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Who uses intermediaries in international trade? Evidence from firm-level survey data

by

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Abstract

The present paper uses data from the World Bank Enterprise Survey conducted in Turkey in 2005 to shed light on the firms which use intermediaries in international trade. It lends robust empirical support to recent theories which suggest that indirect exporters are mostly small firms which are not profitable enough to cover the high fixed costs of building their own distribution network abroad. Manufacturers which introduce entirely new products to foreign markets are more likely to use trade intermediaries, as are firms which produce low quality goods. In contrast, neither foreign ownership nor credit constraints are correlated with the choice of export mode. Moreover, firms which rely on trade intermediaries to sell their goods abroad also do so to source their foreign inputs, implying that the role of intermediaries in facilitating trade may be larger than previous studies suggest.

JEL classification: F12, F14

Keywords: Heterogeneous firms, intermediated trade

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4. *Data and descriptive statistics*
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Non-Technical Summary

Intermediaries play a quantitatively important role in the exchange of goods and services across borders. Only recently, researchers have started to explore why some manufacturers prefer using a trade intermediary to exporting directly. Besides destination country characteristics, the choice of export mode also depends on firms and product characteristics. Theory suggests that smaller firms are more likely to rely on trade intermediaries as they are not profitable enough to cover the high fixed costs of building an own distribution network abroad. It further predicts that firms with low quality goods prefer indirect to direct export modes.

From an empirical perspective, we know little about the firms which use trade intermediaries. This is mainly due to data limitations. Most of the existing studies rely on transaction-level data from customs authorities. While such data indicates whether a particular good is shipped to a specific country by an intermediary, it provides no information on the manufacturer who supplied the intermediary with the good in the first place. However, knowing which firms make use of trade intermediaries is important to design effective export promotion policies, to evaluate the impact of protectionist measures, or to analyze the effect of reforms in the intermediary sector on aggregate welfare and trade volumes, for instance.

The present paper fills this gap using data from the World Bank Enterprise Survey conducted in Turkey in 2005. In addition to information about a variety of firm characteristics, the survey provides information about the share of revenues generated by selling domestically, by exporting directly, and by exporting indirectly via a trade intermediary. It covers a large representative sample of Turkish firms in terms of size, region, and sector.

The empirical analysis indicates that the share of indirect exports in total exports declines significantly with firm size, and this result is robust to the inclusion of a variety of control variables, different estimation methods, and different measures of firm size. To alleviate the problem of reverse causality, I use lagged firm size as an alternative explanatory variable. The estimated coefficient on firm size is only slightly larger in absolute terms and remains negative and highly significant.

Conditional on firm size, manufacturers introducing entirely new products to foreign markets are more likely to resort to trade intermediaries, while those merely upgrading an existing product and not having to search for new customers abroad access the foreign market rather directly. Product quality more generally is negatively correlated with indirect as opposed to direct exports, as theory predicts. Interestingly, firms which sell their goods abroad indirectly are also likely to rely on trade intermediaries to source foreign inputs. This suggests that the role of intermediaries in facilitating trade may be even larger than previous studies suggest.

1 Introduction

In international trade theory, it is typically assumed that manufacturing firms which want to serve the foreign market ship their products directly to their final consumers. What we observe in reality, however, is that very often trade intermediaries are involved in the exchange of goods and services across borders. Intermediaries are *"... economic agents that purchase from suppliers for resale to buyers or that help buyers and sellers to meet and transact"* (Spulber, 1996). If buyers and sellers are based in different countries, these agents are trade intermediaries. They include wholesalers and retailers in the exporting and importing country as well as large trading companies. In the 1990s, for instance, Japanese trading companies exported over 40% and imported over 70% of the country's products (Jones, 1998), and Hong Kong intermediated over 50% of the volume of China's exports to the rest of the world (Feenstra and Hanson, 2004). Wholesalers and retailers account for 10 % of U.S. exports (Bernard et al., 2010b), while the shares of total exports handled by intermediaries amount to 22% and 11% in China and Italy, respectively (Ahn et al., 2011; Bernard et al., 2010a). In the sample of Turkish firms considered in the present paper, more than 17% of all exports are shipped indirectly.

Only recently, researchers have started to explore why firms prefer using a trade intermediary to exporting their goods directly. Not surprisingly, the choice of export mode depends on destination country characteristics, such as the size of the foreign market (Bernard et al., 2010a; Schröder et al., 2005), the risk of expropriation, the enforceability of international contracts, or the cultural distance to the target country (Felbermayr and Jung, 2011). In general, markets that are smaller and more difficult to access are more likely to be served via trade intermediaries.

However, the choice of export mode also depends on firm and product characteristics. An important insight that emerges from novel theoretical contributions is that all else equal, smaller firms prefer to export their products via trade intermediaries, while larger firms prefer to sell their goods abroad directly. Ahn et al. (2011) introduce an intermediation technology in an otherwise standard heterogeneous firm model of international trade. As in the seminal model of Melitz (2003), firms can ship their goods directly if they incur a fixed cost of exporting. Alternatively, firms can export their products via a trade intermediary. This involves lower fixed costs, but as the trade intermediary incurs an additional per unit cost to handle the goods, it also implies lower export revenues. In the presence of such an intermediation technology, firms sort into export modes according to their sizes. The smallest firms do not export at all and sell to the domestic market only. Larger firms export indirectly via a trade intermediary, and the largest firms export directly to final consumers.

A similar approach is taken by Felbermayr and Jung (2011). In their model, lower revenues from indirect as opposed to direct exports result from imperfectly enforceable contracts between exporters and trade intermediaries. Due to this distortion, larger exporters prefer to incur the higher fixed costs of building their own distribution network abroad and export their goods directly. For smaller exporters trading via an intermediary is nevertheless attractive, as it helps them to save on the fixed costs of exporting. Akerman (2010) derives the same sorting pattern of firms by introducing wholesalers who are able to spread the fixed costs of exporting across more than one good, but have to charge an additional markup on the procurement price of the firm to cover these fixed costs.[1]

Other models of trade intermediation emphasize the role of product quality. Crozet et al. (2010) assume that firms which offer high quality goods face greater demand and will thus prefer a direct export mode to save on variable trade costs. Tang and Zhang (2011) develop a model in which an intermediary can verify product quality at lower costs than the manufacturer. However, hold up problems between the intermediary and the manufacturer cause the intermediary to underinvest in quality verification and thus reduce export revenues. This problem is particularly severe for manufactures with high quality products, which therefore choose to access foreign markets rather directly.

From an empirical perspective, although there is a growing literature on the nature of trade intermediaries, the products they ship, and the markets they serve, little is known about the firms that actually use these trade intermediaries. This is mainly due to data limitations. Most studies on the role of intermediaries in international trade rely on transaction level data from customs authorities (e.g. Ahn et al., 2011; Akerman, 2010; Crozet et al., 2010). While such data allows to observe whether a particular good is shipped to a specific country by an intermediary, it provides no information on the manufacturer which supplied the good to the intermediary in the first place. Knowing which firms make use of trade intermediaries is however important to design effective export promotion policies, to evaluate the impact of protectionist measures, or to analyze the effect of regulatory reform in the intermediary sector on aggregate welfare and trade volumes, for instance.

The present paper fills this gap and uses data from the World Bank Enterprise Survey conducted in Turkey in 2005 to shed light on the manufacturers which rely on trade intermediaries to serve foreign markets. In addition to information about a variety of firm characteristics, the survey provides information about the share of revenues generated by selling domestically, by exporting directly, and by exporting

[1] Keller et al. (2011) provide empirical evidence which supports the idea that trade intermediaries reduce the fixed costs of gaining access to foreign markets.

indirectly via a trade intermediary. It covers a comparatively large representative sample of Turkish firms in terms of firm size, and includes both exporters and non-exporters from a broad range of manufacturing sectors. I do not only provide robust evidence on the relationship between firm size and the choice of export mode, as hypothesized by recent theoretical contributions, but also explore a number of other firm characteristics which are potentially correlated with the decision to use a trade intermediary rather than to export directly.

In particular, the empirical analysis indicates that the share of indirect exports in total exports declines significantly with firm size, and this result is insensitive to the inclusion of a variety of control variables, different estimation methods and different measures of firm size. Adding proxies for firm age, skill intensity, ownership structure, or product quality and innovation has no effect on the sign or significance of the estimated coefficient of firm size. Going beyond ordinary least squares regressions and applying a non-linear quasi-maximum likelihood estimator developed for fractional dependent variables does not change the main conclusions either, nor does it matter whether sales or employees are used as a measure of firm size. A potential concern in interpreting the estimated coefficient as the causal effect of firm size on the choice of export mode is reverse causality. It may well be conceivable that firms have less employees simply because they opted for indirect exports and hence do not need a foreign sales department. To alleviate the problem of reverse causality, I use lagged firm size as an alternative explanatory variable. The coefficient on firm size is only slightly larger in absolute terms and remains negative and highly significant.

A drawback of the data is that it does not contain any information on the destination of a firm's exports. However, I will argue that if the number and the identity of a firm's export markets depend on the firm's size, there is still a clear prediction regarding the relationship between firm size and the share of indirect exports in total exports. A small firm will start exporting indirectly to a foreign market which is easily accessible. A large firm will deliver to the same market rather directly. Even if it uses a trade intermediary to enter into additional foreign markets, which are most likely less accessible, the share of indirect exports in total exports will be lower than for a small firm. In other words, if I do not control for the number of destination countries served, I would underestimate the negative relationship between firm size and the relative prevalence of intermediated exports. In that sense, my estimates are very conservative indicators of the negative relationship between firm size and the share of indirect exports in total exports to a given foreign market.

Conditional on firm size, manufacturers introducing entirely new products to foreign markets are more likely to resort to trade intermediaries, while those merely upgrading an existing product and not having to search for new customers access

the foreign market rather directly. While product innovation has been shown to foster exports at the firm level (e.g. Ganotakis and Love, 2010; Lachenmaier and Wößmann, 2006), this result sheds a more nuanced light on how different types of product innovation relate to different modes of foreign market access. Product quality more generally is negatively correlated with indirect as opposed to direct exports, lending support to recent models on the role of product quality in the presence of trade intermediaries. Interestingly, firms which sell their goods abroad indirectly are also likely to rely on trade intermediaries to source foreign inputs. Hence, indirect exporters are also indirect importers, which implies that the role of intermediaries in facilitating trade may be even larger than previous theoretical and empirical studies suggest.

The most closely related empirical papers are Felbermayr and Jung (2011), Ahn et al. (2011), Fryges (2007), and Hessels and Terjesen (2010). Using census data on exports of U.S. firms, Felbermayr and Jung (2011) relate the relative prevalence of trade intermediaries to destination country characteristics as well as to the dispersion of firm size across industries. They find that industries with higher size dispersion exhibit a significantly lower relative prevalence of trade intermediaries, a result that is consistent with their prediction regarding the sorting pattern of firms into different export modes. Yet, they do not provide direct evidence at the firm level regarding the relationship between firm size or other firm characteristics and the choice of export mode.

Ahn et al. (2011) also focus on the correlation between aggregate shares of intermediated exports and destination country characteristics. They use Chinese customs data which allows them to classify exporters into manufacturing firms and trade intermediaries. One of their observations is that trade intermediaries export higher unit values, which is in line with the idea that intermediaries charge additional markups and export more expensive goods produced by less efficient firms. As the customs authorities have no information about the clients of the trade intermediaries, however, Ahn et al. (2011) cannot use the data to test the prediction regarding the relationship between firm size and the choice of export mode directly. Therefore, in a recent revision, they also resort to data from the World Bank Enterprise Survey. Their findings for Chinese firms are largely consistent with my findings for Turkish firms, showing an inverted U-shaped relationship between firm size and the fraction of indirect exports in total sales for a sample of both exporters and purely domestic firms. Yet, they do not control for firm characteristics other than industry affiliation, which may bias their results. This is particularly true as export sales and domestic sales, which both enter their dependent variable, are likely to be affected by different firm characteristics. My work goes beyond theirs not only in addressing

the robustness of the result, but also in exploring the role of a variety of other firm characteristics which turn out to be significantly correlated with the choice of export mode.[2]

Analyzing survey data of German and British firms, Fryges (2007) identifies the factors that drive firms to switch between different export modes. Controlling for destination country characteristics, he finds that firm size has a significantly positive effect on the probability to change from indirect exports to direct exports, and interprets his result as evidence for the claim that larger exporters are more likely to dispose of sufficient resources to establish their own distribution network abroad. But his sample is rather small and covers only young firms in high-tech industries. Hessels and Terjesen (2010) also provide evidence on the determinants of the choice of export mode at the firm level. For a sample of small and medium sized enterprises in the Netherlands, they find no significant effect of firm size on the probability to export indirectly as opposed to directly, which is presumably due to their very small sample which basically excludes the largest firms in the economy.

In the following section, I sketch a very simple and highly stylized model on the relationship between firm size and the choice of export mode to capture the main arguments from the literature. In section 3, I derive some testable hypotheses on the relationship between firm size and other firm characteristics and the use of trade intermediaries. I briefly describe the data in section 4 before I show the results of the empirical analysis in section 5. In section 6, I address the robustness of the results, before I summarize and conclude in section 7.

2 A simple model

There are two symmetric countries each of which is populated by a mass L of consumers with identical preferences over a continuum of varieties of a differentiated good,

$$U = \left(\int c_i^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}} \tag{1}$$

with $\sigma > 1$. The assumption of symmetry is not crucial for the results and can easily be relaxed. Each consumer inelastically supplies one unit of labor, and the

[2]Two other recent studies which use data from the World Bank Enterprise Survey to analyze the export behavior of manufacturers are McCann (2010) and Lu et al. (2010). Both studies pool data from different countries, which is problematic for reasons explained in footnote 7. Neither the revision of Ahn et al. (2011) nor the studies by McCann (2010) and Lu et al. (2010) were available before the first version of the present paper appeared as CDSE Discussion Paper.

wage rate is normalized to one. Aggregate demand in each country for each variety i is

$$q_i = \frac{L p_i^{-\sigma}}{P^{1-\sigma}} \tag{2}$$

where p_i is the consumer price of variety i and $P = \left(\int p_i^{1-\sigma} di\right)^{1/(1-\sigma)}$ is the ideal price index over all consumed varieties.

The differentiated good is produced with increasing returns to scale under monopolistic competition, which implies that each variety will be produced by at most one firm, and no firm will produce more than one variety. To produce one unit of variety i for its domestic market, firm i requires a_i units of labor. Firms differ in their marginal costs a_i. As in Melitz (2003), they can learn about their marginal costs only after they have made a fixed investment of f_E units of labor, which is thereafter sunk. In addition to the variable costs of production, there are fixed distribution costs of f units of labor, which reflect the resources needed to build a distribution network, to maintain customer relations or to meet specific product standards.

If a firm wants to sell its variety abroad, it has the choice between two different export modes. It can either ship its products directly to the final consumers. In this case, the firm has to incur iceberg trade costs $\tau_D > 1$, which reflect transport costs, import tariffs and other variable costs related to shipping the product abroad. In addition, the firm has to pay fixed distribution costs of f_D units of labor. Alternatively, the firm can use a trade intermediary. Exporting indirectly via a third party causes iceberg trade costs $\tau_I > 1$ and fixed distribution costs of f_I units of labor. Using both export modes simultaneously to ship goods to a given destination country is never optimal, as this creates unnecessarily high fixed costs.

It is assumed that the variable trade costs of exporting indirectly are higher than the variable trade costs of exporting directly, $\tau_I > \tau_D$. One interpretation is that the higher variable costs of exporting indirectly reflect an additional markup charged by the trade intermediary (Ahn et al., 2011). Another reason might be that the contract between the firm and the trade intermediary is not enforceable, and hence the trade intermediary has an incentive to hold up the manufacturer, which leads to lower export revenues (Felbermayr and Jung, 2011).[3]

[3]Strictly speaking, higher iceberg trade costs lead to higher marginal costs for the manufacturer, while both the additional markup charged by the trade intermediary and the hold up problem due to incomplete contract enforcement would lead to higher consumer prices, but not to higher marginal costs for the manufacturer. Yet, the effect of higher iceberg trade costs on the revenues and profits of the manufacturer is qualitatively the same as the effect of higher consumer prices. See also the discussion in Felbermayr and Jung (2011) on this point.

Further, the fixed distribution costs associated with indirect exporting are assumed to be lower than the fixed costs of exporting directly, $f_I < f_D$. Intuitively, trade intermediaries can spread the fixed costs of building and maintaining a distribution network across many manufacturers and thus lower them for each individual firm (Schröder et al., 2005). In addition, a trade intermediary is more familiar with the target market and draws on strong networks, making access to this market cheaper (Felbermayr and Jung, 2011). Finally, searching for a trade intermediary is most likely not as costly for a manufacturer as searching for many new customers abroad (Ahn et al., 2011; Blum et al., 2011). In any case, getting access to a distribution network is more expensive abroad than at home, $f < f_I < f_D$.

The profit maximizing consumer price for variety i is $p_i^H = \frac{\sigma}{1-\sigma} a_i$ on the domestic market. On the foreign market, it is $p_i^I = \frac{\sigma}{1-\sigma} \tau_I a_i$ if the good is exported indirectly and $p_i^D = \frac{\sigma}{1-\sigma} \tau_D a_i$ if the good is exported directly. Multiplying prices with the respective quantities and simplifying notation gives the following expressions for the potential sales firm i can make on the domestic and foreign market,

$$s_i^H = A\, \varphi_i \tag{3}$$

$$s_i^I = A\, \tau_I^{1-\sigma}\, \varphi_i \tag{4}$$

$$s_i^D = A\, \tau_D^{1-\sigma}\, \varphi_i \tag{5}$$

where $A \equiv \frac{L}{P^{1-\sigma}} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma}$ captures market conditions such as the size of the population and the aggregate price level, which is determined endogenously, and $\varphi_i = a_i^{1-\sigma}$ is a measure of firm productivity. The potential profits firm i can generate at home or abroad, given aggregate demand in the respective countries, are

$$\pi_i^H = \frac{A}{\sigma}\, \varphi_i - f \tag{6}$$

$$\pi_i^I = \frac{A}{\sigma}\, \tau_I^{1-\sigma}\, \varphi_i - f_I \tag{7}$$

$$\pi_i^D = \frac{A}{\sigma}\, \tau_D^{1-\sigma}\, \varphi_i - f_D. \tag{8}$$

Firm i will be active on the domestic market only if $\pi_i^H \geq 0$. It will export indirectly if $\pi_i^I \geq 0$ and $\pi_i^I > \pi_i^D$, and export directly if $\pi_i^D \geq \pi_i^I$. As marginal costs are constant, the decision to be active on the home market and the decision to export are independent of each other. This defines the following productivity cutoff

values for selling on the domestic market, for exporting indirectly, and for exporting directly,

$$\varphi^H = \frac{\sigma f}{A} \tag{9}$$

$$\varphi^I = \frac{\sigma f_I}{A\ \tau_I^{1-\sigma}} \tag{10}$$

$$\varphi^D = \frac{\sigma(f_D - f_I)}{A\ (\tau_D^{1-\sigma} - \tau_I^{1-\sigma})}. \tag{11}$$

with $\varphi^H < \varphi^I < \varphi^D$, under the assumption that the difference in fixed export costs is sufficiently large to make indirect exporting attractive for small exporters, $f_D/f_I > (\tau_I/\tau_D)^{\sigma-1}$. The least productive firms with $\varphi_i < \varphi^H$ are not able to cover the fixed distribution costs and exit the market. All firms with $\varphi^H \leq \varphi_i < \varphi^I$ sell their products on the domestic market only, while all firms with $\varphi^I \leq \varphi_i < \varphi^D$ also serve the foreign market via indirect exports. The most productive firms with $\varphi_i \geq \varphi^D$ choose to deliver their products directly to their foreign consumers. The productivity cutoff values, together with the distribution of marginal costs or firm productivities, respectively, determine the aggregate price level.

3 Hypothesis on the choice of export mode

The sorting pattern of firms into purely domestic sellers, indirect exporters and direct exporters implies that the share of indirect exports in total exports to a given destination country is

$$S_i = \frac{s_i^I}{s_i^I + s_i^D} = \begin{cases} 1 & \text{if } \varphi^I \leq \varphi_i < \varphi^D \\ 0 & \text{if } \varphi^D \leq \varphi_i \end{cases} \tag{12}$$

In a world with a variety of destination countries with different characteristics, such as population size, the aggregate price level or the extent of the fixed and variable trade costs, a strict partitioning into only indirect and only direct exporters will of course not be observed, as the respective productivity cutoff values for different destination countries will overlap. However, I would expect a negative relationship between the share of indirect exports in total exports and firm productivity to persist. Highly productive firms may serve additional countries which are not profitable enough for inefficient firms,[4] and they may even use a trade intermediary if these countries are hardly accessible. Yet, as highly productive firms will also ship their

[4] A positive relationship between firm productivity or firm size and the number of export destinations is documented by Bernard et al. (2010c) and Eaton et al. (2011), for instance.

goods directly to markets that inefficient firms can access only via a trade intermediary, their share of indirect exports in total exports will most likely be lower.

Ideally, I would like to test the relationship between indirect exports and firm productivity directly. However, firm productivity is unobserved and has to be estimated from the data. This is inherently problematic and estimates of firm productivity are most likely inconsistent due to simultaneity problems. There are methods to deal with such problems, but they generally require a panel dimension that the survey data I use in this paper is lacking.[5] Therefore, I will use firm size as measured by employment as a proxy for firm productivity instead. Employment is observable, and it is positively correlated with firm productivity. To see this, note that the labor used by a firm with productivity φ_i to produce and distribute its variety on the domestic and foreign market is

$$l_i = \begin{cases} A\,\frac{\sigma-1}{\sigma}\,\varphi_i + f & \text{if } \varphi^H \leq \varphi_i < \varphi^I \\ A\,\frac{\sigma-1}{\sigma}\,\left(1+\tau_I^{1-\sigma}\right)\,\varphi_i + f + f_I & \text{if } \varphi^I \leq \varphi_i < \varphi^D \\ A\,\frac{\sigma-1}{\sigma}\,\left(1+\tau_D^{1-\sigma}\right)\,\varphi_i + f + f_D & \text{if } \varphi^D \leq \varphi_i \end{cases} \tag{13}$$

which is a strictly increasing function of firm productivity φ_i under the assumptions made on the fixed and variable trade costs.[6]

There is also strong empirical evidence for the positive relationship between firm size as measured by employment and firm productivity that arises in heterogeneous firm models of international trade. Ark and Monnikhof (1996) show this relationship for France, Germany, Japan, the United States and the United Kingdom. Leung et al. (2008) and Baldwin et al. (2002) add evidence on the positive relationship between employment and productivity for Canada, and Van Biesebroeck (2005) documents it for a variety of African countries. Snodgrass and Biggs (1995) also find a large productivity gap between the largest and the smallest manufacturing firms in Turkey.

I am now ready to formulate the main hypothesis on the relationship between firm size and the choice of export mode as reflected by the share of indirect exports in total exports.

Hypothesis 1 *There is a negative relationship between firm size and the share of indirect export sales in total export sales.*

[5]Usually, firm productivity is interpreted as the residual that results from fitting a specific production function. A simultaneity problem arises because a firm may observe its productivity and change its factor inputs. Panel data methods to deal with this issue have been suggested by Olley and Pakes (1996) and Levinsohn and Petrin (2003), who use lagged investment or intermediate inputs as proxies, respectively.

[6]Two alternative measures of firm size are total sales or export sales. These are also strictly increasing in the productivity of the exporting firm.

Apart from size, other firm characteristics not explicitly modeled here are likely to influence the choice of export mode. The age of the firm may play a role, as hypothesized by the international business literature (e.g. Bilkey and Tesar, 1977). Young firms start out as purely domestic firms, and once they are established on the national market, they start to export indirectly. After having made first experiences in the foreign market and attracted customers for their products abroad, they begin to export also directly. Similarly, Keller et al. (2011) argue that there may be cumulative learning effects which reduce the fixed cost of exporting directly as opposed to trading via an intermediary. Thus, I expect young firms with little export experience or firms which launch new products on foreign markets to rely more heavily on trade intermediaries. Further, Anderson and Gatignon (1986) argue that firms which invest in new technologies and offer innovative and sophisticated products prefer a higher level of control over their foreign activities and therefore rather choose the direct export mode. If they would use a trade intermediary, which has to be trained and equipped with the technological knowhow that is necessary to sell the product, they would risk losing their competitive advantage. From this I hypothesize that a higher degree of sophistication is associated with a lower share of indirect exports in total exports. Another variable that may influence the choice of export mode is the quality of a firm's products. As Tang and Zhang (2011) suggest, a trade intermediary may underinvest in quality verification if contracts are incomplete, and thus reduce export revenues. For firms which offer high quality products, this problem is particularly severe. I would thus expect these firms to have a lower share of indirect exports in total exports. And finally, as the enforceability of international contracts improves, the hold-up problem associated with using a trade intermediary becomes less severe, making indirect exports more attractive (Felbermayr and Jung, 2011).

4 Data and descriptive statistics

This study uses data from the Private Enterprise Survey carried out by the World Bank in Turkey in 2005.[7] All data, together with the survey questionnaire, is freely

[7] Similar surveys have been conducted elsewhere, in particular in a variety of Eastern European and Central Asian countries. Compared to Turkey, however, sample sizes in these countries are very small and hence the empirical results are less reliable. Instead of focusing on just one country, I could also pool observations across countries. However, market conditions and export destinations differ across countries, and a given level of productivity in a particular sector corresponds to different levels of employment or sales in different countries. Hence, the relationship between firm size and the choice of export mode is country specific and thus the addition of more countries to the sample is of little use. Another cross-section of Turkish firms has been surveyed in 2008. I do not pool data across different survey years for the same reason. In addition, only a few explanatory variables are available for both 2005 and 2008.

accessible to researchers[8] and comprises rich information on a stratified random sample of firms with different sizes from different sectors and geographic regions. Excluding firms which are not in the manufacturing sector leaves me with 1.204 establishments for which I have observations on the main variables of interest.[9]

To give a first impression on the relationship between firm size and the relative importance of different export modes, table 1 assigns the 1.204 firms to different size categories according to the number of permanent employees and indicates the percentage of firms within each size category which do not export at all and serve only the domestic market, which export exclusively via trade intermediaries, which use both the indirect and the direct export channel, and which ship their goods only directly.

Table 1: Export status and firm size

	Firm size measured by employees			
Export status	< 20	$20 - 99$	≥ 100	Total
No exports	66%	37%	17%	37%
Indirect exports only	11%	11%	6%	9%
Indirect and direct exports	6%	15%	20%	15%
Direct exports only	17%	37%	57%	39%
Total	100%	100%	100%	100%
Number of firms	301	461	442	1204

About 37% of the 1.204 manufacturers sell all their goods nationally and do not export at all. Approximately 9% of all firms in the sample export only via trade intermediaries, while 15% export both indirectly and directly, and 39% export only directly. The share of non-exporters is considerably higher among small firms with less than 20 employees, and is much lower among large firms with 100 or more employees. The reverse is true for the share of direct exporters. While it is only 23% among small firms, it is 52% and 77% among medium sized and large firms, respectively. This finding is in line with what is now considered a fact in the empirical literature on firms in international trade, namely that in a cross-section of firms, exporters are generally larger than non-exporters.[10] Similarly, the share of indirect exporters rises from 17% to 26% when moving from the small to the large firm category. Comparing the prevalence of different export modes across different firm size categories suggests that as firms get larger, they shift from non-exporters to indirect exporters and further from indirect exporters to direct exporters. The relative prevalence of firms which use an indirect export channel as opposed to firms which do not export at all increases with firm size. However,

[8] http://www.enterprisesurveys.org

[9] For details on the sectoral distribution of the firms in the sample, see table 8 in the appendix.

[10] See for instance Bernard and Jensen (1995) or Bernard et al. (2007).

the relative prevalence of firms which use a trade intermediary as opposed to firms which export only directly declines as firms get larger. This is also reflected in the average share of indirect exports in total exports, which is 0.41 for firms with less than 20 employees, 0.28 for firms with 20–100 employees, and 0.17 for firms with more than 100 employees.

What do the 288 firms which export at least part of their products indirectly use trade intermediaries for? The literature suggests that trade intermediaries provide a range of services for their clients, such as the packaging, transportation, and distribution of goods. More importantly, however, trade intermediaries help to solve informational problems, looking for customers abroad or verifying product quality for the foreign buyer (e.g. Rubinstein and Wolinsky, 1987; Biglaiser, 1993; Spulber, 1996; Feenstra and Hanson, 2004; Tang and Zhang, 2011). This is also true for the present sample of firms. About 44% of all indirect exporters indicated that the intermediary helps them to search for clients in the foreign market, and 37% confirmed that the intermediary performs market research for them. For about 27% of all indirect exporters in the sample, the intermediary controls the quality of their products for the security of the foreign customer.

Table 2: Services provided by trade intermediary

Service	**Share of indirect exporters using this service**
Technical assistance	19%
Transport and logistic	35%
Search of clients	44%
Market research	37%
Quality control	27%

Number of observations $N = 288$, multiple answers allowed

Summary statistics of the main variables of interest for the 760 firms which export either indirectly or directly or both are given in table 3. All information refers to the fiscal year 2004. Since the survey was answered by business owners and top managers, sometimes in cooperation with company accountants and human resource managers, I expect the information to be reasonably accurate. Respondents were asked to indicate the firm's total annual sales in local currency and to report the percentage of total annual sales that were national sales, indirect exports, which were specified as goods sold through a distributor, and direct exports. With this information I can construct the measure S_i. The share of indirect exports in total exports is 0.246 on average and varies considerably across exporters. Firm size as the main explanatory variable is measured by the number of permanent employees.

The distribution of firm size is skewed to the right, with a mean of 186 and a median of 90 employees.[11]

Table 3: Summary statistics

Variable	Mean	(Std. Dev.)	Min.	Max.
S_i	0.246	(0.375)	0	1
Firm size	186.162	(301.656)	1	2300
Firm age	17.428	(12.584)	0	90
New product	0.413	(0.493)	0	1
Product upgrade	0.686	(0.465)	0	1
Quality certification	0.472	(0.5)	0	1
Share university	0.117	(0.131)	0	1
Contract enforceability	3.474	(1.688)	1	6
Multinational	0.147	(0.355)	0	1
Free trade zone	0.162	(0.369)	0	1
Direct imports	0.187	(0.27)	0	1
Indirect imports	0.078	(0.189)	0	1

Number of observations $N = 760$

In addition to firm size, a variety of other firm characteristics may have an impact on the export behavior and need to be taken into account in the empirical analysis in order to avoid that their effect on the share of indirect exports in total exports is wrongly assigned to the effect of firm size.[12] Firm age indicates the years that have passed since the establishment began its operations and thus captures whether the firm is new to the market. Product innovation is reflected by the dummy variables new product and product upgrade, which are 1 if the firm has developed an important new product or product line or has upgraded an existing product line in the last two years, respectively. Quality certification is a dummy variable that equals 1 if the establishment has received an internationally recognized quality certification,[13] and can be interpreted as a measure of product quality. Share university indicates the fraction of employees that have a university degree and thus is a measure for the skill intensity of the firm. Since Felbermayr and Jung (2011) suggested that a weak legal system may discourage firms from indirect exporting, I also control for contract enforceability, a variable which reflects whether a firm is confident that the judicial system will enforce its contractual and property rights in business disputes. Answers are integers ranging from 1 (fully disagree) to 6 (fully agree). Multinational is a dummy variable which equals 1 if the firm has holdings,

[11] Aldan and Günay (2008) find very similar numbers for exporters in the Turkish manufacturing industry, analyzing balance sheet data collected by the Central Bank of Turkey.

[12] For an overview of the variables that are commonly used to explain the export behavior of firms see Bernard and Jensen (2004) or Wagner (2001), for instance.

[13] Examples include ISO 9000, 9002, or 14.000 as well as sector specific certifications such as HACCP in the food industry or AATCC in the textiles industry.

factories, stores or service outlets in other countries. If this is the case, however, all information given in the survey refers to the specific establishment, and not to the larger company. Free trade zone is a dummy that takes a value of 1 if the firm is located in a free trade zone. As will be discussed, this may capture the effect of a more favorable trading environment on the choice of export mode. Finally, to analyze whether a firm's exporting behavior parallels its importing behavior, I also include the fraction of total inputs that were imported directly and indirectly, respectively.

5 Empirical results

To assess the correlation between firm size and the relative importance of intermediated exports, I will first estimate equations of the form

$$S_i = \beta_0 + \beta_1 \ln(\text{firm size}_i) + \beta_2 X_i + \epsilon_i \tag{14}$$

where S_i is the share of indirect exports in total exports of firm i, X_i is a vector of control variables, and ϵ_i is an error term. Nearly all estimations include sector and region dummies.[14] The econometric method used is ordinary least squares with heteroskedasticity robust standard errors.[15] Results are presented in columns (1) to (4) of table 4.

Column (1) shows the estimated coefficient of log firm size from a naive regression without further control variables. It is negative and significant, which is consistent with the hypothesis that larger firms have a lower share of indirect exports in total exports. Including sector dummies to control for sectoral differences in the size distribution of firms in column (2) strengthens this result. However, holding the sector fixed, firm size is correlated with a set of other firm characteristics. For instance, larger firms are more likely to develop new products, to obtain an internationally recognized quality certification, or to have production facilities abroad.[16] Including such firm characteristics, but omitting firm size in column (3) shows that product innovation is associated with a significantly higher share of indirect exports in total exports, while a quality certification tends to reduce the share of intermediated trade. Hence, controlling for these additional firm characteristics is important to estimate the true relationship between firm size and the share of indirect exports

[14] For the purpose of the survey, Turkish provinces have been aggregated into five regions, which are Marmara, Aegean, Black Sea and Eastern Turkey, Central Anatolia, and South Turkey.

[15] A Breusch-Pagan test rejects the hypotheses of constant variance.

[16] The correlation coefficient is 0.121 for firm size and new product, 0.376 for firm size and quality certification, and 0.262 for firm size and multinational.

in total exports. As shown in column (4), this increases the estimated coefficient on log firm size sligthly to -0.045. Yet, the estimated effect of firm size remains negative and highly significant. It is also sizeable in economic terms, implying that an increase in the number of employees by one standard deviation is associated with a decline in the share of indirect in total exports by about 15%.

Table 4: Effect of firm size on S_i

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) QMLE
Ln(firm size)	-0.060***	-0.070***		-0.045***	-0.043***
	(0.011)	(0.011)		(0.013)	(0.012)
Firm age			-0.000	0.000	0.000
			(0.001)	(0.001)	(0.001)
New product			0.113***	0.120***	0.120***
			(0.029)	(0.029)	(0.030)
Product upgrade			-0.061*	-0.055*	-0.049
			(0.032)	(0.031)	(0.030)
Quality certification			-0.111***	-0.068**	-0.059**
			(0.029)	(0.030)	(0.028)
Share university			-0.209**	-0.234***	-0.271**
			(0.088)	(0.088)	(0.116)
Contract enforceability			0.000	0.001	0.000
			(0.008)	(0.008)	(0.007)
Multinational			-0.109***	-0.089***	-0.108***
			(0.027)	(0.028)	(0.027)
Free trade zone			-0.084**	-0.085**	-0.068**
			(0.042)	(0.041)	(0.032)
Direct imports			-0.192***	-0.158***	-0.179***
			(0.046)	(0.046)	(0.056)
Indirect imports			0.293***	0.289***	0.229***
			(0.086)	(0.086)	(0.067)
Sector dummies	no	yes	yes	yes	yes
Region dummies	no	no	yes	yes	yes
N	760	760	760	760	760
R^2	0.043	0.078	0.151	0.167	
Adjusted R^2	0.041	0.053	0.113	0.128	

Constant included
Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As pointed out in the introduction, I cannot control for the number of destination countries, nor for the characteristics of specific foreign markets. Part of this effect may be captured by the sector dummies, which indicate the comparative advantage of an industry relative to potential trading partners, and by the region dummies, which reflect the proximity of the firm to a specific destination country. Nevertheless, if larger firms use a trade intermediary to export to less accessible countries which

are not served by smaller firms, the estimated coefficient is a rather conservative indicator for the negative relationship between firm size and the share of indirect exports in total exports to a given destination country. In other words, if I could run a separate regression for each destination country, I would presumably find a coefficient of firm size that is much larger in absolute terms.

The age of a firm, as opposed to what the business literature hypothesizes, does not seem to play an important role for the choice of export mode. This might not be surprising, as the age of a firm is only a very crude proxy for its experience in foreign markets. However, a firm that has developed a new product is significantly more likely to use a trade intermediary. Intuitively, if a firm wants to introduce an entirely new good not only to the domestic but also to the foreign market, it would have to spend considerable resources to find potential customers, who may be different from the buyers of the already existing product portfolio. Trade intermediaries draw on extensive networks abroad and can exploit economies of scope to introduce new products at a lower cost than the manufacturer. This idea is also supported by evidence on intermediaries, who have been shown to handle a much broader range of products for a given destination country than manufacturers (Ahn et al., 2011; Akerman, 2010; Bernard et al., 2010a). It does not preclude that cumulative learning effects may induce the manufacturer to switch to a direct export mode at later stages. A firm that merely upgrades an already existing and well established product does not have to search for new customers abroad, and hence is no more likely to use a trade intermediary. On the contrary, to the extent that an upgrade entails quality improvements, the negative coefficient is perfectly in line with the notion that a firm's incentive to resort to a trade intermediary declines with product quality.

Unfortunately, I do not have a direct measure for the quality of a firm's products. However, an internationally recognized quality certification such as ISO 9000 may be a good proxy, as argued by Verhoogen (2008) or Hallak and Sivadasan (2009), for instance. Taking it as such, the results in column (4) suggest that firms with high quality products rely significantly less on trade intermediaries. This lends further and more direct support to recent models which emphasize the role of product quality for the sorting of manufacturers into different export modes (Crozet et al., 2010; Tang and Zhang, 2011). Yet, the fact that product quality has explanatory power for the export behavior of firms even if I control for firm size may also encourage attempts to draft models in which firms have more than a single attribute, usually productivity or the ability to produce quality, which perfectly predicts export behavior. An example for such a model with two-dimensional firm heterogeneity is Hallak and Sivadasan (2009), who do however not explore the sorting of firms into different export modes.

The share of university graduates measures the skill intensity of the workforce, and as such may reflect how sophisticated and technologically advanced the firm's products are. The estimated coefficient is negative and significant at the 1% level, and thus consistent with the hypothesis that firms which rely on their technological skills do not want to risk losing their competitive advantage by giving part of their knowledge away to intermediaries.

Contract enforceability is not significantly correlated with the share of intermediated exports in total exports. Firms were not only asked whether they are confident that the judicial system will enforce their contractual and property rights in business disputes, but also whether they perceive the legal system as an obstacle to their operations and the growth of their business. This alternative measure turned out to have no significant impact on the dependent variable either. This may be due to the fact that these measures are highly subjective, and potentially endogenous to the choice of export mode. That is, a firm that frequently contracts with a trade intermediary is more likely to end up in a dispute, and may then perceive dealing with the legal system as a hindrance to its business operations. In addition, agreements between the exporter and the intermediary may be subject to the law system in the importing country, in which case neither variable would have any informative value for the actual enforceability of contracts.

The findings further indicate that multinational firms have a significantly lower share of intermediated trade. To the extent that the foreign subsidiaries are production facilities, a potential explanation for this observation is intra-firm trade. Unfinished products may be shipped for further processing to plants which belong to the same company abroad. As this does not involve any search for customers, market research, or quality uncertainty, there is less scope for trade intermediation. However, to the extent that the foreign affiliates are stores or service outlets, multinational is simply another proxy for the choice of export mode, which reflects whether the firm has built an own distribution network abroad, and should be negatively correlated with the share of intermediated in total exports by definition. As I cannot distinguish between production facilities and sales affiliates, however, I prefer the share of indirect exports as a measure for the choice of export mode. Omitting multinational from the set of regressors has hardly any effect on the size or significance of the estimated coefficients on the remaining variables.

Firms located in a free trade zone have a significantly lower share of intermediated exports. This might not be surprising, as one of the objectives of free trade zones is to offer a business environment which is favorable to international trade. Exemptions from customs duties and corporate taxes, minimal bureaucratic hurdles, as well easy access to sea ports and international airports create a competitive advantage and

boost exports both to the host country and to the rest of the world. This is also what makes free trade zones particularly attractive to firms for which foreign market access is rather important.[17]

Finally, to analyze whether the choice of export mode is correlated with the choice of import mode, I also include the share of total inputs that have been imported directly, as well as the share of total inputs that have been imported indirectly. The results suggest that firms who rely on trade intermediaries to export their products also resort to trade intermediaries to import their inputs. Put differently, indirect exporters also tend to be indirect importers. Thus, intermediaries do not only help firms which cannot cover the high fixed costs of direct exporting to access foreign markets. They may also play an important role in facilitating the import of foreign inputs.[18] And in fact, as pointed out but not further explored by Ahn et al. (2011), the benefits from importing may be understated if indirect imports via trade intermediaries are not accounted for.

A variety of other variables which are potentially correlated with the choice of export mode come to mind. Foreign ownership, for instance, may alleviate the informational problems associated with foreign market entry and thus make trade intermediaries obsolete. I therefore include the percentage owned by private foreign investors as an additional control variable. The estimated coefficient is negative, as I would expect, but insignificant.[19]

Further, a firm may not only ship to multiple destination countries, it may also ship multiple products to a single destination country. If the fixed costs of exporting are in part product specific, the firm may use different export modes for each of the products. Conditional on total export sales, a multiproduct firm would have smaller export sales per product, which makes trade intermediaries more attractive. I do not have information about how export sales are spread across different products, but I know the share of the firm's three most important products in total sales.[20] This allows me to construct a multiproduct dummy which equals one if the share of the most important product in total sales is less than 100%. This is the case for about 25% of all exporters. As it turns out, the estimated coefficient on the multiproduct dummy does not have the expected sign, nor is it statistically significant.

[17] In 2005, Turkey hosted 21 free trade zones who were responsible for a total trade volume of about 23 billion USD. Shipments of these free trade zones from and to Turkey are counted as imports and exports, respectively, and represented about 50% of the total trade volume. For further details, see Deloitte (2006).

[18] Regressing the share of indirect imports in total imports on log firm size, controlling for sector and region dummies, yields a negative and highly significant coefficient of -0.111 with a standard error of 0.014.

[19] All results are shown in table 9 in the appendix.

[20] Products are classified at the 4-digit ISIC Rev.3 level

A growing literature also emphasizes the relevance of financial constraints for the export behavior of firms. Chaney (2005), for instance, proposes a model in which the fixed costs of exporting have to be paid up front and need to be financed either by profits made on the domestic market, which are monotonically increasing in firm productivity, or by exogenous sources of liquidity, which may be uncorrelated with firm productivity. In equilibrium, for some firms with intermediate productivity, access to finance is a binding constraint and prevents them from exporting. Translated into the present framework where firms can choose between different export modes, I would expect that all else equal, credit constrained firms are forced into indirect export modes with lower fixed costs. To capture this, I include a dummy variable indicating whether the firm is credit constrained and would like to borrow more than it is able to at the current interest rate. As expected, a firm that is financially constrained has a higher share of intermediated in total exports. However, the effect is statistically insignificant.[21]

Some researchers have raised concerns about using ordinary least squares regressions if the dependent variable is a proportion that, by definition, can only take values from 0 to 1. Wagner (2001) has argued that this problem may be especially severe if there are many limit observations, as in the case of the export to sales ratio, but also in the present case where the dependent variable is indirect exports over total exports. Basically, because the dependent variable is bounded between 0 and 1, the effect of any explanatory variable cannot be constant throughout its range. Including non-linear functions of the explanatory variable such as log firm size partly alleviates the problem, however, the predicted values from an ordinary least squares regression can never be guaranteed to lie in the interval $[0, 1]$. Papke and Wooldridge (1996) suggest a non-linear quasi-maximum likelihood estimator (QMLE) that yields consistent and asymptotically normal distributed estimates regardless of the distribution of the dependent variable conditional on the controls, and that leads to predicted values between 0 and 1. The results from applying the fractional response model to the relationship between firm size and the relative importance of indirect exports are presented in column (5) of table 4. Note that the reported numbers are marginal effects evaluated at the mean.[22] The marginal effects depend on the specific likelihood function and therefore differ from the estimated coefficients.

[21] Generally, the empirical evidence on the relevance of financial constraints for foreign market entry is inconclusive. See Stiebale (2011), who provides a neat summary of the existing theoretical and empirical contributions in the literature and concludes that once observed and unobserved firm heterogeneity are controlled for, financial constraints have no significant effect on the probability to export.

[22] In case the explanatory variable is a dummy, the reported number is the effect of a discrete change of the explanatory variable from 0 to 1.

When evaluated at the mean, the marginal effect of log firm size on the share of indirect exports in total exports is -0.043 and thus very similar to the marginal effect obtained from an ordinary least squares regression. The marginal effect of log firm size is somewhat stronger when evaluated at the 10th percentile (-0.056) and slightly weaker when evaluated at the 90th percentile (-0.032), which reflects the non-linear relationship between firm size and the choice of export mode. However, it is always negative and significant at the 1% level. The sign and the significance of the marginal effects of other explanatory variables do not change much either, indicating that the results are insensitive to the econometric method used.

6 Robustness checks

In this section, I will perform a number of robustness checks to further strengthen the previous findings. First, I will use different functional forms of firm size. In addition, I will explore alternative measures of firm size. And finally, I will use the status of being an indirect versus a direct exporter as a binary dependent variable to show that the assumption of a continuous share of indirect in total exports does not drive the results.

The results for different functional forms of firm size are given in table 5. The coefficient on firm size remains negative and highly significant at the 5% level if I allow for a quadratic specification, as shown in column (1). Sorting firms into different size categories according to the number of full-time employees and regressing the share of indirect exports in total exports on firm size dummies in column (2) reveals that both medium and large firms drive the result. Compared to small firms, the share of indirect in total exports is about -0.110 lower for medium sized firms and about -0.190 lower for large firms. The coefficients for medium sized and large firms are both significant and differ at the 1% level.

Taking the log of firm size, but using the number of employees in 2002 rather than 2004 gives the results shown in column (1) of table 6. The coefficient on lagged firm size is negative, highly significant, and only slightly smaller than the coefficient on contemporary firm size. To the extent that the share of intermediated trade is not persistent over time and firms do not anticipate their export activities already two years in advance and adopt their production and sales capacities accordingly, this suggests that causality may in fact run from firm size to the relative prevalence of intermediated trade.[23] This finding is consistent with other results from the

[23] Özler et al. (2008) document that the effect of past export experience on the current export behavior of Turkish firms diminishes rather quickly over time.

Table 5: Effect of firm size on S_i for alternative functional forms

	(1) OLS	(2) OLS
Firm size	-0.0004***	
	(0.0001)	
(Firm size)^2	0.0000***	
	(0.0000)	
Firm size $20-99$		-0.110**
		(0.051)
Firm size ≥ 100		-0.190***
		(0.051)
Firm age	0.000	0.000
	(0.001)	(0.001)
New product	0.119***	0.115***
	(0.029)	(0.029)
Product upgrade	-0.064**	-0.053*
	(0.032)	(0.031)
Quality certification	-0.091***	-0.069**
	(0.030)	(0.029)
Share university	-0.211**	-0.257***
	(0.088)	(0.089)
Contract enforceability	0.002	0.001
	(0.008)	(0.008)
Multinational	-0.099***	-0.097***
	(0.028)	(0.028)
Free trade zone	-0.090**	-0.078*
	(0.042)	(0.041)
Direct imports	-0.176***	-0.150***
	(0.046)	(0.046)
Indirect imports	0.282***	0.289***
	(0.086)	(0.085)
N	760	760
R^2	0.169	0.173
Adjusted R^2	0.129	0.133

Constant, region and sector dummies included
Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Effect of firm size on S_i for alternative measures of firms size

	(1) OLS	(2) OLS	(3) OLS
Ln(firm size in 2002)	-0.051***		
	(0.013)		
Ln(sales)		-0.022***	
		(0.008)	
Ln(export sales)			-0.016**
			(0.007)
Firm age	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)
New product	0.138***	0.116***	0.114***
	(0.030)	(0.034)	(0.034)
Product upgrade	-0.060*	-0.082**	-0.084**
	(0.032)	(0.038)	(0.039)
Quality certification	-0.053*	-0.091***	-0.097***
	(0.032)	(0.035)	(0.035)
Share university	-0.242**	-0.266**	-0.286**
	(0.095)	(0.122)	(0.123)
Contract enforceability	0.001	0.001	0.000
	(0.008)	(0.009)	(0.010)
Multinational	-0.089***	-0.104***	-0.102***
	(0.030)	(0.032)	(0.032)
Free trade zone	-0.078*	-0.138**	-0.132**
	(0.043)	(0.056)	(0.056)
Direct imports	-0.162***	-0.181***	-0.185***
	(0.046)	(0.055)	(0.055)
Indirect imports	0.314***	0.270**	0.268**
	(0.087)	(0.114)	(0.115)
N	709	514	514
R^2	0.181	0.183	0.179
Adjusted R^2	0.139	0.125	0.121

Constant, region and sector dummies included

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

empirical trade literature which show that high productivity precedes entry into export markets, substantiating the theory of fixed entry costs.[24]

A potential concern might be that all these results are sensitive to using the number of employees as a measure of firm size. This is however not the case. As shown in columns (2) and (3) of table 6, using the log of total sales or the log of total export sales as alternative measures of firm size yields very similar results, that is larger firms make relatively less use of trade intermediaries.[25]

Given that I cannot regress the share of indirect in total exports on firm size for each destination country separately it seems natural to treat S_i as a continuous variable. In fact, table 1 reveals that if exports are aggregated across all destination countries, about 15% of all exporters use both export modes simultaneously and hence have $S_i \in (0, 1)$. Nevertheless, as a further robustness check, I consider the choice of export mode as a binary variable and estimate the effect of firm size on the probability of being an indirect exporter as opposed to being a direct exporter. I define a firm to be an indirect exporter if indirect export sales represent at least half of all export sales, that is if $S_i \geq 0.5$.[26] The estimated marginal effects, evaluated at the mean, are shown in table 7.

Finally, to check whether outliers drive the result, I excluded the largest and the smallest firms from the sample (top and bottom 5 %). I also excluded sectors with only a few observations, and I used 4-digit industry dummies instead of 2-digit sector dummies. None of this affects the key result, namely that firm size and the share of intermediated trade are negatively correlated, nor does it change the conclusions regarding all other variables included in the regressions.[27]

[24] See Clerides et al. (1998), Bernard and Jensen (1999), or Aw et al. (2000), just to give a few examples.

[25] Using domestic sales rather than total sales or export sales leads to the same conclusions. Unfortunately, annual sales data are not available for all firms in the sample. As these firms do however report an estimate of the percentage of their total annual sales that were due to indirect and direct exports, I decided to keep them in the sample when using the number of employees as a measure of firm size. Excluding firms with missing sales data has however no significant effect on the main results. Results are available upon request.

[26] Alternatively, I could define a firm as an indirect exporter if it makes any positive indirect exports at all, $S_i > 0$, or if it ships all of its goods via a trade intermediary, $S_i = 1$. This changes the estimated marginal effects slightly, but does not invalidate the main conclusions. Results are available upon request.

[27] Results are available upon request.

Table 7: Probability of being an indirect exporter

	(1) Probit	(2) Probit
Ln(firm size)	-0.048***	
	(0.014)	
Firm size $20-99$		-0.106**
		(0.046)
Firm size ≥ 100		-0.198***
		(0.050)
Firm age	0.001	0.001
	(0.001)	(0.001)
New product	0.115***	0.109***
	(0.037)	(0.037)
Product upgrade	-0.061	-0.057
	(0.038)	(0.038)
Quality certification	-0.080**	-0.078**
	(0.037)	(0.036)
Share university	-0.261*	-0.295**
	(0.138)	(0.140)
Contract enforceability	0.008	0.007
	(0.009)	(0.009)
Multinational	-0.155***	-0.158***
	(0.036)	(0.036)
Free trade zone	-0.096**	-0.093**
	(0.040)	(0.041)
Direct imports	-0.210***	-0.206***
	(0.072)	(0.072)
Indirect imports	0.229***	0.228***
	(0.083)	(0.083)
N	752	752

Constant, region and sector dummies included
Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

7 Conclusion

Although trade intermediation is a phenomenon well established in reality, it has only recently been addressed in the international trade literature. While many contributions focus on the nature of trade intermediaries, little is known about the manufacturers that actually ship their goods indirectly. Theoretical research suggests that the choice of export mode depends, among other factors, on the size and the productivity of a firm. Since intermediated exports are associated with lower fixed costs of gaining access to foreign markets, they are an attractive option for small and rather inefficient firms which want to export their goods. Building an own distribution network and maintaining customer relations abroad is much more costly, and only pays for large manufacturers which are profitable enough to cover the higher fixed costs.

The present paper brings this hypothesis to a test. Using data from the World Bank Enterprise Survey conducted in Turkey in 2005, it shows that there is indeed a significant negative correlation between firm size and the relative importance of indirect exports as opposed to direct exports. This relationship is highly robust to the inclusion of a variety of controls, different estimation methods, and different measures of firm size.

The empirical analysis also suggests that trade intermediaries are less attractive for firms with an internationally recognized quality certification, lending further support to recent contributions on the role of product quality for the choice of export mode. In contrast, manufacturers which aim at introducing an entirely new product to the foreign market rely more heavily on trade intermediaries, suggesting that trade intermediaries perform an important role in searching for new customers abroad. Neither foreign ownership nor credit constraints seem to have a strong impact on the choice of export mode. And finally, indirect exporters are also indirect importers, which implies that the potential benefits from trade intermediation are not limited to the export of goods and services, but may well expand to the sourcing of foreign inputs.

Both the import behavior of firms and the potential gains from trade intermediation seem worth exploring in future empirical research. From a theoretical perspective, modeling a trade intermediation sector instead of simply assuming a specific intermediation technology would be the next step. First attempts in this direction have been made by Antràs and Costinot (2011) and Antràs and Costinot (2010).

Appendix

Appendix A: Sectoral composition of firms

Manufacturing firms are classified into sectors as defined in Rev. 3 of the International Standard Classification Code (ISIC) according to their main product. The largest sectors are food and beverages, textiles and apparel. Firms belonging to these sectors account for nearly 50 % of the total number of firms in the sample, which is in line with the most recent firm census for Turkey (Turkish Statistical Institute, 2006). Compared to the firm census, firms in the chemical and non-metallic mineral sector are slightly underrepresented, while firms in the machinery and in the motor vehicle industry are rather overrepresented in the present sample.

Table 8: Sectoral composition of firms

Industry (ISIC Rev. 3)	Number of firms	Share in %
Food and beverages (15)	258	21.43
Textiles (17)	153	12.71
Apparel (18)	183	15.20
Leather (19)	12	1.00
Wood (20)	2	0.17
Paper (21)	4	0.33
Publishing (22)	1	0.08
Coke and fuel (23)	4	0.33
Chemicals (24)	91	7.56
Rubber and plastics (25)	43	3.57
Non-metallic minerals (26)	61	5.07
Basic metals (27)	39	3.24
Fabricated metals (28)	87	7.23
Machinery (29)	129	10.71
Office machinery (30)	3	0.25
Electrical appliances (31)	32	2.66
Communication equipment (32)	11	0.91
Medical instruments (33)	5	0.42
Motor vehicles (34)	70	5.81
Transport equipment (35)	3	0.25
Furniture (36)	13	1.08
Total	1,204	100.00

Appendix B: Additional control variables

Table 9: Effect of firm size on S_i with additional controls

	(1) OLS	(2) OLS	(3) OLS
Ln(firm size)	-0.045***	-0.043***	-0.045***
	(0.013)	(0.013)	(0.013)
Firm age	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
New product	0.120***	0.117***	0.120***
	(0.029)	(0.029)	(0.029)
Product upgrade	-0.055*	-0.057*	-0.055*
	(0.031)	(0.031)	(0.031)
Quality certification	-0.069**	-0.072**	-0.068**
	(0.030)	(0.030)	(0.030)
Share university	-0.232***	-0.236***	-0.234***
	(0.089)	(0.088)	(0.088)
Contract enforceability	0.001	-0.000	0.001
	(0.008)	(0.008)	(0.008)
Multinational	-0.087***	-0.088***	-0.089***
	(0.029)	(0.028)	(0.028)
Free trade zone	-0.085**	-0.085**	-0.085**
	(0.041)	(0.042)	(0.041)
Direct imports	-0.157***	-0.158***	-0.157***
	(0.047)	(0.046)	(0.046)
Indirect imports	0.289***	0.296***	0.289***
	(0.086)	(0.086)	(0.085)
Foreign ownership	-0.000		
	(0.001)		
Multiproduct		-0.025	
		(0.029)	
Credit constrained			0.005
			(0.032)
N	760	757	760
R^2	0.167	0.170	0.167
Adjusted R^2	0.127	0.129	0.127

Constant, region and sector dummies included

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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