years, focused mainly on industrialized countries and expanded trade within their organizations. It may consequently be expected that the results regarding what determines the different categories of intra-firm trade can be generalized as well. Still, there are many interesting factors which remain to be studied, including, e.g., R&D activities in affiliates, the importance of trade policies, market competition, and product-specific factors. In addition, home country characteristics may also come into play, resulting in different patterns for multinationals which originate in countries with larger home markets, or other industrial structures, than Sweden. Finally, the present paper has only investigated intra-firm imports from parent companies. Further research is needed to analyze the composition and determinants of intra-firm trade between affiliates, in order to improve our understanding of how the expansion of multinational firms affects the nature and features of international trade.

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## Appendix

### Variable definitions:

$Y_1$  ; Propensity to import from parent company  
 $Y_2$  ; Propensity to import intermediate goods from parent company  
 $Y_3$  ; Propensity to import finished goods from parent company  
 $X_1$  ; RD  
 $X_2$  ; MULT  
 $X_3$  ; NATION  
 $X_4$  ; NR  
 $X_5$  ; FORWARD  
 $X_6$  ; BACKWARD  
 $X_7$  ; EXSALES  
 $X_8$  ; ACQ  
 $X_9$  ; GNPCAP  
 $X_{10}$  ; GNP

### Correlation matrix I. Dependent variable: Propensity to import from parent company.

$X_1$	0.113									
$X_2$	-0.186	0.202								
$X_3$	-0.218	0.215	0.493							
$X_4$	0.074	-0.215	-0.334	-0.171						
$X_5$	-0.167	-0.048	0.068	0.024	-0.041					
$X_6$	0.023	-0.068	-0.114	-0.191	-0.056	-0.017				
$X_7$	0.189	0.102	-0.059	-0.030	-0.113	-0.120	-0.083			
$X_8$	-0.222	-0.091	-0.032	0.063	0.129	-0.138	-0.022	-0.443		
$X_9$	0.064	-0.094	-0.069	-0.141	0.051	0.199	0.022	-0.112	0.242	
$X_{10}$	0.017	0.045	0.049	-0.030	0.001	-0.020	-0.251	-0.019	0.111	0.461
$Y_1$		$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$	$X_8$	$X_9$

### Correlation matrix II. Dependent variable: Propensity to import intermediate products from parent company.

$X_1$	-0.007									
$X_2$	-0.208	0.213								
$X_3$	-0.184	0.215	0.542							
$X_4$	0.073	-0.223	-0.340	-0.154						
$X_5$	0.055	-0.027	0.013	-0.033	-0.034					
$X_6$	0.145	-0.081	-0.131	-0.186	-0.056	-0.045				
$X_7$	0.003	0.121	-0.068	-0.051	-0.101	-0.097	-0.060			
$X_8$	-0.087	-0.112	-0.040	0.058	0.132	0.073	-0.052	-0.411		
$X_9$	-0.009	-0.093	-0.070	-0.133	0.047	0.176	0.012	-0.071	0.242	
$X_{10}$	-0.031	0.050	0.047	-0.018	-0.001	-0.030	-0.242	0.013	0.108	0.463
$Y_2$		$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$	$X_8$	$X_9$

**Correlation matrix III. Dependent variable: Propensity to import finished products from parent company.**

X <sub>1</sub>	0.044									
X <sub>2</sub>	-0.173	0.213								
X <sub>3</sub>	-0.083	0.216	0.544							
X <sub>4</sub>	0.060	-0.224	-0.339	-0.153						
X <sub>5</sub>	-0.081	-0.027	0.013	-0.033	-0.034					
X <sub>6</sub>	-0.021	-0.081	-0.131	-0.186	-0.056	-0.045				
X <sub>7</sub>	0.220	0.119	-0.073	-0.054	-0.102	-0.098	-0.060			
X <sub>8</sub>	-0.081	-0.111	0.013	0.058	0.133	0.073	-0.051	-0.412		
X <sub>9</sub>	0.072	-0.093	-0.072	-0.136	0.047	0.175	0.012	-0.068	0.240	
X <sub>10</sub>	0.022	0.049	0.044	-0.021	-0.002	-0.030	-0.242	0.019	0.105	0.465
Y <sub>1</sub>	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>	X <sub>9</sub>	

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