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The Removal of Agreements on Textiles and Clothing Quotas

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The Removal of Agreements on Textiles and Clothing Quotas

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Abstract

Trade in textiles and apparel is of special interest among international trade transactions. Removal of the final Agreement on Textiles and Clothing (ATC) quotas in 2005 brought about a division of textile- and apparel-exporting countries into groups of winners and losers. Turkey appeared as a successful country from the former category. Based firm-level data our empirical results suggest that while Turkish enterprises were more successful than most in adapting to the post-quota market in textiles and apparel, their performance paled relative to the performance of enterprises in areas not covered by the ATC. Producers that specialized in textiles and apparel during the ATC quotas removal period had ceteris paribus lower sales revenue and employment growth and a lower profit rate on average than those selling other products. The latter category of producers was also significantly more likely to fail during this period.

Keywords: Agreement on Textiles and Clothing, Quotas, Turkey, Firms

JEL Classification: F13, F14, L67

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Any mistakes and errors in this paper are the authors' own.

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EXECUTIVE SUMMARY

Liberalizing international trade creates both opportunities and threats for productive enterprises. The opportunities stem from the opening of new markets for its products; the threats stem from the entry of competitors to contest the liberalized market. The elimination of textiles and apparel quotas in Canada, the United States of America and the European Union in the period 1995–2005 created opportunities and threats for textiles and apparel exporters worldwide. The system of bilateral quotas covered by the ATC had the explicit goal of providing protection to import-competing producers of these products in importing countries. It had the unintended goal of providing niches within the markets of these importing countries for exports from countries not subject to binding bilateral quotas. Those with binding quotas were constrained in the quantity that they could export to Canada, the United States and the European Union. Those without quotas, or with non-binding quotas, were able to expand exports beyond what would have been possible with quota-less trade. The removal of quotas was thus not only a benefit to the consumers of ATC-importing countries, but also the occasion of a massive dislocation among exporting countries.

The removal of ATC quotas represents a quasi-natural experiment and allows for a consistent and robust testing of the most recent theoretical predictions. Based on firm-level Turkish data,[1] this paper provides evidence on how a trade policy shock has differentiated effects on firms within industries. The paper also provides evidence on how the aggregate sectoral trade response is a combination of within-firm responses and between-firm shifts in the composition of output.

Turkey as an economy responded well to this opportunity, as measured by positive growth in export value to the countries eliminating quota. We decompose this success in this paper by observing the changes in behaviour at the enterprise level.

- When we divide the enterprises into those producing textiles and apparel subject to quota in 2004 (i.e., ATC goods) and others, we find that those enterprises producing ATC goods grew more rapidly in terms of real sales revenue and employment – and that they also had significantly higher profit rates on average.

- When we divide the enterprises into exporting versus non-exporting, we find that the non-exporting enterprises actually grew faster in both real sales and employment during the period associated with quota elimination.

In sum, the textiles and apparel industries were the sources of faster economic growth. However, the enterprises involved in exporting grew more slowly than those involved in exclusively domestic sales.

We are also able to draw conclusions on enterprise-level performance of exporters. For exporters, we found that:

- Those specializing in textiles and apparel during this period had lower sales revenue and employment growth and a lower profit rate on average than those selling other products.

- Those exporting to the United States and the European Union had relatively higher sales revenue and employment growth, and a higher profit rate, on average than those exporting only to other markets.

When we consider the motivations for enterprises to cease operations, we consider a number of alternative explanations. We find that larger enterprises were more likely to survive from one year to

[1] We rely upon two databases maintained by the Turkish Statistical Institute (TUIK): the Enterprise Survey (ES) and the Foreign Trade (FT) databases. The period retained is 2003–2008 inclusive.

the next, whether size was measured by the value of sales, of employment or of the number of plants. Independently of these factors, enterprises that had been exporters were significantly more likely to survive from one year to the next during this period. However, this latter effect was on average counteracted by the effect of being a producer of ATC goods: ATC producers were significantly more likely to fail during this period.

We conclude from this that Turkey's success in the export of textiles and apparel must be taken in context. While Turkish enterprises were more successful than most in adapting to the post-quota market in textiles and apparel, their performance paled relative to the performance of enterprises in non-ATC areas. Exports to markets other than Canada, the United States and the European Union for ATC products were reduced, while production of non-ATC products both for export and domestic use grew rapidly. Enterprises then "voted with their feet" – significantly more enterprises in ATC industries closed during this period than those in other industries.

1. INTRODUCTION

Trade in textiles and apparel is of special interest among international trade transactions. The Agreement on Textiles and Clothing (ATC) signed in 1995 under the auspices of the World Trade Organization was the culmination of a decades-long protective trade-policy initiative in the clothing- and textile-importing countries of the European Union and Canada and the United States. It maintained the pattern of bilateral quotas imposed by these importing countries on the most successful developing-country exporters. It also introduced a fixed timetable for the removal of these quotas. Removal was to occur in four stages, with over half of quota-restricted trade, as measured by value, to be liberalized on 1 January 2005. Textiles and apparel products were separated into four groups, with imports in group 1 liberalized for those importers at the beginning of 1995, imports of group 2 liberalized at the beginning of 1998, imports of group 3 liberalized at the beginning of 2002 and imports of group 4 liberalized at the beginning of 2005.[2]

The system of bilateral quotas covered by the ATC had the explicit goal of providing protection to import-competing producers of these products in the importing countries. It had the unintended goal of providing niches within the markets of these importing countries for exports from countries not subject to binding bilateral quotas. Those with binding quotas were constrained in the quantity that they could export to Canada, the United States and the European Union. Those without quotas, or with non-binding quotas, were able to expand exports beyond what would have been possible with quota-less trade. The removal of quotas was thus not only a benefit to the consumers of ATC-importing countries, but also the occasion of a massive dislocation among exporting countries.

Conway and Fugazza (2011) show that the removal of the final ATC quotas in 2005 brought about a division of textile- and apparel-exporting countries into groups of winners and losers. Large exporters previously constrained by binding quota expanded their value of exports and market share in the ATC importing countries. Smaller exporters in nearly all cases experienced reduced export value and market share as they faced direct competition with larger exporters. Among the larger exporters without binding quotas, there was a division between successful and less-successful ones – some countries were able to maintain or even expand market share, while others could not.

Turkey is a successful country from the latter category – a large exporter, especially to the European Union that was not constrained by quotas in that market prior to 2005. Removal of the ATC quota system put Turkish enterprises in more direct competition with the low-cost producers of East and South Asia. Despite this increased competition, the textile and apparel sectors in Turkey increased the value of their exports to the United States and European Union in the years 2005–2008.

The removal of ATC quotas represents a quasi-natural experiment and allows for a consistent and robust testing of the most recent theoretical predictions. Based on firm-level Turkish data,[3] this paper provides evidence on how a trade policy shock has differentiated effects on firms within industries as predicted by trade models à la Melitz (2003) with imperfect competition and heterogeneous firms. The paper also provides evidence on how the aggregate sectoral trade response is a combination of within-firm responses and between-firm shifts in the composition of output.

The major contribution of this paper is the empirical assessment of firms' responses to trade reform. The paper adds to the quota literature microlevel evidence from the supply side. While there is convincing evidence from the demand side on how quotas affect product quality at the product level, evidence on how firms react to quotas is still very scarce. In other words, there is still need to

[2] Canada, the United States and the European Union identified independently the specific goods to go into each group, and thus the order of liberalization for each good varied among the importers. In this section we use the European Union quota groupings, as the European Union was the dominant importer of Turkish textiles and apparel products.

[3] We rely upon two databases maintained by the Turkish Statistical Institute (TUIK): the Enterprise Survey (ES) and the Foreign Trade (FT) databases. The period retained is 2003–2008 inclusive.

document supply-side responses, especially in terms of reallocation of resources both among and within firms. The paper also represents a unique exercise in providing evidence of firms' reaction in a country which was quota unrestricted and thus benefited from preferential access to European and North American markets. It goes beyond a simple theoretical curiosity as it could help consolidate policymaking.

Turkish data suggest that the textiles and apparel industries were the sources of faster economic growth. However, the enterprises involved in exporting grew more slowly than those involved in exclusively domestic sales. In order to qualify more precisely enterprise-level performance of exporters we adopt a twofold empirical strategy.

We first use a difference-in-difference-in-difference analytical technique. We limit the analysis to manufacturing enterprises, and then divide the enterprises into three categories: textiles, apparel and other. We also subdivide each category into exporting and non-exporting enterprises based upon their status in 2003–2004, and among exporting enterprises in textiles and apparel we distinguish those exporting products in 2003 and 2004 for which quotas were removed in 2005 from those with products for which quotas were removed earlier (or never existed). We further distinguish among exporters between those that exported to ATC countries and those that exported only to other countries. Thus two major effects can be identified: the effect of quota removal in 2005 on economic performance by industrial category and the effect by initial export market. We also identify the marginal contributions for various other categories of enterprises that help to refine our analysis. We then test the average performance of exporting enterprises for which quotas were removed against exporting enterprises in the same category with products for which quotas were not binding in 2003 and 2004. We consider four measures of performance: growth in real sales revenue, growth in employment, evolution of profit rate and growth in total factor productivity – all relative to the 2003–2004 base period.

We then investigate the entry and exit of enterprises in each of these categories. One potential dimension for adjustment is in the exit of less-productive enterprises and the expansion of the remaining more-productive enterprises. To do so we use a probit model with random effects controlling for factors likely to influence the survival of firms' export status.

Our results suggest that producers that specialized in textiles and apparel during the ATC quotas removal period had ceteris paribus lower sales revenue and employment growth and a lower profit rate on average than those selling other products. We also find that ATC producers were significantly more likely to fail during this period.

The rest of the paper is organized as follows. The next section contains a succinct review of recent works dealing with the impact of the removal of ATC quotas. Section 3 briefly describes the raw data and section 4 presents major features characterizing Turkish firms with a focus on those operating in the textiles and apparel sectors. Section 5 presents the empirical strategy adopted. Empirical results are summarized in section 6. The last section concludes.

2. RELATED LITERATURE

This paper relates primarily to the recent empirical quota literature centred on the ending of the ATC in 2005. Various theoretical predictions have been tested using either disaggregated trade data or firm-level data. Most of these predictions were established in the 1960s and 1970s and derive from the 'non-equivalence' of import quotas and tariffs conjecture put forward in Bhagwati (1965). Like tariffs, binding quotas raise the price of constrained goods relative to unconstrained goods. However, quotas give rise to additional distortions.[4] A possible response to these additional distortions is the upgrading of quality (Falvey, 1979). All these predictions however concern importing countries and are demand

[4] See Anderson (1988) for a comprehensive analysis.

oriented. Recent developments in trade theory following the seminal work of Melitz (2003) have allowed a more precise understanding of possible supply-side reactions to trade reform episodes in exporting countries, especially in terms of reallocation of resources both among and within firms.

Harrigan and Barrows (2009) examined the difference in price and quality for United States imports in a difference-in-difference framework for the top 20 exporters to the United States: there was a time difference, from 2004 to 2005, and a categorical difference in quota-constrained versus unconstrained imports. The authors first measured the average adjustment in price and quality for each country in the sample; they found a substantial downward average adjustment in price for quota-constrained imports and a much smaller downward adjustment in quality. There were no such downward adjustments for unconstrained imports. The authors then tested across countries to determine whether the adjustments in price and quality from 2004 to 2005 were on average significantly different between constrained and unconstrained categories. The downward price adjustments were statistically significant for all exporters at the 95 per cent level of confidence, for China alone and for non-China exporters. The downward quality adjustments were significant for China alone and for all exporters at the 90 per cent level of confidence. This work was done at a quite detailed level of disaggregation, and signalled the expected impact of quota removal on both price and quality. It treated the observation of a binding quota as an exogenous event, however, and this could introduce bias.

Edwars and Sundaram (2012), using data for Indian manufacturing firms, find that the ATC quota removal was associated with an increase in market share of quota-constrained products relative to unconstrained products. The magnitude of these effects suggests that quota removal was associated with an increase in sales of about 20 per cent. Estimates are robust to controlling for unobservable firm-specific shocks affecting outcomes. The authors' results are consistent with quality downgrading by textile firms in response to the quota removal. The ATC quota removal appeared to be associated with reallocation of market share towards low-price products. In addition the price decrease associated with quota removal was larger for low-price products. Moreover, their evidence suggests that the estimated effects operated through an extensive margin in the first place, through product-switching by firms.

Brambilla, Khandelwal and Schott (2010) focus their attention on exporters of textiles and apparel to the United States. They work as well with 10-digit HS data on imports from these countries into the United States, and they also categorize the imports as being quota constrained versus unconstrained using the quota classifications of the United States. They analyse carefully the impact of the quota, and then contrast that with behaviour after quota removal: they are careful to distinguish among the four stages of sequential quota elimination under the ATC, and to connect the changes in quantity and price with the appropriate stage of quota removal. They find both an increase in quantity and a reduction in price for Chinese goods that is significantly different from that observed in other quota-constrained exporters. They do not calculate quality as in Harrigan and Barrows (2009), and thus cannot draw conclusions on the impacts of price versus quality. They also treat the quota-constrained period as an exogenous event.

Using Chinese customs data on exports collected at the firm level, Bernhofen, Upward and Wang (2011) found an average price drop of about 30 per cent due to the removal of the ATC quotas. Of this overall drop in price, more than half was found to be caused by firm turnover or changes in the composition of firms in the export market, indicating that quotas probably had an effect more on firm entry than on product composition within existing firms in the export market. Their analysis points to a predominant quality downgrading effect if compared with the competition effect in the fall of prices. This conclusion was reached because differentiated products exhibited significantly greater price reduction compared to homogeneous products.

The same database was used by Khandelwal, Schott and Wei (2011). The authors were interested specifically in the productivity gains to China due to the ATC quota phase-down. In particular, they decomposed productivity gains into gains from removal of the trade barrier and gains

from the removal of export licensing under the ATC quotas. Their results show that quota removal coincided with substantial reallocation of export activity from incumbents to entrants, and that this reallocation was inconsistent with an ex ante assignment of quotas by the Government of China on the basis of firm productivity. As a result, the standard productivity growth expected from the removal of the quota was magnified by the concomitant elimination of inefficient institutions and practices related to the allocation of quota licences. In their counterfactual analysis, productivity growth from quota removal appears to be 27 per cent higher than it would be if quotas had been allocated according to firm efficiency. They also found that evidence for quality downgrading was not very strong. In particular, estimates of such effect were not robust to the inclusion of country-product pair controls.

This study also relates to the literature using microdata to look at the impact of trade liberalization on firm behaviour.[5]

3. DATA

Data used in our investigation are drawn from two sources. The first is the Enterprise Survey conducted by the Turkish Statistical Institute (with Turkish acronym TUIK), soliciting survey responses from roughly 80,000 enterprises each year.[6] The second is the Foreign Trade database, reporting (from customs sources) the roughly 500,000 annual export and import transactions by enterprises. These two can be matched by unique enterprise number and by year so that we have not only the production choices of the enterprise, but also the export and import transactions. We consider the 2003–2008 time period. We briefly examine the two databases in turn below. Details are provided in appendix A.

3.1. THE TURKISH ENTERPRISE SURVEY

The Turkish Statistical Institute conducts a large-scale survey annually. This survey is conducted at the level of the enterprise, with multi-plant enterprises aggregating information for all plants.[7] The survey includes questions on the enterprise's characteristics, its uses of inputs, the value of its sales, and whether it is involved in export activity. In recent years it has tabulated responses from more than 80,000 firms. The number of enterprises surveyed has stayed roughly constant through the years, with the sharp drop in 2005 indicating a simple reduction in the number of enterprises surveyed rather than a fall in total Turkish economic activity.[8]

Light manufactures represent the near totality of sales revenues in the surveys, while other categories (agriculture, some services) make minor contributions to sales but more important contributions to employment.

There are 46 two-digit NACE categories for which at least some enterprises report economic activity.[9]

[5] See for instance Pavcnik (2002), Goldberg, Khandelwal, Pavcnik and Topalova (2010) and Tybout (2000 and 2003).

[6] The Enterprise Survey does not distinguish individual plants, but aggregates to the enterprise level. An earlier survey by TUIK solicited information at the plant level, but from 2003 the responses are by enterprise. We limit ourselves to this aggregation in this report.

[7] Prior to 2003, the Survey was conducted at the plant level, and it is thus difficult to compare pre-2003 responses to those of 2003 and later.

[8] The appendix describes a reduction in 2005 in the number of enterprises invited automatically to participate in the survey. This change could have caused the reduction in total respondents.

[9] The two-digit NACE categories used by TUIK correspond in most regards to the categories of the International Standard Industrial Classification (ISIC). In particular, the categories from 10 to 14 represent mining, the categories from 15 to 37 represent various manufacturing activities, and the higher categories represent retail, wholesale and service (including public service) activities. The categories 17 and 18 are associated with textiles and apparel manufacture, respectively. NACE and ISIC differ in their third and higher digits; the appendix includes a short description.

In 2003, manufacturing enterprises represented about one-third of the total number of enterprises surveyed. The reported sales of manufacturing enterprises were nearly 99 per cent of the total sales reported by all enterprises. Manufacturing enterprises employed over half of the workers reported employed by the surveyed firms. From 2003 to 2008, these percentages evolved: the share of manufacturing enterprises among all surveyed rose to over 40 per cent while the share of total sales by these enterprises dropped slightly, to nearly 98 per cent. The share of manufacturing employees in total employees covered by the survey dropped to just over 43 per cent.

Further breaking down manufacturing enterprises surveyed by three-digit NACE code, we obtain that the top categories in terms of sales in 2003 were apparel, textiles, motor vehicles, iron and steel and chemical products.[10] However, there were significant differences across sectors.

Apparel (182) was the top-ranked manufacturing sector in 2003 by sales revenue. It obtained this ranking in large part because of the large number of enterprises operating in that sector. Given that 12.6 per cent of all manufacturing enterprises reported to be apparel producers, it could be surprising that only 7.3 per cent of all manufacturing sales revenue came from the sector. Table 1 reports the evolution of these shares over time. Although the share in total respondents remained relatively constant, we observe that the incidence of textiles and apparel enterprises had been declining in total sales and employment. Motor vehicles (341), iron and steel (271) and petroleum products (232) were the next three ranked sectors in manufacturing in 2003 (and the top three in 2008), but they reached these rankings with a miniscule share of the enterprises surveyed. The three sectors together represented only 0.7 per cent of the enterprises and 5.0 per cent of the employees in 2003, but they reported 18.1 per cent of the sales revenue. This was due to their characteristics of much larger-than-average size and relative capital intensity – they were less labour-using than average. The category of food products (158) was similar to apparel in having a relatively large share (7.0 per cent) of the manufacturing enterprises surveyed and a relatively smaller share of sales revenues (4.7 per cent). It was not as labour-using as apparel.

Table 1
Textiles and apparel enterprises as a share of all manufacturing enterprises

Year	*Number of enterprises*	*Total sales revenue*	*Number of employees*
2003	0.25	0.21	0.36
2004	0.25	0.18	0.35
2005	0.28	0.17	0.34
2006	0.26	0.16	0.32
2007	0.26	0.16	0.31
2008	0.25	0.13	0.29

Source: TUIK Enterprise Survey database.

3.2. THE FOREIGN TRADE DATABASE

The Enterprise Survey includes two questions on foreign trade: enterprises are asked to provide the Turkish lira value of all exports and (separately) all imports of the enterprise during the year. While these are available, more detailed data about enterprise foreign trade activity is available through the foreign trade statistics collected by the Customs Department. This is a separate database. However, it includes the unique enterprise identification code that allows merging of the two databases.

[10] The top ten three-digit NACE categories are 182, apparel; 341, motor vehicles; 271, basic iron and steel; 232, refined petroleum products; 158, other food products; 171, spinning and weaving of textiles ; 172, manufacture of other textiles; 244, pharmaceuticals ; 241, basic chemicals; 297, domestic appliances.

The Foreign Trade database identifies specific transactions in goods, either export or import, undertaken by Turkish enterprises. Table 2 provides summary statistics for international trade in manufactured goods divided into two groups: textiles and apparel, and other manufactures. The value of exports and the value of imports have increased for both groups during 2003–2008. Figures clearly reflect the decline of the textile and apparel sectors in manufactures sales observed in the Enterprise Survey database. Textile and apparel exports increased by 50 per cent, while exports in other manufacture sectors increased by almost 300 per cent.

Table 2
Trade in manufactures
(Billions of United States dollars)

	Exports			*Imports*		
	Textiles/apparel	*Other*	*Total*	*Textiles/apparel*	*Other*	*Total*
2003	5.1	17.8	22.8	5.5	30.8	36.3
2004	6.1	26.5	32.7	6.3	47.3	53.5
2005	6.1	32.1	38.1	6.3	55.7	62.0
2006	6.9	39.5	46.4	6.3	67.8	74.1
2007	7.9	49.7	57.6	7.7	79.6	87.4
2008	7.7	63.6	71.3	7.1	99.1	106.2

Source: TUIK Foreign Trade database.

There is in general a great variety in export performance by group of goods (NACE two-digit), but we can identify some salient trends. In 2003, the top three product groups for exports were motor vehicles (34), textiles (17) and apparel (18). By 2008, motor vehicles remained the top category but iron and steel (27), appliances (29), food products (15) and petroleum products (23) overtook textile and apparel in terms of export value. Turkey was in fact nearly in balance with trade in textiles and apparel; exports and imports rose through 2007 but then both declined in 2008.

Table 3 shows that for manufactures more than 45 per cent of firms present in the FT database were “importer only” in 2003. This share remained somewhat constant during 2003–2008. The remaining firms were either “exporter only” or “both” in equal shares. A similar pattern is observed for firms in textiles and apparel.

Table 3
Exporters and/or importers in manufacture sectors

	2003	*2004*	*2005*	*2006*	*2007*	*2008*
Exporter only	18 682	20 451	21 661	22 485	25 203	24 486
Importer only	27 255	29 982	32 210	33 899	39 356	37 669
Both	17 009	19 043	20 554	21 749	23 190	23 755
Total	62 946	69 476	74 425	78 133	87 749	85 910

Source: TUIK Foreign Trade database. Authors’ calculations.

4. FACTS ON THE IMPACT OF QUOTAS REMOVAL

Table 4 divides both exports and imports for Turkey as reported in the FT database into five categories and observes the evolution of each of these through the sample period 2003–2008. Category 0 comprises all trade other than in textiles and apparel; as expected, it represents almost all of Turkey's imports and a majority of its exports. Groups 1, 2 and 3 had already been liberalized by the beginning of this time period; they represented a small share of exports and a very small share of imports, and their importance to Turkish trade was in decline throughout this period. Group 4 identifies those textiles and apparel products for which the European Union liberalized its imports in 2005. While the total value of exports rose between 2003 and 2007, indicating that Turkey successfully weathered the increased competition in these products, the share of these goods in total exports declined markedly. While products in this group represented nearly 25 per cent of Turkish exports in 2003, that share had fallen to 15 per cent in 2007 and 11 per cent in 2008.

Table 4
Decomposing foreign trade into quota liberalization categories

European Union quota grouping	*Exports*			*European Union quota grouping*	*Imports*		
	year	*US$ (millions)*	*percentage*		*year*	*US$ (millions)*	*percentage*
0	2003	33 120.2	70.1	**0**	2003	64 366.2	92.8
0	2004	46 733.9	74.0	**0**	2004	91 320.3	93.6
0	2005	56 495.1	76.9	**0**	2005	110 168.5	94.3
0	2006	67 840.2	79.3	**0**	2006	132 305.3	94.8
0	2007	87 876.2	81.9	**0**	2007	161 172.6	94.8
0	2008	113 714.6	86.1	**0**	2008	193 178.4	95.7
1	2003	46.6	0.1	**1**	2003	64.5	0.1
1	2004	58.7	0.1	**1**	2004	89.6	0.1
1	2005	69.1	0.1	**1**	2005	104.3	0.1
1	2006	75.2	0.1	**1**	2006	135.4	0.1
1	2007	81.2	0.1	**1**	2007	142.4	0.1
1	2008	89.7	0.1	**1**	2008	167.3	0.1
2	2003	1 304.8	2.8	**2**	2003	1 052.6	1.5
2	2004	1 452.9	2.3	**2**	2004	1 236.4	1.3
2	2005	1 375.8	1.9	**2**	2005	1 396.8	1.2
2	2006	1 514.9	1.8	**2**	2006	1 567.0	1.1
2	2007	1 602.6	1.5	**2**	2007	1 734.7	1.0
2	2008	1 769.1	1.3	**2**	2008	1 895.2	0.9
3	2003	1 403.8	3.0	**3**	2003	493.3	0.7
3	2004	1 525.7	2.4	**3**	2004	570.9	0.6
3	2005	1 410.4	1.9	**3**	2005	626.8	0.5
3	2006	1 389.4	1.6	**3**	2006	710.6	0.5
3	2007	1 454.2	1.4	**3**	2007	513.4	0.3
3	2008	1 462.4	1.1	**3**	2008	487.4	0.2
4	2003	11 377.5	24.1	**4**	2003	3 363.0	4.9
4	2004	13 396.0	21.2	**4**	2004	4 322.6	4.4
4	2005	14 126.0	19.2	**4**	2005	4 477.8	3.8
4	2006	14 715.0	17.2	**4**	2006	4 857.9	3.5
4	2007	16 257.5	15.2	**4**	2007	6 499.6	3.8
4	2008	14 991.4	11.4	**4**	2008	6 235.2	3.1

Source: TUIK Foreign Trade database. Authors' calculations.

Table 5 reports by European Union quota grouping the mean sales revenue and employment of Turkish enterprises operating in the textile and apparel sectors.[11] There are six groups identified. The first group (group N) includes enterprises with no exports during the period. The second group (group 0) includes enterprises that report positive exports, but no exports in the HS categories associated with the textile and apparel quotas. Groups 1 through 4 are defined, as above, by the timing of quota liberalization for the product. Turkey's producers were not constrained by quotas, but their competitive position was weakened when quotas on other major exporters were removed. There are two entries for each group/year combination. The two entries in group N are the mean sales revenues in Turkish lira and the number of enterprises in the group. The two entries for the other groups include the ratio of mean sales revenue in that group to mean sales revenue in group N and the number of enterprises in the group.

Table 5

Mean revenue and employment for Turkish enterprises active throughout the period 2003–2008

	Mean revenue					
	US$ (millions)	***As a multiple of group N***				
	group N	***group 0***	***group 1***	***group 2***	***group 3***	***group 4***
2003	5 702 367	4.96	0.47	2.57	1.58	2.73
	3 496	*3 481*	*3*	*125*	*84*	*886*
2004	6 732 964	5.30	0.38	2.75	1.75	2.42
	3 644	*4 015*	*4*	*151*	*89*	*994*
2005	6 969 197	5.42	0.77	3.05	1.74	2.29
	3 621	*4 294*	*5*	*145*	*78*	*1013*
2006	8 696 511	5.37	1.00	2.22	1.35	2.18
	3 613	*4 287*	*5*	*140*	*66*	*1044*
2007	8 974 675	5.78	1.49	2.33	1.43	2.37
	3 671	*4 314*	*3*	*128*	*41*	*998*
2008	9 134 049	6.73	1.31	2.79	1.93	2.32
	3 782	*4 275*	*3*	*146*	*46*	*903*

	Mean employment					
	US$ (millions)	***As a multiple of group N***				
	group N	***group 0***	***group 1***	***group 2***	***group 3***	***group 4***
2003	65.9	2.35	0.76	2.37	1.73	2.86
	3 496	*3481*	*3*	*125*	*84*	*886*
2004	72.7	2.22	0.55	2.24	2.17	2.52
	3 644	*4015*	*4*	*151*	*89*	*994*
2005	74.6	2.21	0.90	2.67	2.21	2.57
	3 621	*4294*	*5*	*145*	*78*	*1013*
2006	77.4	2.27	1.56	1.97	1.74	2.42
	3 613	*4287*	*5*	*140*	*66*	*1044*
2007	75.8	2.47	2.54	2.04	1.99	2.67
	3 671	*4314*	*3*	*128*	*41*	*998*
2008	72.6	2.68	2.84	2.28	2.45	2.73
	3 782	*4275*	*3*	*146*	*46*	*903*

Source: TUIK Foreign Trade Database. Authors' calculations.

Notes: Figures in italics are the number of firms in the group; group N: Enterprise with no exports; group 0: Enterprises with exports not covered by ATC agreement; group 1: First group of liberalization (1995); group 2: Second group (1998); group 3: Third group (2002); group 4: Fourth group (2005).

[11] This table is limited to enterprises observed in each year of the Enterprise Survey. A table with all reporting enterprises has similar characteristics.

Comparing mean sales revenue by group in 2003, we see that mean revenue in group 0 (including non-textile, non-apparel exporters) is nearly 5 times larger than mean revenue among non-exporters over a similar number of enterprises (nearly 3,500 in each case). Among the textile/apparel groups, group 4 and group 2 are the largest in mean and roughly half as large as in group 0. Group 4 is also the largest in number of enterprises (with 886), and group 2 is a distant second (with 125). Groups 3 and (especially) 1 include a much smaller number of enterprises.

Revenues for non-exporters (group N) grew rapidly in nominal terms from 2003 to 2008. Those for exporters of non-ATC goods (group 0) and of goods liberalized by 1995 (group1) grew even more rapidly. Exporters of goods liberalized by 1998 (group 2) and by 2005 (group 3) experienced a slowing down of their sales in 2006 with a rapid recovery afterwards. Sales of exporters of ATC-goods (group 4) follow a similar trajectory. However, the inflection point for sales occurred already in 2005 and the recovery has been shaky.

When mean employment is considered, we find that textiles and apparel enterprises were the largest group. Employment in group N enterprises was fairly stable throughout the period, with a mean of nearly 66 employees per firm in 2003 and of 72.6 employees per firm in 2008. Group 0 enterprises had over twice as many employees on average, and that ratio grew during the sample period. Group 4 enterprises were even larger, with nearly three times as many employees as group N enterprises. This ratio declined slightly through 2006 before rising through 2008.

An additional possible outcome of the removal of quotas was the change in the status of firms. In table 6 we examine the subsample of firms for which observations are available in both 2003/2004 and 2005/2006. In panel 1, those exporting in 2003/2004 are represented in the first row. They are divided into those enterprises that continued to export in 2005/2006 and those that ceased exporting (but continued to produce). Those 2,654 that stopped exporting represent just over 4 per cent of the enterprises. The second row is that of enterprises that did not export in 2003/2004; among these, 3,729 (or 5.8 per cent of the total) chose to export in 2005/2006.

Table 6
Transition in enterprise characteristics from 2003/2004 to 2005/2006

	Exporting in 2005/2006	***Not exporting in 2005/2006***	***Row total***
Exporting in 2003/2004	32 770 (50.9 %)	2 654 (4.1 %)	35 424 (55.0 %)
Not Exporting in 2003/2004	3 729 (5.8 %)	25 181 (39.2 %)	28 910 (45.0 %)
Column total	36 499 (56.7 %)	27 835 (43.3 %)	64 334 (100 %)

	ATC in 2003/2004	***Not ATC in 2005/2006***	***Row total***
ATC in 2003/2004	29 334 (45.6 %)	4 026 (6.3 %)	33 360 (51.9 %)
Not ATC in 2003/2004	4 277 (6.6 %)	26 697 (41.5 %)	30 974 (48.1 %)
Column Total	33 611 (52.2 %)	30 713 (47.8 %)	64 334 (100 %)

	Export to European Union/United States in 2005/2006	***Not export to European Union/ United States in 2005/2006***	***Row total***
Export to European Union/United States in 2003/2004	31 462 (48.9 %)	3 235 (5.0 %)	34 697 (53.9 %)
Not Export to European Union/ United States in 2003/2004	2 649 (4.1 %)	26 988 (42.0 %)	29 637 (46.1 %)
Column Total	34 111 (53.0 %)	30 223 (47.0 %)	64 334 (100 %)

Source: TUIK Foreign Trade Database. Authors' calculations.

In panel 2, enterprises are divided between those in the textiles and apparel sector producing goods subject to quota in the European Union or the United States in 2003/2004 (ATC products) and all others. There were 4,026 enterprises that stopped making ATC products (but remained in business), representing 6.3 per cent of the total. By contrast, there were 4,277 enterprises (6.6 per cent) that began making ATC products in 2005/2006 after not having done so in 2003/2004.

In panel 3, enterprises are divided between whether they exported to the United States and the European Union or not. Five per cent of these chose to stop exporting to these countries in 2005/2006 after having done so in 2003/2004, and 4 per cent chose to begin exporting to these countries after not having done so in 2003/2004.

Table 7 reports a similar analysis for enterprises operating in both 2003/2004 and 2007/2008. We also observe that a large majority of firms did not change its status, even though a longer time period is considered. Among those firms that switched, compared to the table 6 sample, more were likely to export, but fewer were likely to export to the European Union/United States and less likely to produce ATC products. Logic suggests that these patterns would be intensified if we examine only enterprises with production of ATC goods.

Table 7
Transition in enterprise characteristics from 2003/2004 to 2007/2008

	Exporting in 2007/2008	***Not exporting in 2007/2008***	***Row total***
Exporting in 2003/2004	25 439 (46.8 %)	3 433 (6.3 %)	28 872 (53.1 %)
Not exporting in 2003/2004	4 171 (7.7 %)	21 284 (39.2 %)	25 455 (46.9 %)
Column total	29 610 (54.5 %)	24 717 (45.5 %)	54 327 (100 %)

	ATC in 2007/2008	***Not ATC in 2007/2008***	***Row total***
ATC in 2003/2004	23 039 (42.4 %)	4 063 (7.5 %)	27 102 (49.9 %)
Not ATC in 2003/2004	3 830 (7.0 %)	23 395 (43.1 %)	27 225 (50.1 %)
Column total	26 869 (49.4 %)	27 458 (50.6 %)	54 327 (100 %)

	Export to European Union/United States in 2007/2008	***Not Export to European Union/United States in 2007/2008***	***Row total***
Export to European Union/United States in 2003/2004	25 086 (46.2 %)	3 145 (5.8 %)	28 231 (52.0 %)
Not Export to European Union/United States in 2003/2004	2 352 (4.3 %)	23 744 (43.7 %)	26 096 (48.0 %)
Column Total	27 438 (50.5 %)	26 889 (49.5 %)	54 327 (100 %)

Source: Authors' calculations.

Table 8 reports the transition of enterprises among exporting states relative to 2003/2004, but calculates the transitions only for those enterprises producing ATC goods in 2003/2004. When the exporting decision is considered for the 2005/2006 horizon, a smaller percentage of these enterprises chose to cease exporting after having exported in 2003/2004. At the same time, a larger proportion of enterprises that did not export in 2003/2004 chose to begin exporting in 2005/2006. This pattern was maintained for the 2007/2008 horizon, while the percentage of enterprises changing behaviour rose. While exporting firms increased in percentage overall, the shares of enterprises exporting to the European Union and the United States decreased. Thus there is no clear pattern among switchers between those that stopped exporting to the European Union and the United States and those that began exporting to those destinations.

Table 8
Transition in enterprise characteristics for ATC producers

	Exporting in 2005/2006	***Not exporting in 2005/2006***	***Row total***
Exporting in 2003/2004	19 501 (39.8 %)	1 925 (3.9 %)	21 426 (43.7 %)
Not exporting in 2003/2004	3 661 (7.5 %)	23 880 (48.8 %)	27 541 (56.3 %)
Column total	23 162 (47.3 %)	25 805 (52.7 %)	48 967 (100 %)

	Exporting in 2007/2008	***Not exporting in 2007/2008***	***Row total***
Exporting in 2003/2004	15 622 (36.9 %)	2 569 (6.1 %)	18 191 (43.0 %)
Not exporting in 2003/2004	4 074 (9.6 %)	20 085 (47.4 %)	24 159 (57.0 %)
Column total	19 696 (46.5 %)	22 654 (53.5 %)	42 350 (100 %)

	Export to European Union/United States in 2005/2006	***Not export to European Union/United States in 2005/2006***	***Row total***
Export to European Union/United States in 2003/2004	19 721 (40.3 %)	2 087 (4.3 %)	21 808 (44.6 %)
Not export to European Union/United States in 2003/2004	1 987 (4.1 %)	25 172 (51.4 %)	27 159 (55.4 %)
Column total	21 708 (44.4 %)	27 259 (55.6 %)	48 967 (100 %)

	Export to European Union/United States in 2007/2008	***Not export to European Union/United States in 2007/2008***	***Row total***
Export to European Union/United States in 2003/2004	16 619 (39.2 %)	2 034 (4.8 %)	18 653 (44.0 %)
Not export to European Union/United States in 2003/2004	1 785 (4.2 %)	21 912 (51.7 %)	23 697 (56.0 %)
Column total	27 438 (43.4 %)	26 889 (49.5 %)	42 350 (100 %)

Source: Authors' calculations.

Were these the same enterprises that changed their characteristics? For example, did an enterprise that stopped exporting also stop producing ATC goods? Table 9 reports the correlation of enterprise switching behaviour for both time horizons, and the correlations indicate quite common behaviour. First, there is a negative correlation between X status and B status – those enterprises that chose to stop exporting were more likely to be those that began selling ATC goods – although that correlation is not perfect. Those enterprises with changing X status – i.e., that chose to stop exporting to the European Union and the United States – exhibit a weaker correlation of the same sign.

Table 9
Correlation of switching behaviour by enterprises

	DX_{i0506}	DB_{i0506}	DZ_{i0506}
DX_{i0506}	1.0		
DB_{i0506}	-0.23	1.0	
DZ_{i0506}	0.28	-0.08	1.0

	DX_{i0708}	DB_{i0708}	DZ_{i0708}
DX_{i0708}	1.0		
DB_{i0708}	-0.26	1.0	
DZ_{i0708}	0.28	-0.08	1.0

Source: Authors' calculations.

Notes: DX_{i0506}: Indicator variable defined as $X_{i0506} - X_{i0304}$. The X_{i0506} variable is a binary variable equal to 1 if the enterprise is an exporter in the years 2005/2006 and 0 otherwise. DB_{i0506}: Indicator variable defined as $B_{i0506} - B_{i0304}$. The B_{i0506} variable is a binary variable equal to 1 if the enterprise produced ATC goods in the years 2005/2006 and 0 otherwise. DZ_{i0506}: Indicator variable defined as $Z_{i0506} - Z_{i0304}$. The Z_{i0506} variable is a binary variable equal to 1 if the enterprise exported to the United States and/or European Union in the years 2005/2006 and 0 otherwise.

5. THE EMPIRICAL STRATEGY

The previous section describes some major changes in features characterizing Turkish firms coincident with the removal of quotas. In this section we further investigate the impact of the latter policy reform by using four performance indicators as dependent variables in a difference-in-difference estimation. We further estimate the impact of quota removal on the survival of firms by implementing a standard probit estimation with random effects.

5.1. TRIMMED DATA

As is typical for firm-level databases, there are numerous extreme values associated with performance measures; these do not reflect substantive differences, but rather seem to be either data-entry mistakes or growth rates predicated on very small initial values. We exclude these extreme values by trimming the top and bottom 1 per cent of observations from the sample we consider. The impact of this trimming process is illustrated in table 10.[12]

Table 10
Moments of panel data, with and excluding extreme values

	G(sales)		*g(employment)*		*G(profits)*		*g(productivity)*	
	Full	*Trim*	*Full*	*Trim*	*Full*	*Trim*	*Full*	*Trim*
Minimum	-1	-0.935	-0.999	-0.864	-6966.7	-0.456	-2484.4	-26.8
Maximum	1 171 398	20.297	1 818	16.28	19 925.9	0.522	792.4	24.1
N	17 998	17 638	37 947	37 187	19 254	18 868	8 188	8 024

Source: Authors' calculations.

[12] We trimmed the top and bottom 2 per cent of the distribution in a robustness check, and the results we derived were little different from those reported here.

5.2. DIFFERENCE-IN-DIFFERENCE ESTIMATION

We use a difference-in-difference-in-difference analytical technique. We limit the analysis to manufacturing enterprises, and then divide the enterprises into three categories: textiles, apparel and other. We also subdivide each category into exporting (X_{it}=1) and non-exporting (X_{it}=0) enterprises based upon their status in 2003–2004. The constant (the coefficient α) represents the average performance of firms producing for the domestic market any product which was not an ATC product. Among enterprises in textiles and apparel we distinguish between those that produced products in 2003 and 2004 for which quotas were removed in 2005 (B_{it} = 1) from those with products for which quotas were removed earlier or never existed (B_{it} = 0). We also distinguish among exporters between those that exported to ATC countries (ATC_{it} = 1) and those that exported only to other countries (ATC_{it} = 0).

$$Y_{it} = \alpha + \beta X_{it} + \gamma B_{it} + \delta ATC_{it} + \varepsilon (B_{it}^* X_{it}) + \eta (ATC_{it}^* B_{it}) + u_{it}, \; u_{it} \sim N(0,1) \qquad (1)$$

The coefficient ε identifies the average performance of exporting enterprises for which quotas were removed against exporting enterprises in the same category with products for which quotas were not binding in 2003 and 2004. The coefficient η identifies the effect by initial export market. It tests the average performance of firms exporting ATC products to the European Union and the United States relative to other markets. We consider four measures of performance (Y_{it}): growth in real sales revenue, growth in employment, evolution of profit rate and growth in total factor productivity – all relative to the 2003–2004 base period. All variables are either found directly in the raw data or are computed based on these data**.** Enterprises reported their sales revenue in current Turkish lira. These are deflated to a common 2003 Turkish lira value through use of producer price indices (PPI) matched with the enterprise's major product at the four-digit NACE level. If the four-digit PPI is not available, we use the least aggregated index available: three-digit in most cases or rarely the two-digit indices. Enterprises reported the average number of employees on an annual basis, and this is the measure used for employment. As to the profit rate we use the profit rate on book value of capital reported by firms. Total factor productivity needs to be estimated. This is done by using residuals from two different estimation approaches. First, we take the residuals from a production function estimated at the two-digit NACE level using four inputs (capital, labour, energy and materials); second, we take the residuals from a value-added function in capital and labour estimated at the two-digit NACE level. Details of this estimation and of the estimated technological coefficients are reported in appendix B.

5.3. CONDITIONAL PROBABILITY OF ENTERPRISE EXIT

The removal of quotas will lead to increased competition for Turkish textiles and apparel enterprises in their export to the markets of the European Union and the United States. We are interested in ascertaining whether this increased competition caused the exit of weaker enterprises.

Our empirical model is based on a standard approach in the empirical exit literature.[13] We view firms as making a decision to continue producing at the start of each year. Then if the firms are still in operation, they decide on specific characteristics such as employment and market destinations including foreign ones. Specifically, a firm *i* decides to produce a given product in year *t+1* by comparing the expected discounted sum of profits from operating, ES_{it+1}, with the value it would earn by exiting. Expected future profits are calculated from knowledge of the profit function Π_{it+1}, the observed state variables for year t (sales, employment, etc.) and knowledge of the transition process for the time-varying state variables. If $ES_{it+1} > \theta$, the firm continues producing and we observe the discrete variable *y=0*. If expected profits are less than the value of exit, the firm terminates production for the market and we observe *y=1*.

Hence, our empirical model expresses the discrete exit variable in year t+1 as a function of state variables in year t. State variables include past sales, past employment, whether the enterprise

[13] See Caves (1998) for an early review of the literature.

has multiple plants, whether the enterprise exports, and whether it was involved in exporting to the European Union and the United States. We then differentiate between those enterprises producing ATC goods and those that were not.

Following the existing literature we estimate a probit model, that is

$$ES_{it+1} = Z_{it}\Phi + u_{it},\ u_{it} \sim N(0,1) \quad (2)$$
$$\textbf{If } ES_{it+1} > \theta,\ \textbf{y}_{it+1} = 0$$
$$\textbf{If } ES_{it+1} <= \theta,\ \textbf{y}_{it+1} = 1$$

Z_{it} is a matrix of state variables at time t which includes sales in the previous year (in logs), the level of employment in the previous years (in logs), whether the firm was a multi-plant enterprise in the previous year, whether the firm was exporting the year before, whether the firm was a producer of ATC products liberalized in 2005 (group 4) and the level of total factor productivity. We consider those manufacturing enterprises observed without interruption from 2003, and we separate them into those observed just for 2003 and 2004 (i.e., exiting after 2004), those observed for the three years from 2003 to 2005 (exiting after 2005) and similarly for 2006, 2007 and 2008.

6. RESULTS

Our empirical strategy is twofold. First we assess the impact of ATC removal on four performance indicators. Results are presented and discussed in the next subsection. We also assess the impact of the removal of ATC quotas on firms' turnover. The latter results are reported and commented in subsection 4.2.

6.1. DIFFERENCE-IN-DIFFERENCE ESTIMATION

Results of the difference-in-difference model as defined in equation (1) are reported in table 11. We consider each specification twice: first with only the explanatory variables X_{it}, B_{it} and ATC_{it}, and then again with each of these variables and the interactive terms $X_{it}*B_{it}$ and $X_{it}*ATC_{it}$.

The top panel reports the regression of growth in the performance measure from its average in 2003–2004 to its average in 2005–2006 for each firm; the bottom panel reports a similar regression from average value for 2003–2004 to average value in 2007–2008 for each firm. The independent regressors are the binary variables defined in subsection 5.1: X_{it} (with coefficient β), B_{it} (with coefficient γ), ATC_{it} (with coefficient δ), the interactive variable $X_{it}*B_{it}$ (with coefficient ε) and the interactive variable $X_{it}*ATC_{it}$ (with coefficient η). The (β) coefficient measures improvement in the performance measure over the period in question comparing non-exporters to exporters, (γ) comparing firms producing textiles and apparel for which quotas were removed to all other firms, (δ) comparing firms selling to the United States and the European Union to all other firms, (ε) among exporting firms, comparing those making textiles and apparel for which quotas were removed to all other exporters and (η) among all exporters, comparing those exporting to the United States and the European Union to all others.

The first column of panel 1 in table 11 illustrates the stylized facts of these regressions. The intercept α indicates that non-exporting firms making goods other than textiles and apparel (under quota restrictions until 2005) had significantly faster growth in terms of sales than did exporting firms or firms making textiles and apparel for the domestic market (under quota restrictions until 2005). The coefficient β indicates that exporting firms had significantly slower sales growth than non-exporting firms over the 2005/2006 horizon. The coefficient γ indicates that when firms making textiles and apparel subject to a European Union quota in 2003/2004 are compared to all other firms, these textiles and apparel firms had significantly faster sales growth for the 2005/2006 horizon. The coefficient δ

compares the firms exporting to the United States and the European Union to all other firms. The sales growth of these firms was significantly greater than that of all other firms.[14]

Table 11
Results for difference-in-difference estimation for Turkey

Panel 1	$g(sales_{0506})$	$g(sales_{0506})$	$g(emp_{0506})$	$g(emp_{0506})$	$g(profit_{0506})$	$g(profit_{0506})$	$g(prod_{0506})$	$g(prod_{0506})$
α	**0.86**	**0.76**	**0.66**	**0.63**	**-0.014**	**-0.019**	0.304	-0.60
	(0.10)	(0.14)	(0.04)	(0.04)	(0.005)	(0.006)	(0.046)	(0.77)
β	**-0.48**	-0.18	**-0.37**	**-0.16**	**-0.009**	0.009	-0.115	1.38
	(0.03)	(0.18)	(0.02)	(0.08)	(0.002)	(0.01)	(0.131)	(0.96)
γ	**0.23**	**0.32**	**0.25**	**0.28**	**0.012**	**0.017**	0.706	**1.63**
	(0.10)	(0.14)	(0.04)	(0.04)	(0.005)	(0.006)	(0.461)	(0.78)
δ	**0.18**	-0.09	0.05	-0.05	0.003	0.009	0.041	1.10
	(0.05)	(0.40)	(0.03)	(0.20)	(0.003)	(0.03)	(0.194)	(1.10)
ε		-0.30		**-0.21**		-0.019		-1.53
		(0.18)		(0.08)		(0.010)		(0.97)
η		0.28		0.10		-0.006		-1.06
		(0.41)		(0.21)		(0.03)		(1.12)
N	17 638	17 638	37 187	37 187	18 868	18 868	8 024	8 024
R^2	0.02	0.02	0.01	0.01	0.002	0.002	0.0004	0.001
Root MSE	1.869	1.878	1.706	1.705	0.117	0.117	5.11	5.11

Panel 2	$g(sales_{0708})$	$g(sales_{0708})$	$g(emp_{0708})$	$g(emp_{0708})$	$g(profit_{0708})$	$g(profit_{0708})$	$g(prod_{0708})$	$g(prod_{0708})$
α	**1.673**	**1.61**	**0.990**	**0.97**	**-0.010**	**-0.015**	1.067	-0.42
	(0.158)	(0.22)	(0.056)	(0.06)	(0.006)	(0.007)	(0.572)	(0.94)
β	**-0.884**	-0.58	**-0.494**	**-0.30**	**-0.014**	0.004	-0.130	**2.47**
	(0.052)	(0.30)	(0.025)	(0.12)	(0.002)	(0.01)	(0.164)	(1.17)
γ	0.171	0.24	**0.242**	**0.27**	0.005	**0.019**	0.656	**2.18**
	(0.159)	(0.22)	(0.058)	(0.06)	(0.003)	(0.007)	(0.566)	(0.94)
δ	**0.280**	**-0.72**	0.078	-0.12		-0.009	0.476	-1.78
	(0.093)	(0.29)	(0.051)	(0.26)		(0.017)	(0.268)	(1.51)
ε		-0.30		-0.20		-0.018		**-2.65**
		(0.30)		(0.12)		(0.011)		(1.18)
η		**1.02**		0.20		0.015		2.28
		(0.30)		(0.27)		(0.018)		(1.53)
N	15 814	15 814	32 969	32 969	16 617	16 617	6 848	6 848
R^2	0.02	0.02	0.01	0.01	0.003	0.003	0.002	0.002
Root MSE	3.276	3.276	2.342	2.342	0.125	0.125	5.899	5.897

Source: Authors' calculations.

Notes: Panel 1 dependent variables**:** Growth of performance indicators from 2003/2004 to 2005/2006. Top and bottom 1 per cent of distribution trimmed in estimation. Panel 2 dependent variables**:** Growth from 2003/2004 to 2007/2008. Top and bottom 1 per cent of distribution trimmed in estimation.

We observe similar direct effects when considering employment growth (column 3, panel 1). When profit rate is considered (column 5, panel 1), we observe that non-exporting firms making goods other than textiles and apparel had significantly lower profit rates (α). Exporting firms on average also had significantly lower profit rates (β), but exporting firms selling ATC goods had significantly higher profit rates over this period (γ). Exporting to the European Union had a positive, though not significant,

[14] This should be considered in conjunction with β. Given that exporters overall had significantly lower sales growth, δ tells us that enterprises exporting to the markets of the United States and the European Union did significantly better than other exporters, but still not well. The point estimate for exporters to the United States and the European Union is δ + β.

edge over other exporters (δ). For firm productivity, none of these direct effects is significantly different from zero.

When we consider the complete specification of equation (1) new features appear. The intercept α and coefficient γ are largely unchanged by this extension of the estimation equation; both remain significantly different from zero. However, the coefficients β and δ become insignificantly different from zero. The sign of β remains negative, while the sign of δ switches from positive to negative. The coefficient ε provides a measure of the difference-in-difference effect: contingent on being an exporter, did a firm producing textiles and apparel subject to quota gain more or less during this period? The answer is "less", as theory would predict when exporting firms faced increased competition in the export market. The coefficient η provides a measure of another difference-in-difference effect: contingent on being an exporter to the United States or the European Union, did firms selling textiles and apparel products subject to quota in 2003/2004 tend to have better or worse performance? The answer is "better", though the results are not statistically significant. The point estimates suggest that sales of exporters to the United States or the European Union grew at the rate of non-exporters – the effect specific to these exporters offsets nearly completely the exporter effect ε.

We note in comparing the first and second columns of panel one that including the difference-in-difference terms leads to a decomposition of the direct-effect coefficients reported in the first column. The coefficient β in column one, for example, is equal to the sum of the coefficients β + ε from column two. The coefficient δ in column one is equal to the sum of the coefficients δ + η in column two.

When the complete specification for employment growth is considered (column 4, panel 1), we observe that the coefficient β is divided into a component attributable to non-ATC goods (-0.16) and the component attributable to ATC goods (-0.21). Those firms exporting into the market protected by quotas will face relatively more competition and will reduce employment by relatively more than a comparator firm in a market not liberalized in this way. The complete specification of the profit rate (column 6, panel 1) has similar significant coefficients for α and γ to the direct-effect specification (column 5, panel 1). The complete specification reveals, though, that the negative return to exporters in the direct-effect specification is attributed exclusively to ATC products – when the two are separated, the coefficient for non-ATC goods (β) becomes positive while the coefficient for ATC goods (ε) is negative.

The results of panel 1 refer to performance over the short run – for the years 2005 and 2006 after quota elimination at the beginning of 2005. In panel 2 we examine the performance from the 2003/2004 average through the years 2007 and 2008. Comparison of column 1 in panel 2 to column 1 in panel 1 illustrates that the two periods have very similar characteristics. The coefficients in panel 2 are larger than in panel 1, as expected when we examine cumulative growth over a longer period. They take the same sign and (for the most part) significance: exporting enterprises had significantly slower sales growth, while enterprises producing ATC goods had more rapid (but statistically insignificant) sales growth. Enterprises exporting to the United States and the European Union grew significantly more rapidly. When the complete specification is considered (column 2, panel 2), the patterns of panel 1 are duplicated. It becomes clear that sales growth over this longer horizon for exporters was significantly better for ATC products (η) than for non-ATC products (δ). The results in panel 2 for employment growth and profit rate are qualitatively similar to those of panel 1.

6.2. PROBIT ESTIMATION

In table 12 we report the mean and median values of the four performance variables by exit year. (We report both the mean/median and the number of enterprises observed for each year/performance variable combination.) If we examine the median values of these, we observe that median total factor productivity (TFP) was rising for all surviving enterprises in 2005–2007, with a fall in 2008. A breakdown by NACE category illustrates that for NACE 17 (textiles) there was a rise in median

TFP through 2006 and a reduction thereafter. For NACE 18 (apparel) the median TFP rose through 2007, but saw a downturn thereafter. For NACE 19 (other products) the TFP rose for each year. The downturn in TFP is thus attributable to the downturn in textiles and apparel production. (The numbers for the other variables – sales, employment, profit rate – were not consistent across years, and suggest that we should recalculate what we have here.)

Table 12
Performance and survival

Last	*Mean*				*Median*			
year	*Productivity*	*Sales*	*Employment*	*Profit*	*Productivity*	*Sales*	*Employment*	*Profit*
2004	6.5	7.46	17.06	0.1	5.3	7.69	6	0.14
	1 109	3 263	3 263	3 263	1 109	3 263	3 263	3 263
2005	6.58	9.17	65.6	0.173	5.44	9.4	26	0.175
	243	542	542	542	243	542	542	542
2006	7.96	9.54	55.04	0.139	5.84	9.41	19	0.14
	568	974	974	974	568	974	974	974
2007	7.26	6.948	74.49	54.13	5.78	1.893	36	3.4
	1 540	2 633	2 633	1 615	1 540	2 633	2 633	1 615
2008	6.92	2.53	132.32	48.88	5.66	4.736	48	3.33
	41 910	55 819	55 819	42 993	41 910	55 819	55 819	42 993

Source: Authors' calculations.

Note: The year column refers to the last year of activity of firms considered in computations.

In table 13, we report the result of probit regressions qualifying the survival of enterprises from the previous year to the year given at the top of the column. Top panel results are derived from probit estimation, while bottom panel results are derived from probit estimation with random effects. The data sample includes all manufacturing enterprises in continuous operation from 2003 to the year prior to the year indicated in each column of the table: for example, in the column indicating "2005" we consider all enterprises operating in both 2003 and 2004. We define the dependent variable as a binary variable, with value 1 indicating continuing operation in that year and value 0 indicating that the enterprise was not observed in that year or in subsequent years. The explanatory variables used include the logarithm of sales revenue in the previous year, the logarithm of employment in the previous year, a binary variable indicating that the enterprise had more than one plant in the previous year and a binary variable indicating that the enterprise was an exporter in the previous year. We also include the measure of total factor productivity derived for each enterprise and a binary variable indicating whether the enterprise was primarily a producer of the textile and apparel products liberalized in 2005 (group 4 producers).[15]

The random-effect probit estimation controls for systematic differences across industries (defined in a disaggregated fashion with over 200 groups) in the probability of survival. If we focus upon those regressions (bottom half of the table), we observe that the scale of the enterprise's operation (as measured by sales revenue) is a significant and positive indicator of survival. The employment of the enterprise, by contrast, is an irregular additional indicator – positively and significantly associated in 2005 and 2007, but negatively and insignificantly associated with survival in 2006 and 2008. Multi-plant enterprises were significantly more likely to survive in 2006 and 2008, but not in the other years. The total factor productivity of the enterprise was negatively and significantly

[15] In table 14, we report the results of probit regressions similar to those of table 13 but excluding the productivity and group 4 regressors. As is evident, the remaining coefficients are similar across the two sets of regressions, but the number of observations in table 14 is larger (since it is no longer necessary to have adjacent observations to estimate the productivity term).

associated with survival of the enterprise in each year – a surprising finding. Exporting enterprises were ceteris paribus significantly more likely to survive. Finally, enterprises producing textiles and apparel goods liberalized in 2005 were less likely to survive, other things equal, in each of the years 2005 through 2008. These effects are significantly different from zero in 2005 and 2008.[16]

Table 13
Duration analysis for Turkish enterprises

Dependent variable: Still producing in	***2005***		***2006***		***2007***		***2008***	
				Probit				
Constant	-2.242	0.131	-1.054	0.147	-1.573	0.140	-2.280	0.309
ln(sales in previous year)	0.163	0.018	0.185	0.020	0.167	0.019	0.207	0.021
Ln(employment in previous year)	0.340	0.026	-0.018	0.029	0.144	0.028	-0.009	0.030
Multi-plant enterprise in previous year	-0.073	0.033	0.129	0.037	0.055	0.035	0.550	0.141
Exporter in previous year	0.241	0.036	0.224	0.039	0.173	0.037	0.197	0.040
Group 4 producer	-0.225	0.047	-0.127	0.049	-0.170	0.045	-0.172	0.049
Productivity	-0.016	0.007	-0.029	0.008	-0.029	0.007	-0.048	0.007
N	8 738		7 998		8 068		7 178	
R2	0.16		0.04		0.07		0.06	
log likelihood	-4 206.83		-3 488.58		-3 950.2		-3 427.47	
				Probit with random effects				
Constant	-2.293	0.141	-1.106	0.151	-1.594	0.150	-2.339	0.315
ln(sales in previous year)	0.161	0.020	0.182	0.021	0.164	0.021	0.212	0.022
Ln(employment in previous year)	0.352	0.028	-0.012	0.030	0.156	0.030	-0.008	0.031
Multi-plant enterprise in previous year	-0.043	0.035	0.132	0.038	0.064	0.036	0.551	0.142
Exporter in previous year	0.226	0.040	0.203	0.041	0.138	0.040	0.187	0.042
Group 4 producer	-0.181	0.054	-0.075	0.055	-0.094	0.054	-0.150	0.054
Productivity	-0.013	0.008	-0.026	0.008	-0.026	0.008	-0.046	0.008
N	8 738		7 998		8 068		7 178	
log likelihood	-4 190.81		-3 484.93		-3 939.53		-3 426.09	
Number groups	224		220		222		219	

Source: Authors' calculations.

Notes: The data sample in each case is of all enterprises in operation the year prior to the year listed and all preceding sample years. The first panel reports the results of a probit analysis. The second panel reports the results of random-effect (RE) probit analysis. The random effects are defined by productive activity group.

We anticipated that once we control for the size, productivity and exporter status of the enterprise, we find that enterprises producing ATC goods will be more likely to exit in the years following the elimination of quotas. As competition is increased in the export markets for the ATC goods, the weaker performers will be driven from the market. The results of Table 13 reflect this; so also may the results of Table 12 in indicating that productivity has increased over time. This could have been the consequence of the elimination of low-productivity enterprises through market exit.

[16] This effect persists despite the use of random effects conditioned on the productive activity of the enterprise. We expect that this random-effect term will capture some of the liberalization effect, given that the goods liberalized were concentrated in a few activity categories. When the probit is run without random effects, as in the top panel of table 13, the negative liberalization effects for group 4 producers are negative and significant in all years.

Table 14

Duration analysis for Turkish enterprises (restricted)

Dependent variable: Still producing in	***2005***		***2006***		***2007***		***2008***	
			Probit					
Constant	-2.299	0.056	-1.81	0.059	-1.466	0.044	-2.914	0.132
ln(sales in previous year)	0.031	0.009	0.054	0.009	-0.001	0.007	0.092	0.008
Ln(employment in previous year)	0.872	0.015	0.604	0.015	0.654	0.012	0.553	0.012
Multi-plant enterprise in previous year	-0.228	0.025	0.173	0.029	0.023	0.025	0.512	0.062
Exporter in previous year	0.228	0.025	0.025	0.025	0.228	0.022	0.322	0.025
N	30 709		25 484		34 130		33 348	
R^2	0.54		0.37		0.41		0.46	
log likelihood	-9 819.369		-8 853.17		-13 391.53		-11 883.9	
			Probit with random effects					
Constant	-2.35	0.073	-1.656	0.073	-1.343	0.058	-2.765	0.139
ln(sales in previous year)	0.018	0.01	0.017	0.011	-0.013	0.008	0.067	0.009
Ln(employment in previous year)	0.952	0.017	0.707	0.017	0.692	0.013	0.628	0.014
Multi-plant enterprise in previous year	-0.172	0.026	0.193	0.03	0.048	0.026	0.563	0.063
Exporter in previous year	0.22	0.026	0.247	0.073	0.213	0.023	0.304	0.026
N	30 709		25 484		34 130		33 348	
log likelihood	-9 380.29		-8 595.02		-13 066.73		-11 474.83	
Number groups	234		233		233		233	

Source: Authors' calculations.

Notes: The data sample in each case is of all enterprises in operation the year prior to the year listed and all preceding sample years. The first panel reports the results of a probit analysis. The second panel reports the results of random-effect (RE) probit analysis. The random effects are defined by productive activity group.

7. CONCLUSIONS AND EXTENSIONS

Liberalizing international trade creates both opportunities and threats for productive enterprises. The opportunities stem from the opening of new markets for its products; the threats stem from the entry of competitors to contest the liberalized market. The elimination of textiles and apparel quotas in the Canada, the United States of America and the European Union in the period 1995–2005 created opportunities and threats for textiles and apparel exporters worldwide.

Turkey as an economy responded well to this opportunity, as measured by positive growth in export value to the countries eliminating quota. We decompose this success in this paper by observing the changes in behaviour at the enterprise level.

When we divide the enterprises into those producing textiles and apparel subject to quota in 2004 (i.e., ATC goods) and others, we find that those enterprises producing ATC goods grew more rapidly in terms of real sales revenue and employment – and they also had significantly higher profit rates on average. When we divide the enterprises into exporting versus non-exporting ones, we find that the non-exporting enterprises actually grew faster in both real sales and employment during the period associated with quota elimination. In sum, the textiles and apparel industries were sources of faster economic growth. However, the enterprises involved in exporting grew more slowly than those involved in exclusively domestic sales.

We are also able to draw conclusions on the enterprise-level performance of exporters. For exporters, we found that those that specialized in textiles and apparel during this period had lower sales revenue and employment growth and a lower profit rate on average than those selling other products. Those that exported to the United States and the European Union had relatively higher sales revenue and employment growth, and a higher profit rate, on average than those exporting only to other markets.

When we consider the motivations for enterprises to cease operations, we consider a number of alternative explanations. We find that the larger enterprises are more likely to survive from one year to the next, whether size is measured by the value of sales, of employment, or of the number of plants. Independently of these factors, enterprises that had been exporters were significantly more likely to survive from one year to the next during this period. However, this latter effect is on average counteracted by the effect of being a producer of ATC goods: ATC producers were significantly more likely to fail during this period.

We conclude from this that Turkey's success in the export of textiles and apparel must be taken in context. While Turkish enterprises were more successful than most in adapting to the post-quota market in textiles and apparel, their performance paled relative to the performance of enterprises in non-ATC areas. Exports to markets other than Canada, the United States and the European Union for ATC products were reduced, while production of non-ATC products, both for export and domestic use, grew rapidly. Enterprises then "voted with their feet" – significantly more enterprises in ATC industries closed during this period than in other industries.

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APPENDIX A: TURKISH FIRM-LEVEL SURVEYS

The Turkish Statistical Institute has two classes of enterprises. The larger enterprises (i.e., those with more than 20 employees or those in selected economic sectors) are surveyed every year. The smaller enterprises are surveyed sporadically; when surveyed, they represent themselves and those of similar size that have been excluded for the year. For these smaller enterprises, their responses are scaled up in estimating the gross domestic product to reflect this role of representation. TUIK defines a weight for each enterprise between 1 (for the large firms) and a very large positive number (for the firms representing a great number of similarly small non-surveyed enterprises).

A1. The Enterprise Survey

The Turkish Statistical Institute (with Turkish acronym TUIK) conducts a large-scale survey annually. This survey is conducted at the level of the enterprise, with multi-plant enterprises aggregating information for all plants.[17] The survey includes questions on the enterprise's characteristics, its uses of inputs, the value of its sales, and whether it is involved in export activity. In recent years it has tabulated responses from more than 80 000 firms.

Table A.1 reports the aggregates for number of enterprises, sales by enterprises and employees of enterprises. The number of enterprises surveyed has stayed roughly constant through the years, with the sharp drop in 2005 indicating a simple reduction in the number of enterprises surveyed rather than a fall in total Turkish economic activity.[18] The total nominal value of sales by surveyed enterprises rose rapidly during this period. Some of this rise was due to inflation, but a large part of this was due to the economic growth that Turkey experienced.[19]

Table A.1
Enterprise Survey: Totals from respondents

	Total enterprises	***Total sales*** *(in billions of TL)*	***Total employees*** *(in millions)*
2003	80 213	171.17	2.56
2004	78 399	238.61	3.12
2005	63 211	269.66	3.87
2006	84 925	334.70	4.28
2007	83 844	365.98	4.50
2008	82 496	418.47	4.58

Source: Enterprise Survey database.

Note: TL, Turkish lira.

Sectoral breakdown. When enterprises are grouped by the category of their most important product or service, it is clear that light manufactures represent the near totality of sales revenues in the surveys, while other categories (agriculture, some services) make minor contributions to sales but more important contributions to employment. In table A.2, enterprises are grouped by the two-digit NACE category of their final product. We report information from 2003 and 2008 for purposes of comparison, and list the categories by share of sales revenue in 2003.

[17] Prior to 2003, the Survey was conducted at the plant level, and it is thus difficult to compare pre-2003 responses to those of 2003 and later.

[18] There was a reduction in 2005 in the number of enterprises invited automatically to participate in the survey. This change could have caused the reduction in total respondents.

[19] Annual inflation in the consumer price index as reported by the IMF was (in terms of per cent) 25.3 (2003), 8.6 (2004), 8.2 (2005), 9.6 (2006), 8.8 (2007) and 10.4 (2008) for these years.

There are 46 two-digit categories for which at least some enterprises report economic activity.[20] The categories range from 10 (mining) to 92 (other service activities). We report only the top 20 categories when ranked by sales in 2003. The entries in the table are the per cent of the total for the year contributed by that category. Concentration ratios for the top 5, 10 and 20 categories are reported at the bottom of the table.

Table A.2
NACE categories statistics
(Share in total)

NACE category	*Sales revenues*		*Employees*		*Enterprises*	
	2003	*2008*	*2003*	*2008*	*2003*	*2008*
15	15.0	13.8	6.4	4.9	4.8	4.0
17	12.6	7.9	10.7	6.7	4.6	4.5
24	9.9	6.0	2.5	1.6	1.2	1.2
27	8.9	14.6	2.4	2.1	0.9	1.5
34	8.6	8.8	2.6	2.6	0.9	1.1
18	7.7	5.2	8.1	6.1	5.6	5.5
23	5.4	6.8	0.2	0.1	0.1	0.1
26	5.2	5.6	3.3	3.3	2.3	2.6
29	5.2	5.9	3.3	3.3	2.9	3.5
25	3.6	4.4	1.9	2.1	2.1	2.2
28	2.7	4.0	2.3	2.6	3.7	4.6
32	2.4	1.3	0.6	0.4	0.1	0.2
36	2.2	2.6	2.0	2.0	3.4	3.3
31	2.2	3.5	1.3	1.5	0.9	1.0
21	1.8	1.7	0.9	0.7	0.6	0.7
16	1.4	0.8	0.9	0.4	0.0	0.0
22	1.1	1.1	0.7	0.7	1.3	1.4
19	1.0	0.7	0.9	0.7	1.1	0.9
51	0.9	1.6	5.9	5.8	10.1	9.7
20	0.7	1.0	0.5	0.4	1.6	1.3
Top five categories	55.0	51.1	24.6	17.9	12.4	12.3
Top ten categories	82.2	79.1	41.4	32.7	25.4	26.2

Source: Enterprise Survey database.

Beginning with the top five categories in the table (all manufactured products, with 15: food products, 17: textiles, 24: chemicals, 27: basic metals, 34: motor vehicles), we observe that these five categories alone represent (in 2003) 55 per cent of total sales revenue as reported in the sample, but only 25 per cent of employment and 12 per cent of the firms surveyed. When the top 20 categories are considered, 48 per cent of the enterprises surveyed report nearly 99 per cent of the sales revenue and 57 per cent of the employment. By 2008, 49 per cent of the firms report themselves to be in these 20 categories; these report 97 per cent of the sales revenue but only 48 per cent of the employment.

Perusal of the individual entries for these top categories leads to two additional conclusions about those responding to the survey:

[20] The two-digit NACE categories used by TUIK correspond in most regards to the categories of the International Standard Industrial Classification (ISIC). In particular, the categories from 10 to 14 represent mining, the categories from 15 to 37 represent various manufacturing activities, and the higher categories represent retail, wholesale and service (including public service) activities. The categories 17 and 18 are associated with textiles and apparel manufacture, respectively. NACE and ISIC differ in their third and higher digits.

- The upper 10 categories in the table have the dual characteristic of representing a higher percentage of both sales and employees than they do of total enterprises: these are sectors in which a new enterprise generates greater-than-average sales and employment growth. This is not true of all categories listed. For example, category 51 includes all enterprises reporting their main activity to be purchase and sale of waste and scrap. These are about 10 per cent of all enterprises surveyed in 2003 and 2008, and they employ nearly 6 per cent of the workers employed in the surveyed enterprises. They contribute only about 1 per cent of the total sales revenue in the survey.

- The manufacturing categories are those between 15 and 37, inclusive. As is evident from the table, the top 20 categories in terms of sales revenue are all manufacturing except for category 51 mentioned above.

In much of the analysis to follow, we will focus upon manufacturing enterprises. In table A.3 we report the summary statistics for just those enterprises, and as a percentage of the totals for the entire Enterprise Survey.

Table A.3
Enterprise Survey: Totals for manufacturing

	Enterprises		***Sales***		***Employees***	
	Number	***Share in total***	***Billions (TL)***	***Share in total***	***Millions***	***Share in total***
2003	27 138	33.8	169.17	98.8	1.34	52.3
2004	30 705	39.2	235.33	98.6	1.59	50.9
2005	25 483	40.3	264.99	98.3	1.79	46.2
2006	34 122	40.2	327.98	98.0	1.91	44.6
2007	33 345	39.8	357.15	97.6	1.97	43.7
2008	33 777	40.9	409.82	97.9	1.99	43.5

Source: Enterprise Survey database.
Note: TL, Turkish lira.

In 2003, for example, we observe that manufacturing enterprises represented about one-third of the total number of enterprises surveyed. The reported sales of manufacturing enterprises were nearly 99 per cent of the total sales reported by all enterprises. Manufacturing enterprises employed over half of the workers reported employed by the firms surveyed. From 2003 to 2008, these percentages evolved: the share of manufacturing enterprises among all surveyed rose to over 40 per cent while the share of total sales by these enterprises dropped slightly to nearly 98 per cent. The share of manufacturing employees in total employees covered by the survey dropped to just over 43 per cent.

We can also break down the manufacturing enterprises surveyed into groups by their final product. After doing so by three-digit NACE code and ranking the resulting 100 groups by sales revenue in 2003, we report characteristics of the top 20 manufacturing categories in table A.4. The top categories are not surprising given what we discovered in table 2: apparel, textiles, motor vehicles, iron and steel and chemical products dominate the list.[21] The breakdown reported in table A2.4, however, indicates large differences among sectors.

[21] The top ten three-digit NACE categories are 182, apparel; 341, motor vehicles; 271, basic iron and steel; 232, refined petroleum products; 158, other food products; 171, spinning and weaving of textiles; 172, manufacture of other textiles; 244, pharmaceuticals ; 241, basic chemicals; 297, domestic appliances.

- Apparel (182) was the top-ranked manufacturing sector in 2003 by sales revenue. It is so in large part because of the large number of enterprises operating in that sector. Given that 12.6 per cent of all manufacturing enterprises reported to be apparel producers, it is a bit surprising that only 7.3 per cent of all manufacturing sales revenue came from the sector.

- Motor vehicles (341), iron and steel (271) and petroleum products (232) are the next three ranked sectors in manufacturing in 2003 (and the top three in 2008), but they are so with a miniscule share of the enterprises surveyed. The three sectors together represent only 0.7 per cent of the enterprises and 5.0 per cent of the employees in 2003, but they report 18.1 per cent of the sales revenue. This is due to their characteristics of much larger than average size and relative capital intensity – they are less labour-using than average. (Apparel, by contrast, has 15 per cent of the employees but only 7 per cent of the sales revenue.)

- The category food products (158) is similar to apparel in having a relatively large share (7.0 per cent) of the manufacturing enterprises surveyed and a relatively smaller share of sales revenues (4.7 per cent). It is not as labour-using as apparel.

- Within manufacturing, the distribution of sales revenue is not as concentrated as was observed in table 1.2 for all surveyed enterprises: the top 5 categories have 30 per cent of the total, the top 10 have 46 per cent and the top 20 have 66 per cent (as compared to 99 per cent above). The distribution of employees is roughly equally concentrated while the distribution of enterprises is more concentrated at the top 5 level but less concentrated at the top 20 level. (There are roughly twice as many categories in the manufacturing breakdown as in the breakdown of table 1.2.)

Table A.4
NACE categories statistics: Manufacturing

NACE category	*Sales revenues*		*Employees*		*Enterprises*	
	2003	*2008*	*2003*	*2008*	*2003*	*2008*
182	7.3	5.0	14.7	13.3	12.6	12.7
341	6.4	6.2	2.2	2.3	0.1	0.1
271	6.2	10.5	2.4	2.2	0.4	0.6
232	5.5	7.0	0.4	0.3	0.2	0.2
158	4.7	3.8	5.4	4.8	7.0	4.4
171	3.9	2.1	5.1	3.8	1.9	1.8
172	3.5	1.7	5.4	3.0	2.3	1.8
244	3.2	1.5	1.8	1.3	0.4	0.4
241	2.8	1.9	1.1	0.7	0.8	0.7
297	2.8	2.6	2.0	2.0	1.2	1.0
252	2.6	3.4	2.8	3.6	4.5	4.5
153	2.4	2.2	2.1	1.9	1.2	1.3
343	2.2	2.5	2.6	3.3	1.7	2.1
154	2.1	1.5	0.7	0.5	0.6	0.5
323	2.0	1.0	0.7	0.5	0.2	0.2
151	1.8	1.5	1.5	1.4	0.7	0.7
174	1.7	1.3	3.1	2.5	1.8	1.8
156	1.6	1.5	0.7	0.6	1.6	1.1
245	1.6	1.0	0.7	0.6	0.7	0.6
265	1.5	1.6	0.7	0.8	0.3	0.3
Top five categories	30.0	32.4	25.1	22.9	20.3	18.0
Top ten categories	46.3	42.2	40.5	33.7	27.0	23.5
Top twenty categories	65.7	59.8	55.9	49.3	40.3	36.5

Source: Enterprise Survey database.

Characteristics of transition of enterprise inclusion across years. Not all enterprises are surveyed in every year. For larger enterprises, the survey is an annual event, while for smaller enterprises the survey may be an event conducted once every two years or once every ten years. There is a unique identifier for each enterprise, and thus these survey responses can be linked across time. Using this identifier, we can identify those enterprises that are entering, continuing, exiting and re-entering the panel.

Table A.5
Firms' sample composition: Manufacturing
(Number of firms)

	2003	*2004*	*2005*	*2006*	*2007*	*2008*	*Total*
Exiting	13 100	15 725	6 103	13 442	12 724		
Continuing		14 037	14 984	19 381	20 687	20 625	
Entering	27 137	16 672	9 654	12 702	11 043	11 029	
Re-entering			846	2 046	1 619	2 127	
Total	27 137	30 709	25 484	34 129	33 349	33 781	184 589
Observed only in that year	10 969	10 085	4 089	8 939	9 076	11 029	
Firms always present	8 022						

Source: Enterprise Survey database.

The panel is created by merging the survey observations for each year into a dataset with a time dimension. An entering firm is one that is observed for the first time in that year. An exiting firm is one that is observed in the database in that year, but not in the following year. A continuing firm is one observed both the previous year and the current year. A re-entering firm is one that was not observed in the previous year, but was observed at some earlier time period in the database. Table A.5 reports the count of manufacturing enterprises in each of these categories in each of these years for the entire survey. The final two rows of the table report the number of enterprises observed only in that one year, and the number of enterprises observed in every year from 2003 to 2008 inclusive. (The difference between the totals of table A.3 and table A.5 is due to observations in which the same enterprise number is assigned to two observations in the same year. In that case, both are excluded in table A.5 but both are included in table A.3.)

Table A.6
Textiles and apparel enterprises as a share of all manufacturing enterprises

Year	*Number of enterprises*	*Total sales revenue*	*Number of employees*
2003	0.25	0.21	0.36
2004	0.25	0.18	0.35
2005	0.28	0.17	0.34
2006	0.26	0.16	0.32
2007	0.26	0.16	0.31
2008	0.25	0.13	0.29

Source: Enterprise Survey database.

Textiles and apparel within the Turkish manufacturing sector. Textiles and apparel enterprises are well represented among the enterprises responding to the Enterprise Survey. Table A.6 reports the share of textiles and apparel enterprises among all manufacturing enterprises. As is evident from the first column, textiles and apparel enterprises represent about one-quarter of the total number of respondents. This share rose slightly in 2005, but then fell back to the pre-liberalization percentage by 2008. By contrast, textiles and apparel enterprises had been declining as a group in terms of both share of total sales revenue and share of total employees for all survey respondents. Table A.7 reports the pattern of transition for textiles and apparel enterprises. We observe that the number of enterprises rose in each year, but we also observe that this was due to increased continuation of enterprises. Entrance of new enterprises declined slightly during the years 2005–2008, in contrast to the behaviour of manufacturing enterprises as a whole.

Table A.7
Firms' sample composition: Textiles and apparel
(Number of firms)

	2003	*2004*	*2005*	*2006*	*2007*	*2008*
Exiting	2 735	3 053	1 324	2 841	2 903	
Continuing		3 988	4 608	5 757	5 931	5 861
Entering	6 724	3 673	2 297	2 164	2 445	2 127
Re-entering			176	291	388	330
Total	6 724	7 661	7 081	8 212	8 764	8 318
Observed only in that year	2 302	1 926	803	1 836	1 947	2 127
Firms available in every year	2 329					

Source: Enterprise Survey database.

A2. The Foreign Trade database

The Enterprise Survey includes two questions on foreign trade. Enterprises are asked to provide the Turkish lira value of all exports and (separately) all imports of the enterprise during the year. While these are available, more detailed data about enterprise foreign trade activity is available through the foreign trade statistics collected by the Customs Department. This is a separate database (we will refer to it as the TUIK foreign trade (FT) database), but it includes the unique enterprise identification code that allows merging of the two files.

The Foreign Trade database identifies specific transactions in goods, either export or import, undertaken by Turkish enterprises. Table A.8 provides summary statistics for international trade in manufactured goods. There were a large number of transactions – 426,954 in 2003, rising to 619,579 in 2008. For a given enterprise, there can be many transactions in each year – each destination country (for exports) or source country (for imports) has a separate transaction, as does every different classification of traded good. The traded good is classified both by 4-digit ISIC code and by the 12-digit HS code associated with trade-balance accounting. In table A.8, the ISIC code is used to identify manufactured goods.[22]

[22] Note that table A.8 does not necessarily describe trade by manufacturing enterprises. While manufacturing enterprises could be exporters of manufactured goods, so also could trading companies that serve as intermediaries for the purposes of international trade. Importers of manufactured goods could be manufacturing enterprises, but they could also be enterprises in agriculture, resource extraction or services industries.

Table A.8
Foreign trade in manufactured goods
(Millions of United States dollars)

Year	*Transactions*	*Export value*	*Import value*
2003	426 954	22 849.6	36 320.5
2004	497 007	32 654.0	53 516.0
2005	526 282	38 131.7	61 968.4
2006	582 534	46 355.7	74 142.4
2007	600 065	57 614.0	87 354.6
2008	619 579	71 302.4	106 178.4

Source: Foreign Trade database.

In table A.9, we limit our consideration to exported goods, but we provide a detailed breakdown by two-digit NACE code of the exported products. There is a great variety in export performance by group of good, but we can identify a few salient trends.

Table A.9
Exports in manufactured goods by sector
(Millions of United States dollars)

	2003	*2004*	*2005*	*2006*	*2007*	*2008*
15	1 972.1	2 899.3	3 969.1	3 744.5	4 088.5	5 184.7
16	301.9	458.6	572.1	620.8	580.4	716.1
17	2 946.7	3 602.5	3 559.5	3 858.8	4 332.7	4 255.0
18	2 118.9	2 543.3	2 514.0	2 998.6	3 540.7	3 477.2
19	147.7	186.0	186.1	209.5	247.5	236.5
20	74.6	114.4	160.2	186.3	283.0	347.9
21	181.9	234.5	298.4	306.7	463.5	618.9
22	63.4	72.6	85.4	82.8	120.9	138.1
23	757.3	948.5	1 916.3	3 127.4	3 340.4	4 506.8
24	1 276.2	2 004.3	1 481.5	1 842.1	2 014.9	2 568.1
25	953.5	1 261.6	1 610.9	1 962.8	2 542.7	3 164.2
26	643.2	845.1	958.4	1 007.4	1 230.4	1 721.1
27	1 476.6	3 070.4	3 819.6	5 245.6	6 814.9	11 216.0
28	590.3	900.0	1 120.3	1 358.2	1 879.2	2 467.4
29	1 931.6	2 186.3	2 639.5	3 277.3	4 412.2	5 382.0
30	6.0	8.8	4.9	2.8	6.6	6.0
31	759.3	1 089.0	1 281.7	1 860.7	2 616.1	3 294.8
32	428.2	485.8	547.5	515.7	445.4	417.5
33	42.7	52.4	68.1	85.2	121.3	132.8
34	5 135.1	8 292.4	9 539.8	11 846.3	15 753.8	17 983.8
35	271.3	413.5	601.3	1 004.4	1 419.4	1 977.8
36	771.1	981.4	1 194.4	1 180.4	1 342.4	1 486.5
37	0.1	3.6	2.7	31.2	17.0	3.0
Total	22.8	32.7	38.1	46.4	57.6	71.3

Source: Foreign Trade database.

- In 2003, the top three product groups for exports were motor vehicles (34), textiles (17) and apparel (18). By 2008, motor vehicles remained the top category but iron and steel (27), appliances (29), food products (15) and petroleum products (23) had passed textile and apparel in terms of export value.

- Textiles and apparel exports declined in value in 2008, but this was more than made up by growth in other sectors. Exports grew by 24 per cent in terms of United States dollars from 2007 to 2008.

We gain another perspective on trade in textiles and apparel by breaking down the value of exports and imports in each year into the part associated with textiles and apparel and the part associated with all other trade. Table A.10 illustrates that Turkey was in fact nearly in balance with trade in textiles and apparel; both exports and imports rose through 2007 but then declined in 2008, and they were quite similar in magnitude. This is not true for the "other" category – both exports and imports grew more rapidly during this period, but imports outstripped exports. In the "other" category, manufactures exports were only 64 per cent of manufactures imports in 2008.

Table A.10
Trade in textiles and apparel
(Billions of United States dollars)

	Exports			*Imports*		
	Textiles/apparel	*Other*	*Total*	*Textiles/apparel*	*Other*	*Total*
2003	5.1	17.8	22.8	5.5	30.8	36.3
2004	6.1	26.5	32.7	6.3	47.3	53.5
2005	6.1	32.1	38.1	6.3	55.7	62.0
2006	6.9	39.5	46.4	6.3	67.8	74.1
2007	7.9	49.7	57.6	7.7	79.6	87.4
2008	7.7	63.6	71.3	7.1	99.1	106.2

Source: Foreign Trade database.

The FT database is assembled from individual international transactions, and as such is a mix of import and export transactions. When the database is concentrated to examine the individual enterprises involved in international trade, the results are as given in table A.11.

There are more enterprises registering import transactions than export transactions. If we examine the top panel of table A.11, it is evident that "Importer" only is larger as a category than "Exporter" only. When the enterprises reporting "Both" are included, 61,425 of the 85,911 enterprises included in the FT database in 2008 were importers, while 48,241 were exporters. Those enterprises involved in both importing and exporting make up about 27 per cent of the total in all these years.

In the second panel of table A.11, the transactions are limited to those involving manufactured goods. As is evident in comparing the two panels, this does not exclude many enterprises – nearly all enterprises reporting international transactions in this period were trading in manufactured goods.

A3. Merging the FT and ES databases

When the FT and ES databases are combined, they include information on a large number of enterprises: 102,253 in 2003, rising to 116,705 in 2008. Table A.12 provides statistics on this sample of enterprises, and demonstrates the large degree of non-overlap in the two samples. Figure A.1 illustrates this non-overlap in a Venn diagram drawn from the 2008 observations in the top panel of table A.12.

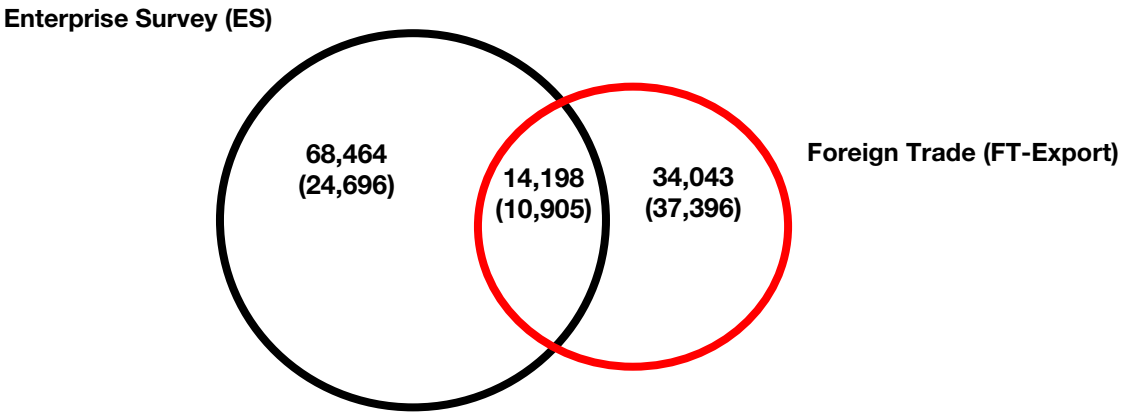
Table A.11
Exporters and importers in the FT database

		2003	2004	2005	2006	2007	2008
All products		63 968	69 483	74 428	78 134	87 751	85 911
	Exporter	18 685	20 452	21 661	22 485	25 203	24 486
	Importer	28 265	29 986	32 213	33 900	39 358	37 670
	Both	17 018	19 045	20 554	21 749	23 190	23 755
Manufactured goods		62 946	69 476	74 425	78 133	87 749	85 910
	Exporter	18 682	20 451	21 661	22 485	25 203	24 486
	Importer	27 255	29 982	32 210	33 899	39 356	37 669
	Both	17 009	19 043	20 554	21 749	23 190	23 755

Source: Foreign Trade database.

The 82,622 enterprises from the ES are divided into two groups, with the majority (68,464) not exhibiting any export behaviour and about 17 per cent (14198) also registering as exporters in the FT database. (Ignore the numbers in parentheses in figure A.1 for now.) The 48,241 enterprises reporting exports in the FT database in 2008 include a majority (34,043) not also included in the ES, while about 30 per cent of those in the FT database (14,198) also report their activity in the ES. The substantial degree of non-overlap is not surprising. There will be many enterprises in the ES that produce only for the Turkish market, and as such will have no export goods to report to Customs. These will be the enterprises among the 68,464 in figure A.1. There will also be many trading companies that are involved in exports but do not produce the goods themselves. These will often be small firms in terms of number of employees, and as such will not be sampled regularly in the ES. These firms contribute to the 34043 in figure A.1.

Figure A.1
Venn diagram: ES and FT-Export databases in 2008



Source: Enterprise Survey database and Foreign Trade database.

In the second panel of table A.12, the ES enterprises are limited to those reporting manufacturing activity. The results for the Venn diagram are reported in parentheses in figure A.1. We observe three large shifts in considering just this subgroup:

- There is a large reduction in the group only found in the ES (from 68,464 to 24,696). Many of the enterprises in this category are retail and service firms, and as such are less likely to be involved in export activity.

- The total number of enterprises in FT-Export does not change, but there is an increase in the number of enterprises only found in FT (from 34,043 to 37,396). This newly excluded group of enterprises are those trading companies that do not themselves produce manufactured goods.

- There is a smaller, but still substantial, group of enterprises (10,905) that both report to ES and have transactions in FT-Export. This will be the group for which we will perform our analysis.

As noted in the text, the Turkish Statistical Institute follows a two-step procedure for selecting participants in the Enterprise Survey each year. In the first step, it selects all enterprises with employment of 20 or more people and all enterprises in key sectors of activity (as defined by the four-digit NACE code); this is the full-enumeration group, and members are automatically invited to participate.[23] In the second step, it assigns smaller enterprises to sampling groups by sector of activity and selects enterprises to participate at random from those groups.

Each enterprise in the survey is assigned a weight – the weight indicates how many similar but unselected enterprises the selected enterprise represents. Enterprises in the full-enumeration group are assigned a weight of one – they represent only themselves. Enterprises from the sampling groups are assigned a weight greater than one, indicating how many other enterprises in their group they represent.[24] The choice of enterprises in the sampling group occurs interactively and is designed to ensure that a pre-determined minimum of enterprises participates from each economic sector.

In our dynamic analysis, it is important to have multiple observations for a single enterprise. This selection process makes it likely that relatively few of the smaller enterprises will be selected multiple times. In table A.12 below, we summarize the weights attached to two groups identified at the bottom of table A.5 – the 54,187 enterprises observed only once in the six-year period 2003–2008, and the 8,022 enterprises observed in all six years.

Table A.12
Sampling weights assigned to enterprises (Shares)

Weight	*Firms observed only once*	*Firms always observed*
1	0.289	0.992
5	0.075	0.005
10	0.075	0.002
20	0.109	0.000
30	0.074	0.000
40	0.225	0.000
50	0.072	0.000
100	0.042	0.000
500	0.038	0.000
Over 500	0.001	0.000

Source: Enterprise Survey database.

Note: The sampling weight indicates approximately the number of enterprises that this enterprise represents for purposes of country-level aggregation. In survey design, the sampling weight is the inverse of the probability of being sampled for an enterprise in this class.

[23] These are the selection criteria governing surveys beginning in 2005. Prior to that, enterprises were in the full-enumeration group if they had 20 or more employees or if they had more than one "local unit" – plants, shops or offices.

[24] The inverse of the weight corresponds to the probability that this enterprise will be chosen at random from its group.

The first row of table A.12 reports the share of the total enterprises with weight exactly 1 in the two groups. Consistent with our description of enterprise selection, we observe that over 99 per cent of the enterprises observed in all six years have unit weight – these will be the large enterprises described above. There are a small number of other firms observed every year, but these generally have weights of less than 10. Surprisingly, though, 30 per cent of the enterprises observed only once also have unit weight. There could be two causes of this. First, it could be that the firm only met the minimum requirements for the unit-weight group in one of the years – in the other years it was in a random-selection group and was not selected. Second, it could be that the enterprise was selected to participate but did not complete and return the survey. If so, it faces a fine of 1,268 Turkish lira as defined by the Turkish Law on Statistics for non-response enterprises.[25]

The remaining rows of table A.12 report the percentage of the enterprises in each group with weights that fall into the ranges indicated in the first column. For example, 7.5 per cent of the enterprises observed only once fall into the range [1, 5], while 7.5 per cent also have weight in the range [5, 10]. While very few of the enterprises observed in all six years fall into these ranges, a majority of the enterprises observed only once do.

Once those with unit weight are excluded, the largest share of enterprises in this group has weights between 30 and 40. These are then small enterprises, with a 2 to 3 per cent probability of being selected in any year. Some, albeit very few, of these enterprises have weights greater than 500.

Table A.13
Sectoral composition in the Enterprise Survey

NACE section	*Population*	*Of which exhaustively covered*	*Of which sampled*	*Sample size*	*In %*	*Total number of questionnaires*
	A	B	C = A - B	D	E	F = B + D
C	2 773	2 773	0	0	-	2773
D	348 162	20 792	327 370	17 843	5.5	38 635
E	712	712	0	0	-	712
F	69 487	3 871	65 616	1 954	3.0	5 825
G	1 134 292	12 398	1 121 894	9 062	0.8	21 460
H	244 917	2 307	242 610	650	0.3	2 957
I	365 659	2 787	362 872	1 524	0.4	4 311
K	145 801	2 479	143 322	3 109	2.2	5 588
Subtotal	2 311 803	48 119	2 263 684	34 142	1.5	82 261
M	10 135	1 719	8 416	363	4.3	2 082
N	43 396	867	42 529	820	1.9	1 687
O	120 326	1 177	119 149	2 252	1.9	3 429
Total	2 485 660	51 882	2 433 778	37 577	1.5	89 459

Source: TUIK (2004), Structural Business Statistics, p. 11.

Notes:

C, D and E	Manufacturing, mining and quarrying and other industry
F	Construction
G, H and I	Wholesale and retail trade, transportation and storage, accommodation and food service activities
K	Financial and insurance activities
M and N	Professional, scientific, technical, administration and support service activities
O	Public administration, human health and social work activities

[25] This fine is stated explicitly on the first page of the ES questionnaire.

Table A.13 reprints a table from TUIK (2004), *Structural Business Statistics* describing the division between large (full-enumeration) enterprises and smaller (sampling) enterprises. Those in the full-enumeration group represent only 2 per cent of the 2.48 million enterprises, and another 1.5 per cent of the total is sampled each year at random.

NACE is a derived classification of ISIC: categories at all levels of NACE are defined either to be identical to, or form subsets of, single ISIC categories. The first level and the second level of ISIC Rev. 4 (sections and divisions) are identical to sections and divisions of NACE Rev. 2. The third and fourth levels (groups and classes) of ISIC Rev. 4 are subdivided in NACE Rev. 2 according to European requirements. However, groups and classes of NACE Rev. 2 can always be aggregated into the groups and classes of ISIC Rev. 4 from which they were derived. The aim of the further breakdowns in NACE Rev. 2, as compared with ISIC Rev. 4, is to obtain a classification more suited to the structures of European economies.

APPENDIX B: ESTIMATING ENTERPRISE-LEVEL PRODUCTIVITY

We begin from a four-factor description of manufacturing technology. Capital, labour, energy and raw materials are used as factors in production, and there is as well an enterprise-specific measure of total factor productivity. If we define variables as follows for enterprise i in time t:

Q_{it} = quantity produced
P_{it} = final good price
L_{it} = number of workers
W_{it} = average wage paid to workers
E_{it} = quantity of energy used
P_{Eit} = price of energy
M_{it} = quantity of raw materials and intermediate inputs
P_{Mit} = price of raw materials and intermediate inputs
K_{it} = value of capital stock
A_{it} = total factor productivity

We will denote the logarithm of a variable by its lower-case letter, for example, $q_i = \ln(Q_i)$. Using a Cobb-Douglas specification, we can then represent the technology as:

$$q_{it} = a_{it} + \alpha_K k_{it} + \alpha_L l_{it} + \alpha_E e_{it} + \alpha_M m_{it} \qquad \text{(B.1)}$$

where the restriction $\alpha_K + \alpha_L + \alpha_E + \alpha_M = 1$ can be imposed or tested econometrically. The technological coefficients are taken as invariant through time except for a_{it} (discussed below).

We will also consider a variant of this technology – one in which energy and materials enter in fixed proportions, while value added (V_{it}) is a well-defined function of capital and labour.

$$V_{it} = P_{it}Q_{it} - P_{Eit} E_{it} - P_{Mit} M_{it} \qquad \text{(B.2)}$$

$$v_{it} = b_{it} + \beta_K k_{it} + \beta_L l_{it} \qquad \text{(B.3)}$$

with b_{it} the measure for total factor productivity in this specification.

Estimation strategy

The Enterprise Survey does not include all of these variables in the form employed here, and so transformations are performed to obtain conformable variables.

- Enterprise-level prices (P_{it}) and quantities (Q_{it}) are not observed. Producer-price indices are matched with enterprises at the four-digit NACE level (and denoted P_{jt}); these are used to deflate enterprise-level sales revenues to obtain a proxy for quantity. This quantity measure will be equal to $Q_{it}(P_{it}/P_{jt})$, and as such will differ systematically from quantity if enterprise-level price differs systematically from four-digit NACE producer price.

- Average number of employees is used as a measure for L_{it}.

- Energy is measured in two forms: electricity purchases and gas purchases. These are deflated by the producer price index for the four-digit NACE index for energy to obtain a measure of E_{it}. Electricity is used in the estimations that follow.

- Raw materials and intermediate inputs are grouped together in the survey and are measured in value terms. We use the four-digit NACE index for materials to deflate this value and obtain a measure of M_{it}.

- Capital is reported in the survey in book-value terms. We use the producer price index for the four-digit NACE category of machinery purchases to deflate the capital value to real terms.

- The variable a_{it} is unobserved, but we conjecture that it is made up of two components: enterprise-specific total factor productivity ω_{it} and random error ε_{it}. The random error is assumed to be normally distributed with errors perhaps clustered by enterprise. The total factor productivity term ω_{it} is assumed to be a state variable evolving according to a first-order Markov process:

$$\omega_{it} = E_{t-1}(\omega_{it} \mid \omega_{it-1}) + \xi_{it} \qquad \text{(B.4)}$$

and with ξ_{it} orthogonal to k_{it} and ω_{it}. As past authors have pointed out (see Olley and Pakes (1996), Levinsohn and Petrin (2003), Ackerburg, Caves and Fraxer (2010)), this leads to the potential for bias in the estimation of production function. We will address this in one manner below.

We estimate this production function for Turkish manufacturing enterprises in three parts – first for NACE 17 (textiles) enterprises, second for NACE 18 (apparel) enterprises, and third for all other manufacturing enterprises. In this first round, we use all manufacturing enterprises for which there are non-zero sales, non-zero capital, non-zero electricity cost and non-zero raw material cost. This leads to unbalanced panels of data of sizes specified below. We estimate five variants of the production-function specification of (1) and (2):

- Least squares with White standard errors (robust)
- Least squares with standard errors clustered by enterprise (cluster).
- Fixed-effect (by enterprise) least squares.
- Random-effect (by enterprise) least squares.
- Least squares using the Levinsohn-Petrin (2003) correction for bias of estimation results in total factor productivity.

We have also included year-specific effects in these regressions. These effects could be interpreted as a time trend in total factor productivity. They are significant, and indicate rising productivity over time, but inclusion does not change the comparison of production-function coefficients. They will be introduced at a later stage.

Estimation Results: NACE 17 (textiles)

Estimation results for textiles enterprises are reported in table B.1. The estimated coefficients for α_K, α_L, α_E, and α_M are reported, as is an intercept coefficient α_0 common to all enterprises. Below each coefficient is the associated standard error. All estimated coefficients are significantly different from zero at the 95 per cent level of confidence. For the fixed-effect and random-effect estimates, we report the variation observed in the systematic term (σ_u) and the unsystematic term (σ_e). Rho indicates the importance of the systematic variation relative to the unsystematic variation. The F statistic reported for the fixed-effect estimation tests whether the estimated fixed effects are jointly significant; the null of non-significance is rejected at the 95 per cent confidence level.

Table B.1
Production function estimation for NACE 17 firms

	Robust	*Cluster (idf)*	*Fixed effects*	*Random effects*	*Levinsohn-Petrin*
α0	2.520	2.520	4.820	2.990	
	0.057	0.071	0.080	0.036	
αK	0.027	0.027	0.008	0.015	0.013
	0.004	0.004	0.003	0.002	0.004
αL	0.350	0.350	0.347	0.393	0.328
	0.013	0.016	0.015	0.009	0.015
αE	0.073	0.073	0.079	0.116	0.063
	0.009	0.010	0.009	0.007	0.009
αM	0.593	0.593	0.355	0.503	0.328
	0.012	0.015	0.009	0.006	0.089
σ u			0.690	0.380	
σ e			0.263	0.263	
rho			0.873	0.675	
F(u=0)			5.110		
R2	0.94	0.94	0.93	0.93	
R2 within			0.55	0.55	
R2 between			0.94	0.95	
Nobs	6 027	6 027	6 027	6 027	6 025
Ngroups			2 439	2 439	2 439

Source: Authors' calculations.

The coefficient estimates for the "robust" and "cluster" estimations are identical by design. The difference between the two comes from calculating standard errors – either using White residuals (robust) or calculating the standard errors clustered by enterprise (cluster). The cluster standard errors are in all cases larger than the robust errors.

The final three regressions (fixed-effect, random-effect and Levinsohn-Petrin) have in common that they calculate explicitly the enterprise-specific term for total factor productivity. (The first two regressions assume that total factor productivity is randomly distributed around the intercept.) Levinsohn-Petrin in addition controls for the simultaneity bias potentially due to unobserved differences in total factor productivity causing systematic adjustments in the use of variable factors such as labour.

While the regression results differ in small details, there are strong similarities across results:

- The coefficient associated with labour is relatively constant at about 0.35.
- The coefficient associated with energy is small but significant at 0.06 – 0.12.
- The coefficient associated with capital is quite small throughout – around 0.03 before accounting for enterprise-specific total factor productivity, and closer to 0.01 once those enterprise-specific corrections are made.

The significant difference in coefficient on raw materials when comparing fixed-effect and Levinsohn-Petrin estimators to the robust, cluster and (to a lesser extent) random-effect estimators provides evidence of the simultaneity bias associated with unobserved total factor productivity influencing input choices. The coefficient on materials is much greater when corrections are not made for enterprise-specific productivity differences. Levinsohn-Petrin is designed to correct for that, and to move that "between" difference in productivity to the productivity term and away from spurious correlation with materials. The fixed-effect estimator in this instance proves to have very similar properties.

The role of materials as a proxy for the unobserved total factor productivity raises the question of whether a value added specification will be a more satisfactory representation of the technology. In table B.2 we report the results of estimation of the value added function (3) using the same five techniques. We observe the same pattern in coefficients for capital; while they are roughly three times higher in the value added function, they take a similar dip in value when estimated in the Levinsohn-Petrin and fixed-effect regressions. We observe as well that the coefficient on labour, as the sole remaining variable input, now takes on some of the characteristics of the materials coefficient in table B.1. For the robust, cluster and random-effect estimations, this coefficient is insignificantly different from 1, but once the correction is made for unobserved productivity in Levinsohn-Petrin the coefficient falls to a significantly smaller 0.738. The fixed-effect estimation makes a similar, even more striking, downward adjustment in that coefficient.

Table B.2
Value added function estimation for NACE 17 firms

	Robust	*Cluster (idf)*	*Fixed effects*	*Random effects*	*Levinsohn-Petrin*
β0	4.307	4.307	6.415	4.602	
	0.044	0.052	0.121	0.049	
βK	0.108	0.108	0.014	0.054	0.030
	0.007	0.008	0.006	0.006	0.008
βL	1.028	1.028	0.631	1.023	0.738
	0.014	0.015	0.031	0.014	0.021
σ u			1.200	0.779	
σ e			0.626	0.626	
rho			0.786	0.607	
F(u=0)			4.050		
R2	0.72	0.72	0.71	0.72	
R2 within			0.11	0.11	
R2 between			0.76	0.77	
Nobs	5 760	5 760	5 760	5 760	5 760
Ngroups			2 367	2 367	2 367

Source: Authors' calculations.

These regressions define the technical coefficients reported in tables B.1 and B.2. They also define implicitly an estimate of the enterprise-specific total factor productivity. In table B.3 we report aggregate statistics about those ω_{it} in each year. Four statistics are reported – median, mean, skewness and kurtosis.[26] Notice from these statistics the striking jump in value in 2005. Controlling for other factors (as we did in running the regression), total factor productivity in 2005 jumped strongly. Interestingly, it did not retain that increase in later years.

Table B.3
Distribution of fixed and random effects for NACE 17 firms

Based on the production function (B.1)								
	Fixed effects				*Random effects*			
	Median	*Mean*	*Skewness*	*Kurtosis*	*Median*	*Mean*	*Skewness*	*Kurtosis*
2003	-0.009	-0.026	-0.22	3.82	-0.022	0.008	0.49	5.8
2004	-0.015	-0.042	-0.34	3.51	-0.025	-0.01	0.38	4.62
2005	0.06	0.06	-0.19	3.6	0.009	0.032	0.438	4.2
2006	0.001	-0.06	-0.48	3.24	-0.012	0.009	0.3	4.34
2007	0.024	-0.01	-0.44	3.47	0.014	0.036	0.65	5.32
2008	0.088	0.082	-0.52	5	0.047	0.077	0.68	6.24
All	0.025	0	-0.41	3.75	0.007	0.026	0.474	5.05

Based on the value added function (B.3)								
	Fixed effects				*Random effects*			
	Median	*Mean*	*Skewness*	*Kurtosis*	*Median*	*Mean*	*Skewness*	*Kurtosis*
2003	0.03	-0.035	-0.693	4.616	0.064	0.044	-0.41	4.88
2004	0.026	-0.054	-1	7.94	0.024	0.023	-0.7	8.27
2005	0.114	0.106	-0.425	4.49	0.078	0.111	0.054	3.97
2006	0.006	-0.114	-0.531	3.47	0.042	0.049	0.069	3.82
2007	0.026	-0.024	-0.565	4.33	0.0967	0.1103	-0.033	4.57
2008	0.153	0.128	-0.66	5.27	0.172	0.187	0.06	4.3
All	0.059	0	-0.68	5.16	0.084	0.091	-0.172	5.14

Source: Authors' calculations.

Estimation results: NACE 18 (apparel)

We follow the same steps in analysing enterprise behaviour in the apparel sector, and we find the same pattern of coefficient estimates and of productivity measures. These can be found in tables B.4 through B.6.

In table B.4, the technological parameters α_0, α_K, α_L, α_E and α_M have similar magnitudes in these regressions. The α_M are quite large when no correction is made for enterprise-specific effects, but they are reduced in magnitude (and impact transferred on average to the enterprise-specific effects) when the enterprise-specific corrections are introduced. The α_K are once again quite small, and with the Levinsohn-Petrin correction they disappear altogether. The labour coefficients here again are near one-third.

[26] Skewness measures the non-symmetry of the distribution. A negative value indicates a "fatter tail" at the lower end of the distribution, while a positive value indicates a fatter tail at the upper end. Kurtosis measures the peakedness of the distribution. The distribution is more concentrated around its mean than a normal distribution if this statistic is greater than 3, and is less concentrated than a normal distribution if the value is less than 3.

Table B.4
Production function estimation for NACE 18 firms

	Robust	*Cluster (idf)*	*Fixed effects*	*Random effects*	*Levinsohn-Petrin*
α0	2.940	2.940	4.840	3.300	
	0.035	0.042	0.053	0.025	
αK	0.034	0.034	0.010	0.027	0.000
	0.003	0.004	0.003	0.002	0.002
αL	0.340	0.340	0.358	0.370	0.280
	0.009	0.011	0.010	0.007	0.010
αE	0.150	0.150	0.090	0.166	0.133
	0.008	0.009	0.007	0.006	0.008
αM	0.528	0.528	0.355	0.467	0.331
	0.008	0.009	0.006	0.004	0.115
σ u			0.690	0.423	
σ e			0.310	0.310	
rho			0.831	0.650	
F(u=0)			4.700		
R2	0.92	0.92	0.91	0.92	
R2 within			0.57	0.56	
R2 between			0.92	0.93	
Nobs	12 125	12 125	12 125	12 125	12 125
Ngroups			5 245	5 245	5 245

Source: Authors' calculations.

In table B.5, the value added formulation is used. Once again, both capital and labour shares are magnified relative to those found in table B.4. Once again, the share of capital is reduced once the enterprise-specific effects are allowed for. Once again (as in table B.2), the labour coefficients take on the positive correlation with unobserved variability in total factor productivity. In the robust and cluster regressions, the β_L coefficient is much larger than that observed once the enterprise-specific corrections are made. The Levinsohn-Petrin coefficient is an unbiased estimate, and we see once again that the fixed-effect estimate is insignificantly different from that.

Table B.6 reports the average fixed and random effects by year. There is some evidence of an upward bump in 2005, but this effect is less pronounced than in textiles.

Estimation results for the rest of the manufacturing sector. Our estimates for the rest of the manufacturing sector are provided in tables B.7 through B.9. The patterns of technology coefficients in tables B.7 and B.8 are all familiar from our analysis of textiles and apparel, although these other industries appear to be less labour-using (that is, smaller α_L than in the textiles and apparel sectors). The Levinsohn-Petrin correction once again removes any effect of capital in the production function.

Table B.5
Value added function estimation for NACE 18 firms

	Robust	*Cluster (idf)*	*Fixed effects*	*Random effects*	*Levinsohn-Petrin*
β0	4.620	4.620	6.600	4.980	
	0.032	0.037	0.074	0.033	
βK	0.156	0.156	0.020	0.090	0.022
	0.006	0.008	0.006	0.005	0.006
βL	0.918	0.918	0.600	0.900	0.577
	0.011	0.012	0.018	0.009	0.014
σ u			1.190	0.810	
σ e			0.620	0.620	
rho			0.790	0.630	
F(u=0)			4.720		
R2	0.68	0.68	0.67	0.68	
R2 within			0.14	0.14	
R2 between			0.72	0.73	
Nobs	11 718	11 718	11 718	11 718	11 718
Ngroups			5 125	5 125	5 125

Source: Authors' calculations.

Table B.6
Distribution of fixed and random effects for NACE 18 firms

Based on the production function (B.1)								
	Fixed effects				***Random effects***			
	Median	***Mean***	***Skewness***	***Kurtosis***	***Median***	***Mean***	***Skewness***	***Kurtosis***
2003	-0.042	-0.065	-0.66	5.21	-0.046	-0.032	0.001	4.46
2004	-0.007	-0.011	-0.47	4.1	-0.004	0.009	0.02	3.75
2005	0.017	0.048	-0.2	3.85	-0.002	0.037	0.031	3.75
2006	-0.025	-0.048	-0.33	3.95	-0.008	0.024	0.58	6.97
2007	0.004	-0.034	-0.22	3.34	0.006	0.043	0.59	4.91
2008	0.088	0.101	-0.36	6.23	0.108	0.117	0.128	6.16
All	0.008	0	-0.39	4.43	0.01	0.037	0.287	5.12
Based on the value added function (B.3)								
	Fixed effects				***Random effects***			
	Median	***Mean***	***Skewness***	***Kurtosis***	***Median***	***Mean***	***Skewness***	***Kurtosis***
2003	-0.085	-0.057	-0.44	3.74	-0.01	0.045	0.09	3.42
2004	-0.065	0.013	-0.4	4.11	0.006	0.089	0.14	3.56
2005	-0.04	0.06	-0.17	3.68	0.035	0.111	0.277	3.32
2006	-0.128	-0.111	-0.369	3.95	-0.019	0.058	0.26	3.77
2007	-0.012	-0.056	-0.16	3.07	0.046	0.113	0.37	3.54
2008	0.12	0.155	-0.223	4.66	0.25	0.27	0.17	3.89
All	-0.03	0	-0.32	3.9	0.051	0.118	0.23	3.62

Source: Authors' calculations.

Table B.7
Production function estimation for other manufacturing

	Robust	*Cluster (idf)*	*Fixed effects*	*Random effects*	*Levinsohn-Petrin*	*Random*	*Levinsohn*
α0	1.916		1.916		3.960	2.370	
	0.022		0.026		0.027	0.013	
αK	0.035		0.035		0.011	0.022	0.000
	0.001		0.002		0.001	0.001	0.001
αL	0.288		0.288		0.370	0.352	0.273
	0.005		0.006		0.005	0.003	0.005
αE	0.084		0.084		0.077	0.099	0.078
	0.002		0.003		0.000	0.002	0.002
αM	0.671		0.671		0.445	0.597	0.755
	0.004		0.005		0.003	0.002	0.007
σ u					0.630	0.410	
σ e					0.280	0.280	
rho					0.845	0.680	
F(u=0)					5.050		
R2	0.94		0.94		0.94	0.94	
R2 within					0.60	0.59	
R2 between					0.94	0.95	
Nobs	58 747		58 747		58 747	58 747	58 743
Ngroups					24 312	24 312	24 312

Source: Authors' calculations.

We observe a similar diminution of capital coefficient in the value-added function, although in this case the value remains small but significant in the Levinsohn-Petrin estimate. The labour coefficient β_L is inflated in the initial regressions, but settles to a value of 0.732 similar to that observed in the other sectors.

Table B.9 reports the yearly evolution of fixed and random effects. Our hypothesis is that there will be no 2005 "bump" in total factor productivity; that in the textiles and apparel sectors was associated with the opening of the European Union market once quotas were removed, and we do not expect to see anything similar for the rest of manufactures. In fact, there is some evidence of a similar bump in the fixed-effect terms, though not in the random-effects terms.

Table B.8

Value added function estimation for other manufactures

	Robust	*Cluster (idf)*	*Fixed effect*	*Random effect*	*Levinsohn-Petrin*
β0	3.727	3.727	5.960	4.120	
	0.014	0.018	0.044	0.016	
βK	0.189	0.189	0.028	0.105	0.066
	0.002	0.003	0.003	0.002	0.003
βL	1.047	1.047	0.732	1.076	0.732
	0.005	0.006	0.012	0.005	0.008
σ u			1.250	0.810	
σ e			0.670	0.660	
rho			0.780	0.590	
F(u=0)			4.080		
R2	0.76	0.76	0.74	0.75	
R2 within			0.11	0.11	
R2 between			0.77	0.78	
Nobs	54 766	54 766	54 766	54 766	54 766
Ngroups			22 840	22 840	22 840

Source: Authors' calculations.

Table B.9

Distribution of fixed and random effects for other manufactures in Turkey

Based on the production function (B.1)								
	Fixed effects				***Random effects***			
	Median	***Mean***	***Skewness***	***Kurtosis***	***Median***	***Mean***	***Skewness***	***Kurtosis***
2003	-0.004	0.001	-0.310	4.980	0.008	0.029	0.467	7.400
2004	0.005	0.002	-1.360	22.510	0.012	0.028	-1.440	39.850
2005	0.042	0.043	-0.200	5.580	0.016	0.029	0.460	9.640
2006	-0.030	-0.040	-1.350	24.800	0.000	0.011	-1.260	43.130
2007	-0.010	-0.024	-0.780	12.270	0.001	0.015	-0.425	29.220
2008	0.020	0.030	-0.700	10.850	0.032	0.047	-0.550	19.790
All	0.004	0.000	-0.860	14.910	0.010	0.026	-0.560	26.920
Based on the value added function (B.3)								
	Fixed effects				***Random effects***			
	Median	***Mean***	***Skewness***	***Kurtosis***	***Median***	***Mean***	***Skewness***	***Kurtosis***
2003	0.064	0.035	-0.410	4.630	0.109	0.114	-0.160	4.600
2004	0.057	0.036	-0.290	4.250	0.104	0.105	-0.060	4.250
2005	0.104	0.083	-0.320	4.510	0.095	0.090	-0.019	3.870
2006	-0.029	-0.107	-0.460	4.200	0.040	0.033	-0.080	4.000
2007	0.005	-0.059	-0.320	4.040	0.056	0.055	-0.020	4.590
2008	0.073	0.054	-0.250	4.580	0.127	0.138	0.037	4.580
All	0.039	0.000	-0.360	4.370	0.085	0.086	-0.037	4.310

Source: Authors' calculations.

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