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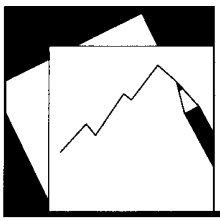

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Globalization Drives Strategic Product Switching

Marialuz Moreno Badia,
Veerle Slootmaekers, and Ilke Van Beveren

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Globalization Drives Strategic Product Switching

Prepared by Marialuz Moreno Badia, Veerle Slootmaekers, and Ilke Van Beveren[1]

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Abstract

Using firm-level data for Estonia for the years 1997-2005, we analyze the impact of international competition on firm dynamics, considering both firm closedown and product switching. We contribute to the literature in two important ways: (1) this is the first paper to study the determinants of exit and product switching in an emerging market; and (2) we consider explicitly the role of export opportunities. Our results indicate that globalization does not affect firm exit significantly but it is an important factor explaining product switching. Previous studies on industrial countries have shown that product switching has been a defensive strategy against low-cost imports. In contrast, our results suggest that Estonian firms have switched products as an offensive strategy to take advantage of the export opportunities created by trade liberalization.

JEL Classification Numbers: D21, D24, F18, L25, L60

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Authors' E-Mail Address: mmorenobadia@imf.org, veerle.slootmaekers@oecd.org, ilke.vanbeveren@lessius.eu

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I. INTRODUCTION

Globalization has led to increasingly integrated markets across the world, changing the competitive environment in which firms operate. In the face of international competition in domestic and foreign markets, the least productive firms may be forced into bankruptcy while the most productive ones will take advantage of new business opportunities in foreign markets. Moreover, incumbent firms may respond by increasing their productivity or, since this may prove difficult in mature industries, by diversifying into a different industry or product variety. The importance of firm shutdown and changes in the product mix as a response to pressures from international trade has been highlighted in recent empirical studies (see, for example, Bernard, Jensen, and Schott, 2006; and Greenaway, Gullstrand and Kneller, 2008). However, this literature has focused on only one aspect of trade—import competition—ignoring firm dynamics induced by profitable opportunities in export markets. This second aspect is potentially very important for emerging markets, particularly in the aftermath of trade liberalization.

The purpose of this paper is to analyze the impact of international trade on firm dynamics, focusing on how production patterns are adjusted in response to import competition and changing conditions in export markets. Our focus is Estonian manufacturing firms from 1997 to 2005. Estonia is a particularly interesting case because of the firm restructuring and trade liberalization that took place in the aftermath of the transition process and in the run-up to European Union (EU) membership. Buoyed partly by the Association Agreement with the EU, Estonian exports of goods increased by 240 percent.[2] This extraordinary performance was accompanied by an increase in product variety (Kandogan, 2006) and a shift toward exports of higher quality and technological intensity (Fabrizio, Igan, and Mody, 2007). This seems to suggest that Estonian firms may not have merely responded defensively to increased competition from importers, but also reacted offensively by taking advantage of the opportunities created by trade liberalization.

To identify these effects, we use a longitudinal data set of Estonian manufacturing firms and consider three potential firm strategies: continue its business, switch products, or close down. To model these strategic alternatives, we estimate a multinomial logit model in which the firm decision is a function of firm-level and product-market characteristics. Following the previous literature, we include the value of imports, type of trade (intra- or interindustry), and revealed comparative advantage as measures of trade. To identify the effect of export opportunities, we also include in our estimation the value of exports, the degree of competition in export markets, and the quality of exports relative to direct competitors.

[2] The Association Agreement with the EU was signed in 1995 and entered into force in 1998. The agreement replaced previous treaties with the EU (an Agreement on Trade and Commercial Cooperation, signed in 1992, which was converted into a Free Trade Agreement in 1994). For a more detailed description, see Weber and Taube (1999).

Overall, we find that firm exit is mainly determined by firm characteristics, whereas product switching also depends on conditions in export markets. In particular, firms are more likely to switch if they are in sectors without revealed comparative advantage, with less exports, or with lower product quality relative to export competitors. One interpretation of this result is that firms are more willing to incur the sunk costs of breaking into a new product line or industry when the long-term prospects of the current export market for their products are weak, particularly early in the sample when trade flows were increasing rapidly. These results are in contrast with previous studies on industrial countries that find that firms switch products as a defense against low-cost imports. Interestingly, we find that the conditions on export markets matter predominantly for switches within the same industry or what we call *product* switches.[3] Switches across industries on the other hand are determined by firm-level characteristics. These results suggest that product diversification was a major strategy of Estonian firms faced with increasing trade openness. Finally, we find a positive link between a firm's capital intensity and quality upgrading. However, moving up the quality ladder is not necessarily related to technology upgrading; it occurs mainly within the medium-high-tech sector.

The literature on the relationship between globalization and firm dynamics has expanded rapidly in recent years (see, for example, Melitz, 2003; Bernard, Eaton, Jensen and Kortum, 2003; and Helpman, Melitz and Yeaple, 2004). This literature builds on Melitz's (2003) dynamic industry model with heterogeneous firms, where sunk costs of market entry result in self-selection into export markets. More recent theoretical work models how these dynamics interact with a country's industry characteristics (Bernard, Redding, and Schott, 2007; and Melitz and Ottaviano, 2008). Rigorous empirical work, triggered by the work of Bernard and Jensen (1995), has further nourished the understanding of firm adjustment to trade liberalization and falling trade costs.[4] In short, these studies document substantial variation in productivity across firms, frequent firm entries and exits, sizeable sunk costs of entry into export markets, and better performance among exporting firms.

Our paper is more closely related in spirit to the work of Bernard, Jensen, and Schott (2006) and Greenaway, Gullstrand, and Kneller (2008).[5] These papers reveal a new dimension of adjustment to increased international competition by illustrating that firms are more likely to

[3] Product switches are defined as changes in industry at the four-digit level henceforth. Although four-digit NACE codes are not true products in the strictest sense of the word, this is the most detailed classification we have in our data. This notation has also been used in Bernard, Jensen, and Schott (2006) and Greenaway, Gullstrand, and Kneller (2008).

[4] For an overview of the empirical literature, see Tybout (2003) and Bernard, Jensen, Redding and Schott (2007).

[5] These papers build on the work of Bartelsman and Doms (2000), Foster, Haltiwanger, and Krizan (2006), and Bernard and Jensen (2007).

change their product mix than to shut down in response to globalization. Controlling for a number of firm and industry characteristics, they find that firms are more likely to switch away from industries where exposure to low-wage countries is high. Bernard, Jensen, and Schott (2006) note that U.S. firms shift towards industries facing less competitive pressure, but with greater capital and skill intensity than the industry of origin. Greenaway, Gullstrand, and Kneller (2008) broaden the analysis, and consider mergers and acquisitions as a third exit strategy. They report that closure is the least likely exit strategy in Sweden, as most firms merge with or acquire another firm in response to higher levels of international competition. A primary contribution of our paper relative to these studies is that we consider explicitly the role of export opportunities in determining firm dynamics. Also, ours is the first paper to examine the impact of globalization on firm dynamics in an emerging market context.[6] Since countries at different stages of development exhibit large differences in terms of firm size distribution, efficiency, and cost structure it is important to explore whether enterprises in emerging markets respond differently to globalization than enterprises in more advanced countries.

The remainder of this paper is organized as follows. Section II describes the industry dynamics in Estonia. Section III outlines the estimation strategy used to analyze the impact of international trade on firm dynamics in Estonia. Section IV presents the results. Section V discusses the robustness checks. Section VI concludes.

II. INDUSTRY DYNAMICS IN ESTONIA

The data used in this paper are provided by the Estonian Business Registry and cover the years 1997-2005. The data set is an unbalanced panel containing detailed information on balance sheets and income statements of all registered firms in Estonia. The unit of observation is the firm, which can be tracked over time using a unique registration code.[7] As all business entities in Estonia are required to file their annual accounts with the registry, the data set comprises firms from all size classes, including microenterprises with less than 10 employees.

Our primary interest lies in identifying the impact of international competition on firms' strategic choices. Therefore, we focus on the sector for which we observe trade flows at a disaggregated level, namely, the manufacturing sector. Nonetheless, since companies active in sectors other than manufacturing are equally obliged to report to the registry, we are able to identify not only industry switches within the manufacturing sector, but also switches to

[6] Goldberg, Khandelwal, Pavcnik and Topolova (2008) analyze the response of Indian firms to trade liberalization but they focus on product margins rather than looking into the firm dynamics per se.

[7] For a detailed description of the data, see Appendix I. More information on the Estonian Business Registry can be found in Masso, Eamets, and Philips (2004).

other sectors of the economy.[8] The sample used in the empirical analysis consists of 4,844 firms and 16,117 observations (see Table 1). Entry and exit are observed, and the number of manufacturing entities in the registry increased significantly over the sample period, from 1,196 firms in 1997 to 2,767 firms in 2004.[9] For each firm we observe its primary sector of activity at the four-digit NACE (General Industrial Classification of Economic Activities within the European Community) level.[10] Unfortunately we do not have information on the total number of different products per firm, but we do observe changes in its main product line over time.

Firm exit ($Exit_{it+1}$) is identified using the firm's official liquidation date, available from the registry. In addition to exit, we are interested in industry switches at both the two-digit ($Switch_{2d,it+1}$) and four-digit ($Switch_{4d,it+1}$) NACE level. For the remainder of the paper, we refer to two-digit switches as *industry* switches and to four-digit switches as *product* switches. Whereas Bernard, Jensen, and Schott (2006) study switches at the product level, Greenaway, Gullstrand, and Kneller (2008) study switches at the industry level because they want to focus on big changes in production and to minimize the possibility of classification problems. Nevertheless, the latter analyze the product switches as a robustness check and report substantial differences in the determinants of both types of switching. In our analysis, we focus on the product-level switches, but we also discuss the differences with the industry switches.

Table 1 reports the distribution of the sample over time. Out of 4,844 firms, 452 firms exited between 1997 and 2004, and 1,566 firms switched products. Of the latter group, 1,090 changed to a different industry and 476 firms only switched products within the same industry. Industry and product switches were more frequent at the end of the 1990s, but the rates declined steadily toward the end of the sample period. On average, the industry switching rate is 7.7 percent, compared with a switching rate of 11.9 percent at the product level. The product switching rate is only slightly higher than the figures reported by Bernard, Jensen, and Schott (2006) and Greenaway, Gullstrand, and Kneller (2008), who find a product switching rate of 7-8 percent for the U.S. and Sweden, respectively.

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[8] Firms switching to other sectors of the economy are retained until their last year of activity within the manufacturing sector.

[9] Since we cannot observe switching for 2005 (no data for 2006 are available), this year is omitted from the analysis.

[10] The classification used by the Registry is the EMTAK Classification of Economic Activities of Estonia. EMTAK is a five-digit extension of the four-digit European NACE classification system, the official statistical classification system of economic activities in the European Community. The first four digits of the EMTAK codes are therefore equivalent to the NACE (Rev. 1.1.) codes. The NACE classification system can be downloaded from the Eurostat Ramon server (http://europa.eu.int/comm/eurostat/ramon/).

Tables 2, 3, and 4 give a preliminary indication that there are broad differences in firm dynamics across sectors. First, it is clear from Table 2 that sectors facing a high number of exits also tend to undergo more industry changes. This is, however, related to the size of the sectors, and switching and exit rates are not necessarily correlated. For example, the switching rates of "basic metals," "office machinery and computers," and "coke, petroleum products" are very high but the exit rates in these sectors are zero. Rather than permanently exiting the market, companies in those sectors seem to look for other opportunities by switching to a different industry. Second, about 35 percent of all product switches occur within the same two-digit sector; 23 percent to other two-digit manufacturing sectors; 4 percent to the primary sector; and 38 percent to services (Table 3).[11] Third, the majority of firms in our sample are active in low-tech manufacturing (65 percent) and most of the product switches take place among firms in this group (Table 4).[12] However, product switches from medium-high-tech and medium-low-tech industries account for 13.9 percent and 23.6 percent of switches, respectively, which is more than the proportion of observations in these groups (10 percent and 20 percent, respectively). Meanwhile, about three-fourths of the total number of bankruptcies take place in low-tech manufacturing sectors. Within the manufacturing sector, firms switch mostly to products with similar technology content. This is especially the case for the medium-low-tech to low-tech firms, where half of all firms switch to other sectors in the same technology class. Table 4 also shows that a significant proportion of manufacturing firms are moving into the less-knowledge-intensive services sector, independently of the technology intensity of the origin industry.

III. Determinants of Firm Dynamics

At the end of each observed period, a firm decides whether to continue its activities in the same product line or to exit. It can exit from a particular product line and enter a new product line or even a new industry in the next year, or it can exit altogether (i.e., "die"), in which case the firm drops permanently out of the sample. To model these strategic alternatives, we estimate a multinomial logit model, as follows (Greene, 2008, p. 844):

$$\Pr\left(Y_{it+1} = j \middle| \overline{X}_t\right) = \exp\left(\beta_j' X_{it}\right) \Big/ \left(1 + \sum_{k=1}^{2} \exp\left(\beta_k' X_{it}\right)\right), \qquad (1)$$

where j equals 0 for continuing firms, 1 for firms that switch products (industries), and 2 for

[11] The 'primary' sector comprises NACE 1-14 (agriculture and mining activities); manufacturing sector or 'secondary' sector comprises NACE 15-37; and services or the 'tertiary' sector comprises NACE 40-99. Most firms that switch to services end up in industries like "wholesale trade" and "retail trade". We explore further the nature of these switches in Section IV.

[12] Using the Eurostat classification, which is available at (http://europa.eu.int/comm/eurostat/) in the section "Science and Technology", we classify the manufacturing sectors according to technology intensity and services according to knowledge intensity. Appendix III provides a list of NACE (Rev. 1.1) codes assigned to each particular technology class.

closing enterprises. The vector of covariates (X_{it}) contains a number of 1-year lagged firm- and product-level variables, in addition to a constant, year dummies, and two-digit industry dummies:

Firm level: $\{\ln(Size)_{it}, \ln(Age)_{it}, \ln(Capital)_{it}, \ln(Wage)_{it}, \ln(TFP)_{it}, Foreign_{it}\}$

Domestic market: $\{Sunk_{jt}, Herf_{jt}\}$

International market: $\{\ln(Imports)_{jt}, IIT_{jt}, CA_{jt}, \ln(Exports)_{jt}, Herfex_{jt}, \ln(UVR)_{jt}\}$.

Subscript *i* refers to firms, *j* to products and *t* to time. All product-level variables are defined at the four-digit NACE level. For the complete definitions of these variables, we refer to Appendix II.

Whereas the determinants of firm and plant "death" have been an active area of empirical and theoretical research, the literature on product switching is still in its infancy. Our motivation for deciding which variables to include in the multinomial logit model is therefore grounded in the relevant literature and complemented by the salient facts emerging from the summary statistics presented in Table 5. Our goals are (1) to identify groups of variables—firm and product level—that may matter for the exit/switching decision; and (2) to check whether they differ according to the exit strategy.

A. Firm Characteristics

A common feature of the theoretical models on heterogeneous firms is the negative relation between failure rates and a firm's age and size (Jovanovic, 1982; Hopenhayn, 1992; and Ericson and Pakes, 1995). This selection effect is driven by the interaction of economies of scale and an idiosyncratic learning process, and is confirmed by a large empirical literature.[13] To capture this scale effect, we include a firm-size variable—measured by employment in year *t* ($Size_{it}$). Additionally, Dunne, Klimek, and Roberts (2005) demonstrate that a firm's past experience positively affects its survival rate. We control for this experience effect by including the age of the firm (Age_{it}), which is calculated as the number of years since its official registration date. A priori, we expect exit to be negatively related to size and age. However, the effect of these variables on product switching is ambiguous: small and young firms have greater flexibility to switch but larger and older firms have more experience and

[13] The existence of economies of scale implies, on the one hand, sunk costs for larger firms, which discourage or delay exit, and, on the other hand, strong cost disadvantages for smaller companies. Moreover, larger firms are in general more diversified, which makes them less vulnerable to negative productivity shocks. See Caves (1998) for an overview of the empirical literature on firm turnover.

resources to switch.[14]

A further implication of the theoretical models on firm dynamics is the link between the productivity of a firm and its survival. Upon entering the market, firms pay a sunk cost of entry, after which they discover their true productivity. If firm productivity is below the zero profitability cutoff, the firm will immediately exit the market. Hence, from these models, a negative relationship between firm-level productivity and exit is predicted, a finding which is confirmed by the empirical literature. Fariñas and Ruano (2005) explore the relationships among entry, exit, and firm-level productivity for a sample of Spanish manufacturing firms. They find that entry and exit decisions by firms are systematically related to productivity differences and that the productivity distribution of exiting firms is stochastically dominated by that of continuing firms. We therefore expect firm productivity to be negatively related to firm death.

Switching products could be seen as a form of exit, where unproductive companies that cannot face competition turn to a market with a lower degree of competition. Yet, entering a new industry or product market implies that a firm has to incur additional adjustment costs, related to the production of a new good. If these sunk costs of entry in a new product market are substantial, the same reasoning as above applies, that is, only the more productive firms will be able to enter this product market and start production. We therefore expect firm-level productivity to be negatively or positively related to product switching —depending on the importance of product market entry barriers. Productivity is defined as total factor productivity (TFP_{it}). We estimate TFP at the two-digit industry level, while allowing firms to switch industries over time, and apply the methodology of Levinsohn and Petrin (2003) to account for selectivity and simultaneity.[15]

The labor cost variable ($Wage_{it}$) is defined as total real labor costs per employee at the firm level. The expected effect of this variable on firm dynamics is ambiguous. To the extent that higher labor costs reflect higher skill intensities and associated sunk costs at the firm level (related to investments in firm-specific human capital), higher wages can, ceteris paribus, act as a barrier to exit from a particular product market. Audretsch and Mahmood (1995) find a negative relationship between wages and the propensity to exit in a study on the performance of 12,000 U.S. manufacturing plants. However, it is not clear whether this relationship will continue to hold when productivity at the firm level is taken into account. If firms pay higher wages for a given level of productivity, this could signal lower competitiveness and, hence, increase their exit probability, ceteris paribus (Konings, 2005).

[14] In fact, Greenaway, Gullstrand, and Kneller (2008) do not find significant effects of age and size on industry switching. Bernard, Jensen and Schott (2006), on the other hand, find a positive coefficient for size and a negative coefficient for age (both significant).

Capital intensity ($Capital_{it}$) is defined as total fixed assets per employee. Firms with higher capital intensity are expected to face higher sunk costs, which will act as an exit barrier both at the product and firm level. Firms with larger capital stock can also expect larger future returns for a given level of current productivity and, hence, will continue operating at lower productivity levels (Olley and Pakes, 1996). Therefore, we expect capital intensity to be negatively related to firm exit. In the case of product switching, the overall effect is less clear-cut. Even though capital intensity can be interpreted as a form of sunk cost, an opposite force may be at work. Instead of being passive or defensive when faced with increasing competitive pressures, a firm can actively look for the new opportunities offered by globalization. The production of these new goods requires additional investment to enter the new product market, which can be more easily incurred by capital-intensive firms that liquidate or transfer their assets into the new sector. Hence, the sign of the capital intensity variable for product switching is ambiguous.

Several empirical studies have provided evidence that foreign multinational enterprises are more footloose than domestic firms, that is, they are more likely to exit the market than domestic firms of comparable size, productivity, and wages (Görg and Strobl, 2003; Bernard and Sjöholm, 2003; and Van Beveren, 2007). However, foreign multinationals typically lack in-depth knowledge of the host market and need to overcome substantial disadvantages when entering foreign markets, causing them to incur higher sunk costs and hence reducing their exit probabilities. Moreover, since they usually have more diversified sources of income, they can withstand larger shocks before being forced to exit the market. Hence, the effect of foreign ownership ($Foreign_{it}$) on exit is ambiguous. Nevertheless, since multinationals are, by their very nature, more flexible than purely domestic firms, they can respond more quickly to adverse shocks in the host country and reinvent themselves through product switches. Hence, we expect to find a positive relationship between foreign ownership and product switching.

B. Product Market Characteristics: Domestic Market

Besides firm structure, the characteristics of the product market in which a firm operates also affect its evolution. While international competition may exert a strong influence on firm dynamics, conditions in the domestic market can also play an important role. This is especially true in a country with a history of a planned economic system, and where the domestic market may still be undergoing substantial changes as state monopolies are broken up and a new private sector emerges. Hence, in our empirical model on exit strategies, we incorporate the product market characteristics of both the home and foreign markets in which Estonian firms are active.

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[15] For a detailed description of the methodology employed to estimate TFP using the current data set, we refer to Moreno Badia and Slootmaekers (2008).

Hopenhayn (1992) illustrates how an increase in sunk entry costs lowers the entry rate and, hence, also the probability of exit since incumbent firms face less competition through new entry. Intuitively, the argument is as follows. High initial investment costs to enter a product market will act as a natural deterrent to entry, since only the most promising firms will be able to start production. A lower entry rate implies less competition for incumbent producers and will induce fewer firms to exit. In addition, the high initial investment cost will act as an exit barrier, forcing inefficient firms to stay in the market to recover at least some of the initial sunk cost. We define sunk costs ($Sunk_{jt}$) as the natural logarithm of the median of real sales in each particular four-digit industry j at time t.[16] We expect to find a negative relationship between sunk costs at the product level and both types of exit in our empirical analysis, since higher sunk costs are associated with both higher entry and exit barriers at the product level.

A central prediction of the stochastic dynamic model in Asplund and Nocke (2006) is that the level of firm turnover is positively related to the size of the domestic market. The smaller average markup in larger markets, resulting from tougher competition, implies that the marginal surviving firm has to be more efficient in larger than in smaller markets. To capture this competition effect, we include the Herfindahl-Hirschman index for the domestic market ($Herf_{jt}$). It is defined as the sum of the squares of the market shares of each individual firm. As such, it ranges from 0 to 1 as it moves from a very large amount of very small firms to a single monopolistic producer.

As noted by Görg and Strobl (2003), the impact of industry concentration on firm turnover is ambiguous. On the one hand, higher concentration is associated with wider price-cost margins, which will increase the survival chances of firms. However, behavior by aggressive rivals in a concentrated market can actually raise exit probabilities. Görg and Strobl (2003) in fact find a positive relationship between industry concentration and exit, using data on the Irish manufacturing sector between 1973 and 1996. Hence, the impact of concentration on firm exit (whether through firm death or product switching) can be negative or positive, depending on the behavior of the firm's rivals in the domestic market.

C. Product Market Characteristics: International Competition

Increased international trade implies higher competitive pressure in the domestic market. This pressure may force firms to improve their efficiency or to switch to products in which they have a comparative advantage. However, greater economic openness also creates new business opportunities in foreign markets. With improved access to the international markets, firms can raise their sales and expand their production capacity to benefit from economies of scale, or explore new product markets with better prospects. To analyze the impact of

[16] This measure is known in the literature as the minimum efficiency scale (MES). We prefer the MES based on sales to a MES based on median employment in the sector, since the latter is not able to capture the fixed costs of capital-intensive industries adequately.

increasing globalization, we include a number of variables capturing various aspects of international trade.

In theory, the impact of trade on exit could be driven by two aspects: import competition, through smaller markups (Melitz and Ottaviano, 2008), and export intensity (Melitz, 2003). The empirical literature so far has mainly focused on the first aspect, import competition, which is associated with higher exit and switching rates (Bernard, Jensen, and Schott, 2006; Coucke and Sleuwaegen, 2007; and Greenaway, Gullstrand, and Kneller, 2008). A recent study by Colantone and Sleuwaegen (2007) draws attention to the significance of the second aspect of international competition: export intensity. In this case, the most successful firms self-select into the export market and continue to grow by capturing new market opportunities abroad. This raises the average efficiency level and increases the pressure on factor prices in the home market, thereby crowding out the least efficient firms. At the same time, firms in sectors with promising exporting markets will be less likely to switch sectors. To capture both aspects of increasing international competition, we include imports ($Imports_{jt}$) and exports ($Exports_{jt}$), both defined at the four-digit product level, in our empirical model.[17] We expect imports to have a positive effect on exit and product switching. Exports, however, are expected to have a positive effect on exit but a negative one on product switching.

Rising intra-industry trade due to falling trade costs raises the number of products supplied in a market. This, in turn, raises competition and cuts into firms' markups. Only the more productive firms survive this pressure, while others are forced out of business. To capture this effect, we include the Grubel-Lloyd intra-industry trade index (IIT_{jt}) in our empirical model, defined as $1-\left\{\left|X_{jt}-M_{jt}\right|/\left(X_{jt}+M_{jt}\right)\right\}$. The effect of IIT on exit and switching is however ambiguous since this index captures both the effect of import competition and export opportunities.

In product markets where Estonia has a revealed comparative advantage and, therefore, good export opportunities, we expect fewer exits irrespective of its form (either firm closedown or product switch). The comparative advantage dummy (CA_{jt}) takes the value of one if exports are larger than imports for a given four-digit product.

Finally, we want to check how firms' strategies are related to changes in the quality embedded in Estonian exports. A substantial amount of theoretical work predicts that quality systematically affects the direction of international trade, a finding that is confirmed by some

[17] Ideally, we would have preferred to weight imports and exports at the product level by domestic production and include measures of import penetration and export intensity in the empirical model. However, no reliable data exist on domestic production by sector (either at the two-digit industry or four-digit product level) for Estonia. Hence, we include the value of imports and exports in our empirical model.

recent empirical papers (e.g., Hallak, 2006).[18] As a measure of product quality, we use a composite index of the unit value of Estonia's exports in a given geographic market relative to the unit value of all exporters in that market *(UVR_{jt})*. On the premise that a higher relative price reflects higher quality than direct competitors', UVR_{jt} acts as a proxy for product quality (Hallak and Schott, 2008). However, concerns remain that this measure could be picking up factors other than quality. This is especially the case if local monopolies exist and competition does not arbitrage away differences in quality-adjusted prices. To control for this effect of markups on the unit value of exports, we include the Herfindahl-Hirschman index of the export market ($Herfex_{jt}$). This measure of competitiveness is a composite index of the weighted sum of the Herfindahl-Hirschman indices for each of the relevant geographical export markets.

Table 5 gives a first indication of the differences in characteristics across the exit strategies by summarizing a number of firm- and product-level characteristics for three groups separately: (1) all firms in the sample; (2) firms undergoing either an industry switch (two-digit) or product switch (four-digit); and (3) exiting firms.

Compared with continuing firms, enterprises that exit or switch industries are significantly smaller and younger. Firms that switch industries are on average more capital intensive than continuing firms, while both exiting firms and product switching firms have a significantly lower labor cost and productivity. Turning to product characteristics, we find that industry switchers tend to be active in industries with a higher level of sunk costs, while the opposite is true for exiting firms. Switchers also tend to come from sectors with significantly higher market power, as indicated by the Herfindahl-Hirschman index for the domestic market. Sectors characterized by higher imports, less intra-industry trade and lower exports display a higher rate of industry and product switching than other sectors. Prior to switching, these firms tend to be in sectors with relatively lower revealed comparative advantage. Enterprises that permanently exit the market, however, are active in sectors with lower imports and higher exports. They also tend to be more present in industries with revealed comparative advantage than do continuing firms.

IV. RESULTS

A. Baseline Results

In this section we report the results from a multinomial logit regression in which we analyze the determinants of three alternative strategies at the firm level: (1) stay active in the same product market (the baseline category); (2) change its main product line or (3) exit entirely from the market. Table 6 reports the coefficients and standard errors as well as the marginal

[18] For a theoretical background of trade and quality, see, among others, Falvey and Kierzkowski, (1987), Flam and Helpman (1987), Stokey (1991), and Murphy and Shleifer (1997). Empirical papers on this topic include Schott (2004), Hummels and Klenow (2005), and Hallak and Schott (2008).

effects of the variables on the probability of exit (whether in the form of a product switch or a true exit). These marginal effects are calculated at the mean of the independent variables, to provide some guidance on the magnitude of the effect (reported in italics in the tables). We pool the observations across years for all firms in the sample, and we include year and two-digit industry fixed effects to control for aggregate variation in industry dynamics. Standard errors are clustered at the firm level.

The results on the firm characteristics confirm our priors on firm dynamics as discussed in Section III. Controlling for size at the firm level, exiting firms are on average younger, less productive and have lower capital intensity.[19] These results suggest that the performance of these firms is not good enough to keep up with the dynamics in the market. The probability of product switching, on the other hand, is significantly decreasing with plant size and age, while significantly increasing with firm productivity and capital intensity. In other words, smaller and younger firms are more likely to change their main product line than their older and larger counterparts. Moreover, only the more productive and capital-intensive firms switch to different product markets. This is a first indication that switches are not necessarily driven by a lack of competitiveness but are rather the outcome of firms' own choices.

Controlling for the other firm-level characteristics discussed above, foreign ownership of the firm has no significant impact on either product switching behavior or exit. A possible explanation for this can be found in the motives of foreign firms to invest in central and eastern European countries. Although cost advantage plays a role, various studies illustrate the importance of high market potential as an incentive for foreign firms to enter these markets.[20] This suggests that these investments are partly strategic and forward looking and that foreign firms will not necessarily exit the market more rapidly than domestic firms when faced with short-run adverse shocks.

With respect to the conditions in the domestic market, the sunk cost variable is never significant, whereas the coefficient on the Herfindahl-Hirschman index only has a positive and significant sign for product switching. As noted by Caves (1998), concentration and sunk costs of a particular industry are simultaneously determined, since the forces of exit and entry will influence the equilibrium number of firms in an industry. Hence, including both variables together as independent variables may be the reason for the insignificant coefficients on sunk costs. As a robustness check, we ran the empirical model including either only the Herfindahl-Hirschman index or only the sunk cost measure in our basic specification, but the results are equivalent to those shown in Table 6.[21] The positive coefficient on the Herfindahl-Hirschman index for product switching tells us that firms are

[19] The marginal probabilities for exit are quite small in magnitude because the likelihood of exit in any period is relatively small.

[20] See, for instance Bevan and Estrin (2004), and Carstensen and Toubal (2004).

more likely to switch away from the more concentrated industries. A marginal increase in average sector concentration pushes the probability of switching up with 2.5 percentage points. This result suggests that firms confronted with the aggressive behavior of their rivals may be persuaded to exploit opportunities in a different product market.

Contrary to our initial expectations we do not find that international competition is driving firm exit in Estonia. Conversely, switching is strongly influenced by the product market evolution, both in the domestic and international scene. As a rule, Estonian firms active in a sector with more exports should be able to compete in global markets. Export-intensive sectors are therefore more dynamic and promising for companies. Unfortunately, the data do not allow us to distinguish between exporters and nonexporters at the firm level. However, following Melitz's (2003) arguments, developments in the export market will have repercussions on domestic market structure. In this spirit, we expect enterprises to react to changes in global markets to remain viable in an increasingly competitive environment. This idea is reflected in all export variables listed in Table 6. The comparative advantage variable indicates that firms have a 2.1 percentage point lower probability to switch away from products in which Estonia has a revealed comparative advantage, that is, products for which exports are larger than imports. On the other hand, the total value of exports decreases the likelihood of product switching but does not have a significant impact on the likelihood of exit. This is in contrast with Melitz's argument that the least productive firms, confronted with international competition (i.e. exports), will be forced to close down.

A similar idea is reflected in the result on intra-industry trade for product switching. Higher rates of intra-industry trade denote that Estonia is simultaneously exporting and importing a particular product, and thus that the number of varieties supplied in that product market is higher. This increase in intra-industry trade could either represent stiffer competition from imports or better export opportunities. Whereas inefficient firms could be driven into bankruptcy due to this increased pressure, the more productive firms may take advantage of these opportunities. Indeed, controlling for firm and domestic market characteristics, firms are less likely to leave industries in which export opportunities abound. A rise of intra-industry trade leads to a decrease in the probability of product switching. It does not generate, however, a destructive competition effect on domestic firms, as reflected in the insignificant coefficient for exit. Turning to the unit value variable, we find that, to the extent that price differences reflect differences in quality, there is a negative relation between the quality of Estonia's exports and the probability of switching. In other words, the lower the quality of the products, the more likely firms will change their products. Thus, firms tend to exit low-quality exporting sectors.

Existing empirical work, in particular the paper of Bernard, Jensen, and Schott (2006), focuses on the impact of imports coming from low-wage countries. The authors provide

[21] Results are not reported here for brevity but can be obtained from the authors upon request.

evidence, using data on the U.S. manufacturing sector, that a higher degree of import penetration from low-wage countries is associated with a higher probability of exiting and switching products. However, in the case of Estonia, the origin of imports does not seem to play a role in the strategic decisions taken by firms.[22]

Overall, we notice that the determinants of product switching are very different from the determinants of firm death. On the one hand, the insignificant coefficients for all domestic and international product market characteristics for firm exit show that bankruptcy in Estonia is entirely driven by the firm's own behavior, rather than by a reaction to external factors. On the other hand, the results for our trade variables suggest that Estonian firms are exploiting opportunities in global markets. These findings imply that product switching might be more than just an alternative way of escaping from increasing competition. Both firm and industry characteristics point toward an active policy of looking for new and better opportunities. Rather than switch products out of defense, firms seem to be changing their product lines out of choice. In the following sections, we will investigate this hypothesis in more detail.

B. Self-Selection into New Markets

Our results suggest that firms systematically self-select into new product markets on the basis of their performance in and knowledge about the market. This result is a first new insight in firm dynamics and an important contribution to the existing empirical literature which restricted its attention to the import side of international competition. Whereas these studies find that firms in industrial countries change their product lines out of defense against low-cost competition, we find that Estonian firms follow an offensive strategy by actively exploring the market. In this subsection we want to dig deeper into this new facet of product switching. We start by exploring potential differences between product switching and industry switching. Afterward, we look more closely at the characteristics of the product markets or industries to which firms switch. In particular, we investigate the differences in export unit value ratio and technology intensity between the origin and destination industry.

Industry versus product switching

In order to compare the determinants of industry (two-digit) and product (four-digit) switches, we split the group of product switches into (1) product switches that are not observed at the two-digit level, that is, firms that change their main four-digit product line but stay within the same two-digit industry; and (2) industry switchers, that is, those firms that switch to a new product line in a different two-digit industry. Using this distinction, we estimate the same multinomial logit model as before, except that the dependent variable now takes on four different values (rather than three): 0 for firms that stay in the same product market, 1 for firms that switch products but not industries, 2 for firms that change two-digit

[22] Results are not reported here for brevity, but can be obtained from the authors upon request.

industries, and 3 for exit.

Table 7 shows a striking difference between the determinants of industry switching and those of product switching. International trade does not seem to play a significant role in the dynamics behind industry switching. Firms change to a different two-digit industry in response to changes in their own performance and the domestic market, but not on account of international trade aspects. We also find that, while more productive and more capital-intensive firms are more likely to switch industries, the effect of these variables on product switches is insignificant. This implies that the results obtained earlier on these variables are driven by industry switches rather than product switches. The insignificant effect of the trade variables on industry switches, along with the negative link between exports and unit values, on the one hand, and product switching, on the other hand, further suggests that the switching pattern in Estonia is determined by product differentiation. Enterprises observe changes within their sector and respond by modifying their products to take part in the growth process.

As was already noted in section II, firms that switch industries towards the services sector are retained in the sample until their last year of activity in the manufacturing sector. This allows us to delve deeper into the determinants of industry switching by comparing firms that switch within the manufacturing sector to firms that switch towards services. In our sample, 7 percent of the 1,244 industry switches are to the primary sector, 35 percent stay within the manufacturing sector, and 58 percent of industry switches are to the services sector. Each of these dynamics is likely to be driven by diverging underlying causes. Given the growing importance of the services sector in Estonia's domestic economy, the switches to services are of particular interest to us.

We therefore define a new dependent variable that equals zero for two-digit switches within manufacturing and 1 for switches to services, and run a logit regression (Table 8). In this case, we do not compare stayers with switchers, but instead explore dissimilarities *among* the switchers. Similar to our previous regressions, we include time and two-digit industry fixed effects, and cluster the standard errors at the firm level. This regression reveals that larger firms and foreign firms are more likely to switch within the manufacturing sector. Conversely, the more productive firms tend to leave the manufacturing sector and enter the services sector. A closer look at the destinations reveals that the majority of the firms enter the "wholesale trade" and "retail trade" sectors.[23]

Turning to the trade variables, we see that a higher concentration in exporting markets drives firms into the services sector while import growth is associated with industry switches within manufacturing. Further data analysis reveals that the increase in switching to services is

[23] Out of the 727 industry switches to the services sector observed in the sample, about 54 percent goes to the retail and wholesale sectors (NACE codes 50, 51, and 52).

entirely driven by switches to the distribution sector.[24] These results suggest that firms tend to move from the production side to the distribution sector if the export market is highly concentrated. This does not necessarily mean, however, that a firm stops producing the product. For example, an enterprise that realizes the potential in the market for its products, could continue production but shift its attention toward the distribution of its products. Unfortunately, our data set provides only firms' *main* sector of activity, and not the global picture of their activities. We also find that, if imports generate strong pressures there is less incentive for the firm to move into the distribution sector, given the lack of competitiveness of its product. To minimize the loss of sunk investments, it is more efficient to enter into a comparable market where firms can continue employing their physical and human capital without much additional cost or effort.

Hence, Estonian firms that are switching in response to changes in the international trade environment either move into the distribution of goods (some of which they may have produced in the past) or switch toward other manufacturing industries. Which switching strategy they adopt depends on whether the changes in the global environment are manifested through imports or rather driven by the concentration in export markets. These results suggest that Estonian companies are aware of the prospects in the global market and are trying to exploit these opportunities by proactively changing their business plans.

Quality upgrading versus technology upgrading

In our baseline results, we observed that Estonian companies tend to leave low-quality exporting sectors (as measured by the relative export unit value). The question now is to which sectors these firms are moving. Do they switch to products with an even lower relative unit value because they are not able to compete within the price quality range of the export market, or do they switch to sectors with a higher relative unit value because they see opportunities at the higher end of the quality array? Fabrizio, Igan, and Mody (2007) document an impressive shift in product quality and technology intensity of exports for Estonia and other central and eastern European countries over the past decade. With these facts in our mind, we now explore the direction of switches and accompanying firm characteristics in detail.

Of the total number of product switches within manufacturing, 483 switches occur to markets with a lower relative export unit value, whereas 429 switches go in the opposite direction. In other words, almost half of the product switches result in quality upgrading. In the first column of Table 9, we check the firm characteristics behind this shift up the quality ladder. To do so, we calculate for each firm that switches within manufacturing the log difference in the export unit value ratio between its origin and destination industry, at the four-digit level.

[24] If we exclude the wholesale and retail sectors from the analysis, no significant results are obtained for the export variables.

More specifically, a positive value for the log difference stands for a switch to a product with a higher unit value, and thus of higher quality. These log differences in export unit value ratios are then regressed on a number of firm characteristics using ordinary least squares (OLS), while controlling for market power in the export market, as well as for industry and time fixed effects. The results indicate a positive link between a firm's capital intensity and quality upgrading. Among the firms that alter their product line, only the more capital-intensive firms are able to move into higher-quality product markets. Controlling for other characteristics, these firms tend to be smaller than the average Estonian switching firm.

To explore whether this quality upgrading is related to technology upgrading, we define two dummies to capture the change in technological intensity. The dummy *Technology upgrading* equals 1 if a firm moves towards a sector with a higher intensity of technology (this is the case for 97 observations), whereas the dummy *Technology downgrading* equals 1 if a firm moves down the technology ladder (123 observations). As can be seen in the second column of Table 9, technology downgrading is negatively related to the log difference in export unit value ratio, whereas the coefficient on technology upgrading is positive but statistically insignificant. These results suggest that quality upgrading is not necessarily related to technology upgrading. Yet this finding is not completely unexpected, as the majority of the product changes happen along the same level of technology (877 observations).

To understand at which technological level this quality upgrading is taking place, we return to our original specification, used in column 1 of Table 9, while adding three dummies identifying the technological intensity of the industry of destination for product switches. The results in column 3 of Table 9 should be interpreted relative to the base category—the low-tech industry. The positive and significant coefficient on the medium-high-tech industry dummy shows that Estonian companies are moving up the quality ladder mainly within the medium-high-tech sectors.

V. Robustness Checks

A. Results by Size Class

Because of data constraints, the empirical literature so far has been able to look only at the switching behavior of relatively large firms. The U.S. Longitudinal Research Database used by Bernard, Jensen, and Schott (2006) includes only firms with a minimum of 10 employees, while Greenaway, Gullstrand, and Kneller (2008) study Swedish manufacturing firms with at least 50 employees. An important advantage of our data is the absence of any size thresholds. This allows us to draw conclusions for the entire population of manufacturing firms in Estonia and also reveals important insights in the dynamics of the smallest among them, namely, microenterprises employing fewer than 10 employees. This feature is particularly important for a transition country: while a small number of large enterprises dominated the economic landscape of Estonia during the Soviet era, the transition period has been characterized by the emergence of many small and medium-sized enterprises. Masso,

Eamets, and Philips (2004) compare the average size of Estonian enterprises to the Organization for Economic Cooperation and Development (OECD) average and find that, while the mean size is very close to this average, the standard deviation is much smaller due to the small number of very large enterprises in Estonia. In fact, about 50 percent of manufacturing firms in our sample are microenterprises (Figure 1), and more than three fourths of the firms employ fewer than 50 employees. These microbusinesses are also more dynamic (Table 1, Panel B). Compared with the sample average (Table 1, Panel A), we notice that microbusinesses modify their product lines more frequently (13.4 percent in the micro sample versus 11.9 percent in the full sample) and have a higher exit rate than the average Estonian firm (3.3 percent versus 2.8 percent).

To analyze differences in determinants across size categories, we run our baseline specification for small and big firms separately. Table 10 shows the results for firms with fewer than 10 employees (product switching in column 1 and exiting in column 2) versus the rest of the sample (columns 3 and 4). The results for the firm-level characteristics are very similar to our baseline results in Table 6, except for labor cost which turns out to be a significant determinant of both product switching and exiting for firms with 10 employees or more. In particular, larger firms with relatively high wages are, on the one hand, more likely to go bankrupt and, on the other hand, less likely to change their product line. Remember from Section III that high labor cost can either reflect inefficient use of labor or high skill intensity of the work force. If the labor costs of a firm are too high compared to its competitors, for a given level of productivity, the firm will not be able to compete in the market and will face bankruptcy. For firms with a large pool of employees the efficient use of its labor force becomes more crucial than for small firms where labor costs are not a determinant of its strategies. Yet, to the extent that higher wages reflect higher skill intensities, investments in product-specific human capital become a sunk cost acting as a barrier to change to a different product market. These sunk costs are substantially lower for firms with few employees since fewer employees will have to be re-trained for the production of the new products. This is reflected in the insignificance of the coefficient on labor cost for the smallest firms, whereas a marginal change in this variable implies a decrease in the probability of product switching of 2.4 percentage points for larger firms.

Another major difference between small and larger firms is the effect of international openness on their switching behavior. Product switching among microenterprises does not seem to be driven by the level of exports per se, but is fairly sensitive to changes in the relative unit values of Estonia's export products, with an elasticity of around 0.13. The opposite is true for product switching among larger firms, which seems to be affected only by the level of exports.

B. Results by Time Period

Now we consider whether the determinants behind firm dynamics have changed over time by splitting the sample into two periods, 1997-2000 and 2001-04 (Table 11). Several interesting

insights come out of this exercise. The firm determinants of product switching are roughly alike across both periods. Remarkably, trade emerges as an important driver of the product-switching behavior of firms in the first half of the sample period (1997-2000), while acting solely as a driver of firm death in the second half of the period. This seems to reflect a Melitz-type effect: as the quality of Estonia's exported products increases relative to its competitors in a certain sector, the most successful firms will probably self-select into the export market. Over time, this raises the average efficiency level in the sector and firms that cannot cope with the pace of quality upgrading are forced to exit. On the other hand, globalization is no longer encouraging firms to switch products or industries in the most recent period. Changes in a firm's product mix are rather driven by evolutions in the domestic market, as reflected by the Herfindahl-Hirschman index.

From a pessimistic point of view, one could argue that the driving forces behind the self-selection process of moving into more promising markets have tapered off in Estonia. Whereas Estonia significantly expanded its market share in the 1990s, this process has decelerated since the beginning of the new century. This could indicate that some firms might be losing market share because they cannot withstand competition and are unable to proactively search for better opportunities. However, from a positive point of view, this finding could also be interpreted as a sign that Estonia has reached a steady state after the wide-ranging restructuring process of the 1990s. Switching and exit rates were substantial at the end of the 1990s before gradually declining toward the end of the sample period in 2004. Estonia's transition from a planned economic system was accompanied by extensive privatization and restructuring, in conjunction with the dismantling of trade barriers and the inflow of foreign investment. This catching-up process has now slowed, and changes in the market are mainly serving to keep the industrial sectors healthy by forcing the least efficient firms to exit.

VI. CONCLUSIONS

This paper provides new evidence on the link between globalization and firm dynamics, focusing on the case of Estonia. We contribute to the literature in two important respects. First, this is the first paper to study the determinants of exit and product switching in an emerging market. Second, we consider explicitly the effect of export market conditions on firm dynamics. For that purpose, we include three product-level measures in our estimation: (1) the value of exports; (2) the degree of competition in exports markets; and (3) the quality of exports relative to direct competitors.

Our results indicate that globalization is generally not an important driver of firm exit, while it emerges as an important factor explaining product switching. What matters for exit are firm characteristics: younger firms and those with lower productivity and capital intensity are more likely to exit. Meanwhile, product switching is also affected by conditions in export markets. In particular, firms are more likely to switch if they are in sectors with relatively small revealed comparative advantage, and where the total value and quality of exports are

relatively low. However, this effect only matters for product switches and for the early sample period when trade flows were increasing rapidly. A possible interpretation of our results is that firms initially moved out of products for which prospects in the export markets, which were increasingly opening up, were not good. This result is in contrast with previous studies on industrial countries which have found that firms change their product line as a defensive strategy against low-cost imports. Finally, we find that firms switching to relatively higher quality products are more capital intensive; however, these switches are not related to technology upgrading.

Our findings raise a number of questions worthy of further research. First, it would be interesting to know whether the effect of intra-industry trade on product switching is related to trade in different products (vertical intra-industry trade) or similar products (horizontal intra-industry trade). Second, additional theoretical models need to be developed to gain further insights into the determinants of product switching versus industry switching, occurring both within the manufacturing sector and to services. Finally, it could be important to explore whether the quality of exports matters for the product switches irrespective of the exporting status of the firm.

Table 1. Exits and Industry Switches, 1997-2004 1/
(Percent, unless otherwise indicated)

Year	Number of Observations	Industry Switch	Product Switch	Exit
Panel A: Distribution of the Full Sample				
1997	1,196	14.8	21.7	5.1
1998	1,398	9.5	14.5	4.9
1999	1,621	11.0	16.5	4.4
2000	1,930	8.9	12.8	3.1
2001	2,175	6.6	11.4	3.3
2002	2,396	6.2	9.9	2.2
2003	2,634	6.0	9.3	1.8
2004	2,767	4.8	7.3	0.7
Total (observations)	16,117	1,244	1,912	452
Total (firms)	4,844	1,090	1,566	452
Panel B: Distribution for Microenterprises				
1997	515	19.6	26.8	6.8
1998	616	12.2	16.6	6.3
1999	765	12.7	17.9	5.2
2000	944	11.2	14.4	3.2
2001	1,100	8.6	13.5	4.5
2002	1,232	8.4	11.5	2.5
2003	1,423	7.6	11.1	2.0
2004	1,553	6.2	8.4	0.8
Total (observations)	8,148	782	1,092	267
Total (firms)	3,214	709	949	267

Sources: Estonian Business Registry database; and authors' calculations.

1/ Industry (product) switches are identified at the two-digit (four-digit) NACE level.

Table 2. Sector Distribution 1/

NACE	Two-digit Industry	Observations		Industry Switches		Product Switches		Exits	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
15	Food and beverages	1,314	8.2	83	6.3	131	10.0	58	4.4
17	Textiles	689	4.3	44	6.4	61	8.9	21	3.0
18	Clothing	1,396	8.7	59	4.2	111	8.0	48	3.4
19	Leather (products)	270	1.7	8	3.0	10	3.7	6	2.2
20	Wood (products)	3,529	21.9	255	7.2	410	11.6	120	3.4
21	Pulp, paper (products)	198	1.2	13	6.6	16	8.1	3	1.5
22	Publishing and printing	1,455	9.0	74	5.1	139	9.6	33	2.3
23	Coke, petroleum products	5	0.0	1	20.0	1	20.0	0	0.0
24	Chemicals	356	2.2	41	11.5	48	13.5	8	2.2
25	Rubber and plastic	601	3.7	48	8.0	74	12.3	12	2.0
26	Non-metallic mineral products	509	3.2	43	8.5	63	12.4	13	2.6
27	Basic metals	16	0.1	5	31.3	5	31.3	0	0.0
28	Fabricated metal products	1,819	11.3	150	8.3	273	15.0	41	2.3
29	Machinery and equipment	812	5.0	125	15.4	160	19.7	18	2.2
30	Office machinery and computers	59	0.4	17	28.8	17	28.8	0	0.0
31	Electrical machinery	340	2.1	40	11.8	51	15.0	9	2.6
32	Communications equipment	290	1.8	45	15.5	53	18.3	5	1.7
33	Medical, precision, optical instruments	413	2.6	38	9.2	44	10.7	6	1.5
34	Motor vehicles	121	0.8	12	9.9	14	11.6	2	1.7
35	Other transport equipment	295	1.8	34	11.5	37	12.5	8	2.7
36	Furniture	1,630	10.1	109	6.7	194	11.9	41	2.5
Total		16,117	100.0	1,244	7.7	1912	11.9	452	2.8

Sources: Estonian Business Registry database; and authors' calculations.

1/ Industry (product) switches are identified at the two-digit (four-digit) NACE level. All industry switches are also observed at the product level; out of 1,912 product switches in the sample, 1,244 are observed at both the product and industry level.

Table 3. Four-Digit Product Switches Decomposed 1/
(Percent, unless otherwise indicated)

Nace	Two-digit Industry	Number of Product Switch	Within Same Industry (two-digit)	To Primary	To Manufacturing	To Services
15	Food and beverages	131	36.6	14.5	2.3	46.6
17	Textiles	61	27.9	0.0	39.3	32.8
18	Clothing	111	46.9	0.0	23.4	29.7
19	Leather (products)	10	20.0	0.0	50.0	30.0
20	Wood (products)	410	37.8	11.5	15.9	34.9
21	Pulp, paper (products)	16	18.8	0.0	31.3	50.0
22	Publishing and printing	139	46.8	1.4	10.1	41.7
23	Coke, petroleum products	1	0.0	0.0	0.0	100.0
24	Chemicals	48	14.6	4.2	22.9	58.3
25	Rubber and plastic	74	35.1	0.0	32.4	32.4
26	Non-metallic mineral products	63	31.8	9.5	25.4	33.3
27	Basic metals	5	0.0	0.0	100.0	0.0
28	Fabricated metal products	273	45.1	0.0	24.5	30.4
29	Machinery and equipment	160	21.9	1.9	30.0	46.3
30	Office machinery and computers	17	0.0	0.0	5.9	94.1
31	Electrical machinery	51	21.6	0.0	29.4	49.0
32	Communications equipment	53	15.1	0.0	39.6	45.3
33	Medical and optical instruments	44	13.6	0.0	38.6	47.7
34	Motor vehicles	14	14.3	7.1	28.6	50.0
35	Other transport equipment	37	8.1	0.0	46.0	46.0
36	Furniture	194	43.8	1.6	23.7	30.9
Total		1,912	34.9	4.3	22.7	38.0

Sources: Estonian Business Registry database; and authors' calculations.

1/ The last four columns in the table decompose product switches into four different categories: product switches that occur within the same two-digit manufacturing sector; to the primary sector; to other two-digit manufacturing sectors; and to services. The row total of these four categories equals 100 percent for each two-digit industry.

Table 4. Destination of Product Switches by Technology Class 1/

(Percent, unless otherwsie indicated)

Origin Industry	Number of Firms	Number of Exits	Number of Product Switches	Destination Industry by Technology Class						
				Manufacturing				Services		Other
				High Tech	Medium-High Tech	Medium-Low Tech	Low Tech	Knowledge Intensive	Less-Knowledge Intensive	
Number of observations	16,117	452	1,912	52	122	298	630	174	445	191
High tech	5.1	2.7	6.4	25.2	12.2	4.9	5.7	17.1	32.5	2.4
Medium-high tech	9.8	8.0	13.9	4.5	21.1	20.7	2.3	7.5	32.3	11.7
Medium-low tech	20.0	16.4	23.6	1.3	10.4	47.0	7.5	7.5	15.5	10.6
Low tech	65.0	73.0	56.1	0.3	0.4	2.3	54.4	9.2	23.2	10.2
Total	100.0	100.0	100.0	2.7	6.4	15.6	32.9	9.1	23.3	10.0

Sources: Estonian Business Registry database; and authors' calculations.

1/ Sectors are classified according to technology intensity, based on the classification of industry according to technology level from Eurostat. The list of NACE (Rev. 1.1) codes assigned to each particular technology class is given in Appendix III.

Table 5. Summary Statistics

Variable	All	Industry Switch	Product Switch	Exit
Number of observations	16,117	1,244	1,912	452
(Percent of total)	(100.0)	(7.7)	(11.9)	(2.8)
Size	28.1	21.6***	26.9	20.7***
(Number of employees)	(100.4)	(73.9)	(131.4)	(46.2)
Age	6.9	6.1***	6.3***	5.7***
(Years)	(3.5)	(3.3)	(3.3)	(3.1)
Capital	104.7	119.7**	109.7	91.4
(Thousands of Krooni)	(270.8)	(307.6)	(266.6)	(455.6)
Wage	60.3	60.3	58.4*	50.7**
(Thousands of Krooni)	(66.6)	(71.7)	(63.0)	(112.9)
TFP	61.2	60.4	58.3**	41.3***
(Thousands of Krooni)	(99.6)	(85.8)	(80.8)	(130.2)
Foreign	0.1	0.1	0.1**	0.1**
(Ownership dummy)	(0.3)	(0.3)	(0.3)	(0.3)
Sunk	14.7	14.7*	14.8	14.7
(Minimum Efficient Scale)	(0.7)	(0.7)	(0.7)	(0.6)
Herf	0.1	0.1***	0.1***	0.1**
(HHI domestic market)	(0.2)	(0.2)	(0.2)	(0.2)
Imports	417,270	489,774***	448,386**	337,168***
(Imports, thousands of Krooni)	(583,623)	(707,494)	(644,580)	(349,766)
IIT	0.5	0.5***	0.5***	0.5**
(Intra-industry trade)	(0.3)	(0.3)	(0.3)	(0.2)
CA	0.6	0.5***	0.5***	0.6***
(Comparative advantage)	(0.5)	(0.5)	(0.5)	(0.5)
Exports	766,759	715,993**	692,268***	807,780
(Exports, thousands of Krooni)	(1,046,466)	(1,050,674)	(1,019,043)	(973,382)
Herfex	0.2	0.2*	0.2	0.2
(HHI export market)	(0.1)	(0.1)	(0.1)	(0.1)
UVR	1.3	1.2	1.3	1.3
(Relative unit values)	(3.3)	(2.7)	(4.1)	(3.8)

Sources: Estonian Business Registry database; and authors' calculations.

Notes: Reported values are means (except for the first row), with the standard deviations in brackets. Significance levels (*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$) refer to one-tailed test on the difference between the means for the exit strategy considered (exit, industry switch, or product switch) and the baseline category (continuing firms).

Table 6. Baseline Specification

	Product Switch		Exit	
ln(Size)	-0.143***	*-0.014*	-0.036	*0.000*
	[0.026]		[0.054]	
ln(Age)	-0.178***	*-0.017*	-0.300***	*-0.005*
	[0.044]		[0.072]	
ln(TFP)	0.092**	*0.010*	-0.367***	*-0.007*
	[0.041]		[0.066]	
ln(Capital)	0.051**	*0.005*	-0.220***	*-0.004*
	[0.020]		[0.036]	
ln(Wage)	-0.08	*-0.008*	0.169	*0.003*
	[0.049]		[0.108]	
Foreign	-0.088	*-0.008*	0.044	*0.001*
	[0.094]		[0.185]	
Herf	0.253*	*0.025*	-0.23	*-0.004*
	[0.144]		[0.334]	
Sunk	0.008	*0.000*	0.139	*0.002*
	[0.057]		[0.093]	
ln(Exports)	-0.064*	*-0.006*	0.063	*0.001*
	[0.038]		[0.068]	
Herfex	0.007	*0.002*	-0.739	*-0.013*
	[0.386]		[0.679]	
ln(UVR)	-0.102*	*-0.010*	0.07	*0.001*
	[0.055]		[0.105]	
ln(Imports)	0.014	*0.001*	-0.011	*0.000*
	[0.049]		[0.091]	
IIT	-0.212*	*-0.020*	-0.135	*-0.002*
	[0.128]		[0.235]	
CA	-0.218**	*-0.021*	-0.011	*0.000*
	[0.106]		[0.207]	
Number of observations: 16,043				
Pseudo *R*-square: 0.054				

Sources: Estonian Business Registry database; and authors' calculations.

Notes: This table reports the result from a multinomial logit (0=continuing; 1=switching products; 2=closing). Robust standard errors are in brackets below coefficient estimates. The numbers in italics next to the coefficient estimates represent the marginal probability change at the mean of the independent variable or the discrete change of a dummy variable from 0 to 1. Though not reported, all regressions include a constant, two-digit industry, and time fixed effects. Standard errors are clustered at the firm level. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Variables are defined in Appendix III.

Table 7. Product Switching Versus Industry Switching

	Product Switch Within the Same Industry		Industry Switch		Exit	
ln(Size)	0.070*	*0.003*	-0.258***	*-0.016*	-0.036	*0.000*
	[0.040]		[0.033]		[0.054]	
ln(Age)	-0.201***	*-0.006*	-0.166***	*-0.010*	-0.300***	*-0.005*
	[0.071]		[0.053]		[0.072]	
ln(TFP)	0.058	*0.002*	0.104**	*0.007*	-0.368***	*-0.007*
	[0.063]		[0.050]		[0.066]	
ln(Capital)	0.01	*0.000*	0.070***	*0.005*	-0.220***	*-0.004*
	[0.035]		[0.024]		[0.036]	
ln(Wage)	-0.091	*-0.003*	-0.069	*-0.004*	0.169	*0.003*
	[0.078]		[0.059]		[0.108]	
Foreign	-0.169	*-0.005*	-0.045	*-0.003*	0.045	*0.001*
	[0.151]		[0.117]		[0.185]	
Herf	0.194	*0.005*	0.275*	*0.017*	-0.229	*-0.004*
	[0.251]		[0.165]		[0.335]	
Sunk	0.003	*0.000*	0.003	*0.000*	0.14	*0.002*
	[0.109]		[0.062]		[0.094]	
ln(Exports)	-0.156***	*-0.005*	0.002	*0.000*	0.064	*0.001*
	[0.058]		[0.046]		[0.068]	
Herfex	-0.738	*-0.023*	0.426	*0.029*	-0.743	*-0.013*
	[0.697]		[0.436]		[0.679]	
ln(UVR)	-0.277**	*-0.008*	-0.009	*0.000*	0.071	*0.001*
	[0.111]		[0.060]		[0.105]	
ln(Imports)	-0.026	*-0.001*	0.042	*0.003*	-0.011	*0.000*
	[0.074]		[0.060]		[0.091]	
IIT	-0.149	*-0.004*	-0.262	*-0.016*	-0.136	*-0.002*
	[0.191]		[0.160]		[0.236]	
CA	-0.268*	*-0.008*	-0.209	*-0.013*	-0.011	*0.000*
	[0.162]		[0.129]		[0.208]	
Number of observations: 16,043						
Pseudo *R*-square: 0.059						

Sources: Estonian Business Registry database; and authors' calculations.

Notes: This table reports the results from a multinomial logit regression (0=continuing; 1=product switching within the same industry; 2=industry switching; 3=closing). Robust standard errors are in brackets below coefficient estimates. The numbers in italics next to the coefficient estimates represent the marginal probability change at the mean of the independent variable or the discrete change of a dummy variable from 0 to 1. Though not reported, all regressions include a constant, two-digit industry, and time fixed effects. Standard errors are clustered at the firm level. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Variables are defined in Appendix II.

Table 8. Industry Switching: Manufacturing versus Services

ln(Size)	-0.461***	*-0.111*
	[0.063]	
ln(Age)	0.072	*0.017*
	[0.103]	
ln(TFP)	0.182**	*0.044*
	[0.083]	
ln(Capital)	-0.021	*-0.005*
	[0.045]	
ln(Wage)	0.135	*0.033*
	[0.107]	
Foreign	-0.401*	*-0.098*
	[0.208]	
Herf	0.244	*0.059*
	[0.312]	
Sunk	0.133	*0.032*
	[0.118]	
ln(Exports)	0.058	*0.014*
	[0.096]	
Herfex	2.380**	*0.572*
	[1.026]	
ln(UVR)	-0.009	*-0.002*
	[0.124]	
ln(Imports)	-0.221*	*-0.053*
	[0.123]	
IIT	-0.173	*-0.042*
	[0.308]	
CA	0.312	*0.075*
	[0.266]	
Number of observations: 1,244		
Pseudo *R*-square: 0.091		

Sources: Estonian Business Registry database; and authors' calculations.

Notes: Results reported are from a logit estimation comparing (two-digit) industry switches to other manufacturing sectors (dependent variable equal to 0) with industry switches to services (dependent variable equals 1). Robust standard errors are in brackets below coefficient estimates, the numbers in italics next to the coefficient estimates represent the marginal probability change at the mean of the independent variable or the discrete change of a dummy variable from 0 to 1. Though not reported, all regressions include a constant, two-digit industry dummies, and time dummies. Standard errors are clustered at the firm level. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Variables are defined in Appendix II.

Table 9. Unit Value Difference Between Industry of Origin and Destination

	(1)	(2)	(3)
ln(Size)	-0.032*	-0.027	0.005
	[0.018]	[0.018]	[0.020]
ln(Age)	0.028	0.024	0.001
	[0.031]	[0.031]	[0.034]
ln(TFP)	0.052	0.052	-0.044
	[0.042]	[0.043]	[0.029]
ln(Capital)	0.048***	0.048***	0.043**
	[0.018]	[0.018]	[0.019]
ln(Wage)	-0.017	-0.025	0.016
	[0.046]	[0.047]	[0.044]
Foreign	0.022	0.007	0.022
	[0.070]	[0.070]	[0.069]
Herfex	-0.453	-0.473	-0.625**
	[0.33]	[0.330]	[0.250]
Technology upgrading	...	0.085	...
		[0.094]	
Technology downgrading	...	-0.186**	...
		[0.079]	
Destination H-tech	...	...	-0.119
			[0.150]
Destination MH-tech	...	...	0.202**
			[0.091]
Destination ML-tech	...	...	0.069
			[0.049]
Industry fixed effects (two-digit)	Yes	Yes	No
Year fixed effects	Yes	Yes	Yes
Number of observations:	1,097	1,097	1,097
R-square	0.097	0.103	0.036

Sources: Estonian Business Registry database; and authors' calculations.

Notes: The dependent variable is the log difference in export unit value ratio between the origin industry and destination industry, at the four-digit level. The dummy technology up- (down-) grading equals 1 if the firm moves up (down) one category of technology intensity. The dummies *H-tech*, *MH-tech*, and *ML-tech* destination equal 1 if a firm moves to respectively a high-tech, medium-high-tech or medium-low-tech sector. The regressions are estimated using OLS, and robust standard errors are in brackets below the coefficient estimates. Coefficients for the constant and industry and year dummies are suppressed. Standard errors are clustered at the firm level. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Variables are defined in Appendix II.

Table 10. Determinants of Firm Dynamics Across Size Categories

	Firms With Fewer Than 10 Employees (*N*=8,125)				Firms With 10 Employees or More (*N*=7,918)			
	Product switch (*N*=1,092)		Exit (*N*=267)		Product switch (*N*=820)		Exit (*N*=185)	
ln(Size)	-0.182***	*-0.019*	-0.111	*-0.002*	-0.031	*-0.003*	0.239**	*0.003*
	[0.055]		[0.113]		[0.055]		[0.096]	
ln(Age)	-0.168***	*-0.018*	-0.191**	*-0.003*	-0.160**	*-0.013*	-0.434***	*-0.005*
	[0.053]		[0.090]		[0.075]		[0.120]	
ln(TFP)	0.091*	*0.010*	-0.280***	*-0.006*	0.113	*0.010*	-0.660***	*-0.008*
	[0.048]		[0.070]		[0.076]		[0.150]	
ln(Capital)	0.067***	*0.008*	-0.218***	*-0.004*	0.025	*0.002*	-0.254***	*-0.003*
	[0.025]		[0.047]		[0.035]		[0.057]	
ln(Wage)	-0.001	*0.000*	0.07	*0.001*	-0.282***	*-0.024*	0.490**	*0.006*
	[0.058]		[0.115]		[0.094]		[0.246]	
Foreign	-0.067	*-0.009*	0.557**	*0.014*	-0.074	*-0.006*	-0.378	*-0.004*
	[0.147]		[0.247]		[0.121]		[0.266]	
Herf	0.262	*0.028*	-0.088	*-0.002*	0.242	*0.021*	-0.401	*-0.005*
	[0.199]		[0.445]		[0.218]		[0.521]	
Sunk	0.109	*0.011*	0.286**	*0.005*	-0.092	*-0.008*	-0.077	*-0.001*
	[0.078]		[0.125]		[0.093]		[0.162]	
ln(Exports)	-0.014	*-0.002*	0.126	*0.002*	-0.131**	*-0.011*	-0.053	*0.000*
	[0.050]		[0.091]		[0.059]		[0.102]	
Herfex	0.243	*0.028*	-1.015	*-0.020*	-0.238	*-0.020*	-0.36	*-0.004*
	[0.506]		[0.939]		[0.610]		[1.038]	
ln(UVR)	-0.141**	*-0.015*	0.104	*0.002*	-0.034	*-0.003*	0.013	*0.000*
	[0.071]		[0.124]		[0.088]		[0.198]	
ln(Imports)	-0.043	*-0.004*	-0.068	*-0.001*	0.086	*0.007*	0.062	*0.001*
	[0.065]		[0.122]		[0.074]		[0.142]	
IIT	-0.236	*-0.025*	-0.056	*-0.001*	-0.152	*-0.013*	-0.299	*-0.003*
	[0.169]		[0.305]		[0.201]		[0.388]	
CA	-0.367***	*-0.039*	-0.359	*-0.006*	-0.029	*-0.003*	0.622*	*0.007*
	[0.142]		[0.265]		[0.161]		[0.353]	
Pseudo *R*-square	0.055				0.061			

Sources: Estonian Business Registry database; and authors' calculations.

Notes: This table reports the results from a multinomial logit regression (0=continuing; 1=switching products; 2=closing), for two groups: firms with fewer than 10 employees (columns 1 and 2) and firms with 10 employees or more (columns 3 and 4). Robust standard errors are in brackets below coefficient estimates. The numbers in italics next to the coefficient estimates represent the marginal probability change at the mean of the independent variable or the discrete change of a dummy variable from 0 to 1. Though not reported, all regressions include a constant, two-digit industry and time fixed effects. Standard errors are clustered at the firm level. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Variables are defined in Appendix II.

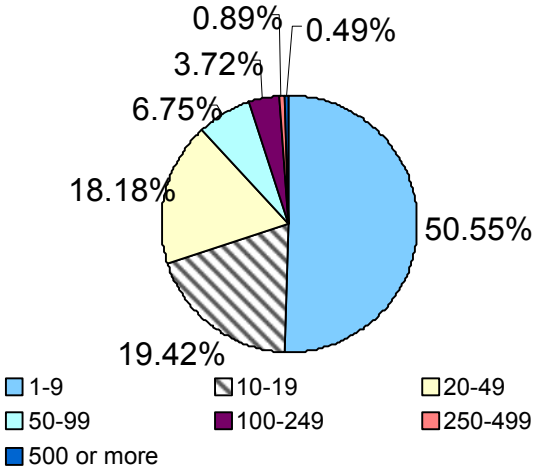
Table 11. Determinants of Firm Dynamics Across Time

	1997–2000 (*N*=6,090)				2001–04 (*N*=9,953)			
	Product switch (*N*=979)		Exit (*N*=262)		Product switch (*N*=933)		Exit (*N*=190)	
ln(Size)	-0.130***	*-0.017*	0.007	*0.001*	-0.122***	*-0.010*	-0.032	*0.000*
	[0.035]		[0.069]		[0.038]		[0.080]	
ln(Age)	-0.167**	*-0.019*	-0.471***	*-0.013*	-0.217***	*-0.017*	-0.152	*-0.001*
	[0.065]		[0.100]		[0.055]		[0.096]	
ln(TFP)	0.114**	*0.016*	-0.308***	*-0.009*	0.092*	*0.008*	-0.385***	*-0.004*
	[0.058]		[0.102]		[0.055]		[0.083]	
ln(Capital)	0.057**	*0.008*	-0.180***	*-0.005*	0.040	*0.003*	-0.271***	*-0.003*
	[0.029]		[0.053]		[0.027]		[0.046]	
ln(Wage)	-0.072	*-0.010*	0.123	*0.004*	-0.179***	*-0.014*	-0.014	*0.000*
	[0.068]		[0.156]		[0.066]		[0.129]	
Foreign	-0.196	*-0.023*	-0.192	*-0.004*	0.019	*0.001*	0.342	*0.004*
	[0.126]		[0.255]		[0.126]		[0.264]	
Herf	-0.132	*-0.014*	-0.651	*-0.018*	0.724***	*0.057*	0.622	*0.006*
	[0.195]		[0.415]		[0.210]		[0.560]	
Sunk	0.108	*0.014*	0.110	*0.003*	-0.089	*-0.007*	0.166	*0.002*
	[0.074]		[0.126]		[0.080]		[0.159]	
ln(Exports)	-0.085*	*-0.012*	0.114	*0.004*	-0.031	*-0.002*	0.003	*0.000*
	[0.048]		[0.090]		[0.058]		[0.120]	
Herfex	-0.397	*-0.053*	0.363	*0.012*	0.595	*0.049*	-1.918	*-0.021*
	[0.557]		[0.856]		[0.547]		[1.185]	
ln(UVR)	-0.156*	*-0.019*	-0.303*	*-0.008*	-0.071	*-0.006*	0.241**	*0.003*
	[0.085]		[0.169]		[0.072]		[0.116]	
ln(Imports)	-0.058	*-0.007*	-0.010	*0.000*	0.038	*0.003*	0.000	*0.000*
	[0.065]		[0.127]		[0.074]		[0.147]	
IIT	-0.233	*-0.029*	-0.227	*-0.006*	-0.108	*-0.009*	0.112	*0.001*
	[0.171]		[0.324]		[0.191]		[0.401]	
CA	-0.310**	*-0.039*	-0.220	*-0.005*	-0.216	*-0.018*	0.100	*0.001*
	[0.155]		[0.287]		[0.144]		[0.322]	
Pseudo *R*-square	0.039				0.035			

Sources: Estonian Business Registry database; and authors' calculations.

Notes: This table reports the results from a multinomial logit regression (0=continuing; 1=switching products; 2=closing), for two periods: 1997-2000 (columns 1 and 2) and 2001-04 (columns 3 and 4). Robust standard errors are in brackets below coefficient estimates. The numbers in italics next to the coefficient estimates represent the marginal probability change at the mean of the independent variable or the discrete change of a dummy variable from 0 to 1. Though not reported, all regressions include a constant, and two-digit industry fixed effects. Standard errors are clustered at the firm level. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Variables are defined in Appendix II.

Figure 1. Sample Size Distribution, 1/



Sources: Estonian Business Registry; and authors' calculations.
1/ Size is measured by number of employees. Total number of observations is 16,117.

APPENDIX I. DATA AND SAMPLE SELECTION

A. TRADE DATA

The trade data are from the UN Comtrade (commodity trade statistics) database and consist of the trade values and quantities of import flows. We include all goods (not just manufacturing) and use import flows because reporting of imports is generally more reliable than that of exports. This means that Estonia's exports are calculated by looking at the imports of its trading partners. The import data are at the six-digit product level, according to the Harmonized System (HS) classification 1988/92. For each product, an observation consists of the reporter, country of origin, time, trade value in dollars, quantity, and units in which the quantity is expressed. In order to create our sample, we focus on the top geographic destinations of Estonia's imports/exports that account for at least 90 percent of imports/exports during the period 1997–2005.

B. FIRM DATA

The firm-level data used in this paper are provided by the Estonian Business Registry and cover the period 1995-2005. Due to missing information on employment for the years 1995 and 1996, these years are omitted from the sample. Since the main purpose of this paper is to identify the impact of international trade on firm dynamics, we can work only with those sectors for which we observe imports and exports. This implies that those firms that are not active in the manufacturing sector have to be excluded from the sample.[25] However, firms that switch to the primary or services sector are retained until their last year of activity within the manufacturing sector. This allows us to distinguish between switches occurring within the manufacturing sector and those to other sectors of the economy. Several cleaning procedures are applied to the sample:

- We construct a longitudinal panel using registration codes and apply several corrections to take into account changes in firms' registration codes (i.e., firms' identification number): (1) firms that change registration codes because of a transfer from the Enterprise Registry to the Business Registry are considered the same firm; (2) in case of acquisitions, the acquiring and acquired firms are considered to be a single entity for the entire sample period; and (3) for all other transactions (e.g., merger, breakup and divesture), firms are treated as separate entities both before and after the transaction.

- Observations with extreme values on one of the variables used in the empirical analysis are dropped, as well as all observations with missing information on some variables. This

[25] Trade data from Comtrade are available only for 3 out of 28 two-digit service sectors ("computers and related activities," "business services," and "other service activities"). Given this limited coverage of services trade, we exclude these sectors from the analysis and focus on the manufacturing sector.

leaves us with 38 percent of the registered firms, accounting on average for about 60 percent of aggregated value added in the manufacturing sector.[26]

- Because state-owned firms are not necessarily profit-maximizing agents, it is not certain whether their behavior can be captured accurately by our empirical model. Hence, we exclude state-owned firms from the sample (eight firms).

- All observations for which no matching trade data could be obtained are omitted. While some of these missing trade data are related to incorrect EMTAK[27] (NACE) codes reported by firms, others are related to the concordance used to convert the trade data from Harmonized System (HS, six-digit, 1992) to NACE (Rev.1.1., four-digit). The trade data are converted using a concordance table provided by Eurostat. For the majority of the codes, the concordance gives a many-to-one mapping, that is, multiple HS 6 digit codes are mapped into one NACE code. However, there are a number of cases where one HS code maps into more than one NACE code. To minimize potential errors, we have omitted these codes from our concordance table and dropped the resulting observations from our sample. Firms active in sectors that do not appear in our concordance table are also dropped.

[26] Comparability between the micro and macro data is limited, however, owing to methodological inconsistencies. Value added at the macro level is a broader concept since it covers not only the activities of enterprises but also of other economic units. According to the Statistical Office of Estonia, all enterprises registered in Estonia accounted for about 70 percent of aggregate value added in 2005.

[27] The industry classification used in the Estonian Business Registry, EMTAK, is a five-digit extension of the NACE (Rev.1.1.) classification, that is, the official statistical classification of economic activities in the European Community.

APPENDIX II. DEFINITIONS OF VARIABLES

A. FIRM-LEVEL VARIABLES

All monetary variables are expressed in real terms. Output and intermediate input deflators, as well as the gross capital formation price index, were obtained from the Statistical Office of Estonia. Deflators are available for 16 sectors corresponding to the International Standards Industrial Classification (ISIC Rev.3.1) at the one-digit level.

$Exit_{it+1}$ Dummy variable, equal to 1 in period t if the firm exits in period t+1. Firm exit is defined based on the official date of liquidation from the Commercial Register. If a firm disappears from the data set and it has an official liquidation date, it is considered to exit in the last year of observation. Liquidation due to a merger, acquisition or reregistration in the registry is not considered an exit.

$Switch_{2d,it+1}$ Dummy variable, equal to 1 in period t if the firm switches two-digit NACE industries in period t+1. An industry switch is defined as a change in the firm's primary sector of activity.[28]

$Switch_{4d,it+1}$ Dummy variable, equal to 1 in period t if the firm changes four-digit NACE products in period t+1. A product switch is defined as a change in the firm's main product line.

Age_{it} Age of the firm in period t, defined as the number of years the firm has been in the registry (using the registry entry date).

$Size_{it}$ Firm size, measured by the number of employees in period t.

$Wage_{it}$ Average real labor cost, defined as total firm-level labor costs divided by the number of employees.

$Capital_{it}$ Capital intensity, measured as real capital per employee. Capital is defined as the sum of tangible and intangible assets, net of goodwill at the firm level.

TFP_{it} Total factor productivity at the firm level, estimated at the two-digit industry level using the methodology of Levinsohn and Petrin (2003) while taking into account industry switches over time.

$Foreign_{it}$ Foreign ownership dummy, equal to 1 if at least 50 percent of the firm's shares are foreign owned.

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[28] Firms in Estonia are asked only about their *primary* sector of activity. This implies that, if a firm reports a particular industry/product code in one year and a different code in the next, it has changed its main sector of activity.

B. PRODUCT-LEVEL VARIABLES

All product-level variables are defined at the four-digit NACE level.

$Sunk_{jt}$ Sunk cost variable, defined as the natural logarithm of the median of real sales in each particular four-digit industry j at time t.

$Herf_{jt}$ Herfindahl-Hirschman index for the domestic market, defined as the sum of squared market shares. Market shares are defined as firm-level real sales over product-level total real sales.

$Imports_{jt}$ Total imports of product j at time t, measured in Estonian Krooni (EEK).

IIT_{jt} Intra-industry trade variable, defined as the Grubel-Lloyd index, that is, $\left[1-\left(\left|X_{jt}-M_{jt}\right|/\left(X_{jt}+M_{jt}\right)\right)\right]$, where X_{jt} and M_{jt} are, respectively, exports and imports of product j at time t.

CA_{jt} Revealed comparative advantage dummy, equal to 1 if $X_{jt} > M_{jt}$, i.e. if exports are larger than imports for product j at time t.

$Exports_{jt}$ Total exports of product j at time t, measured in Estonian Krooni (EEK).

$Herfex_{jt}$ The Herfindahl-Hirschman index for the export market is calculated at the Harmonized System (HS) six-digit level. Conversion to NACE Rev. 1.1. at the four-digit level is achieved using a concordance table provided by Eurostat (cfr. Appendix I). We define a market as a pair consisting of a geographic destination and a product. We calculate the index of concentration in market m as

$$H^{j}_{m,t} = \sum_{\forall Exporter} s^{2}_{n,t},$$

where $s_{n,t}$ is the market share of exporter n in market m at period t.

Aggregating across all export markets for product j, we obtain the overall index of market concentration for exports of product j:

$$Herfex_{jt} = \sum_{\forall m} H^{j}_{m,t} * \beta^{j}_{m,t},$$

where $\beta^{j}_{m,t}$ is the share of market m in total exports of product j in period t.

UVR_{jt} Average relative unit values index for Estonian export products, taking into account Estonia's main competitors. In particular, we compute the unit value for product j in market p by dividing the export value of each exporter by the

export quantity. We consider only those markets in which quantities are expressed in the same unit across the sample of exporters for that market. Relative unit values for product *j* in market *p* are then calculated dividing the unit value of Estonia by the weighted average of the unit values of its competitors in that market. The overall relative unit value for product *j* is the weighted sum of the relative unit values across all markets, with weights equal to export shares.

APPENDIX III. SECTOR CLASSIFICATION ACCORDING TO TECHNOLOGY INTENSITY AND KNOWLEDGE INTENSITY

Manufacturing		Services	
NACE	Description	NACE	Description
High-technology manufacturing		*Knowledge-intensive services*	
244	Pharmaceuticals	61	Water transport
30	Office machinery - computers	62	Air transport
32	Radio, TV, communication equipment	64	Post and telecommunications
33	Medical, precision, optical instruments	65	Financial intermediation
353	Aircraft - spacecraft	66	Insurance and pension funding
		67	Ancilliary financial activities
Medium-high-technology manufacturing		70	Real estate activities
24	Chemicals, excl. pharmaceuticals	71	Renting activities
29	Machinery and equipment	72	Computer and related activities
31	Electrical machinery	73	Research and development
34	Motor vehicles	74	Other business activities
35	Other transport equipment (excl. 351 & 353)	80	Education
		85	Health and social work
Medium-low-technology manufacturing		92	Recreational activities
23	Coke, refined petroleum products		
25	Rubber and plastic	*Less-knowledge-intensive services*	
26	Nonmetallic mineral products	50	Wholesale/retail trade of motor vehicles
27	Basic metals	51	Wholesale trade
28	Fabricated metal products	52	Retail trade
351	Building/repairing of ships and boats	55	Hotels and restaurants
		60	Land transport
Low-technology manufacturing		63	Supporting transport activities
15	Food and beverages	75	Public administration, defense
16	Tobacco	90	Sewage and refuse disposal
17	Textiles	91	Activities of membership organizations
18	Clothing	93	Other service activities
19	Leather (products)	95	Activities of households
20	Wood (products)	99	Extraterritorial organizations and bodies
21	Pulp, paper (products)		
22	Publishing and printing		
36	Furniture		
37	Recycling		

Source: Eurostat.

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