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Production Dynamics in Multi-Product Firms' Exporting[§]

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Abstract: *To create room for production capacity for exported products, new exporters may decrease either the production of exported products or of other products for the domestic market, or of both. Namely, when firms begin to export, they must reallocate their resources across products and markets. This study investigates the within-plant reallocation of resources across products and markets when multi-product firms begin exporting. To this end, we employ the Indonesian manufacturing surveys during 2000–2012. As a result, we found a different pattern of resource reallocation between when the first exported product is a core-competence product and when it is not. Further, the magnitude of such reallocation is found to be different according to firms' resource abundance.*

Keywords: Production dynamics, multi-product, Indonesia

JEL Classification: F15, F53

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1. Introduction

Firms must devote many resources to begin exporting. This can be difficult, especially for small- and medium-sized enterprises (SMEs) that usually have few resources. Therefore, governments often offer SMEs support to begin exporting, since increasing the number of exported products and exporting firms is the major engine of national export growth (Hummels and Klenow, 2005). It can be difficult for SMEs not only to manage administrative procedures for exporting but also to expand their production capacity for supplying the foreign market. To create room for production capacity for exported products, the new exporters may decrease the production of exported products, that of other products for the domestic market (i.e. non-exported products), or of both. In general, when firms begin exporting, they must drastically reallocate their resources across products and markets.

The purpose of this study is to investigate the within-plant reallocation of resources across products and markets when multi-product firms begin exporting. New exporters must choose which of their multiple products to export, for example, they may choose the product with the largest sales or that which represents their core competency. In addition to this selection of exported products, the exporters need to decide how to allocate resources across products and markets. Namely, when a firm begins to export a product, it may either decrease production of that product for the domestic market or decrease the production of other products (i.e. non-exported products). We empirically investigate such within-plant resource allocation by using the Indonesian manufacturing surveys from 2000 to 2012, which include domestic and export sales separately at a plant-product level. Indonesia is furthermore a good example for this analysis because it is still a developing country, where firms are likely to face resource constraints. Secondly, due to the country's rapid economic growth, a large number of new exporters are born in Indonesia during this period. Therefore, Indonesia will be a good example for our analysis.

Our analysis consists of three steps. First, we obtained casual observations on within-plant resource allocation across products and markets by new exporters. Our key findings can be summarised as follows. First, firms are likely to export their core-competence products (defined as those with the largest sales) before any others. Second, when firms begin exporting a product, they decrease the domestic sales of non-exported products more than those of exported products. Third, we found a contrasting result in the domestic sales of the exported product. Its domestic sales decrease when the product being exported is a core-competence product but increase when it is not. Thus, although the second finding shows a relative increase in sales of the export product in the domestic market, on average, this is not necessarily true for all products. We also found a different pattern of resource reallocation between when the first exported product is a core-competence product and when it is not.

In the second step, we construct a theoretical model to understand the mechanisms that underlie these findings. Specifically, our theoretical analysis sheds light on resource reallocation within firms. Multi-product firms facing limited physical and management resources must give priority to different products. When starting to export a product, they shift resources from products supplied only in the domestic market to the exported product. The reduction in resources results in the contraction of their domestic sales. Resource reallocation also occurs for the exported product, creating different implications for core and non-core products in the domestic market. Specifically, the domestic sales of core products decrease more than those of non-core products once firms start exporting, regardless of the product category (i.e. core versus non-core). Before firms begin exporting, the core products attract more internal resources for domestic sales than the non-core products because they are produced more efficiently. After exports begin, more resources are shifted away from the domestic sales of the core products than from those of the non-core products. This is because a resource shift has a smaller impact on the profits from domestic sales of core products, whose initial allocation of resources within firms is larger. This translates into a disproportionate shift in the composition of domestic sales.

In the last step, we conduct econometric analyses to investigate new exporters' resource allocation more formally. For example, we confirm the different pattern of resource reallocation between when the first exported product is a core-competence product and when it is not. In addition, our theoretical model demonstrates that the amount of available resources (capital) plays a key role in determining new exporters' behavior. That is, the impact of exporting on domestic sales reallocation is smaller for firms with more resources. If abundant resources are available, firms specialise more in core products and are thus less vulnerable to the initiation of exporting. To investigate this theoretical hypothesis empirically, we examine the role of resources (proxied by tangible fixed assets or the number of workers) on the effect of exporting on domestic sales reallocation. As a result, we found that the negative effect of export initiation on the domestic sales of core products becomes smaller in resource-abundant plants.

Our study is related to at least three strands of literature. The first examines export initiation by multi-product firms (Eckel et al., 2015; Eckel et al., 2016; Iacovone and Javorcik, 2010; Iacovone and Javorcik, 2012).[1] By employing firm-product-destination-level export data in Chile during 1992–2004, Eckel et al. (2016) found that product rank in terms of domestic sales is positively correlated with that in terms of export sales. Iacovone et al. (2010) used plant-product-level data on total sales and export sales in Mexico during 1994–2003 to determine that first-year exports account for only a small fraction of a firm's total sales (about 12%). This study is also the first to examine how multi-product firms change domestic sales after export initiation by focusing on two different dimensions: (i) the domestic sales of exported products and

[1]Hur and Yoon (2018) examine how reductions in trade costs triggered by the Republic of Korea–United States (US) free trade agreement affects the product portfolio of firms. Although they focus on resource reallocation within a firm, as we do, they do not look at firms' export decisions, which is the central question of our study.

those of non-exported products, and (ii) whether or not the exported product is the core-competence product.

This study is also related to the literature on the firm-level relationship between export sales and domestic sales. Empirical studies in this area include Salomon and Shaver (2005); Vannoorenberghe (2012); Berman, Berthou, and Hericourt (2015); Bugamelli, Gaiotti, and Viviano (2015); Ahn and Mcquoid (2017); and Bardaji et al. (2018). Ahn and Mcquoid (2017) examine this relationship within Indonesian manufacturing plants, just as we do in this paper. Some studies address the simultaneity bias between export sales and domestic sales by using domestic demand size and/or foreign demand size as an instrumental variable. As a result, although the sign of correlation in all sample firms differs according to the studies, it is consistently found to be negative in smaller firms in terms of financial and physical resources. Similar to these studies, we examine the relationship between exports and domestic sales.

However, our study differs from these studies in at least two areas. First, we investigate the effect of the extensive margin of exports (export initiation) on domestic sales, while the existing studies examine that of the intensive margin (export values). Once firms begin exporting, they will enjoy some positive effects on their performance (i.e. learning-by-exporting). Therefore, our analysis focuses on resource allocation during the period before these effects can be fully enjoyed, when firms face more resource constraints. Similar to our findings, Blum, Claro, and Horstmann (2013) theoretically demonstrate that when firms operate with increasing marginal costs due to the fixed amount of capital, beginning exports of a product reduces domestic sales of that product. Secondly, our analysis is conducted at a firm-product level rather than at a firm level. In particular, we examine the effects of the extensive margin on the domestic sales of not only the exported product but also non-exported products. As a result, we show, both theoretically and empirically, that the type of exported products (i.e. core or non-core) plays a key role in the effect of exporting on domestic sales.

Lastly, some theoretical studies on multi-product firms and globalisation are useful to understand the mechanism underlying our empirical analysis. For example, Eckel and Neary (2010) consider the cannibalisation effect and the role of core competencies, and demonstrate that opening a country to international trade, which increases both the market size and the level of competition, will lead to a reduction in the scope of firms' products as firms drop their fringe varieties. Mayer, Melitz, and Ottaviano (2014) demonstrate that tougher competition in an export market induces a firm to skew its export sales towards its best performing product. Nocke and Yeaple (2014) assume that firms differ in terms of productivity, but all varieties produced within a firm are symmetric. They then show theoretically that multilateral trade liberalisation results in large firms' decreasing their scope, and small firms' doing the opposite. Our theoretical model sheds light on firms' resource reallocation by focusing on two different dimensions not yet discussed in these theoretical studies.

The rest of this paper is organised as follows. Section 2 takes an overview of within-plant resource allocation across products and markets when starting exporting. To understand the mechanism underlying the empirical findings in section 2, we theoretically examine such within-plant resource allocation in section 3. It is also demonstrated that such allocation differs according to the resource size in plants. This difference is empirically investigated in section 4. Section 5 concludes.

2. Casual Facts

This section takes an overview of plant-product-level sales. As mentioned in the introduction, our main data source is the Indonesian manufacturing surveys from 2000–2012 produced by Indonesia's Statistical Agency (*Badan Pusat Statistik*). These surveys cover all manufacturing plants with 20 or more workers and include two kinds of information: (i) production and cost information at a plant level, including the total number of workers, establishment year, amount of capital stock, total value of production, value added, costs of material inputs and labor, and so on; and (ii) a unique plant-product-level dataset that reports the value, quantity, and export share of each product produced by a plant, as well as the nine-digit level of the Commodity Classification of Indonesia (*Klasifikasi Komoditi Indonesia* [KKI]). We can merge the two datasets by using a common plant-identification code.

There are three issues with regard to the data that are worthy of note. First, since our dataset is plant-level data and cannot be aggregated according to firms, we conduct our analysis at a plant level. Such a difference in the aggregation level of datasets becomes a significant issue when resource allocation is determined by firms' headquarters rather than by each plant. However, this difference may be not a serious issue because most firms in Indonesia are known to be single-plant firms (Amiti and Konings, 2007). Second, we define 'product' at the seven-digit commodity level instead of at the original nine-digit level because a non-negligible number of plants only report production information at a seven-digit level. The seven-digit level is comparable to the Harmonized System six-digit level. Third, product-level sales data cannot be decomposed separately into domestic sales and export sales in 2006, although total sales (i.e. the sum of domestic sales and export sales) are available. Thus, to assess the dynamic aspect of exporting behavior, we split our sample period into two periods: 2000–2005 and 2007–2012.

Table 1 presents the number of plants in the original dataset and demonstrates how we select our sample plants. First, since our aim is to examine how domestic firms behave when starting to export, we exclude plants owned by foreign companies (defined as firms whose foreign capital share is greater than 50%). As a result, we drop around 1,500 plants every year, on average. Second, we classify all plants owned by domestic companies according to exporting status. Around 2,500 plants are regarded as exporting plants in each year. Finally, we focus on 'export starters.' Specifically, we restrict our sample plants to those that have no record of export sales during 2000–2002 or during 2000–2005 and 2007–2008 (remember that export sales are not available for 2006). In such plants, the export after 2002 or 2008 is taken as their first export.

Table 1: Number of Exporting Plants and Export Starters

Year	Total	Domestic firm	Non-exporter	Exporter	Export starter
2000	20,067	18,752	15,706	3,046	NA
2001	19,368	18,089	15,291	2,798	NA
2002	19,405	18,137	15,034	3,103	NA
2003	18,446	17,109	14,750	2,359	289
2004	18,528	17,276	14,578	2,698	225
2005	18,549	17,367	14,485	2,882	200
2006	26,034	24,552	NA	NA	NA
2007	24,625	23,155	21,444	1,711	NA
2008	23,081	21,529	19,294	2,235	NA
2009	21,760	20,218	17,719	2,499	516
2010	19,871	18,367	16,213	2,154	192
2011	20,579	19,033	16,607	2,426	193

Source: Authors' calculation based on Indonesian manufacturing surveys.

Next, we investigate the rank of the first exported product in domestic sales. In this exercise, we focus on the products exported for the first time for each plant in the above sample period. We call these products 'first exported product' and the year in which the exports began 'the first export year.' Next, we look at the ranking of product sales value before exports began and explore which product is more likely to be exported. Specifically, we investigate the rank of the 'first exported product' in terms of domestic sales in the year prior to the first export year. Since the number of products produced varies among plants, we show the sales rank of the first exported product according to the number of products. One issue is that plants may begin exporting multiple products. The results are shown in Table 2. Some plants may start producing and exporting new products simultaneously, and these products might be categorised as the first exported product. Such products are shown in the column titled 'New' in Table 2, which shows that the product with the largest domestic sales is likely to be the first exported product.

Fact 1: *The product with the largest domestic sales is likely to be the first exported product.*

Table 2: Rank of the First Exported Product in Domestic Sales According to the Number of Produced Products

	Rank in sales							
# of products	1	2	3	4	5	6	7	New
1	715							807
2	151	91						187
3	75	47	42					105
4	28	17	17	16				53
5	17	15	13	9	8			33
6	6	3	4	3	3	1		12
7	2	1	4	2	1	1	1	1
8	2	1		1				4
9				1				
10			1					2
11				1				1

Note: Each product is ranked based on the amount of domestic sales 1 year before the first export year. 'New' indicates the number of products that are produced and exported simultaneously.
Source: Authors' compilation, using the Indonesian manufacturing surveys from 2000–2012 produced by Indonesia's Statistical Agency.

Third, we investigate changes in sales across products within a plant after the first export. To this end, the plants are restricted to those that produce multiple products 1 year before the first export year. We examine this sales change by the survival years of the first export (i.e. 1-year survival, 2-year survival, and more than 2-year survival).[2] We then aggregate domestic sales and export sales separately for the first export product and the rest of the products. Figure 1 depicts the average share of export sales in the first export product out of total sales. The horizontal axis indicates the years after the first export year; '0' indicates the first export year. The figure shows that, as long as exports continue, the export sales account for about half of total sales. In other words, plants allocate half of their resources to the exported product. Similarly, Figure 2 depicts the share of domestic sales of the first exported product out of total domestic sales. It shows that the share of domestic sales of the exported product rises when

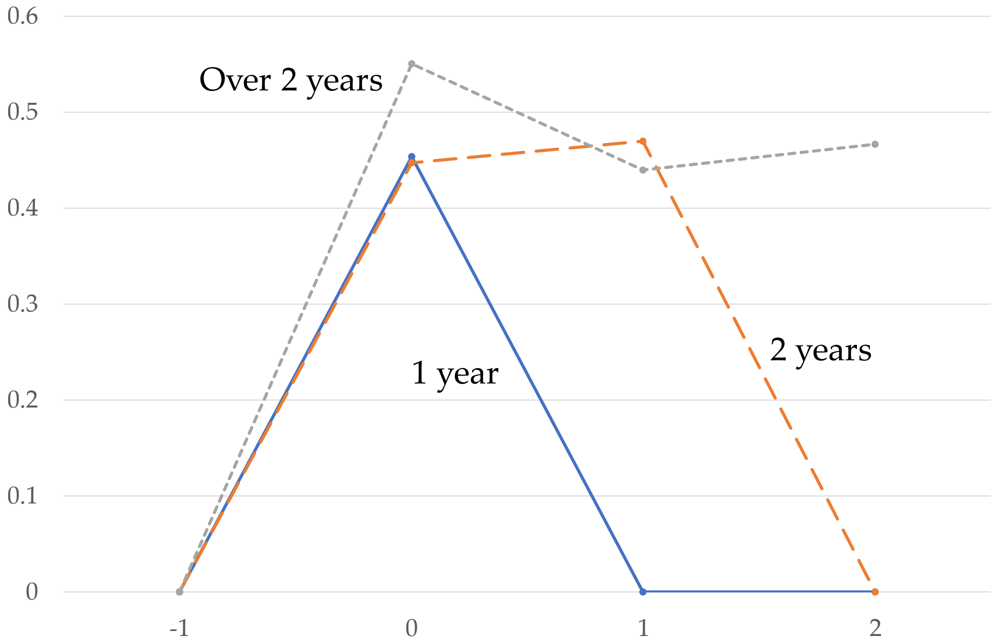
[2]One observation is that sales data are not available for domestic sales and export sales separately in 2006, although total sales (i.e. the sum of domestic sales and export sales) are available. Therefore, we have to be careful to define the survival years (see Table A1).

exports begin, compared with that of non-exported products. As long as exports continue, the first exported product accounts for about 80 percent of total domestic sales.

Fact 2: *When a plant starts exporting for the first time, the export sales account for about half of total sales on average.*

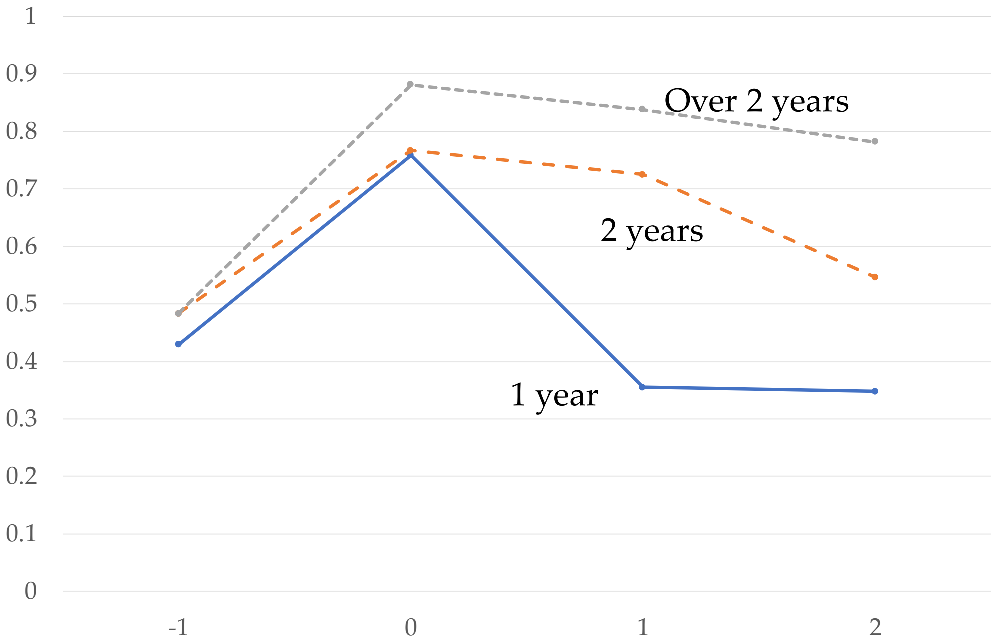
Fact 3: *When a plant starts exporting for the first time, the share of domestic sales of the exported product rises on average, compared with that of non-exported products.*

Figure 1: Average Shares of Export Sales out of Total Sales of Exported Products by Export Survival Years



Notes: The share changes are depicted by the survival years of the first export, i.e. 1-year survival, 2-year survival, and more than 2-year survival. The horizontal axis indicates the years after the first export year: '0' indicates the first export year.
Source: Authors' compilation, using the Indonesian manufacturing surveys from 2000–2012 produced by Indonesia's Statistical Agency.

Figure 2: Average Shares of Domestic Sales of Exported Products out of Total Domestic Sales by Export Survival Years



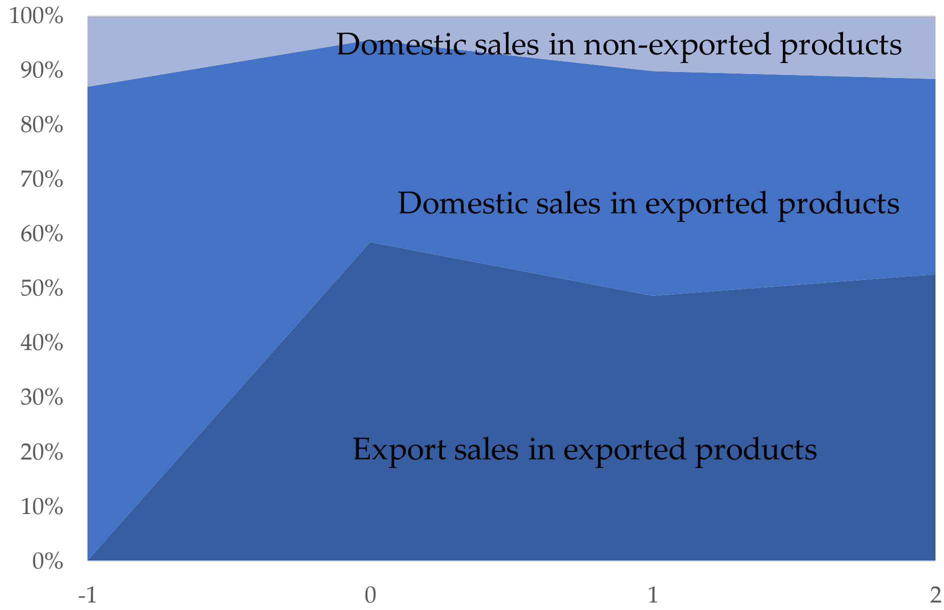
Notes: The share changes are depicted by the survival years of the first export, i.e. 1-year survival, 2-year survival, and more than 2-year survival. The horizontal axis indicates the years after the first export year: '0' indicates the first export year.
Source: Authors' compilation, using the Indonesian manufacturing surveys from 2000–2012 produced by Indonesia's Statistical Agency.

Last, we investigate the changes in domestic sales of the first exported product and of non-exported products in addition to changes in the export sales of the first exported product. Although Fact 3 indicates the relative rise of the exported product in terms of its share of total domestic sales *on average*, the figures are different if we differentiate two cases: (i) when the first exported product is a core-competence product ('core product'), and (ii) when it is not ('non-core product'). The product with the first rank in Table 1 is defined as the core product. Unlike the previous two figures, we only consider plants whose exports survive for more than 1 year. Figure 3 depicts the case of core products and indicates that the share of domestic sales of the first exported product decreases after exports begin. Instead, the share of export sales of the first exported product rises to a similar level as its share of domestic sales. Since the share of domestic sales of the non-exported product does not change, this implies within-product resource reallocation between domestic and export sales, rather than across-product reallocation. The case of non-core products is shown in Figure 4, which indicates that non-core products become the top product in terms of total sales after exports begin. Like with core products, the share of export sales of the non-core products becomes almost the same as that of domestic sales. This result implies that unlike the case of core products, exporting non-core products induces across-product reallocation.

Fact 4. *When the first exported product is a core product, the share of domestic sales of the first exported product decreases after exports begin.*

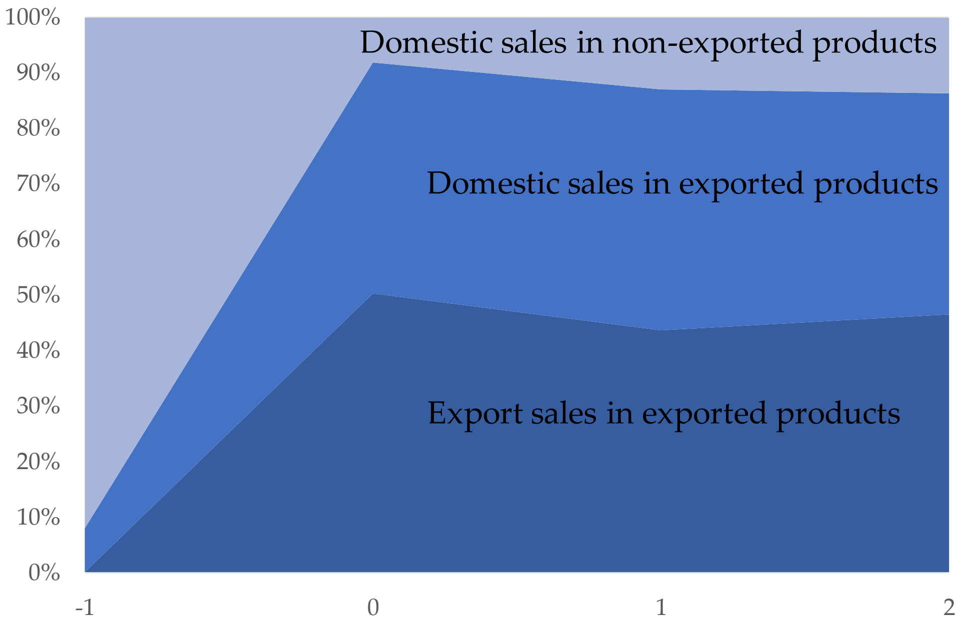
Fact 5. *When the first exported product is a non-core product, the share of domestic sales in the first exported product increases after exports begin.*

Figure 3: Average Shares of Each Sale out of Total Sales when the First Exported Product is a Core Product



Note: The horizontal axis indicates the years after the first export year: ‘0’ indicates the first export year.
Source: Authors’ compilation, using the Indonesian manufacturing surveys from 2000–2012 produced by Indonesia’s Statistical Agency.

Figure 4: Average Shares of Each Sale out of Total Sales when the First Exported Product Is a Non-Core Product



Note: The horizontal axis indicates the years after the first export year: '0' indicates the first export year.
Source: Authors' compilation, using the Indonesian manufacturing surveys from 2000–2012 produced by Indonesia's Statistical Agency.

3. Theory

In the previous section, we identified five facts regarding within-plant resource allocation across products and markets by new exporters. To explain these findings, we develop a simple model that highlights the within-firm allocation of internal resources. Using this model, we further propose a testable implication of the impact of firm size on the reallocation of the composition of domestic sales due to export initiation.

3.1. Consumer

Let us first explain the demand side of the model. The utility of the representative consumer in the home country takes the following form:

$$U = \left(\sum_{i=1}^{N} \alpha_i^{\frac{1}{\sigma}} q_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} + q^O,$$

where α_i is a taste parameter for variety i, q_i is the consumption of variety i, q^O is the consumption of the homogenous good, and $\sigma > 1$ is the elasticity of substitution between varieties. The representative consumers maximise the utility subject to the budget constraint:

$$\sum_{i=1}^{N} p_i q_i + q^O = E,$$

where p_i is the price of variety i. The income E is spent on the varieties $\{q_i\}$ and the homogeneous good q^O. To make the model as parsimonious as possible, we consider only two varieties ($N = 2$). The foreign counterpart is defined by putting the asterisk (*) on each variable.

The domestic demand for variety i is given by

$$q_i = \left(\frac{p_i}{P}\right)^{-\sigma} \frac{\alpha_i E}{P} = p_i^{-\sigma} D_i,$$

where $D_i \equiv \alpha_i E P^{\sigma-1}$ and P is the constant elasticity of substitution price index in home. Similarly, the foreign demand for variety i is given by

$$q_i^* = \left(\frac{p_i^*}{P^*}\right)^{-\sigma} \frac{\alpha_i^* E^*}{P^*} = (p_i^*)^{-\sigma} D_i^*,$$

where $D_i^* \equiv \alpha_i^* E^* (P^*)^{\sigma-1}$. To ease the notational burden, we impose symmetry of tastes for varieties: $\alpha_i = \alpha$; $\alpha_i^* = \alpha^*$ for all i.

3.2. Multiproduct Firms

Next, we consider the supply side of the model. There is a multi-product firm producing two goods, indexed as 1 and 2. These goods are produced using different forms of technology and can be exported to a foreign country. The firm invests internal resource k_i in reducing the marginal cost of variety i. The internal resource is limited and bounded by K.

The marginal cost of producing variety i is

$$MC_i = \frac{c}{k_i^{\beta_i}},$$

where c is the base level of technology, and β_i measures the effectiveness of the internal investment to variety i. We assume that variety 1 is better than variety 2 in terms of the effectiveness of the internal investment: $\beta_1 > \beta_2 > 0$, implying $MC_1 < MC_2$ at $k_1 = k_2 = k$. We call variety 1 the *core product* in the sense that it is produced using more efficient technology. Accordingly, variety 2 is called the *non-core product*.

While there is no fixed cost of entering the domestic market, the firm has to pay a fixed cost, F, when exporting a variety. It does so if the profit from exporting exceeds F. We assume that F is large enough to allow only one of the two products to be exported.[3] The export product $i \in \{1,2\}$ requires internal resource k_i^* for cost-reducing investment.

The timing of the multiproduct firm's decision proceeds as follows. In the first stage, the firm decides whether and which product to export. In the second stage, the internal resources are allocated to a product intended for a foreign market. In the third stage, the remaining resources are devoted to products for the domestic market and are divided between the core and non-core products. In the final stage, the firm engages in production, sets prices, and earns profits. We will solve the firm's problem backward below.

3.3. Price Setting, Incentive to Export, and Resource Allocation

The profit of the multiproduct firm is given by

$$\pi = \pi_1 + \pi_2 + \lambda_i \pi_i^*,$$

$$\pi_i = \left[p_i - \frac{c}{k_i^{\beta_i}}\right] q_i, \quad \pi_i^* = \left[p_i^* - \frac{c}{(k_i^*)^{\beta_i}}\right] q_i^* - \frac{\delta (k_i^*)^2}{2},$$

[3]Because varieties are substitutes, the profit from exporting a variety decreases as a multiproduct firm exports more varieties. Therefore, there is a range of F in which a firm makes a profit by exporting only if it exports a single variety.

where π_i is profit from product $i \in \{1,2\}$ for the domestic market and π_i^* is profit from product i for the foreign market. When shifting resources to the production of an export product, the firm incurs an additional adjustment cost of $\delta(k_i^*)^2/2$, where $\delta > 0$ captures the difficulty of adjustment. $\lambda_i \in \{0,1\}$ is the index parameter that takes one if the firm exports product i and takes zero otherwise. Since the firm can export only one of the two products, $\lambda_2 = 0$ if $\lambda_1 = 1$ and $\lambda_1 = 0$ if $\lambda_2 = 1$.

In the final stage, the firm sets prices to maximise π given the allocation of internal capital. The optimal prices are

$$p_i = \frac{\sigma c k_i^{-\beta_i}}{\sigma - 1}, \quad p_i^* = \frac{\sigma c (k_i^*)^{-\beta_i}}{\sigma - 1}.$$

Clearly, shifting resource k_i or k_i^* into the product reduces its marginal cost and thus its price.

Substituting these optimal prices into the profit gives

$$\pi(k_1, k_2, k_i^*) = \pi_1(k_1) + \pi_2(k_2) + \lambda_i \pi_i^*(k_i^*),$$

$$\pi_i(k_i) = \frac{D}{\sigma}\left(\frac{\sigma c}{\sigma - 1}\right)^{1-\sigma} k_i^{\beta_i(\sigma-1)}, \quad \pi_i^*(k_i^*) = \frac{D^*}{\sigma}\left(\frac{\sigma c}{\sigma - 1}\right)^{1-\sigma} (k_i^*)^{\beta_i(\sigma-1)} - \frac{\delta (k_i^*)^2}{2},$$

each of which is a function of devoted resources. We assume $\beta_1 < 1/(\sigma - 1)$ to ensure that the second-order condition of the profit maximisation is satisfied. The first term of the above equation is a domestic profit and the second term an export profit. To see which product the firm is likely to export, we compare the profit of exporting the core product 1 (i.e., $(\lambda_1, \lambda_2) = (1,0)$) with that of exporting the non-core product 2 (i.e., $(\lambda_1, \lambda_2) = (0,1)$). If the firm were to allocate the same amount of resources, $k_0 > 1$, to each of the two export products, the export profit of the core product would be greater than that of the non-core product:

$$\begin{aligned} &\pi_1^*(k_0) - \pi_2^*(k_0) \\ &= \left[\frac{D^*}{\sigma}\left(\frac{\sigma c}{\sigma - 1}\right)^{1-\sigma} k_0^{\beta_1(\sigma-1)} - \frac{\delta (k_0^*)^2}{2}\right] - \left[\frac{D^*}{\sigma}\left(\frac{\sigma c}{\sigma - 1}\right)^{1-\sigma} k_0^{\beta_2(\sigma-1)} - \frac{\delta (k_0^*)^2}{2}\right] \\ &= \frac{D^*}{\sigma}\left(\frac{\sigma c}{\sigma - 1}\right)^{1-\sigma} k_0^{\beta_2(\sigma-1)} \left(k_0^{\frac{\beta_1}{\beta_2}} - 1\right) > 0, \end{aligned}$$

because $\beta_1 > \beta_2$. Since the core product reflects higher effectiveness of internal investment, it generates a larger export profit than does the non-core product. Therefore, the core product is more likely to overcome the fixed cost and thus be exported.[4] This explains the empirical fact that firms tend to export their core products.

Let us consider the situation where core product 1 is exported. In the third stage, given the resources devoted to the export product, denoted by k_1^*, the firm allocates the remaining resources for domestic products, denoted by $K_d = K - k_1^*$, between the core and the non-core products. Since capital for export product k_1^* and thus export profit π_1^* are fixed at this stage, the firm solely maximises the domestic profit $\pi_1 + \pi_2$. From the first-order condition, we obtain the optimal resources for core product 1 given K_d, which we denote by $k_1(K_d)$, as the solution of the following equation:[5]

$$G(k_1) \equiv \left(\frac{\beta_2}{\beta_1}\right)^{\frac{1}{\gamma_2}} k_1^{\frac{\gamma_1}{\gamma_2}} + k_1 - K_d = 0,$$

where $\gamma_i \equiv 1 - \beta_i(\sigma - 1) > 0$, and we can confirm that $G(k_1) = 0$ has a unique solution in $k_1 \in (0, K_d)$ by noting that (i) $G(0) < 0$, (ii) $G(K_d) > 0$, and (iii) $G'(k_1) > 0$. The optimal resource for non-core product 2 is thus $k_2(K_d) = K_d - k_1(K_d)$.

It can be easily verified that more resources are devoted to core product 1 than to non-core product 2 (i.e. $k_1 > k_2$), as shown in Figure 5. The resource allocation is determined at the point where marginal returns from investing resources are equalised between the two products (i.e. $\frac{\partial \pi_1}{\partial k_1} = \frac{\partial \pi_2}{\partial k_2}$).

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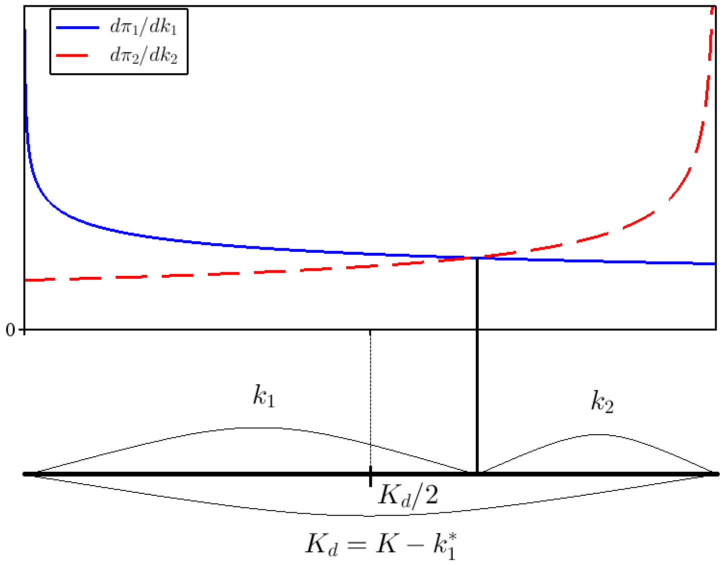
[4]Strictly speaking, we should compare the two export profits under the optimal resource allocation. This comparison also yields the same conclusion.
[5]The derivations of the theoretical results in the text are available upon request from the authors.

Figure 5: Resource Allocation between Domestic Products



Note: The figure shows the representative case and does not depend on specific parameter values.

Source: Authors.

In the second stage, the firm chooses capital for the export product to maximise the export profit π_x^*. The optimal choice is

$$k_1^* = (\beta_1 D^* \Theta)^{\frac{1}{1+\gamma_1}}, \quad \text{where } \Theta \equiv \frac{c^{1-\sigma}}{\delta}\left(\frac{\sigma - 1}{\sigma}\right)^{\sigma}.$$

As long as there is positive foreign demand, i.e. $D^* > 0$, capital is allocated to the exported product: $k_1^* > 0$. As a result, the remaining share goes to domestic products: $K_d = K - k_1^*$. As D^* becomes higher, more capital is allocated to the exported product.

In the first stage, based on the export profit at the optimal resource allocation, the firm decides whether and which product to export.

3.4. Foreign Demand Shocks and Domestic Sales

Here, we look at the effect of export initiation, caused by foreign demand shocks, on domestic sales. Once the foreign demand D^* becomes positive, the firm starts investing in the export product and engages in exporting. As long as K_d is not too large, the export initiation causes within-firm reallocation of resources in such a way that:

$$\frac{dk_1}{dD^*}|_{D^*=0} = \frac{\partial k_1}{\partial K_d}\frac{dK_d}{dD^*}|_{D^*=0} < \frac{\partial k_2}{\partial K_d}\frac{dK_d}{dD^*}|_{D^*=0} = \frac{dk_2}{dD^*}|_{D^*=0} < 0,$$

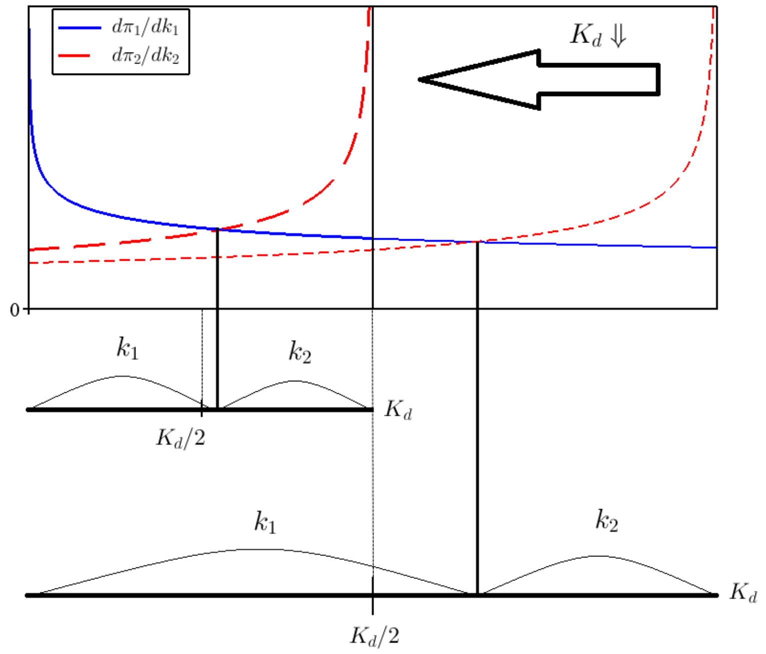
where $\frac{dK_d}{dD*} = \frac{d(K-k_1^*)}{dD^*} = -\frac{dk_1^*}{dD^*} < 0$. The positive demand shock in the export market shifts resources away from domestic products to the export product. That is, a decrease in resources for domestic products caused by the initiation of exports decreases resources for both the core and non-core products: $\frac{dk_1}{d(-K_d)} < 0$; $\frac{dk_2}{d(-K_d)} < 0$. The resource reallocation then translates into changes in the domestic sales of the two products. Because the sales of product i are increasing in k_i,[6] the initiation of exports also decreases the domestic sales of both products.

However, the magnitude of the impact differs across products. It can be confirmed that the core product loses more resources than does the non-core product as long as K_d is not extremely large.[7] This is illustrated in Figure 6. As the core product already has ample resources before the shock, its marginal return does not change much in response to the resource shift. To equate the marginal returns between products, more resources move away from the core product than from the non-core product.

[6]The domestic profit from product $i \in \{1,2\}$ is $D\left(\frac{\sigma c}{\sigma-1}\right)^{1-\sigma} k_i^{\beta_i(\sigma-1)}$, which is increasing in k_i.

[7]Formally, the sufficient condition for $\frac{dk_2}{dK_d} > \frac{dk_1}{dK_d} (> 0)$ is $K < (\gamma_1 + \gamma_2)\left(\frac{\beta_1\gamma_1^{\gamma_1}}{\beta_2\gamma_2^{\gamma_2}}\right)^{\frac{1}{\gamma_2-\gamma_1}}$.

Figure 6: The Effect of Export Initiation on the Allocation of Resources between Domestic Products



Note: The figure shows the representative case and does not depend on specific parameter values.
Source: Authors' calculation.

The resource reallocation triggers changes in the composition of domestic sales. The domestic share of the core product is

$$s_1 \equiv \frac{p_1 q_1}{\sum_{i=1}^{2} p_i q_i} = \frac{k_1^{\beta_1(\sigma-1)}}{k_1^{\beta_1(\sigma-1)} + k_2^{\beta_2(\sigma-1)}} = \frac{1}{1 + [\left(\frac{\beta_2}{\beta_1}\right)^{\beta_2} k_1^{\beta_2-\beta_1}]^{\frac{\sigma-1}{\gamma_2}}},$$

where we used $G(k_1) = 0$ from the first to the second equality. Accordingly, the domestic share of the non-core product is $s_2 = 1 - s_1$. Because of $\beta_2 - \beta_1 < 0$, we can see that a decrease in k_1 caused by the foreign demand shock leads to[8]

$$\frac{ds_1}{dD^*}|_{D^*=0} = \frac{\partial s_1}{\partial k_1}\frac{dk_1}{dD^*}|_{D^*=0} < 0,$$
$$\frac{ds_2}{dD^*}|_{D^*=0} = \frac{\partial s_2}{\partial k_1}\frac{dk_1}{dD^*}|_{D^*=0} > 0.$$

That is, export initiation reduces the domestic share of the core product and

[8]If the firm exports the non-core product, the results are qualitatively the same.

increases that of the non-core product in the home market. The disproportionate decrease in resources for the two domestic products creates an asymmetric impact on their domestic sales, as empirically demonstrated in section 2. Before the initiation of exports, the core product has already attracted more resources so that a resource shift has a smaller impact on its return. Therefore, the core product allows more resources to move to the export product.

3.5. Firm Size and Resource Allocation

Here, we look at how the firm size, measured by total internal resource K, affects the degree of resource reallocation. First, as long as K is not too large, it can be confirmed that the larger firm invests more in core product 1:

$$\frac{dk_1}{dK} > \frac{dk_2}{dK} > 0.$$

If extra resources are available, a disproportionate share of resources is devoted to the core product. The diminishing marginal profits imply that additional resources reduce the marginal profits for investing in core product 1 less than they do those for investing in non-core product 2. As the firm shifts more resources to the product with higher returns, k_1 increases more than k_2 upon the expansion of total internal resources. This resource shift, in turn, leads to a change in the composition of domestic sales:

$$\frac{ds_1}{dK} > 0, \quad \frac{ds_2}{dK} < 0.$$

The larger firm makes more domestic sales from the core product in terms of resources than it does from the non-core product.

As for the response to the foreign demand shock, the more resource-abundant firm reduces the domestic-sales share of the core product less:

$$\frac{d}{dK}\left(\frac{ds_1}{dD^*}\right)|_{D^*=0} > 0,$$

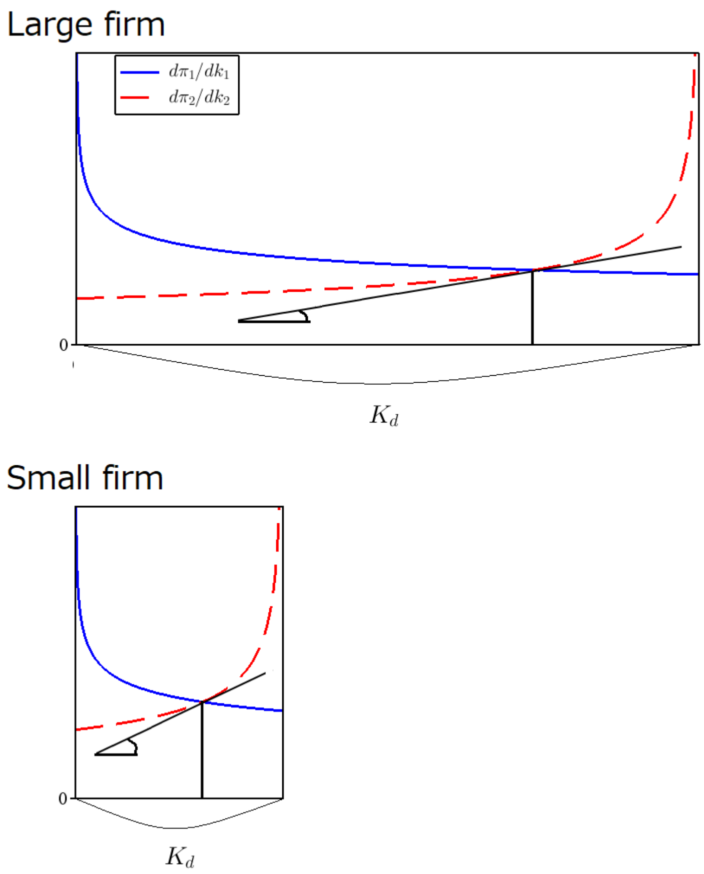
while increasing the domestic-sales share of the non-core product less:

$$\frac{d}{dK}\left(\frac{ds_2}{dD^*}\right)|_{D^*=0} < 0.$$

The magnitude of resource reallocation due to the foreign demand shock becomes smaller for the larger firm. As the larger firm tends to concentrate more on the core product in the domestic market, it changes the marginal profit from investing in core product 1 less than does the smaller firm in response to the foreign demand shock (see Figure 7). This implies that, upon export initiation, the degree of within-firm reallocation is lower in the larger firm than in the smaller firm. The foreign demand shock forces the smaller firm to change its domestic sales share more drastically. This is because the smaller firm specialises less in the core product in the domestic market and is thus vulnerable to foreign demand shocks. These considerations lead to the following hypothesis:

Hypothesis: *The impact of export initiation on the composition of domestic sales differs according to firms' resource abundance. Firms that start exporting a core product reduce its domestic share regardless of their size, but the magnitude of this reduction is smaller for larger firms in terms of resources. Firms that start exporting a non-core product raise its domestic share regardless of their size, but the magnitude of this increase is smaller for larger firms.*

Figure 7: Marginal Profits of Internal Resources in a Large Firm and a Small Firm



Note: The figure shows the representative case and does not depend on specific parameter values.

Source: Authors' calculation.

4. Empirical Analysis

In this section, we conduct formal empirical tests on the theoretical prediction that we derived in the previous section. After explaining our empirical method, we report our estimation results.

4.1. Specification

To examine the validity of our theoretical prediction (i.e. the hypothesis), we estimate the following equation for plant *i* in year *t*.

$$Y_{it}^{Core} = \beta_1 \mathrm{D}(Export_{it}^{Core}) + \beta_2 Capital_{it-1} + \beta_3 \mathrm{D}(Export_{it}^{Core}) \times Capital_{it-1} + \mathrm{u}_i + \mathrm{u}_t + \epsilon_{it} \quad (1)$$

$$Y_{it}^{Non} = \eta_1 \mathrm{D}(Export_{it}^{Non}) + \eta_2 Capital_{it-1} + \eta_3 \mathrm{D}(Export_{it}^{Non}) \times Capital_{it-1} + \mathrm{u}_i + \mathrm{u}_t + \epsilon_{it}, \quad (2)$$

where Y_{it}^{Core} is domestic sales of core products as a share of total domestic sales and Y_{it}^{Non} is domestic sales of non-core products as a share of total domestic sales. For consistency with our theoretical analysis, the denominator does not include export sales. $\mathrm{D}(Export_{it}^{Core})$ ($\mathrm{D}(Export_{it}^{Non})$) is the dummy variable that takes the value of one if firms export core products (non-core products) and zero if otherwise. *Capital* is a proxy variable for a plant's internal resources. We use the logged tangible fixed asset (ln *K*) or the logged number of workers (ln *L*) as a proxy for this variable. u_i is the plant fixed effect, u_t is the year fixed effect, and ϵ_{it} is an error term.

In Equation (1), our expectation for the sign of coefficients is as follows. First, we expect $\beta_1 < 0$. As partly confirmed in Facts 4 and 5 and theoretically demonstrated in section 3.4, the initiation of exports due to a foreign demand shock is expected to have a larger negative impact on the domestic sales of core products than on those of non-core products. This is because the core product permits more resources to move to products for the export market due to the larger allocation of resources in the pre-export period. Second, we expect $\beta_2 > 0$ as demonstrated in section 3.5. Namely, in terms of capital the larger plant makes more domestic sales from the core product than from the non-core product. This is because additional resources decrease the resource return less for the core product for the domestic market, whose initial resource allocation is larger than that of the non-core product. Third, as summarised in the hypothesis in section 3, we expect $\beta_3 > 0$. Namely, the negative effect of export initiation on domestic sales of core products is expected to become smaller in capital-abundant firms. In response to export initiation, plants with more abundant capital tend to retain more capital in the core product for the domestic market than do those with less abundant capital.

In contrast, for non-core product exporters, the expected sign of the coefficient for the dummy becomes the opposite, namely, $\eta_1 > 0$. This is because plants allocate fewer resources to non-core products before initiating exports, and changes in resource allocation have a larger impact on its returns. Therefore, more resources are allocated to non-core products and increase their domestic as well as foreign sales. Regardless of which product they export, larger plants (in terms of resources) concentrate more on the core product for the domestic market: $\eta_2 < 0$. Accordingly, the positive effect of export initiation on the domestic share of non-core products becomes smaller for more resource-abundant plants: $\eta_3 < 0$.

We estimate these equations by the ordinary least square method. One possible cause for concern is the self-selection of plants into exporting status. However, in our sample, we include only the plants that start exporting, not those that have never exported during our sample period. Thus, the self-selection of plants into exporting is out of our focus. Nevertheless, there would be large heterogeneity across exporters in terms of when and what kind of products plants start exporting. Although there are potential endogeneity problems regarding the choice of export products and the timing of export activity initiation, we believe that our findings are valuable even without causality claims.[9] As a result, we interpret our estimation results as indicating conditional correlations.

The data source for all variables is the same as in section 2, i.e. the Indonesian manufacturing surveys from 2000–2012. The sample design is also very similar to that used in Figures 3 and 4, in that sample plants are those that produced multiple products 1 year before export initiation and those that survive more than 1 year in the export market.[10] The observations categorised into 'New' in Table 2 are also included. The

[9] To address these issues explicitly, we must find appropriate instrument variables that account for when and what kind of products firms start to export. We tried to model the decision to export using typical instrumental variables, such as world export demand at the product level and the distance to the nearest international sea port. However, as all of our sample plants are export starters, these variables do not explain well the variation in terms of timing of export and choice of export products among exporting plants. Therefore, this issue remains open for future research.

[10] The denominator of the share in the dependent variable is total *domestic* sales, not total sales as in Figures 3 and 4. For those plants that stop selling their products to the domestic market after they start

basic statistics and correlation matrix among variables are available in the Appendix.

4.2. Estimation Results

We report the estimation results, which are presented in Table 3. Columns (I) and (II) show the estimation results of Equation (1) for core-product exporters, while those of Equation (2) for non-core products are presented in Columns (III) and (IV). First, the coefficients for the *Export* dummy are estimated to be negative for core-product exporters and positive for non-core product exporters, although this is insignificant in Column (III). These results are consistent with Facts 4 and 5, and are obtained even when we examine for the shares in total domestic sales and control for the plant and year fixed effects. Thus, these findings are rather robust. Second, the coefficients for the resource amount (i.e. capital and number of workers) are insignificantly estimated. Third, the interaction terms have positive and significant coefficients in the case of core-product exporters, as shown in Columns (I) and (II). This result is consistent with our theoretical hypothesis that the negative effect of export initiation on the domestic sales of core products is expected to shrink in resource-abundant firms. On the other hand, Column (IV) shows that the interaction term in non-core products is negative, as is consistent with our expectation but not significant.

exporting, we cannot define the share in dependent variables. To minimise the loss of observations, we included these plants in our sample by replacing the value of their missing share with zero.

Table 3: Baseline Estimation Results

	(I) Core	(II) Core	(III) Non-core	(IV) Non-core
D(*Export*)	-0.564**	-0.297**	0.0640	0.813***
	(0.244)	(0.135)	(0.408)	(0.152)
ln *K* (*t* -1)	-0.0108		-0.0443	
	(0.0174)		(0.0341)	
D(*Export*) * ln *K* (*t* -1)	0.0329**		0.0458*	
	(0.0156)		(0.0272)	
ln *L* (*t* -1)		-0.0667		-0.00895
		(0.0472)		(0.0471)
D(*Export*) * ln *L* (*t* -1)		0.0575**		-0.0146
		(0.0235)		(0.0297)
Number of observations	450	644	334	543
R-squared	0.630	0.567	0.717	0.650

Notes: Robust standard errors are in parentheses. *, **, and *** indicate the statistical significance at 10 percent, 5 percent, and 1 percent, respectively. Columns 'Core' and 'Non-core' indicate the cases where exported products are core products and non-core products, respectively. In all specifications, we control for plant and year fixed effects.
Source: Authors' calculation.

Our use of the export dummy variable implicitly assumes that the share of domestic sales of products changes only when exports begin and are constant afterward. However, one may be interested in whether or not the share associated with exporting changes as time goes by. As one of the extension analyses, instead of the export dummy variable, we introduce the export experience dummy, D(*Export* for *X*-year), which takes the value of one if it takes *X* years since they began exporting their core or non-core products. Since our sample is restricted to the period from 1 year before starting exporting to 2 years after that, we include three dummy variables and their interaction terms with the proxy of resources.

The estimation results are presented in Table 4. As in Table 3, core-product exporters significantly reduce their share of core-product sales in total domestic sales as time goes by after they start exporting. However, its time trend is not stable: the absolute magnitude rises 1 year after exporting but declines 2 years after that. Further, the coefficients of the interaction terms with capital are positive but only significant 1 year after exports begin, while those with the number of workers are all significant.

These results imply that the production adjustment process is heterogeneous in terms of plants' resource size, especially when it is measured by the number of employees. The time trend of the magnitude in the interaction terms is similar to that of non-interacted export experience dummy variables. On the other hand, in the case of non-core products, there is little systematic correlation between exporting and resources. One finding in Column (IV) indicates that the coefficients for export experience dummy variables decrease.

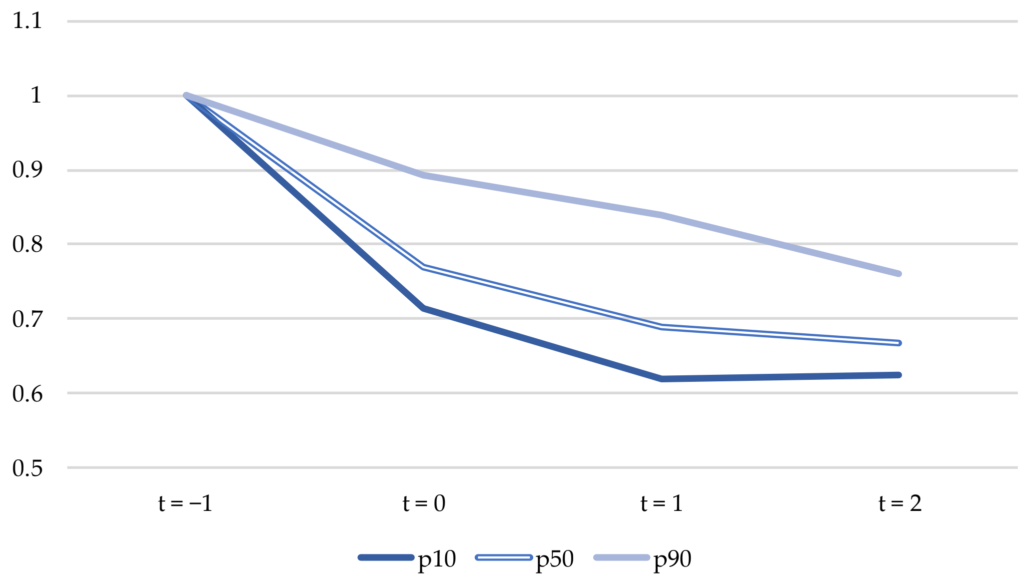
Table 4: Estimation Results: Export Experience Dummy

	(I) Core	(II) Core	(III) Non-core	(IV) Non-core
D(*Export* for 0-year)	-0.674**	-0.464***	-0.210	0.623***
	(0.283)	(0.149)	(0.430)	(0.162)
D(*Export* for 1-year)	-0.858***	-0.579***	-0.183	0.568***
	(0.263)	(0.130)	(0.434)	(0.159)
D(*Export* for 2-year)	-0.671**	-0.567***	-0.369	0.474***
	(0.264)	(0.137)	(0.424)	(0.154)
D(*Export* for 0-year) * ln K (t-1)	0.0321		0.0492*	
	(0.0196)		(0.0293)	
D(*Export* for 1-year) * ln K (t-1)	0.0395**		0.0326	
	(0.0177)		(0.0293)	
D(*Export* for 2-year) * ln K (t-1)	0.0244		0.0418	
	(0.0178)		(0.0289)	
ln K (t-1)	-0.00780		-0.0392	
	(0.0175)		(0.0352)	
D(*Export* for 0-year) * ln L (t-1)		0.0630**		-0.00963
		(0.0294)		(0.0339)
D(*Export* for 1-year) * ln L (t-1)		0.0646**		-0.0326
		(0.0254)		(0.0326)
D(*Export* for 2-year) * ln L (t-1)		0.0580**		-0.0232
		(0.0269)		(0.0318)
ln L (t-1)		-0.0638		0.00747
		(0.0481)		(0.0484)
Number of observations	450	644	334	543
R-squared	0.627	0.562	0.718	0.649

Notes: Robust standard errors are in parentheses. *, **, and *** indicate the statistical significance at 10 percent, 5 percent, and 1 percent, respectively. Columns 'Core' and 'Non-core' indicate the cases where exported products are core products and non-core products, respectively. In all specifications, we control for plant and year fixed effects.
Source: Authors' calculation.

In Table 4, the relationship between exporting and resources was unclear because it examined export experience and its interaction with resources simultaneously. To see how far the changes in the share associated with export initiation differ according to plant resource size, we calculate the predicted share of domestic sales of core products for plants with capital stock or the number of workers at the 10th, 50th, and 90th percentiles. We normalise each share to have a value of one as of 1 year before export starting. The predicted shares are shown for capital stock in Figure 8 and for the number of workers in Figure 9. These figures show that the reduction in the share of domestic core-product sales differs substantially according to plant resource size. While it decreases over time in all plants, the absolute magnitude of its decrease is smaller in firms that are larger in terms of resources.

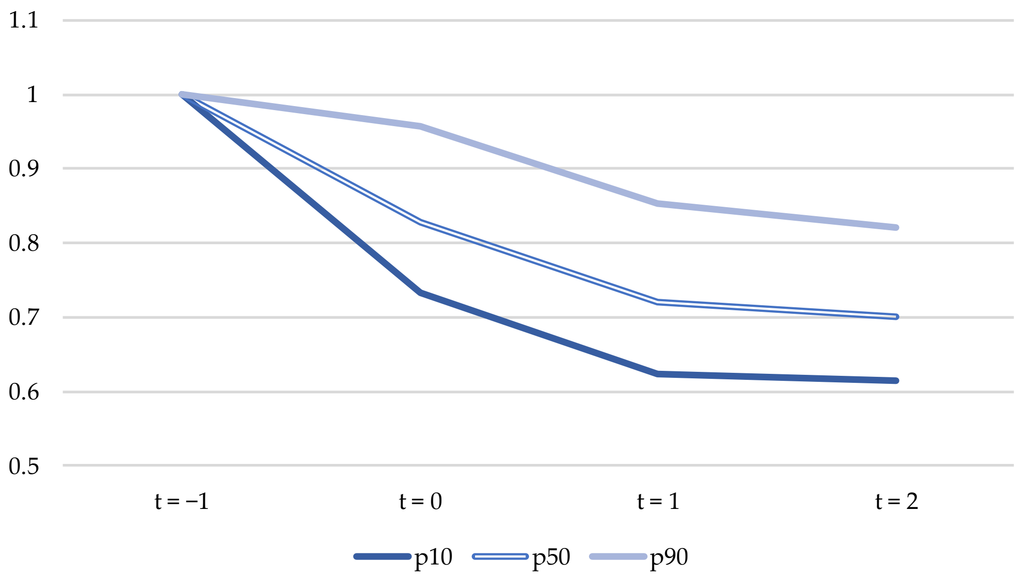
Figure 8: Predicted Shares of Domestic Sales for Core Products According to Capital Stocks



Note: Each share is rescaled to be the value of one as of 1 year before exports begin.

Source: Authors' calculation.

Figure 9: Predicted Shares of Domestic Sales for Core Products According to the Number of Workers



Note: Each share is rescaled to be the value of one as of 1 year before exports begin.

Source: Authors' calculation.

Finally, we conduct three robustness checks and extended analyses. The first uses a different definition of core products, that is, those products with the largest sales share within a plant 1 year before export initiation, without any threshold for their sales share. This definition becomes problematic if their sales ranking changes frequently over time before they start exporting. To focus on products with a majority sales share, we use three different thresholds for pre-export sales share: 60 percent, 75 percent, and 90 percent. The results are presented in Table 5. The results do not change much when we use the threshold of 60 percent; however, in case of the higher level of thresholds (75 percent and 90 percent), the coefficient for D(*Export*) and its interaction become insignificant, probably due to the loss of the number of observations.

Table 5: Estimation Results: Different Definition of Core Products

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
	Core product: Share ≥ 60%				Core product: Share ≥ 75%				Core product: Share ≥ 90%			
	Core	Core	Non-core	Non-core	Core	Core	Non-core	Non-core	Core	Core	Non-core	Non-core
D(*Export*)	-0.634**	-0.374**	0.708	0.828***	-0.772*	-0.249	0.237	0.883***	-1.283	-0.207	0.261	0.678
	(0.313)	(0.155)	(0.527)	(0.194)	(0.426)	(0.193)	(0.592)	(0.261)	(0.963)	(0.341)	(2.185)	(0.450)
ln *K* (*t*-1)	-0.00560		0.0256		-0.0324		0.00593		-0.102		0.0110	
	(0.0245)		(0.0390)		(0.0521)		(0.0467)		(0.0873)		(0.144)	
D(*Export*) * ln *K* (*t*-1)	0.0418**		0.00334		0.0557*		0.0324		0.0988		0.00410	
	(0.0203)		(0.0350)		(0.0299)		(0.0390)		(0.0698)		(0.136)	
ln *L* (*t*-1)		-0.100*		0.0166		-0.0348		0.106		0.00832		-0.116
		(0.0528)		(0.0543)		(0.0725)		(0.0846)		(0.107)		(0.209)
D(*Export*) * ln *L* (*t*-1)		0.0743***		0.00170		0.0431		-0.00529		0.0355		0.0217
		(0.0268)		(0.0370)		(0.0330)		(0.0486)		(0.0567)		(0.0914)
Number of observations	323	474	226	360	190	293	140	236	80	133	46	77
R-squared	0.641	0.580	0.722	0.663	0.636	0.539	0.765	0.675	0.728	0.561	0.818	0.682

Notes: Robust standard errors are in parentheses. *, **, and *** indicate the statistical significance at 10 percent, 5 percent, and 1 percent, respectively. Columns 'Core' and 'Non-core' indicate the cases where exported products are core products and non-core products, respectively. In all specifications, we control for plant and year fixed effects.

Source: Authors' calculation.

Second, we examine whether or not the decline in domestic sales of the core or non-core products is related to the size of exports. To this end, we replace the export dummy (D(*Export*)) with a log of exports. To include the observations before firms' start of exporting, we add the value of one to the export value and then take its log. The magnitude is normalised by our control of the plant fixed effect. The results are presented in Table 6 and show that our major results do not change

Table 6: Estimation Results—Logged Exports

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
					Core product: Share ≥ 60%			
	Core	Core	Non-core	Non-core	Core	Core	Non-core	Non-core
ln (*Exports* + 1)	-0.0329**	-0.0208**	-0.0114	0.0367***	-0.0382*	-0.0250***	-0.00585	0.0306**
	(0.0156)	(0.00841)	(0.0225)	(0.00911)	(0.0202)	(0.00947)	(0.0340)	(0.0120)
ln *K* (*t* -1)	-0.00793		-0.0255		-0.00129		0.00446	
	(0.0160)		(0.0314)		(0.0245)		(0.0402)	
ln (*Exports* + 1) * ln *K* (*t* -1)	0.00227**		0.00274*		0.00266**		0.00241	
	(0.000995)		(0.00147)		(0.00129)		(0.00220)	
ln *L* (*t* -1)		-0.0568		0.00147		-0.0793		0.00405
		(0.0454)		(0.0467)		(0.0512)		(0.0588)
ln (*Exports* + 1) * ln *L* (*t* -1)		0.00474***		-0.00136		0.00563***		0.000550
		(0.00154)		(0.00177)		(0.00175)		(0.00231)
Number of observations	450	644	334	543	323	474	226	360
R-squared	0.630	0.573	0.753	0.689	0.643	0.587	0.754	0.706

Notes: Robust standard errors are in parentheses. *, **, and *** indicate the statistical significance at 10 percent, 5 percent, and 1 percent, respectively. Columns 'Core' and 'Non-core' indicate the cases where exported products are core products and non-core products, respectively. In all specifications, we control for plant and year fixed effects.
Source: Authors' calculation.

Third, to see whether the changes in domestic sales associated with export initiation can be seen at the level of sales as well as the product share, we replace the share of the core or non-core products in domestic sales with a log of domestic sales of the core or non-core products. The results are reported in Table 7. While the coefficients for the export dummy are significant with a sign similar to that of the share, we have no significant coefficients for its interaction terms with the proxy of resources. It is worth discussing the former result further. The export dummy has negative coefficients in core products and positive coefficients in non-core products. While the negative sign in the core products is consistent with our theoretical prediction, our theoretical model also predicted the negative sign in the non-core products when we examine the level of domestic sales rather than their share. Nevertheless, we can at least say that the negative impact on domestic sales of the exported product is larger when exporting core products.

Table 7: Estimation Results—Logged Domestic Sales as a Dependent Variable

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
					Core product: Share ≥ 60%			
	Core	Core	Non-core	Non-core	Core	Core	Non-core	Non-core
D(*Export*)	-7.493**	-5.462***	-3.284	7.173**	-7.198	-5.387**	15.21	10.22***
	(3.790)	(2.014)	(9.348)	(2.939)	(4.952)	(2.332)	(10.29)	(3.501)
ln *K* (*t*-1)	0.234		-0.668		0.443		1.404*	
	(0.290)		(0.856)		(0.413)		(0.788)	
D(*Export*) * ln *K* (*t*-1)	0.180		0.900		0.246		-0.336	
	(0.252)		(0.642)		(0.339)		(0.717)	
ln *L* (*t*-1)		-1.022		-0.284		-1.281		0.542
		(0.758)		(1.042)		(0.891)		(1.094)
D(*Export*) * ln *L* (*t*-1)		0.514		0.426		0.631		0.163
		(0.347)		(0.635)		(0.409)		(0.742)
Number of observations	450	644	334	543	323	474	226	360
R-squared	0.700	0.624	0.620	0.532	0.704	0.617	0.629	0.553

Notes: Robust standard errors are in parentheses. *, **, and *** indicate the statistical significance at 10 percent, 5 percent, and 1 percent, respectively. Columns 'Core' and 'Non-core' indicate the cases where exported products are core products and non-core products, respectively. In all specifications, we control for plant and year fixed effects.
Source: Authors' calculation.

5. Summary and Policy Implications

This study investigated, both theoretically and empirically, the within-plant reallocation of resources across products and markets when multi-product firms start exporting. Our empirical analysis was conducted using the Indonesian manufacturing surveys from 2000–2012. As a result, we showed that, to create room for production capacity for exported products, new exporters reduced the production of their core-competence products for the domestic market more than they did that of their non-core-competence products. This result does not depend on whether firms start exporting their core-competence or non-core-competence products. Furthermore, the magnitude of such reallocation differs according to the firms' resource abundance, especially when exporting their core products. Firms that are less resource-abundant in terms of capital and labour decrease production for the domestic market more than their resource-abundant counterparts. In other words, these firms experience more drastic resource reallocation.

These theoretical and empirical findings suggest that it is key to determine how SMEs obtain resources to start exporting. The decline in the production of core-competence products for the domestic market may harm the economy in the following ways. First, core-competence products are those that firms were originally good at producing. The reallocation of resources from such products to non-core products in the domestic market may reduce firms' efficiency, especially in the long run. Second, sacrificing domestic sales makes it possible to begin exporting. Therefore, this may not increase total sales more than firms had originally expected. Third, the decline in domestic sales may raise the price of core-competence products in the domestic market, harming consumers' welfare. To avoid these consequences, it will be important to soften the drastic shift of resources within SMEs by enabling them to obtain additional resources to begin exporting. For instance, policies that enhance capital market liquidity and labour market flexibility may promote the reallocation of resources from non-exporting firms to exporting firms. Moreover, direct support from the government, such as financial support, is a natural policy option. Such policy measures may mitigate firms' resource constraints as well as the possible negative effects from the within-firm reallocation of resources on export initiation.

Another implication is that domestic sales do not play a crucial role in determining the performance of exporting firms. For example, when policy makers support the promotion of exports to firms, the impact of the policy varies depending on which products (whether core or non-core competence) firms choose to export. When firms start exporting core-competence products with this form of support, policy makers will see a decline in domestic sales of their core-competence products. The magnitude of the decline will be greater for firms with fewer internal resources in particular. This may lead them to think that the support has failed and must thus be stopped. However, reductions in domestic sales are more or less inevitable as a result of within-firm reallocation, and judging the effectiveness of export promotion from the domestic performance of the supported firms may lead to a wrong conclusion. We recommend judging the success of a policy based on the performance of exports, not on domestic performance.

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Appendix 1: Other Tables

Table A1: Correspondence Table on Export Survival Years

	Start							
End	2003	2004	2005	2008	2009	2010	2011	2012
2003	1							
2004	2	1						
2005	3	2	1					
2006								
2007	3	3	3					
2008	3	3	3	1				
2009	3	3	3	2	1			
2010	3	3	3	3	2	1		
2011	3	3	3	3	3	2	1	
2012	3	3	3	3	3	3	2	1

Notes: 'Start' refers to the first export year. 'End' shows the final year in which positive exports are observed. Numbers in the table indicate the duration year of export survival. The case of '3' is categorised as 'Over 2 years' in Figures 1 and 2. Notice that the data for 2006 do not report sales for domestic and export markets separately.

Source: Authors' calculation.

Table A2: Basic Statistics

	N	Mean	SD	p10	p90
Share of core-product domestic sales	1,208	0.557	0.438	0.000	1.000
Log of core-product domestic sales	1,208	10.798	7.237	0.000	18.233
Log of core-product export sales	1,208	7.894	7.635	0.000	16.946
D(*Export*)	1,208	0.750	0.433	0.000	1.000
ln K (t-1)	804	14.583	2.413	12.196	17.881
ln L (t-1)	1,187	4.691	1.308	3.135	6.603
D(*Export*) * ln K (t-1)	804	11.797	6.223	0.000	17.615
D(*Export*) * ln L (t-1)	1,187	3.577	2.301	0.000	6.399

Source: Authors' calculation.

Table A3: Correlation Matrix

		[1]	[2]	[3]	[4]	[5]	[6]	[7]
[1]	Share of core-product domestic sales	1						
[2]	Log of core-product domestic sales	0.83	1					
[3]	Log of core-product export sales	0.18	0.17	1				
[4]	D(*Export*)	-0.01	-0.07	0.53	1			
[5]	ln *K* (*t*-1)	0.03	0.19	0.13	0.07	1		
[6]	ln *L* (*t*-1)	0.00	0.20	0.15	0.03	0.65	1	
[7]	D(*Export*) * ln *K* (*t*-1)	0.02	0.01	0.53	0.93	0.39	0.24	1
[8]	D(*Export*) * ln *L* (*t*-1)	0.02	0.06	0.52	0.84	0.38	0.52	0.91

Source: Authors' compilation.

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