FEMISE RESEARCH PROGRAMME

2006-2007

Trade liberalisation and productivity A comparison of the Spanish and Turkish experiences using firm-level data

Research n°FEM31-11
Coordinated By
Juliette MILGRAM, University of Granada, Spain

In collaboration with:

Marion DOVIS, CEFI Université de la Méditerranée, France
Teoman PAMUKCU, METU, Ankara, Turkey
Erol TAYMAZ, METU, Ankara, Turkey
Kamil YILMAZ, Koç University, Istambul, Turkey

Avril 2008

Ce rapport a été réalisé avec le soutien financier de la Commission des Communautés Européennes. Les opinions exprimées dans ce texte n'engagent que les auteurs et ne reflètent pas l'opinion officielle de la Commission.

This report has been drafted with financial assistance from the Commission of the European Communities. The views expressed herein are those of the authors and therefore in no way reflect the official opinions of the Commission.

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Participants

DOVIS Marion,	CEFI Université de la Méditerranée, France
Dr. MILGRAM Juliette,	University of Granada, Spain
Dr. PAMUKCU Teoman,	METU, Ankara, Turkey
Dr. TAYMAZ Erol,	METU, Ankara, Turkey
Dr. YILMAZ Kamil,	Koç University, Istambul, Turkey

Résumé

L’objectif de cette étude est d'examiner le lien entre commerce et productivité totale des facteurs (PTF) dans une double perspective. Premièrement, nous étudions l'impact des droits de douane sur le niveau de la PTF des firmes et deuxièmement, nous analysons l'impact de la PTF ainsi que des autres caractéristiques de firmes, sur la probabilité de survie et la décision d’exporter des entreprises. A l'aide de la méthode d'Olley et Pakes (1996), nous mesurons la PTF des firmes espagnoles et turques. Sur la période étudiée, la réassignation des parts de marché au profit des firmes les plus productives contribue positivement à la croissance de la productivité alors que l'amélioration de la productivité des firmes n’est significative que dans certains secteurs.

Nos résultats confirment qu’une réduction des niveaux de protection tarifaire améliore la PTF de manière significative dans les deux cas. Pour la Turquie, cela est particulièrement vrai dans les secteurs concurrencés par les importations. Pour l'Espagne, nous trouvons que la présence de produits étrangers sur le marché domestique a aussi un impact positif sur la PTF. Nous montrons également que les firmes qui utilisent des biens intermédiaires ou de capital provenant de l’étranger bénéficient de gains additionnels en termes de productivité. Dans les deux pays, nous identifions un effet positif de l'agglomération au niveau des provinces sur la PTF. Par conséquent, les politiques industrielles devraient encourageant les regroupements d’entreprises de manière à favoriser les économies d'échelle externes. Notre analyse suggère aussi l'existence d'un degré élevé d'hétérogénéité entre les firmes. En particulier, les résultats de l'Espagne et de la Turquie divergent en ce qui concerne l'effet d'une modification des taux de protection sur la productivité des petites entreprises. En Espagne, les petites entreprises une réduction des droits de douane provoquerait une croissance plus forte de la productivité des petites entreprises que des grandes alors que pour la Turquie, les grandes firmes obtiennent des gains supérieurs.

Concernant la décision d'exporter, les résultats appuient clairement l'hypothèse selon laquelle les firmes les plus productives s'auto-sélectionnent sur le marché des exportations. De plus, il y a un effet positif et très significatif d'une précédente expérience sur le marché des exportations, ce qui confirme l’importance des coûts d’entrée sur les marchés d’exportation, coûts considérés comme irrécupérables. Enfin, concernant l'effet de la protection, sur la participation au marché des exportations, les résultats ne sont pas homogènes entre les deux pays. Pour l'Espagne, notre étude montre qu'une diminution des droits de douane et la croissance des importations en provenance des pays développés accroit la probabilité d'exporter. Dans le cas turc, les firmes qui opèrent sur des marchés relativement protégés ont une probabilité plus élevée d'exporter. Concernant l’impact des réformes commerciales sur la survie des

firmes, les résultats montrent que les exportateurs ont une probabilité de survie supérieure (à productivité et taille égales), et la protection commerciale réduit la perspective de survie des exportateurs.

Synthèse non technique

Introduction

Le passage d'un processus de croissance basée sur la substitution aux importations à un processus de promotion des exportations devrait conduire à une assignation plus efficace des ressources. Ce processus devrait positionner l'économie sur un sentier de croissance soutenable avec une augmentation régulière du revenu par tête. Plusieurs études, résumées dans Rodrick (1995), distinguent deux effets de la libéralisation des échanges sur la croissance des pays en développement : d'une part, des effets statiques qui impliquent des transferts de ressources entre secteurs suite à la modification de la structure des prix relatifs et d'autre part, des effets dynamiques qui proviennent de la croissance de la productivité en raison de l'exposition accrue des firmes locales à la concurrence sur les marchés domestiques et étrangers, de l'acquisition de nouvelle technologie parle biais des biens de capital et des biens intermédiaires importés et du transfert d'autre type de connaissance technologique par des canaux plus informels. Ces effets dynamiques se traduisent par une croissance soutenue de la productivité des firmes et une intensification des activités d'exportation. Les données d'entreprise permettent de vérifier dans quelle mesure ces propositions théoriques sont réalistes.

Ce rapport entend contribuer à la littérature empirique concernant le lien entre échanges, productivité totale des facteurs (PTF) et statut d'exportation, au niveau microéconomique. Nous étudions d'une part l'impact des niveaux de protection et d'autre variables importantes, comme la part de capital étranger, les effets d'agglomération, la concurrence sur les marchés, les statuts d'exportation et d'importation, sur la productivité et d'autre part, l'impact des caractéristiques des firmes et des marchés sur la décision d'exporter des firmes. Notre étude porte sur deux études de cas : l'Espagne et la Turquie, deux pays avec un accord de libre-échange bilatéral avec l'UE.

Méthodologie

Un effort particulier a été fourni pour rendre les deux études comparables en estimant des modèles empiriques similaires, même si certaines restrictions n'ont pu être évitées.

Premièrement, l'enquête turque est large et exhaustive alors que celle de l'Espagne ne l'est pas. Toutes les firmes turques doivent répondre au questionnaire, nous disposons donc de l'information pour l'ensemble des firmes après 1982, en particulier celles créées après 1982 et celles qui sortent du marché après 1982. Ce n'est pas le cas de l'enquête espagnole qui ne scrute pas de manière exhaustive les petites entreprises et certaines firmes peuvent ne pas répondre même si elles sont toujours en activité. Il est donc difficile d'étudier les sorties de marché et par conséquent, il est impossible d'estimer de manière fiable un modèle de survie dans le cas espagnol. Pour cette raison également, nous pouvons procéder aux estimations pour des sous échantillons de secteurs dans le cas turc mais pas dans le cas espagnol. Dans le cas turc, nous utilisons un panel non cylindré de plus de 150,000 observations par an sur la période de 1983-2001. Les données sur les exportations sont seulement disponibles après 1990. Cette immense base de données contient assez d'observations pour que l'on pusisse distinguer trois types de secteurs selon l'orientation de leurs échanges : orientés vers les exportations, concurrents des importations et non-échangeables. Dans le cas espagnol, l'échantillon est plus petit 3,107 firmes (20,882 observations pour la période 1991-2002). Cependant, nous avons des informations sur les importations et les exportations des firmes pour l'ensemble de la période.

Deuxièmement, dans les deux cas, les données sont disponibles pour une période temporelle relativement longue (1982-2000 pour la Turquie et 1991-2002 pour l'Espagne) mais ne couvrent pas la période de libéralisation des échanges pour l'Espagne puisque ce pays est entré dans la CEE en 1986. Les droits de douane espagnols étaient déjà peu élevés et harmonisés avec la politique commerciale commune pour les produits en provenance des pays non-membres et nuls pour les produits communautaires. Néanmoins, les importations espagnoles ont augmenté durant l'ensemble de la période étudiée et le taux de pénétration des importations (TPI) capture correctement les effets de la libéralisation des échanges. Le TPI reflète l'importance des produits en provenance des membres et des non-membres sur le marché espagnol, alors que les droits de douane représentent la protection vis-à-vis des pays tiers. Le TPI n'a pas été pris en compte dans le cas turc puisque ce pays s'est engagé dans un accord de libre-échange bilatéral avec l'UE plus tardivement (l'union douanière est entrée en vigueur en 1996).

Néanmoins, nous avons suivi, dans la mesure du possible, des procédures d'estimations similaires pour les deux études. La PTF est mesurée dans les deux analyses à l'aide de la méthode d'Olley et Pakes (1996) dans le but d'éliminer les biais potentiels de simultanéité et de sélection. Dans les deux cas, les gains de PTF ont été importants sur les périodes étudiées. En Espagne, dans la majorité des secteurs, la productivité agrégée a augmenté entre 1991 et 2002 de 1,5% à 3,3% par an, exception faite du secteur de l'alimentation. La croissance de la PTF est expliquée à la fois par l'augmentation de la productivité intra-firmes, la réallocation à travers les firmes et les entrées et sorties. Le cas turc est différent. Les firmes ont

eu une croissance de la productivité de 1,77% en moyenne par an (1982-2000) mais 2,96% dans les secteurs concurrencés par les importations. La productivité intra-firmes a négativement contribué à la croissance de la PTF au niveau des secteurs. La croissance de la PTF s'explique par la réallocation entre les firmes, l'entrée et la sortie.

Pour chaque pays, nous nous intéressons à deux types de questions. La première concerne l'impact des échanges sur la PTF. La seconde concerneles déterminants de la décision d'exporter des firmes. Les deux études sont des contributions originales à la littérature et conduisent à des conclusions intéressantes en matière de politiques économiques.

Déterminants de la décision d'exporter

En ce qui concerne les décisions d'entrée des firmes sur les marchés d'exportation, nos résultats appuient l'hypothèse selon laquelle les coûts irrécupérables (« sunk costs ») conditionnent de manière importante l'entrée sur les marchés d'exportation. Lorsqu'une firme parvient à financer les coûts irrécupérables nécessaires pour vendre sur les marchés étrangers, elle tend a rester sur ce marché. Par conséquent, ces coûts irrécupérables expliquent la persistance du comportement d'exportation (autrement dit, une fois qu'une firme commence à exporter, elle tend à rester sur le marché d'exportation).

Deuxièmement, nos résultats montrent que les firmes les plus grandes et les plus productives ont une propension à exporter plus importante. Les estimations économétriques confirment l'hypothèse d'un processus d'autosélection en vertu duquel, les firmes les plus productives entrent sur les marchés d'exportation. En outre, même après la prise en compte de leur niveau de productivité dans le modèle, la probabilité des grandes firmes de commencer à exporter est toujours plus élevée que celles des autres firmes.

En ce qui concerne l'impact de la protection commerciale sur la décision d'exporter, les résultats diffèrent quelque peu entre les deux pays.

En ce qui concerne l'Espagne, les résultats montrent qu'une baisse des droits de douane à l'importation accroît la probabilité d'exporter des firmes. Par ailleurs, la croissance des produits importés en provenance des pays développés exerce un impact positif sur les exportations. En revanche, la croissance des exportations au niveau sectoriel vers les pays développés tend à réduire cette même probabilité car elle traduit certainement la difficulté qu'auront les nouvelles firmes à accroître leurs parts de marché. En outre, nos estimations économétriques mettent en évidence deux autres éléments : la décision d'exporter des firmes de taille moyenne, des firmes importatrices et de celles avec une faible participation étrangère dans

leur capital est particulièrement sensible à la croissance des échanges commerciaux avec les pays développés. En revanche, la décision d'exporter des grandes firmes et de celles avec une forte participation étrangère est plus sensible aux droits de douane.

En ce qui concerne la Turquie, nos résultats montrent que la probabilité d'exporter est moindre dans le cas des firmes opérant dans des secteurs manufacturiers peu exposés au commerce international et/ou fortement protégés. Cependant, dans le cas turc, les droits de douane n'ont pas d'influence sur la décision d'exporter des firmes. Quant a l'impact des réformes du commerce extérieur entreprises par la Turquie sur la survie des firmes, nos résultats montrent que les firmes exportatrices ont une plus grande chance de survivre sur leur secteur d'activité, même lorsque l'on controle l'effet de la productivité et de la taille. En échange, des tarifs douaniers élevés semblent exercer un effet négatif sur la probabilité de survie des exportateurs, un résultat lié vraisemblablement au fait que la protection douanière augmente, en termes relatifs, la compétitivité des firmes qui vendent sur le marché intérieur par rapport à celle des firmes exportatrices. Les firmes opérant dans des secteurs où les exportations vers les pays développés croissent fortement ont une plus grande probabilité de survivre. Le fait d'exporter et la taille sont les principaux déterminants de la survie des entreprises. Les firmes de petite taille ont une probabilité élevée de sortir du marché.

Selon Tybout (2001), les effets des politiques commerciales sur les exportations et sur la structure du marché intérieur sont largement conditionnés par l'ampleur des coûts irrécupérables liés à l'exportation et par le degré d'hétérogénéité caractérisant les firmes. Nos résultats vont également dans ce sens. Pour les petites entreprises qui n'ont pas recours aux inputs intermédiaires ou aux biens de capital d'origine étrangère, il s'avère que l'expérience passée influence plus la décision d'exporter que leur niveau de productivité. Pour les entreprises appartenant à cette catégorie, la concurrence provenant des autres exportateurs constitue un obstacle plus sérieux à leur entrée sur les marchés d'exportations qu'un taux de pénétration des importations plus important ou des tarifs douaniers plus bas. Les grandes entreprises font face, elles aussi, à des coûts irrécupérables importants pour entrer sur les marchés d'exportation mais leur niveau de productivité compte également tout comme le degré de protection tarifaire. Les coûts irrécupérables liés à l'exportation sont associés aux coûts qu'entraînent la recherche d'information concernant les marchés étrangers, la mise sur pied de réseaux de distribution et l'adaptation aux standards et législation prévalant dans les pays de destination des exportations.

Les politiques visant à promouvoir les exportations devraient agir sur les coûts fixes liés à cette activité, et non uniquement sur les autres coûts de commerce. Les pouvoirs publics ne devraient pas privilégier uniquement les politiques visant à l'accroissement des capacités d'assimilation des innovations pour accroître la productivité des entreprises mais également, participer à la diffusion des connaissances

concernant l'accès aux marchés d'exportation et faciliter non seulement l'entrée mais aussi éviter la sortie du marché d'exportation. Les agences de promotion des exportations et les organismes visant a harmoniser les standards sur le plan international ont donc un rôle important à jouer sur ce plan.

Impact du commerce sur la productivité

Nous avons analysé l'impact de la protection tarifaire sur la productivité des firmes espagnoles et turques. La méthode d'estimation par effets fixes a été utilisée pour la Turquie et la méthode généralisée des moments dans le cas de l'Espagne. Dans les deux cas, nous retenons parmi les variables explicatives les valeurs retardées de la variable dépendante (productivité totale des facteurs, PTF) ainsi que d'autres variables de contrôle (y compris une mesure du degré de concurrence sur le marché intérieur) et nous tenons compte du caractère endogène de la protection tarifaire.

Nos résultats mettent en évidence qu'une baisse des tarifs douaniers a un impact positif et significatif sur la productivité des firmes. Pour la Turquie, l'impact susmentionné de la baisse de la protection douanière est plus prononcé dans les secteurs relativement plus ouverts au commerce international. Dans le cas de l'Espagne, un démantèlement des tarifs douaniers vis-à-vis des produits en provenance de l'UE exerce un effet positif sur la productivité des firmes. Par ailleurs, la présence de produits d'origine importée sur le marché intérieur exerce également un effet positif sur la productivité des firmes. Nous montrons également que les firmes qui utilisent des biens intermédiaires ou de capital provenant de l'étranger bénéficient de gains additionnels en termes de productivité. Nous concluons que, même un pays comme l'Espagne, membre de l'UE et se caractérisant donc par des droits de douane relativement bas, pourrait améliorer sa productivité en réponse à une baisse des droits de douane. Cependant, nos résultats démontrent également que la majeure partie de ces bénéfices est due à l'accroissement du taux de pénétration des importations et à des effets indirects de l'ouverture, plutôt que de la baisse des tarifs douaniers.

Dans les deux pays, nos résultats font ressortir un effet positif des économies d'agglomération au niveau des provinces sur la productivité des firmes. Dès lors, la politique industrielle devrait promouvoir le « clustering » afin de favoriser ces économies d'échelle externes aux firmes.

Toutes les firmes ne réagissent pas de la même manière au processus de libéralisation du commerce extérieur : certaines firmes sont plus sensibles à la réduction des tarifs et à la présence de produits d'origine importée sur le marché intérieur. En Espagne, les petites firmes, les firmes non exportatrices ou non importatrices, ainsi que celles avec une participation étrangère très faible dans leur capital réagissent

plus fortement que les autres firmes à la baisse des tarifs. En revanche, les grandes firmes, les firmes exportatrices et celles qui importent des produits intermédiaires et des biens de capital tirent plus profit, en termes de productivité, de l'intensification de la concurrence étrangère. Concernant l'impact des tarifs sur la productivité des petites et des grandes entreprises, on observe l'effet inverse dans le cas de la Turquie : les grandes firmes sont plus sensibles aux barrières tarifaires que les petites. Pour ces dernières, l'accès limité aux marchés de capitaux en raison des taux d'intérêt élevés les empêche de réagir de manière appropriée à la libéralisation du commerce extérieur. Il se peut que cela ait été également le cas des firmes espagnoles au début de la décennie 1980. En revanche, la période examinée dans cette étude est marquée par une relative stabilité macroéconomique et par des taux d'intérêt faibles. Les petites entreprises espagnoles en sont probablement à un stade ou elles peuvent bénéficier raisonnablement de la libéralisation du commerce extérieur alors que cela n'était possible que pour les grandes firmes dans les années 80.

Abstract

The aim of this report is to examine the link between trade and total factor productivity (TFP) in two manners. First, we study the impact of tariffs on the plant-level TFP, and then, we separately analyze the impact of TFP and other plant characteristics on the survival and export decision of plants. Using Olley and Pakes (1996) method, we calculate TFP of Spanish and Turkish manufacturing firms. In the period analysed, the reallocation of market shares to more productive plants contributes positively to productivity growth while, within plant productivity improvements are significant only in some sectors.

We find that **productivity improvements resulting from declining protection levels are statistically significant and economically important in both cases**. For Turkey, this is especially true in import competing sectors. For Spain, we also show that TFP also increases with the presence of foreign products in the domestic market. Importing firms benefit from additional gains. In both countries, we find evidence of positive effect of agglomeration at the province level for productivity. As a consequence, industrial policy should favor external scale economies by encouraging clustering. Our analysis also suggests that there is a huge degree of heterogeneity among plants. In particular, results from Spain and Turkey differ concerning the reaction of small firms' productivity, in response to changes in protection rates. In Spain, small firms react more positively than others to tariff reduction while in Turkey, large plants would obtained larger gains.

Concerning the **entry decision of firms on export markets**, estimation results are strongly in favor of the hypothesis that more productive firms self-select into export markets. Secondly, there is a positive and highly significant effect of previous experience to export, suggesting the presence of considerable sunk costs at exporting. Concerning the effect of protection on the participation in exports markets, the results are not so homogeneous among the two countries. For Spain, our study shows that a decrease in import tariffs and the growth of imports from developed countries increase the probability of exporting. In the Turkish case, the study shows that firms operating in protected non-trading industries are more likely to export. As for the impact of trade reforms on the **survival patterns of firms**, results provide evidence that exporters are more likely to survive (after controlling for productivity and size), and trade protection worsens the survival prospects of exporters.

Keywords: Total factor productivity, Spain, Turkey, Exports behavior, Survival, tariffs, heterogeneity of firms. JEL codes: F12

Non technical synthesis

Introduction

The switch from an inward-oriented growth process to a much more outward-oriented one would bring about, as was expected, a more efficient allocation of resources which would then transmit into a sustainable growth path with a steady increase in per capita income. Several studies, surveyed in Rodrik (1995), distinguish between two effects of trade liberalization on growth in DCs: on the one hand, static effects which entail intersectoral resource transfers due to the modification of the relative price structure and, on the other hand, dynamic effects arising from productivity growth due to increased exposure of local firms to competition on foreign and domestic markets, to a increase in technology imports embodied in capital and intermediate goods and to the transfer of other kind of technical knowledge through informal means. These dynamic effects are to be materialized through sustained productivity growth in firms and a switch to export activities. These proposals can be verified thanks to firm-level data.

This report aims at contributing to the empirical literature about the link between trade, total factor productivity (TFP) and export behaviour, at the micro level. We study the impact of protection levels and other important variables like foreign ownership, agglomeration effects, competition of the markets, export and import status on productivity and the impact of firm's and market's characteristics on export status. We include two case studies: Spain and Turkey, **two countries with a bilateral trade agreement with the EU**.

Methodological issue

A special effort has been made to make the two studies comparable by estimating similar empirical models, unless we were unable to avoid some restrictions.

First, the Turkish survey is larger and totally exhaustive while the Spanish survey is not. All the Turkish firms have to answer the survey, so we have information about all firms after 1982, in particular firms created after 1982 and those who exited the market after 1982. This is not the case for the Spanish survey which is not exhaustive for small firms. Some firms could have disappeared from the survey, even if they are still active. In particular, this reduces the number of firms for which we are able to affirm that they exit and the possibility to estimate a survival model in the case of Spain. For this reason, we were able to run estimations for some subsets of sectors in the Turkish case but not in the Spanish one. In the Turkish case,

we use an unbalanced panel of more than 150,000 observations per year for the 1983-2001 period. Data for exports at the plant level are only available after 1990. In this huge data set, we have sufficient observations to distinguish among three types of sectors based on their trade orientation: Export-oriented, import-competing, and the non-traded sectors. In the Spanish case, the sample is much smaller: 3,107 firms (20,882 observations for the period 1991-2002). Though, we have information about imports and exports of the firms, all over the period.

Second, in both cases, data are available for very large periods (1982-2000 for Turkey and 1991-2002 for Spain) but do not cover the period of trade liberalisation of Spain since Spain entered the CEE in 1986. Spanish tariff was already lowered and harmonized with the Common trade policy for third countries product and set to zero for EU products. Though, Spanish imports increased all over the period under study and the import penetration rate (IPR) captures accurately the effect of trade liberalisation. IPR and tariffs drove different information in this case. IPR reflects the importance of EU and non-EU products in the Spanish markets, while tariffs reflect protection towards third countries. IPR was not taken into account in the Turkish case since it engages in bilateral free trade with the EU later. Actually, the Customs Union agreement entered into force in 1996.

Nevertheless, we follow **similar estimations strategies** in both studies, as far as we are able to. Total Factor Productivity (TFP) is measured in both studies following the procedure of Olley and Pakes so as to eliminate potential simultaneity and selection biases. In both cases, TFP gains have been large in the studied period. In the majority of sectors, in Spain, the aggregate productivity has increased between 1,5% to 3,3% per year except for the Food sector from 1991 to 2002. TFP growth is explained both by the increase of intra-firm productivity, reallocation among firms, exit and entry. The Turkish case is different. Firms have experienced on average 1.77% of TFP growth per year (1982-2000) but 2.96% in Import competing sectors. Intra-firm productivity negatively contributes to TFP growth at the sector level. TFP growth is explained by reallocation among firms, exit and entry.

For each country, we focus on two sets of questions. The first one concerns **the impact of trade on TFP**. The second one concerns the **export behaviour of firms**. The studies are original contributions to the literature and lead to interesting conclusions for policy makers.

Export behaviour

Concerning the **entry decision of firms on export markets**, our results provide strong support for the hypothesis that sunk costs in entering foreign markets are important. Once a firm commits itself into

foreign markets by covering the sunk costs at the time of entry, the firm tends to stay in foreign markets. Therefore, sunk costs create persistence in export behavior, i.e., exporters tend to remain as exporters.

Secondly, the most productive firms and the large firms are more willing to export. Estimation results are strongly in favor of the hypothesis that more productive firms self-select into foreign markets. Moreover, even after controlling for productivity, large firms are found to have higher probability of participating in foreign markets.

Concerning the effect of protection on the participation of exports markets, the results are not so homogeneous among the two countries. For Spain, our study shows that a decrease in import tariffs increases the probability of exporting. Consistent with this fact, the growth of imports from developed countries have a positive impact on export status, that is the presence of foreign products in the domestic markets is an important incentive for exporting. The growth of exports to developed countries of the industry is a negative incentive for exports since it may increase the costs for new entrants to increase their share of the market. Firms with medium size, importers and firms with low foreign participation in their capital are especially sensitive to the growth of trade with developed countries while large firms or firms with an important participation of FDI are sensitive to tariffs.

In the Turkish case, the study tends to show that firms operating in protected non-trading industries are less likely to export. But in general, for Turkish firms, the decision of exporting ins not influenced by import tariffs. As for the impact of trade reforms on the survival patterns of firms, results provide strong evidence for the hypothesis that exporters are more likely to survive even after controlling for their productivity and size. However, high tariff barriers are detrimental for the survival of exporters. This result may be explained by the fact that foreign trade protection increases the relative competitiveness of non-exporters in relation to the one of exporters. Firms operating in industries that experience a surge in exports to developed countries have better survival prospects. Export status and size are the main determinants of survival. Consistent with previous results, we find that small firms are more willing to exit the market.

As pointed by Tybout (2001), the effects of trade policies on the exports and, on the structure of the domestic market, depend widely on the initial conditions, the importance of sunk costs and the importance of the heterogeneity of firms. Our results are very much in this line. For small firms, firms that do not import intermediate goods or capital goods, the previous experience is more important than the productivity level. For these firms, the competition of the other exporters is a more important barrier for exporting than the growing presence of foreign products or the lowering of tariffs. Though, large firms

also face large costs to enter export markets but they additionally have to be very productive and care about protection. The presence of sunk costs at exporting is associated with costs of gathering market information, establishing networks of distribution and adjusts to national standards and legislation. Although trade policy has traditionally concentrated in trade costs, a policy that aims at reducing fixed costs of exporting could have considerable effects on exporting. To this end, public policies should, not only increase the capacity of the firms to assimilate innovations in order to increase their productivity, but also facilitate the knowledge and access to foreign markets and favor the permanence in the export market. Export promotion agencies and international harmonization standards may have an important role to play, especially for small firms.

Impact of trade on productivity

We investigate **the effects of protection rates on plant/firm level productivities** using fixed-effect estimations for Turkey and System-GMM for Spain. In both cases, we include the lagged level of productivity since we believe that TFP determinants are highly persistent. In these regressions, we control for endogeneity of protection rates as well as other potential important determinants of productivity improvements during the period under consideration, such as intensity of domestic competition.

We find that productivity improvements resulting from declining protection levels are statistically significant and economically important in both cases. For Turkey, tariff cuts lead to more important productivity gains in import competing sectors. For Spain, w also find that a removal of European tariffs would translate into improvements of TFP. Moreover, the presence of foreign products leads to additional gains. Another important finding is that, firms that import intermediate and capital goods from abroad benefit from additional productivity improvements. We conclude that, even in a European country, with relatively low levels of protection such as Spain, there are additional gains to expect from trade liberalisation process. However, a large part of the positive effect comes from the presence of foreign products and more indirect effects of openness rather than from tariff reduction.

In both countries, we find evidence of positive effect of agglomeration at the province level for productivity. As a consequence, industrial policy should favor external scale economies by encouraging clustering.

All firms do not react in the same way to trade liberalisation and some firms are more sensitive than others to tariffs and to the presence of foreign products in the domestic market. In Spain, small firms and firms that do not participate in foreign market via exports, imports or ownership react more positively than

others to tariff reduction. In turn, large firms, importers and exporters, take more advantage of foreign competition in terms of TFP gains than the other firms. In Turkey, the opposite results holds: the larger the plant size, the larger will be the productivity improvement as a result of a tariff cut. In the case of Turkey, the small firms are more likely to face credit constraints than the large ones. Consequently, their response to trade liberalization is constrained by their limited access to credit due to high interest rates. This could have been the case of Spanish small firms at the beginning of the eighties but not during the period under study, marked by a stable macroeconomic context and low interest rates. Spanish small firms could rather be in the second step of the trade liberalisation where the context allows them to benefit from trade liberalisation while in a first step, only robust firms seem to be able to do so.

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A. Introduction

Since 1980s, developing countries (DCs) which had previously pursued development strategies based on import substitution policies have progressively liberalized their economies. This reform process entailed measures that aimed at liberalizing the foreign trade regime and deregulating the financial sector in DCs, and has been implemented in general as part of the stabilization and structural adjustment programs of the International Monetary Fund and the World Bank. The switch from an inward-oriented growth process to a much more outward-oriented one would bring about, as was expected, a more efficient allocation of resources which would then transmit into a sustainable growth path with a steady increase in per capita income. But subsequent growth experiences of the countries that implemented these programs have been somewhat mixed and cast some doubts about their ability to put these countries on a sustainable growth path.

Several studies, surveyed in Rodrik (1995), distinguish between two effects of trade liberalization on growth in DCs: on the one hand, static effects which entail intersectoral resource transfers due to the modification of the relative price structure and, on the other hand, dynamic effects arising from productivity growth due to increased exposure of local firms to competition on foreign and domestic markets, to a increase in technology imports embodied in capital and intermediate goods and to the transfer of other kind of technical knowledge through informal means. According to these studies, static effects of trade liberalization on growth are limited and only the dynamic effects of these reforms might have a sustained positive effect on economic growth. These dynamic effects are to be materialized through sustained productivity growth in firms, of which their innovation activities is one of the main determinants. This justifies the emphasis on the analysis of the effects of trade reforms on the performance of firms – however measured – in DCs.

New micro evidence concerning the relation between trade and productivity is obtained thanks to firm-level data. Tybout and Westbrook (1995) proposed a useful decomposition of the potential productivity improvements at the micro level. They distinguish three possible sources of productivity gains. The first one comes from the exploitation of scale economies (often designed as pro-competitive effect). The second one refers to the market-share effect and describes the reallocation of resources among firms in favour of the most productive ones. The third one is a residual effect referring to the other possible sources of productivity like learning-by-doing and externalities, technical innovation through

imports of intermediate goods and managerial effort[1]. Thus, taking into account heterogeneous behaviours of firms may shed new lights on the possible channels between trade liberalisation and productivity gains[2] although country and industry specificities may also be important to explain different impact of the same trade liberalisation process[3].

In recent years, substantial research has been conducted on channels through which the trade liberalisation process affects the firms in developing countries[4], but, as pointed by Trefler (2004), there is a lack of evidence for industrialised countries and for countries that engage in bilateral free trade. Studying the Canada-US free trade agreement, he finds that liberalisation leads to large labour productivity gains. Another motivation to focus on industrialised country or transition economies is that the diffusion of technology and knowledge through the acquisition of intermediary goods or exchange of goods is more willing to occur among countries that are very close and have flexible markets (Eaton and Kortum, 1996).

This report aims at contributing to the above empirical literature studying the case of **two countries that entered in bilateral liberalisation**. We focus on the effect of tariffs and foreign competition on TFP of Spanish and Turkish manufacturing firms. A special effort has been made to make the two studies comparable by estimating similar empirical models, unless we were unable to avoid some restrictions. First, the Turkish survey is larger and practically exhaustive while the Spanish survey is not. For this reason, we were able to run estimation for subsets of sectors in the Turkish case. Second, the periods for which we have the data (1982-2002 for Turkey and 1991-2002 for Spain) are very large but do not cover the period of liberalisation of Spain. Nevertheless, the studies are original contributions to the litterature and lead to interesting conclusions for policy makers.

For each country, we focus on two sets of questions:

[1] These possible effects of foreign exposure on productivity at the industry level have been evidence by different theoretical models. Krugman (1979) and Helpman and Krugman (1985) suggested that openness ensure external and internal externalities; Leibenstein (1966) and Schmidt (1997) focussed on the reduction of X-inefficiency. Grossman and Helpman (1991), Ethier (1982), Markusen (1989) pointed that foreign competition may also affect the incentives to innovate; increase technology transfers or raise intra-firm productivity through an increase in the variety of intermediate inputs or capital goods due to higher quality and/or better technology. Openness can also foster technological spillovers through FDI (Coe and Helpman, 1995).

[2] Unlike most trade models that use a representative firm framework and assume that macroeconomic context affects all firms symmetrically, Melitz (2003), Bernard et al. (2003), Yeaple (2005) and Bernard et al. (2003) include firms' heterogeneity in a trade model to analyse the consequences of a decrease in trade costs. They conclude that a decrease in trade costs will lead to a reallocation of endowments among domestic firms: least efficient domestic firms may exit the market while the most efficient firms start to export or expand their sales, increasing the number of exporters and the volume of exports. As a consequence, market shares of the surviving domestic firms will diminish and productivity at the industry-level will be pulled up. However, these models do not directly contemplate the effect of the decrease in trade costs on intra-firm productivity. Bernard, Jensen and Schott (2006) offer strong support for their main conclusions.

[3] For instance, Vogel (2007) suggests that the quality of institutions may explain the unequal effect of trade liberalisation on growth.

[4] Focussing on trade liberalisation period offers strong advantage but could hide some response of the productive sector that may occur in a medium term since specialisation may be a long dynamic process (Cuñat and Maffezzoli, 2007).

The first one concerns **the impact of trade on TFP**. First, do trade policy indicators directly affect productivity of firms? We find that additional improvements of TFP could be obtained in both cases from a decline in tariffs Secondly, are there some asymmetries among firms in the sensitivity to these trade openness indicators? We find sensitivity to tariffs differ sharply among firms depending on their size and involvement in foreign markets.

The second one concerns the **export behaviour of firms**. We find strong support for a self selection of most productive firms in the export market and of important sunk costs at exporting in both countries.

This report is organised as follows: Section C offers a general review of the literature concerning the empirical and theoretical literature about trade and productivity of firms in a context of heterogeneity of firms. Section D and E are respectively devoted to the Spanish and Turkish case. Section F provides some conclusions, comparison of the two studies and possible developments for our analysis.

B. Literature review

I. Models of trade with heterogeneity of firms

Recent empirical and theoretical studies offer new evidence concerning the determinants of international trade at the firm-level with important consequences for trade models and policy. The increasing availability of data at the firm level emphasizes an important heterogeneity of firms while the most important models of international trade, neo-classic or monopolistic competition à la Krugman (1979) and Krugman and Helpman (1985) are based on the hypothesis of a representative firm, at least at the sectorial level. All these models consider that the macroeconomic context affects all the firms in the same way and that all the firms' export, what is very far from the reality. However, firms' level studies pointed that the decision to export is not a random process but clearly related to firms' characteristics.

Melitz (2003) develops a model à la Krugman (1979) of monopolistic competition with increasing returns. These returns come from the existence of sunk costs that supposes either the introduction of a new variety in the market or the entrance in the export market. Entry costs in the export market are usually presented as a consequence of imperfect information and presence of formal or informal barriers to trade like administrative and technical requirements (Dixit, 1989).

The heterogeneity of firms comes from different levels of productivity randomly distributed. The companies that export have to support a higher marginal cost. Then, only the companies with a sufficient level of productivity can remain in the market. Thus, exporters must have a greater level of productivity to

support the additional cost what leads to the so-called self-selection effect. On the import side, a reduction in trade costs causes an increase in the threshold productivity level which is necessary to remain in the domestic market. On the export side, if access to foreign market is facilitated, the threshold productivity level to enter the export market decreases. The least productive companies and those that do not export will leave the market. However the most productive ones, which did not export will begin to export and the exporter increase their sales outside. This reallocation of endowments among firms leads to a gain of productivity at the aggregated level and an increase of welfare. Similar conclusions with different hypothesis can be found in Bernard et al. (2003) and Yeaple (2005). That is, productivity growth does not arise from a learning-by-exporting effect but from a reallocation of resources from the less productive firms to the most productive ones.

II. Empirical evidence for exports

Wagner (2005) summarizes the results of 45 econometric studies with micro data referred to 33 countries. He concludes that the exporters are, in general, more productive than the non-exporters. This may be due to the fact that productivity may be improved when accessing foreign markets because their exposure to useful technological innovations from international contacts makes easier the technological diffusion and fostering a more efficient organization of firms, i.e., "learning by exporting". Alternatively, it may be explained by the presence of sunk costs at exporting, i.e. self-selection effect, since the most productive firms self select into the export markets because they are more likely to cope with the sunk costs of entry and survive in the international market.

A large number of empirical studies have focussed on the relationship between productivity and export status including either the self-selection effect, or the learning by doing effect or both. These studies are sensitive to the sample and the methodology used to estimate the productivity. The empirical evidence to support either of the two theories has been mixed. Very few studies reject the self selection hypothesis except Yasar and Rejesus (2005) for Turkey while other studies tend to support the self selection theory and reject the other one, see Bernard and Jensen (1999). Most studies find that the two phenomena apply like Clerides et al (1998) for Morocco, Hahn (2004) for Korea, Van Biesebroeck (2005) for 9 African countries, Girma et al. (2004) for UK. The learning by exporting scenario applies only in some cases: Aw et al. (2003) for Taiwan in some sectors, Delgado et al. (2002) for Spain for young firms. Focusing only on learning by doing effect, Castellani (2002) for Italia and Kray (1999) for China, find that only firms with a substantial involvement in exporting activity have a significantly higher rate of TFP growth.

Fernandes and Isgut (2005) and Trofinenko (2005) demonstrate that exporting to advanced countries generates the highest productivity premium in the case of Columbian manufacturing plants.

An additional problem arises since exporters may already face a bigger growth rate of productivity before exporting than non-exporters what complicate the verification of the learning by exporting hypothesis. Clerides et al. (1998) or Bigsten et al. (2004) choose to estimate simultaneously two equations reflecting both hypothesis, and in other cases instrumental variables or GMM method were performed. Finally, Blalock and Gertler (2004) and Van Biesebroeck (2005) change the estimation of the production function following the method of Olley and Pakes (1996), including exchange variables to control for this endogeneity bias. Baldwin and Gu (2003) use a double-difference approach to deal with this problem and confirm the presence of learning by exporting and self selection in the Canadian case. Alvarez and Lopez (2005) rises the same conclusions for Chilean plants and find that firms make conscious efforts to increase their productivity before entering the export markets.

A more direct way to verify the existence of sunk exporting costs was proposed by Roberts and Tybout (1997). From a theoretical model with sunk costs they derive an empirical model. One of the main features is that export status depends on the past of exports if the firm faces sunk costs at exporting. They find that the exporting experience of the Colombian companies has a positive impact on their capacity to remain in a market. Bernard and Jensen (2004) use a linear probit model with fixed effects and also find evidence of the existence of sunk costs bound to the exporting activity, in this case with a panel of manufacturing companies of the U.S.A. and for period 1984 to 1992.

In the Spanish case, Moreno and Rodriguez (2004) find that exporting companies have greater marginal costs when they export and the margins are therefore inferior in the domestic market than in the foreign one, and in addition is more pro cyclical. Delgado, Fariñas and Ruano (2002) identify a self-selection effect. Campa (2004) uses a sample of Spanish manufacturing firms and finds sunk costs hysteresis to be an important determinant of export market participation.

III. Imports and productivity

The models above propose a most detailed explanation of the traditional gains driven by competition pressures described by trade policy models since they point some effects on the heterogeneity of firms, exit and entry, productivity and volume of trade. Apart from this “static” competition effect that basically consists in a diminution of prices, there are other possible linkages between trade policy and efficiency gains.

Static and dynamic effects of trade liberalisation have been at the heart of the debate about trade policies for decades. Dynamic effects suggested by the theoretical literature are more mysterious since they may take several types and are almost hard to identify. Dynamic effects is a very general denomination of a large varieties of phenomena like external and internal externalities provoked by foreign exposure (Krugman (1979), Krugman and Helpman (1985) or reduction of X-inefficiency (Schmidt, 1997). Other possible dynamic linkage between foreign competition and efficiency gains is how the exposure modifies the incentives to innovate or technology transfers. Liberalisation can also raises intra-firm productivity through an increase in the variety of intermediate inputs (high quality, better technology) or capital goods (Grossman et Helpman (1991) Ethier (1982) Markusen (1989)). These effects can also arise when domestic firms enter into joint venture with foreign companies. It can reduce the opportunity cost of technological efforts and push the firm to innovate Goh (2000). On the opposite, Rodrik, 1991) suggests that incentives to innovate could be linked to their predicted output and market share so trade liberalisation could reduce these incentives. In the opposite, Traca (2002) proposed that productivity of firms depends on their constant innovations, so old firms are better prepared to face the international competition.

Empirical findings do not offer strong support for the theoretical predictions concerning how trade liberalisation affects domestic firms. Tybout, de Melo and Corbo (1991) and Tybout and Westbrook (1995) tend to show that import competition reduces the heterogeneity of firms. Head and Ries (1999) confirm that industries with lower entry barriers are less affected by import competition. Dutz (1996) finds that Moroccan small plants shrank dramatically after the dismantling of NTB in 1980. Rejesus (2005)'s study contradicts the insight that plants entering the market have higher productivity than plants that exit the market.

Tybout (2001) surveyed studies about the **effects of liberalisation process on market structure** This author concludes that foreign competition forces down mark-ups among firms although methodological problems arise in estimations techniques. Second, import competing firms cut their production levels when foreign competition intensifies. This suggests that sunk entry or exit costs are important, confirming and extending Melitz theoretical findings, according to the so-called market share effect and scale effect provoked by trade. The former relates to the fact that firms at the lowest end of the productivity distribution exit or contract. The latter describes the fact that firms at the top of the productivity distribution expand their exports more than they contract their domestic sales. Thus, access to foreign market and competition allows the most efficient firm to become larger, thus pulling-up the industry productivity levels. Tybout (2001) pointed that a more adequate way to estimate the market share effect due to trade liberalization is to link productivity directly with a measure of trade liberalisation that is

uncorrelated with the production. Using disaggregated U.S. import data and a new measure of trade costs, Bernard, Jensen and Schott (2006) find that productivity growth is faster in industries with falling trade costs. The results do not apply equally across all sectors but are strongest for industries most likely to be producing horizontally-differentiated tradable goods.

Pavcnik (2002) find also a robust evidence that foreign competition both reduces the market share of import-competing firms and reallocates from inefficient to efficient firms. She looks at the contribution of market share reallocations to sectoral productivity growth following trade liberalisation in Chile. She finds that these reallocations significantly contribute to productivity growth in the tradable sectors while Tybout y Westbrook (1995) found more mixed results in the case of Mexico. Taking explicitly into account tariffs, Pavcnik finds that TFP increases more in sectors that compete with imports. Others studies found also evidence in the same sense Krishna et Mitra (1998), Topalova (2005), Harrison (1994) Halpern et Korosi (2001) for several countries. Handoussa, Nishimizu and Page (1986) for Egypt found the strange conclusion that sectors competing with imports have a greater growth of productivity than exporting sectors.

More mixed results are founded by others studies. Driffield and Kambhampati (2003) point that the increase of Indian imports did not raise efficiency. For Columbia, Fernandes (2006) agrees that liberalisation raises productivity but this impact is more important for large firms and in sectors with less competition. This is mainly due to the increase in intermediary inputs.

Others linkages than the traditional competition effect have been studies but are more scarce. Tybout, de Melo and Corbo (1991) focus on the productivity growth. They find a greater dispersion of productivity in Chilean industries that compete with imports. Kathuria (2002) confirms for India an increase of productivity after the liberalisation but overall for firms with foreign capitals. There are very few studies that try to assess more dynamical effects of trade liberalisation at the firm-level. One possibility to assess this phenomenon is to study how an increase of varieties and liberalisation of inputs. When Schor (2004) includes tariffs on input in its study, the effect of final tariffs on output is reduced. Access to better inputs contributes to productivity gains but it does not occur for all Brazilian firms. For Amiti & Konings (2005), the most important gains of the Indonesian Trade liberalisation came from the liberalisation of inputs. Muendler (2004) found that access to capital and inputs of better quality allow the firms to adopt new method of production and increase their productivity.

C. The Spanish case

Our dataset covers the period 1991-2002. This period can be considered as a post-liberalisation period for the Spanish economy since the last big part of trade liberalisation occurred during the 1980s and the dismantling of trade barriers in the framework of the adhesion to the European Economic Community (EEC) ended in 1992. A massive reallocation process among industries, labour markets and political reforms and dismantling of capital flows restriction marked the 1980s. After the 1992 crisis of its exchange rate, Spain experienced an exceptional growth of its openness ratio without facing big imbalances all over the period. Its trade with the EU and especially intra-industry trade increased sharply.

This section is organised as follows. Section 1 presents some previous studies concerning Spain; Section 2 presents some important stylized facts concerning Spanish trade liberalisation. Section 3 presents the data and the empirical methodology. Results concerning the link between imports and productivity are analysed in Section 4, and Section 5 explains the export behaviour of Spanish firms.

I Previous studies concerning Spain:

For Spain, as far as we know the link between trade liberalisation and productivity has not been studied at the firm level. Most studies have focused on the relationship between productivity and exports where productivity is estimated using index method or stochastic frontier method that is non-parametric method. Barrios et al. (2001) show that R&D activities exert a determinant effect on the decision to export and on the intensity of exports, as much for national as foreign companies. They find that the marginal effect is greater for the companies that export to OECD countries. Barrios, Görg and Strobl (2003) tested Roberts and Tybout (1997)'s model with sunk costs at exporting. They find that R&D is a positive impact on export status and export intensity for domestic and foreign firms. Furthermore, the marginal impact of R&D on export intensity is greater for firms exporting to developed markets Farinas and Martin-Marcos (2007) estimates TFP using semi-parametric approach based on double system and difference GMM methods with dummies for export status. They observe that Spanish exporters have a greater productivity, what they interpret as a self-selection effect. Campa (2004) confirms that sunk costs seems to have an important impact on firms decision to enter export market They found that exchange rate does not really affect the number of exporters. Merino and Salas (2002), Salomon and Shaver (2005) evidence a learning by exporting effect.

Concerning sunk costs at exporting, Mañez et al. (2005) addressed the question directly. They find that the presence of sunk costs, the labour productivity, observed and unobserved characteristics of products and correlations in exogenous shocks are important determinants of the decision to export. They demonstrate in addition that the largest firms or, firms with greater R&D and marketing intensities have greater probability to export. Finally, they find some evidence of spill over at the regional level but none at the industry level. In the same line, Esteve-Perez et al. (2003) find that survival rate at exporting is positively correlated with the export intensity. Furthermore, firms exporting to closest markets export a longer time.

Other articles study productivity distributions. Delgado, Fariñas and Ruano (2002) study differences between exporters and non-exporters. Fariñas and Ruano (2004) distinguish among firms that stay in the market all over the period and those that enter or exit in the meanwhile. Fariñas and Ruano (2005) insist in the size of the firms and build an original measure of sunk entry costs. These costs are shown to explain a great part of productivity's heterogeneity of firms and its persistence. Productivity of existing firms is superior to the ones that enter or exit the market. However, the one of new entrants grow faster. This is also demonstrated by Huergo and Jaumandreu (2004) with another estimation method. Castellani and Zanfei (2003) take into account the share of employees in foreign firms and Herfindahl index. They find that presence of foreign firms seems to have a negative impact on domestic firms.

II Data and stylised facts about Spanish trade

II.1 Spanish annual survey for manufacturing firms

The Encuesta sobre Estrategias Empresariales (ESEE) is an annual survey of Spanish manufacturing firms carried out by the SEPI Ministry of Industry. The ESEE is representative of the Spanish manufacturing firms classified by industrial sector and size categories[5] and includes exhaustive information at the firm level. The ESEE offers detailed data on balance sheet, sales, inventories and materials, volume of exports and imports among others. For each firm, we know the region it is located in and sector of the NACE-93 classification.

We cleaned the data to correct or eliminate the problems due to no reporting or misreporting. We have dropped 2198 observations corresponding to 1990 (too incomplete) and the rest due to non reporting value mainly for fixed assets or non answering cases. In 1991, 2359 firms were surveyed. Their number

[5] Participation rate to the survey is about 70% for firms with more than 200 employees. Firms that employed between 10 to 200 (small firms) were randomly sampled by industry and size strata holding around a 5% of the population.

increased up to 3462 in 2002[6]. At the end, our sample consists in 3107 firms (20882 observations for the period 1991-2002).

We made the following adjustments.

1) In some cases, the value of the variable is missing although the main values like sales, production or labour are reported. In this case, we usually considered that non-reported value to be zero values.

2) We use interpolation to fill the gaps for a particular variable if a firm reported no value in a given year, while values were reported in the year prior and the year after the missing one. In particular, we did so, for all the components of the value added except external services and for labour and investment, in order to obtain better estimates for the PTF. This only applies for 114 observations of 24241.

3) We dropped from the sample all the observations corresponding to firms that did not answered this year except if data were interpolated using the criterion explained above.

4) The capital stock is measured using the inventory perpetual method with a depreciation rate of 9% base on the average depreciation rate as used in FBBA (2005). After eliminating the firm for which we do not have fixed asset in any year we have 3167 observations per year.

5) We finally dropped observations with unrealistic large spikes in the data (e.g. value added negative, growth in value added of more than 300% with a reduction of employment).

6) We use production price indexes at the industry level to express in constant terms the values of sales and exports and price indexes at the manufacturing level to deflate the value of imports since the survey does not provide information about the composition of these imports. Deflators come from *Instituto Nacional de Estadística*.

Some summary statistics are displayed in Table 1.

II.2 Spain after its entry in the EU

According to the agreement between Spain and the CE, the dismantling of trade barriers among members started in 1986. For products for which the difference between Spanish tariff rates and the common external tariff was inferior to 15%, the Common external rate (CET) was applied at the beginning. For the rest of the products, they follow a progressive dismantling that ended up in 1993. Initial tariffs for manufacturing products (except for the one with agricultural components) are summarised in Table 3. For all those products, external tariff was higher than the Spanish one. For agricultural and Food products, the

[6] However, the number of answers is lower in all years due to the fact that some firms do not answer that year or simply because the firms disappeared.

opposite occurs. In these sectors, diversion effect in favour of European exports has been higher as Table 8 shows.

The Spanish average tariff for non agricultural products was 12,33 for products from the CE and 16,44 for products from third countries. The dismantling of tariff barriers was accompanied by a dismantling of quantitative restrictions, a new VAT tax and suppression of ICGI (tax of internal compensation that consisted in a lower tax on sales for locally produced products). The amount of taxes on imports (effective rate) in 1985 was estimated at 5.44% while the ICGI brought 7.81% of imports value. The suppression of ICGI had a great dismantling effect (Cañada et al. 1991). Globally, the dismantling effect was estimated to be around 35-40% of the initial price.

For quantitative restrictions, they were generally eliminated in 1986 between CE and Spain and Spain had to maintain the same barriers as the CE for third countries. However, there was a large list of exceptions for "sensitive products". Among others, Spain was allowed to maintain quantitative restrictions during three additional years for cars, metal, naves, TV, textiles, wearing (see Tamames R., 1987).

Although, Spanish tariffs were completely adapted to CE norms at the end of 1992, the dismantling was just the beginning of Spanish trade taking-off. Table 5 and Table 9 display for imports and exports, the share of Spanish PIB respectively by industries and stages of production. Import penetration rate increased from 16.02 % to 24.68% between 1990 and 2002 while exports represented 10.75% of Spanish PIB in 1990 and 18.88% in 2002. Volume of trade represented 26.7% of PIB in 1990 and 43.56% in 2002. Amazingly, the trade deficit has remained stable over the period (5.8% PIB) what can be considered a successful integration experience. These data confirm that the Spanish experience over the period 1990-2002 is a very interesting case to study.

Concerning sectors, the evolution of the Vehicle industry is striking since the volume of trade and the surplus for this industry has doubled. Chemical products flows have also intensified sharply though imports have overcome exports in this case. Agriculture of Food products have passed from a deficit to a surplus trade balance. In Machinery, volume of trade has increased while the trade balance remained stable. Thus, intensification of imports has been very important in plastic and Rubber products, Vehicles, Machinery as mentioned above and also in Leather products and Electrical products. The share of imports in GDP has increased strongly for Consumption goods, Equipment goods and Intermediate goods. It increased slower for primary and basic manufacturing goods. The raise of Spanish exports has been based overall, on consumer goods and, to a lesser extent, on intermediate and equipment goods.

To sum-up, Spanish comparative advantage patterns has changed over the period (Table 10). Agriculture and Food products, Other non-metallic products and Vehicles are clearly the new advantages of Spain. In

the case of the first one, the entry into the EU has consisted in an increase of the protection. Textiles and Leather products can be considered as old advantages. The traditional disadvantages have increased in Energy, Mining, Machinery and Office Equipment.

We study the 1991-2002 period, due to the availability of data. In 1991, Spanish tariffs was already adapted to the External tariff rate and we use MFN tariff of the EU. Due to the application of GATT, EU tariff rate slightly diminish all over the period. They are higher in Food products (42%) and range from 4% to 10% in the remaining industries. Tariffs for 1991 and 2002, by industry, are displayed in Table 4.

III. Imports and productivity

As most recent studies, we follow a two-step strategy. In a first step, we use Olley and Pakes (1996) method to estimate a total factor productivity of firms. In a second step, we estimate an equation where TFP is explained by a set of characteristics of the firms and trade policy indicators. Thus, our empirical approach differs from previous studies in two manners. First, unlike most studies except Fernandes (2007), we control for lagged productivity since we believe that TFP determinants are highly persistent. In contrast to Fernandes (2007) who run OLS and fixed effects estimations of this equation accounting for plant fixed effect, we use dynamic panel data techniques. Indeed, our data set allows us to take into account other crucial observable characteristics of the firms that may influence their reaction to trade like import and export intensities. However, these characteristics are not strictly exogenous and fixed-effect estimations may lead to biased and inconsistent estimates. We prefer then the system – GMM method proposed by Blundell and Bond (1998) to deal with this issue. Another possibility is proposed by Fernandes and referred as the direct approach. It consists in introducing trade policy indicators and all characteristics in the first equation of the production function. Thus, since trade policy indicators has an industry dimension, this leads to estimate production function pooling firms across industries and years and assuming that input coefficients are common across industries. Thus, she finally finds that there is no strong difference between the direct and indirect approaches.

We use two different measures for openness for each industry: MFN tariffs of the EU and Spanish import penetration rate (IPR). Another important distinctive feature of our study is that these two measures are not substitutes due to the characteristics of the country under study. The first one is the result of EU negotiations with GATT members. It is a direct component of third country prices while EU countries are granted duty-free access in the EU market. Thus, IPR brings some additional information since it measures the degree of foreign competition in the Spanish market taking into account the growing import flows from third countries but also from the EU.

We address at least three questions. First, do trade policy indicators directly affect productivity of Spanish firms? We find that TFP is negatively impacted by European tariffs and positively benefits from presence of foreign products. Moreover, these two effects are complementary. Secondly, is there evidence of TFP gains via imports of inputs? We find evidence of additional productivity gains for importing firms. Third, are there some asymmetries among firms in the sensitivity to these trade openness indicators? We find that the impact of exposure to trade and sensitivity to tariffs differ sharply among firms by exploring not only the productivity variation over time but also across firms with different involvements in foreign markets.

III.1 Empirical strategy

a) TFP measurement

As mentioned above we follow a two-step strategy that became relatively standard in previous studies like Pavcnik (2002), Schor (2004), Topalova (2004), Amiti and Konings (2005) and Fernandez (2007). The first test consists in inferring TFP at the firm-level as the difference between the observed output and the output predicted function. The main point consists in choosing the most accurate estimation of the production function. In general, there are two types of productivity measurement, parametric methods and non parametric methods. The non-parametric approaches are flexible in the specification of technology but they do not allow for measurement errors in the data. Currently, the most efficient methodologies are the semi-parametric approach of Olley and Pakes (1996) and the instrumental variables of Blundell and Bond (2000), which takes into account the simultaneity bias. In the Olley and Pakes' method, the selection bias problem is solved assuming that investment is a proxy for the unobserved productivity shocks while the GMM method solves it by introducing an autoregressive form of the idiosyncratic productivity shocks. In the system-GMM method, the validity of instruments (lagged levels and lagged first differences of inputs) is only relevant when measure errors are very low. We adopt the Olley and Pakes method as many recent articles do since it also controls the selection bias. This is another contribution of our paper since, as far as we know, it hasn't been performed yet for Spain.

Finally, we use the input coefficients to build a measure of firm productivity as in Pavcnik (2002). This index is calculated by subtracting the productivity of a reference firm from an individual firm's productivity, measured as the difference between its predicted output and its actual output at time t[7]. The reference firm is obtained using the mean output and the mean input level in the based year. We obtain:

$$pr_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_m m_{it} - \hat{\beta}_k k_{it} - \left(y_r - \hat{y}_r\right) \qquad (1)$$

[7] This index is transitive and insensitive to the units of measurement.

where y_{it} is the logarithm of the firm's output, l_{it} the logarithm of the input labour, m_{it} the logarithm of the intermediary consumptions, k_{it} is the logarithm of the capital, y_r is the average of the log output of firms in 1991 ($y_r = \bar{y}_{it}$) and $\hat{y}_r$ is the predicted mean log output in 1991 ($\hat{y}_r = \hat{\beta}_l \bar{l}_{it} + \hat{\beta}_m \bar{m}_{it} + \hat{\beta}_k \bar{k}_{it}$). This index represents the deviation of a firm from the mean industry practice in a base year.

Since there is not a lot of zero-investment values in our sample, we are able to build a consistent measure of capital stock[8].

Coefficients are reported in Table 2 for 17 industries. Coefficients are significant at the 1% level in most cases and range in similar intervals as others studies.

b) Decomposition of TFP growth

We also decompose aggregated productivity growth by sector as in Pavcnik (2002). Results are reported in terms of growth relative to 1991 (Table 6).

We report aggregate productivity (column 1), unweighted productivity growth (column 2) and covariance (column 3). This enables us to distinguish whether the productivity growth is due to the growth of productivity of firms and/or to a reallocation of the resources from the less to more productive plants (positive covariance). The aggregate productivity and the unweighted productivity increase from 1991 to 2002 in all sectors except food and tobacco. Sectors that have increased their productivity the most are the rubber and plastic products sector and the electrical and optical equipments sector. In the majority of sectors except food, metal products, office equipment and other manufactures, the reallocation among firms contributes positively to the growth of productivity. In some sectors like wood, paper, plastics and rubber products, non-metallic mineral products and other transport equipment this reallocation explains the main part of the productivity growth. For the majority of sectors the aggregate productivity has increased between 15% to 33%.

This decomposition does not take into account the effect of entry and exit of firms. For this reason we implement the Foster, Haltiwanger and Krizan (1998) decomposition. They measure the total factor productivity of firms as:

$$TFP_{it} = y - \hat{\beta}_l l - \hat{\beta}_m m - \hat{\beta}_k k \qquad (2)$$

[8] Results excluding zero-values lead to very similar results.

This decomposition identifies five components of the aggregate productivity (Table 7):

$$\Delta TFP_{jt} = \sum_{i \in C} s_{ijt-\tau}\, \Delta TFP_{ijt} + \sum_{i \in C} \left(TFP_{ijt-\tau} - TFP_{jt-\tau}\right)\Delta s_{ijt} + \sum_{i \in C} \Delta TFP_{ijt}\, \Delta s_{ijt} + \sum_{i \in N} s_{ijt}\left(TFP_{ijt} - TFP_{jt-\tau}\right) + \sum_{i \in X} s_{ijt-\tau}\left(TFP_{ijt-\tau} - TFP_{jt-\tau}\right) \quad (2)$$

where C represents continuer firms, N entering firms and X exiting firms. TFP_{jt} is the weighted average TFP of the industry j in log with $\Delta TFP_{jt} = TFP_{jt} - TFP_{jt-\tau}$.The first component represents the "within effect" calculated as the sum of firm-level productivity changes, weighted by its initial market share. The second component represents the "between effect" (or the reallocation effect). It measures change in market shares weighted by the deviations of initial firm productivity from the initial overall industry average. The third component is the "covariance effect" of the firm's productivity variations and market shares changes. The last two terms in equation 10 are the entry and the exit effects that represent the contribution of entering and exiting firms to the sector level TFP growth. This decomposition of the aggregate productivity in five components sheds new lights on the Spanish TFP growth process that complete the first decomposition proposed above. The "within effect" is always positive except for the leather sector. The average increase in weighted productivity of firms is important for textile, wood, paper, printing products, other non metallical mineral products, basic metals, machinery and equipment and other manufactured products. The higher are the initial market share of the firms that increase their productivity the higher will be this effect. The "between effect" is mostly negative (12 sectors on 17) and has a poor contribution on aggregate productivity growth. The "covariance effect" for all the sectors except wood, paper, printing products and other manufactured goods, is positive. In chemical products, machinery and equipment, vehicles and other transport equipment it seems to play an important role in the aggregate productivity growth. The effect of exit is very weak and mostly positive. The firms that exit our sample are not necessarily less productive than the average. On the opposite, the entrance of firms is positive and has a big impact on aggregate productivity growth of leather and leather products, wood, paper, rubber and plastics products and electrical and optical equipments. This result is in line with theoretical predictions according to which an increase in competition forces entering firms to have a higher level of productivity.

c) Empirical model

The next step consists of estimating the effect of trade policy measures on TFP. Regarding the estimation techniques, fixed effects estimation that takes into account unobservable characteristics of firm may not be valid if explanatory variables are not strictly exogenous. This could be a strong assumption concerning

TFP since all characteristics of firms are usually highly persistent and fixed-effect estimations may lead to biased and inconsistent estimates if the lagged level of TFP is correlated with the error term. The idiosyncratic shock, may adopt an autoregressive form, capturing factors such as omitted characteristics that persist or non-instantaneous adjustment. For this reason we use the Generalized Method of Moments (GMM) technique. Blundell and Bond (1998) show that, when the dependent variable follows a path close to a random walk, the differenced-GMM (Arellano and Bond, 1991) has poor finite sample properties, and it is downwards biased, especially when T is small. Therefore, Blundell and Bond (1998) propose another estimator (the System-GMM) derived from the estimation of a system of two simultaneous equations, one in levels (with lagged levels as instruments) and the other in first differences (with lagged first differences as instruments). In multivariate dynamic panel models, the System-GMM estimator is shown to perform better than the differenced-GMM when series are persistent and there is a dramatic reduction in the finite sample bias due to the exploitation of additional moment conditions (Blundell and Bond. 2000). This estimation method allows us to assume that firm characteristics, tariffs and the import penetration rate are endogenous variables and use them as instruments. Thus, to capture the impact of changes in trade policy we use the following framework:

$$TFP_{it} = \alpha_0 + \alpha_1 TFP_{it-1} + \beta' X^C_{it} + \gamma' X^T_{jt} + \eta_t + \eta_i + \varepsilon_{it} \qquad (4)$$

where TFP_{it} is a total factor productivity at the firm level as measured by equation 7[9], $X^C_{it/it-1}$ is a vector of firm's characteristics, $X^T_{jt/jt-1}$ is a vector of trade variables and η_t time specific effects which take into account macroeconomic shocks common to all firms. The error term is composed of an individual-specific effect η_i, and an error term ε_{it}.

We check the impact of trade intensification using two trade policy variables: tariff rates and import penetration rates. For tariffs, we use the tariffs for the Most Favoured Nation (MFN)[10] of the EU at 2-digit level since Spain already adapted its tariffs to the CET in 1991. We choose to use the simple average of these indicators at the industry level since a weighted average (using imports or value added as weights) tends to underestimate tariffs. However, it could be argued that tariffs are endogenously determined but we think that using EU tariffs rate guarantees that there is a sufficient disconnection between the choice of these tariffs and Spanish lobbies. Tariffs are supposed to protect firms and should have a negative impact on TFP. We define Import Penetration Rate at the industry level for year t (IPR_{jt}) as the ratio between imports and imports plus production at the two-digit level. Since the IPR directly depends on the

[9] Industry indicators are not necessary in our regression analysis because the reference firm included in the total factor productivity measure plays the same role. To integrate industry indicators would absorb the reference firm.

[10] Note that we find same results with the use of the AHS tariffs.

production of the industry, there is also a potential endogeneity bias in this case. Thus, we use the lagged value of tariffs and IPR to control for this. We also take into account the Herfindahl index calculated as the sum of the squared market share of firms for an industry. The higher the Herfindahl index, the less competitive is the market. We guess that in non-competitive industries, firms adjust their margins in response to trade liberalisation, rather than their productivity so we should expect a negative sign for this variable. We also include a variable called AGGLOMERATION. It measures the possible local specific externalities in production, It is calculated as the industry output share of the region where the firm is located.

Grossman and Helpman (1991), Ethier (1982), Markusen (1989) pointed that foreign competition may also affect the incentives to innovate; increases technology transfers or raises intra-firm productivity through an increase in the variety of intermediate inputs or capital goods due to higher quality and/or better technology. To test for this hypothesis, we also include the import share of firms to explain firm's TFP and expect a positive impact of this variable. Another important expected result concerning bilateral trade liberalisation is that it allows better access to international market. However, Spanish producers were granted free-access from 1986 onwards. The rapid increase of Spanish exports all over the 1990s is sufficient to think that the effects of the EU entry were diffused over time. It could be the case that a decrease in trade costs in the EU lowered the minimum productivity level that Spanish exporters needed to enter the EU market. As explained in the first part, it has been demonstrated empirically and theoretically that the exporters are, in general, more productive than the non-exporters. This, may be due to the "learning by exporting" effect or, alternatively, to the "self-selection" effect. For all these reasons, we expect the export intensity to have a positive effect on TFP.

Another important phenomenon to take into account is the link between FDI and TFP. It appears robust in most studies for developing countries, confirming the hypothesis of Coe and Helpman (1995) that openness can also foster technological spillovers through FDI. It seems that some kind of joint venture or participation of foreign companies brings new managerial abilities and techniques that benefit to TFP. We also include the foreign capital share that accounts for this effect.

Finally, to control for the possible specific characteristics of new entrants and firms that exit the market, we include two dummies: ENTRY (respectively EXIT) that takes the value 1 if the firm was created this year (respectively if it exits next year).

III.2 Results

a) Average sensitivity to protection and competition

Table 11 show the result of the estimation of a simple version of equation 4 using Fixed-effects method. We can observe that tariff has a positive unexpected sign, certainly due to endogeneity. That's why we turn next to GMM methods. Estimations with GMM method are based on two-lagged variables as instruments. This is justified by the results of Sargan test since correlation between residuals and lagged value of the dependent variable could not be rejected. Table 12 shows the results for IPR and Tariff or lagged tariff. These levels were chosen according to the results of the Sargan test and the test of autocorrelation of order 2[11].

Our results[12] show that IPR and tariff have respectively a positive and a negative impact[13]. These results are in harmony with theoretical predictions. Though, it was not so evident that in the case of a European country, the sensitivity of TFP to tariff will be significant. More interesting is the fact that foreign competition measured by IPR and tariffs seems to have complementary effects. Indeed, when we introduce both variables in the regression, there are both significant at the 1-% level. One may ask if the potential correlation between the two variables biases these coefficients estimate. Let us recall that EU tariffs can be considered as exogenous for the Spanish economy since they are decided at the EU level. As a matter of fact, they only apply for Spanish imports coming from non-EU countries and IPR is only weakly correlated with tariff rate (30%). IPR represents the presence of foreign products in this market and, in particular, of European products while tariffs represents a measure of government intervention and international prices.

These indicators allow us to capture complementary effects of increased competition. Namely, the quantity side of the competition pressure operates through an decrease in domestic market share and the price side of the competition effect works through a decline of tariffs, pressuring prices of domestic products down. According to the estimations that take into account both indicators, the sensitivity is rather

[11] The test of autocorrelation of order 1 and 2 of residuals represents the validity of the estimators and consist in the null hypothesis of no correlation of residuals in order 1 and 2. If the instrumental variable TFP_{it-2} is correlated with the error term, the estimation is biased. As a result, if the test of autocorrelation of order 1 can reject the null hypothesis of absence of autocorrelation, the test of order 2 cannot reject it. Here, the test of autocorrelation of order 2 is not rejected. Après discution avec l'économètre, je supprimerai cette note qui n'est pas nécessaire car tout le monde le sais.

[12] Another important issue is the case of the Food sector that is highly protected by the EU. The entry of Spain into the EU consisted in a raise in the protection level toward third country and thus a reorientation of its import, production and export in this sector. Then, it could be the case that external tariff had protected Spanish firms from the international competition in this sector. We run the estimations excluding this sector and obtained similar results (available upon request) which confirms that the negative impact of protection on productivity is an important concern for European countries.

[13] Note that we find the same results when we exclude firms that appear only two or three years.

large: a 10% reduction in tariff will lead to an increase of 1.4% of TFP and an increase of IPR of 10% would lead to an increase of 2.2%. These results are very important since they confirm a high sensitivity to price component although tariffs' levels are lower than in the eighties.

Concerning the effect of market structure, Herfindahl index calculated at the industry level has usually a negative sign or is weakly significant. Our results demonstrate that there are important local spillovers at the industry level since the variable Agglomeration has a significant positive impact. Some of the characteristics of firms we introduced are relevant and confirm, as other studies, that the productivity distribution is not a random process but can be controlled by an explanatory process. The share of foreign capital has a positive and significant impact. The coefficient of the export to output ratio is not significant. It is possible that the level of productivity is better explained by the fact that firms participate in the export market rather than by the intensity of their participation measured through the export intensity. Actually, results commented in the next section, demonstrate that the export and import status are important element to take into account. Firms that enter the market or are about to exit do not display a specific behavior in terms of TFP. Though, it may be due to the fact that our survey is a unbalanced panel because the survey is not exhaustive in Spain.

b) Asymmetries in the sensitivity to protection and competition

It is especially interesting to study whether the effect of trade variables on firm level productivity is conditioned by firms' characteristics. Our previous results describe accurately the behaviour of the average but data at the firm level allow for a deeper analysis of heterogeneity of firms. In particular, firms may react differently depending on their size, origin of capital, export and import status. Obviously, there is some correlation between these characteristics as shown by the summary statistics (Table 1). In particular, large firms have, on average, larger export intensities, import intensities and share of foreign capital than small firms. Thus, the share of small firms that export or import is rather low compare to the one of large firms.

In this section, we propose further estimations to investigate this issue. To this aim, we interact trade openness indicators with dummies that distinguish among these types of firms. The dummies we consider are: *Large*, firms with more than 50 employees in its first year in the sample; *Foreign,* firms with more than 10% of the capital coming from abroad at least one year in the sample; *Exporters*, firms that export more than 10% of their production at least one year in the sample; *Importers*, firms that imported at least

one year over the period. Results are displayed in Table 13. InTable 14, we display results for an alternative decomposition of firms in 4 size groups.

Concerning size, our results show that the presence of foreign products has a similar impact on the productivity of large and small firms. Largest firms seem to react in a similar way as small firms to the increase of imports. In contrast, size of firms matter concerning their reactions to tariffs cut. Small firms are largely sensitive to tariffs while the coefficient estimate is not significant for large firms. IPR not only reflects the presence of non-EU products but also of EU products in Spanish market while tariffs only affect non-EU products. The insensitivity of large firms to tariffs may reflect the fact that large firms are more sensitive to the competition at the EU level while small firms are sensitive to any kind of competition. This result may also reflect the fact that EU products represent the main part of Spanish imports. Nevertheless, small firms are also sensitive to third countries prices while large firms are not. When a more detailed desagregation is used (**¡Error! No se encuentra el origen de la referencia.**), we observe that the presence of foreign products has a very different impact for the smallest firms (less than 24 employees) and a larger and similar impacts for the other groups. For tariffs, only the TFP of firms with less than 50 employees are impacted by tariffs while the other categories are not affected.

The removal of tariffs and the increase of the presence of foreign products translate into more competition pressure. Our previous results confirm that they enhance productivity gains. However, they are not the only source of trade liberalisation gains. The decrease of tariffs and non-tariff barriers generates a reduction of the price of imported inputs as well. It also increases the amounts and the diversity of the supply of inputs. Domestic firms can access to a wider range of qualities for their intermediate goods at lower prices and/or to unknown technologies. This technology transfer may improve their productivity as well. We investigate this issue by taking into account firm's import share. While non-importing firms are not affected by IPR, importers' productivity raises 1,4% for an increase of 1% in the IPR. Without more qualitative information about imported capital and intermediate goods and the share of each one of the two categories, it is difficult to test if firms' imports translate into a better technology, or better quality or better price. Indeed, our results show that importing firms benefit from an additional positive effect when foreign competition increases. On the opposite, Firms that do not import are highly sensitive to tariffs while importers are not. Non-importers are more affected by tariffs cut which is consistent with the fact that non-importers are mostly small firms that are also more sensitive to third countries prices.

We find some similar asymmetries among exporters and non-exporters and among firms with low or important foreign participation. Our results show that the connections of firms with the international market are important determinant of their productivity level. Exporters take more advantage of foreign competition than non-exporters and are less sensitive to tariffs. The same result holds for small firms and

firms with lower foreign participation whose TFP is more sensitive to tariffs than large and foreign firms (non-significant).

In sum, small firms and those that do not import or export or, firms with mainly domestic ownership react more positively to tariffs cuts. Tariff rates are a direct component of foreign products prices and the weakest firms (small firms, non-exporting, non-importing or fully domestic owned firms) react strangler to prices than the others. In fact, the robust firms (big firms, exporting and importing firms, partially or fully owned by foreigners) are more willing to produce under increasing returns. They face costs of production lower enough to decrease their prices via a reduction of their margin. On the opposite, the import penetration rate takes into account the reduction of non-tariff barriers of trade and the intensification of trade inside the EU. The higher the IPR, higher is the amount of foreign products on the domestic market. When the number of foreign products increases, the range of varieties available in the market raises. This process improves the quality of products and also can reduce the quantity sold by domestic firms. At this moment even the most competitive firms have to react to the intensification of competition. In other words, when an increase of trade influences foreign prices it does not influence the productivity of the most competitive firms but on the opposite, when there is a strong additional increase in the quantity imported and a quality improvement then, all the firms react strongly. In the period under study, Spanish tariffs for EU products was already set to zero but the presence of European products in the Spanish market increases all over the period. Then, it is natural It is, then logical to find that all firms may have been affected by this phenomenon. During this post-liberalisation process, the varieties of products have increased and in particular the availability of capital and intermediate goods. Importers have been able to match with their needs, or, to find inputs with better quality or with technologies still unknown. Therefore, importers benefit from additional positive effects on their productivity level.

III.3 Conclusions about TFP and imports

During the last decade, Spain has experienced a rapid growth of external trade without facing big trade imbalance. Considering the huge increase of Spanish internal demand from the early nineties, the question of how to increase domestic production, competitiveness and productivity has been a key issue for Spain. This country is often viewed as a successful case for new EU members that worry about large trade imbalances since Spain seems to have managed this transition process quite well over the period 1992-2002.

We show that a removal of European tariffs and an increase in the presence of foreign products would translate into improvements of TFP. Moreover, these two effects are complementary. Another important finding is that, firms that import intermediate and capital goods from abroad benefit from additional productivity improvements.

All firms do not react in the same way to trade liberalisation and some firms are more sensitive than others to tariffs and presence of foreign products in the domestic market. In particular, small firms and firms that do not participate in foreign market via exports, imports or ownership react more positively than others to tariff reduction. In turn, large firms, importers and exporters take more advantage of foreign competition in terms of TFP gains than the other firms.

We conclude that, even in a European country, with relatively low levels of protection such as Spain, there are additional gains to expect from trade liberalisation process. However, a large part of the positive effect comes from the presence of foreign products and more indirect effects of openness rather than from tariff reduction.

IV. Exports behaviour of Spanish firms

IV.1 Empirical Model

Melitz's model suggests that export decision depends on the productivity level of the firm since only the most productive firms are able to pay the sunk costs to enter (re-enter) the export market. Entry costs in the export market are usually presented as a consequence of imperfect information and presence of formal or informal barriers to trade. Actually, to entry in a foreign market, firms have to adapt their products to foreign demand and technical and administrative standards, find distribution networks. These costs could be reduced by the presence of other exporting firms in the same country or region. Public or private institutions could organize the access to information concerning harmonisation of administrative and technical standards among trading partners.

Roberts and Tybout's (1997) model a multi-period export decision for entry and exit with sunk costs. They consider that, in each period t, a firm decides to export if the increment to the expected gross profits associated with exporting is positive. That is, export decision is a dynamic discrete choice that depends on previous decisions of the firm. Usually, in this literature, a reduce form is estimated, that is, it is assumed that the expected gross profits depend on exogenous firm characteristics, macro conditions and passed exports. More specifically, firm i exports, in year t, if its profit abroad is positive.

We define I_{it} an indicator function, that takes value 1 if firm *i* exported in year *t*. Because the fixed cost is not observed, we include the lagged export status (I_{it-1}) in the explanatory variables as in Roberts and Tybout (1997) and Bernard and Jensen (2004) and the past TFP level that integrated past characteristics. Firm's characteristics and macro conditions are assumed to be observable to the firm in the period. Therefore the equation for the decision to export is :

$$I_{it} = \begin{cases} 1 \quad if \ 0 \le \alpha + \beta X_{it} + \gamma TFP_{t-1} + \eta I_{it-1} \\ + tariff_i + Herfindahl_i + grm\_dc_i + grm\_ldc_i + grx\_dc_i + grx\_dc_i + \varepsilon_{it} + \mu_t \\ 0 \quad otherwise \end{cases}$$

(1)

where ε_{it} is an error term.

The vector X_{it} is a set of characteristics of the firm that includes

- FDI intensity in logarithm
- Age, the age of the firm in logarithm (lage);
- Size, the number of employees of the firm in logarithm

Following numerous studies like the work of Mañez et al. (2005), we include time-specific effects to capture macro-level changes in export conditions (business cycle, exchange rate movements, trade-policy conditions, world demand for Spanish products, etc).

We use the panel probit with random effects maximum likelihood estimator to control for the other unobservable characteristics that may explain the persistence in the exporting status.

We investigate the effect of some industry's characteristics on export status. We introduce the Herfindahl index. The higher the Herfindahl index, the less competitive is the market. We guess that in non-competitive industries, firms could obtain more gains if they sell to larger market. We also take into account, growth rates of imports and exports from developed countries and from developing countries, in order to check the effect of the presence of foreign products and of a growing access to foreign markets, on the export status at the firm level. We expect tariffs to have a negative impact on the probability of exporting since, more protected markets increase the price in the domestic market compared to the foreign one. Though, it could be the case that, only the less productive firms react this way. To verify this hypothesis, we interact tariff and TFP and introduce it as an additional explaining variable.

IV.2. Econometric results

We estimate six different specifications of the empirical model proposed above to explain the probability of exporting, In all specifications, we consider firm's TFP, age and size, the tariff and tariff interacted with the TFP. Differences among these specifications depend on whether we consider also the lag export status, the intensity of foreign ownership, Herfindahl index and Growth rates of exports and imports. Results are reported in Table 15 for all firms. In Table 16, we present the results of the most complete model for different type of firms.

In general, the firm's characteristics have a robust impact on export participation and the persistence in the exporting activities is high. Having previously exported is a strong determinant of current export status. Its coefficient may be interpreted as sunk costs parameters. As in Mañez et al., the coefficient of Ijt-1 is large and positive. Having exported last year has a strong and positive impact on the probability of exporting this year. These results are consistent with that of Bernard and Jensen (2004).

When the experience at exporting is taken into account, not each of the current firm's characteristics are significant: TFP and age are not, while Foreign capital intensity and size, are. The larger the firm and the foreign participation in capital, the higher the probability of exporting, even after controlling for previous export status.

The age of the firm and the current TFP do not bring more information than the past export status. When the export experience is left out, these characteristics have an important positive effect. The eldest firms are more likely to export, what is consistent with the idea that firms, generally sell their products in the domestic market as a first step and then, examine the possibility to export in a next step. Exporting requires a preparation regarding administrative and technical barriers. It is also necessary to study the demand of foreign market and distribution network. Concerning the productivity measured by the TFP, its effect is positive and significant in all cases (independent of considering one ore two period lagged). These results are the expected from the Melitz model and confirm a presence of self-selection effect in the export market. The same effects are observed when past investment is used as a proxy for past characteristics of the firms.

Firms with a higher foreign participation in their ownership have also a higher probability of exporting. It is interesting to note that this characteristics already important in the Spanish market. Since Spanish internal demand has increased in an important manner during the last decade, it could have been the case that foreign participation to be attracted by this increasing demand. Though, during the first year of the accession of Spain to CEE, Spain attracted important FDI because of its low laboral costs and thanks to

the fact that products could be exported duty-free to CE members. Ten years after, it seems that FDI is still a crucial determinant of export status.

Turning to industries characteristics, we find very interesting results concerning tariffs. The more protected is the industry, the lower the probability of exporting. Our result confirms the hypothesis that an increase in the competition in the domestic market increases the probability of exporting. Consistent with this fact, the growth of imports from developed countries have a positive impact on export status, that is the presence of foreign products in the domestic markets is an important incentive for exporting. More surprisingly, the growth of exports to developed countries has a negative impact, probably because it is more related to the export volume than with the probability of exporting.

We estimate model 1 for several type of firms: small, medium and large firms, firms with high proportion of foreign capital; importer and non importers. Sunk cost parameters do not change very much among the models. The cost to enter the export markets seems similar for different type of firms. Compare to the results for all the firms, we observe that the productivity is especially relevant for large firm, since it has an additional effect on export status that is not reflected by the previous experience at exporting. This is also the case (but less robust) for importer. The presence of foreign products and the growth rate of exports at the industry level seem to affect over all, firms with medium size, importers and firms with low foreign participation in their capital.

IV.3. Conclusion: who exports?

From these findings, we can conclude first, that there is a positive and highly significant effect of previous experience to export, suggesting the presence of considerable sunk costs. Secondly, the most productive firms and large firms are more willing to export, especially the large ones.

Our result confirms the hypothesis that an increase in the competition in the domestic market increases the probability of exporting. Consistent with this fact, the growth of imports from developed countries have a positive impact on export status, that is the presence of foreign products in the domestic markets is an important incentive for exporting. More surprisingly, the growth of exports to developed countries has a negative impact, probably because it is more related to the export volume than with the probability of exporting. Firms with medium size, importers and firms with low foreign participation in their capital are especially sensitive to these questions.

As pointed by Tybout (2001), the effects of trade policies on the exports and on the structure of the domestic market depend widely on the initial conditions, the importance of sunk costs and the importance

of the heterogeneity of firms. Our results are very much in this line. For small firms, firms that do not import intermediate goods or capital goods, the previous experience is more important than the productivity level. For these firms, the competition of the other exporters is a more important barrier for exporting than the growing presence of foreign products or the lowering of tariffs. Though, large firms also face large costs to enter export markets but they additionally have to be very productive and care about protection. The presence of sunk costs at exporting is associated with costs of gathering market information, establishing networks of distribution and adjusts to national standards and legislation. Although trade policy has traditionally concentrated in trade costs, a policy that aims at reducing fixed costs of exporting could have considerable effects on exporting. To this end, public policies should, not only increase the capacity of the firms to assimilate innovations in order to increase their productivity, but also facilitate the knowledge and access to foreign markets and favor the permanence in the export market. Export promotion agencies and international harmonization standards may have an important role to play, especially for small firms.

V. Tables

Table 1 Spain: Summary statistics

EXPORTER VERSUS NON-EXPORTER								
Variables	**All**			**Small firms**			**Large firms**	
	Export.	***Non Exp.***		***Export.***	***Non Exp.***		***Export.***	***Non Exp.***
Production	9 316 340	508 732		404 155	181 479		15 300 000	3 059 179
Nb of employees	327	38		27	20		526	174
Intermediate cons.	5 431 087	245 136		226 445	96 640		8 897 566	1 402 444
Capital	4 166 867	255 124		120 067	60 243		6 862 182	1 773 935
Export Share	22.5			13.5			28.6	
Import Share	11.3	1.9		5.8	1.6		15.1	3.8
Foreign Capital Share	24.6	1.3		4.4	0.4		38.0	8.3
Herfindahl	7.1	8.1		6.5	8.0		7.5	8.8

IMPORTER VERSUS NON-IMPORTER								
Variables	**All**			**Small firms**			**Large firms**	
	Import.	***Non Imp.***		***Import.***	***Non Imp.***		***Import.***	***Non Imp.***
Production	9 222 062	257 821		430 983	147 004		14 900 000	1 730 882
Nb of employees	324	28		28	19		517	139
Intermediate cons.	5 366 680	122 751		245 867	71 969		8 702 912	797 783
Capital	4 134 707	116 008		128 204	49 857		6 744 961	995 333
Export Share	21.2	2.4		11.8	2.0		27.4	8.9
Import Share	11.8			7.1			14.9	
Foreign Capital Share	24.3	0.6		4.6	0.2		37.2	6.7
Herfindahl	7.2	8.0		6.6	7.9		7.5	9.3

Table 2 Spain: Production Function etsimates with de Olley et Pakes (1996) method ($\ln(y_{it})$)

INDUSTRY	L	K	M	N
1 Food and tobacco	0.280*** (0.011)	0.163*** (0.019)	0.505*** (0.006)	2890
2 Textiles and textile products	0.401*** (0.012)	0.043** (0.018)	0.433*** (0.006)	2232
3 Leather and leather products	0.273*** (0.023)	0.136*** (0.011)	0.488*** (0.012)	652
4 Wood	0.389*** (0.029)	0.278*** (0.022)	0.360*** (0.017)	526
5 Paper	0.292*** (0.020)	0.092*** (0.012)	0.577*** (0.016)	602
6 Printing products	0.472*** (0.020)	0.105*** (0.009)	0.500*** (0.011)	1100
7 Chemical products	0.334*** (0.014)	0.184*** (0.010)	0.499*** (0.009)	1198
8 Rubber and plastic products	0.394*** (0.014)	0.115*** (0.011)	0.469*** (0.009)	1155
9 Other non-metallic mineral product	0.415*** (0.014)	0.199*** (0.007)	0.449*** (0.010)	1421
10 Basic metals	0.224*** (0.016)	0.092*** (0.021)	0.626*** (0.009)	688
11 Fabricated metal products	0.329*** (0.013)	0.096*** (0.018)	0.523*** (0.007)	1900
12 Machinery and equipment	0.416*** (0.016)	0.037*** (0.021)	0.513*** (0.008)	1527
13 Office equipment and precision	0.416*** (0.036)	0.079*** (0.017)	0.523*** (0.016)	352
14 Electrical and optical equipment	0.383*** (0.014)	0.103* (0.009)	0.565*** (0.008)	1506
15 Vehicles motor	0.365*** (0.017)	0.100*** (0.004)	0.532*** (0.009)	957
16 Other transport equipment	0.300*** (0.032)	0.119*** (0.011)	0.559*** (0.016)	358
17 Other manufactured products	0.393*** (0.015)	0.068*** (0.024)	0.517*** (0.009)	1478

Source : Authors' calculation Stand. dev in brackets * significant at 10%, **at 5%; ***at 1%

Table 3 Spain: Tariffs for Spain and the CEE in 1985 for manufacturing products

	Industry	Spanish Tariff on CE products	Spanish tariff on Third Countries	CE tariffs on Third Countries	CE tariffs on Spanish products
1	Food and tobacco	-	-	-	-
2	Textiles and textile products	14,67	20,49	6,81	2,73
3	Leather and leather products	14,67	20,49	6,81	2,73
4	Wood	-	-	-	-
5	Paper	8,19	9,3	4,32	1,73
6	Printing products	7,38	9,62	2,69	1,08
7	Chemical products	11,52	14,74	6,07	2,65
8	Rubber and plastic products	12,56	17,29	5,87	2,35
9	Other non-metallic mineral product	2,22	3,37	0,83	0,33
10	Basic metals	0,26	0,3	0	0
11	Fabricated metal products	11,7	12,8	4,92	4,87
12	Machinery and equipment n.e.c	11,92	14,95	3,96	1,58
13	Office equipment and precision	11,92	14,95	3,96	1,58
14	Electrical and optical equipment	16,93	19,46	5,06	2,02
15	Vehicles motor	20,2	26,64	8,6	3,44
16	Other transport equipment	20,2	26,64	8,6	3,44
17	Other manufactured products	16,81	22,59	5,04	2,02

Source: Authors calculation based on Cañada A. Carmena A (1991) p 13

Table 4 Spain: MFN tariffs, EU

		1991	1996	2002
1	Food and tobacco	42.28	37.77	33.81
2	Textiles and textile products	10.81	10.14	9.20
3	Leather and leather products	8.34	7.35	6.52
4	Wood	5.52	4.25	3.45
5	Paper	7.97	5.46	1.50
6	Printing products	4.79	3.73	1.47
7	Chemical products	7.12	4.85	4.64
8	Rubber and plastic products	7.23	6.13	4.87
9	Other non-metallic mineral product	5.53	4.32	3.42
10	Basic metals	5.18	3.83	5.38
11	Fabricated metal products	5.48	4.03	2.89
12	Machinery and equipment n.e.c	4.29	2.81	1.85
13	Office equipment and precision	5.39	3.58	1.54
14	Electrical and optical equipment	6.21	4.78	2.68
15	Vehicles motor	8.4	7.08	6.34
16	Other transport equipment	4.67	3.23	2.32
17	Other manufactured products	5.73	4.02	2.72

Source : TRAINS, UNCTAD

Table 5 Spain: Import, Export, Volume of trade and trade imbalances by industry (% of Spanish GDP), 1990, 2002

		IMPORT		EXPORT		TRADE VOLUME		TRADE BALANCE	
		90	02	90	02	90	02	90	02
	Agriculture	0,91	1,00	0,86	1,44	1,77	2,44	-0,05	0,44
	Mining	0,23	0,21	0,06	0,10	0,28	0,31	-0,17	-0,12
	Energy	1,89	2,58	0,56	0,50	2,45	3,08	-1,33	-2,08
1	Food and tobacco	1,16	1,74	0,88	1,70	2,04	3,44	-0,28	-0,05
2	Textiles and textile products	0,66	1,25	0,39	0,88	1,05	2,12	-0,27	-0,37
3	Leather and leather products	0,17	0,34	0,43	0,45	0,60	0,79	0,26	0,11
4	Wood	0,06	0,14	0,07	0,13	0,13	0,27	0,02	-0,01
5	Paper	0,41	0,55	0,23	0,40	0,64	0,95	-0,19	-0,15
6	Printing products	0,07	0,08	0,09	0,17	0,16	0,24	0,02	0,09
7	Chemical products	1,22	2,40	0,68	1,67	1,91	4,08	-0,54	-0,73
8	Rubber and plastic products	0,66	1,13	0,53	0,99	1,19	2,11	-0,13	-0,14
9	Other non-metallic mineral product	0,32	0,44	0,39	0,68	0,71	1,13	0,06	0,24
10	Basic metals	0,72	1,01	0,71	0,74	1,43	1,75	-0,02	-0,27
11	Fabricated metal products	0,55	0,88	0,46	0,74	1,01	1,62	-0,09	-0,14
12	Machinery and equipment n.e.c	1,85	2,15	0,77	1,06	2,62	3,20	-1,07	-1,09
13	Office equipment and precision	1,45	2,08	0,36	0,65	1,81	2,73	-1,09	-1,43
14	Electrical and optical equipment	1,08	1,73	0,56	1,25	1,64	2,98	-0,52	-0,47
15	Vehicles motor	1,89	3,74	2,22	4,37	4,11	8,11	0,33	0,63
16	Other transport equipment	0,43	0,45	0,30	0,38	0,73	0,83	-0,13	-0,07
17	Other manufactured products	0,30	0,77	0,20	0,59	0,50	1,36	-0,10	-0,18
	Total	16,02	24,68	10,75	18,88	26,77	43,56	-5,28	-5,80

Source: Authors calculation based on CHELEM, CEPII

Table 6 Spain: Decomposition of productivity growth (1991-2002), Olley and Pakes (1996)

Industry		Aggregated TFP	Unweighted TFP.	Cov.
1	Food and tobacco	**-0.059**	-0.046	-0.012
2	Textiles and textile products	**0.242**	0.166	0.075
3	Leather and leather products	**0.157**	0.044	0.114
4	Wood	**0.308**	0.097	0.211
5	Paper	**0.288**	0.070	0.218
6	Printing products	**0.166**	0.079	0.086
7	Chemical products	**0.276**	0.159	0.118
8	Rubber and plastic products	**0.334**	0.111	0.224
9	Other non-metallic mineral product	**0.243**	0.076	0.167
10	Basic metals	**0.171**	0.138	0.032
11	Fabricated metal products	**0.023**	0.024	-0.001
12	Machinery and equipment n.e.c	**0.223**	0.185	0.037
13	Office equipment and precision	**0.083**	0.277	-0.194
14	Electrical and optical equipment	**0.329**	0.236	0.093
15	Vehicles motor	**0.195**	0.189	0.005
16	Other transport equipment	**0.147**	0.007	0.139
17	Other manufactured products	**0.051**	0.095	-0.044

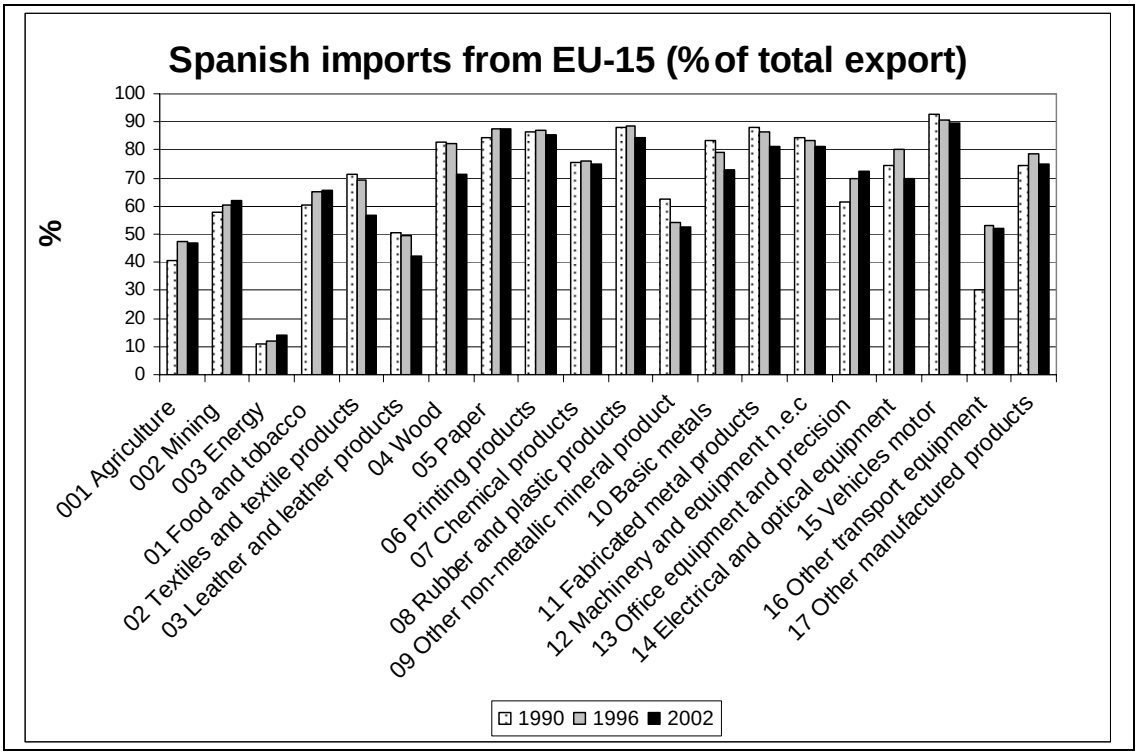
Source: Authors calculation.

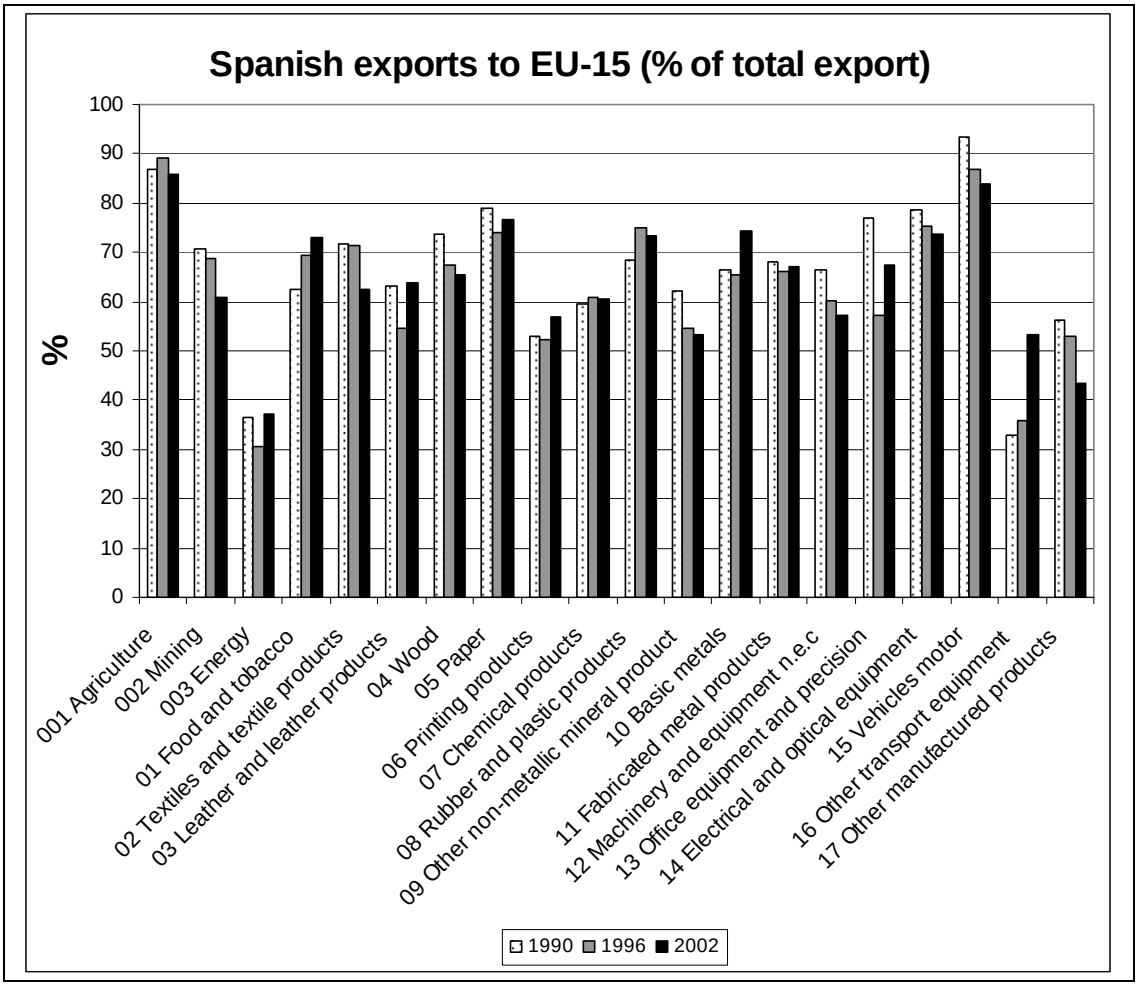
Table 7 Spain: Decomposition of productivity growth (1991-2002), Foster, Haltiwanger and Krizan (1998)

Industry	Within effect	Between effect	Covariance effect	Entry effect	Exit effect	Total
1	0.024	-0.081	0.067	-0.021	0.049	**-0.059**
2	0.091	0.014	0.092	0.037	-0.009	**0.242**
3	-0.004	-0.031	0.047	0.173	0.027	**0.157**
4	0.242	0.022	-0.054	0.122	0.024	**0.308**
5	0.133	-0.001	-0.032	0.192	0.005	**0.288**
6	0.126	-0.001	-0.046	0.095	0.008	**0.166**
7	0.077	0.044	0.102	0.072	0.019	**0.276**
8	0.084	0.004	0.079	0.173	0.005	**0.334**
9	0.104	0.012	0.085	0.058	0.016	**0.243**
10	0.093	-0.007	0.017	0.084	0.017	**0.171**
11	0.029	-0.003	0.019	0.018	0.040	**0.023**
12	0.098	-0.020	0.101	0.037	-0.007	**0.223**
13	0.016	-0.002	0.020	0.060	0.011	**0.083**
14	0.052	-0.007	0.086	0.209	0.011	**0.329**
15	0.027	-0.036	0.110	0.099	0.006	**0.195**
16	0.020	-0.014	0.107	0.002	-0.031	**0.147**
17	0.160	-0.023	-0.088	-0.014	-0.016	**0.051**

Source: Authors calculation.

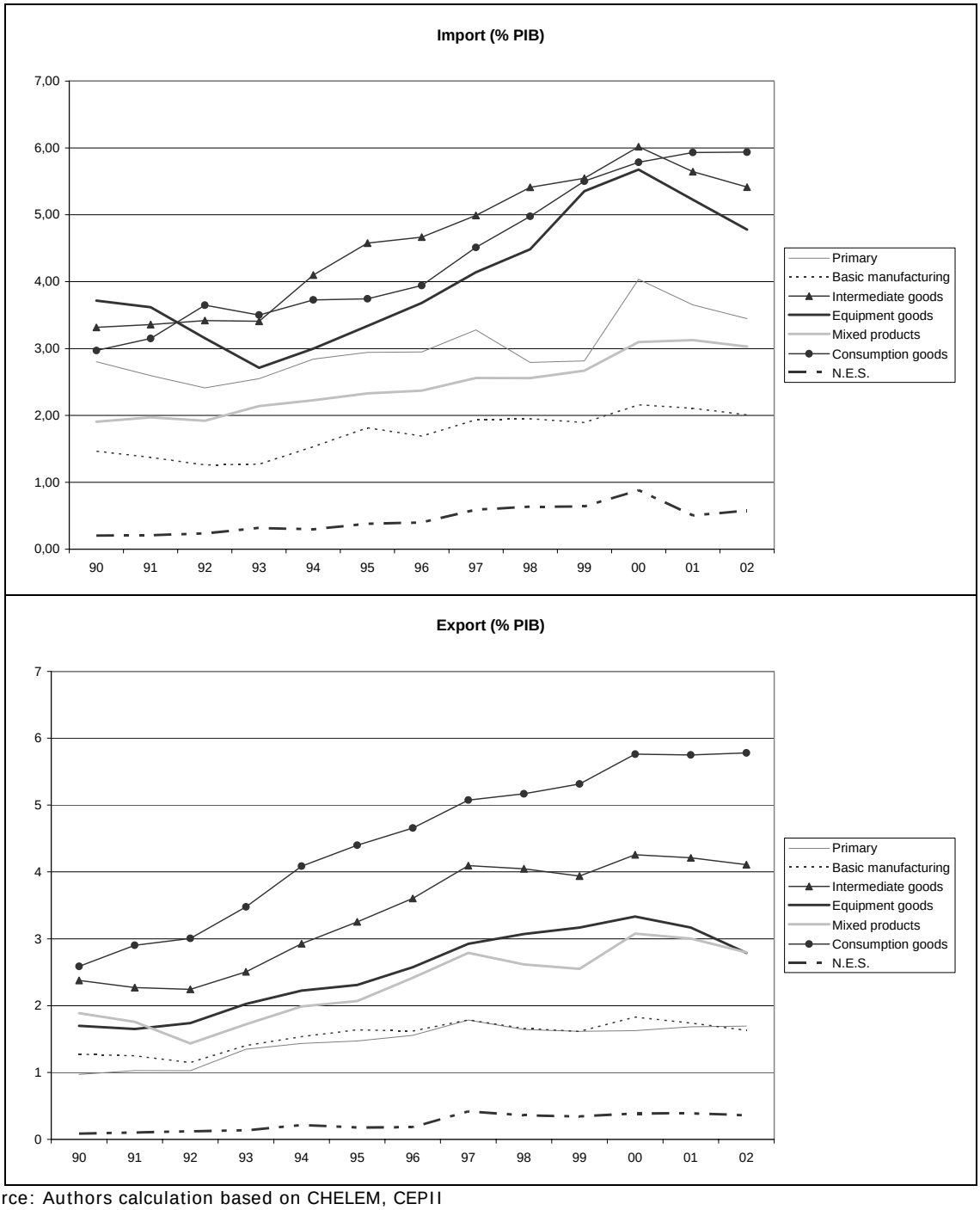
Table 8 Spain: Share of EU in Spanish trade.





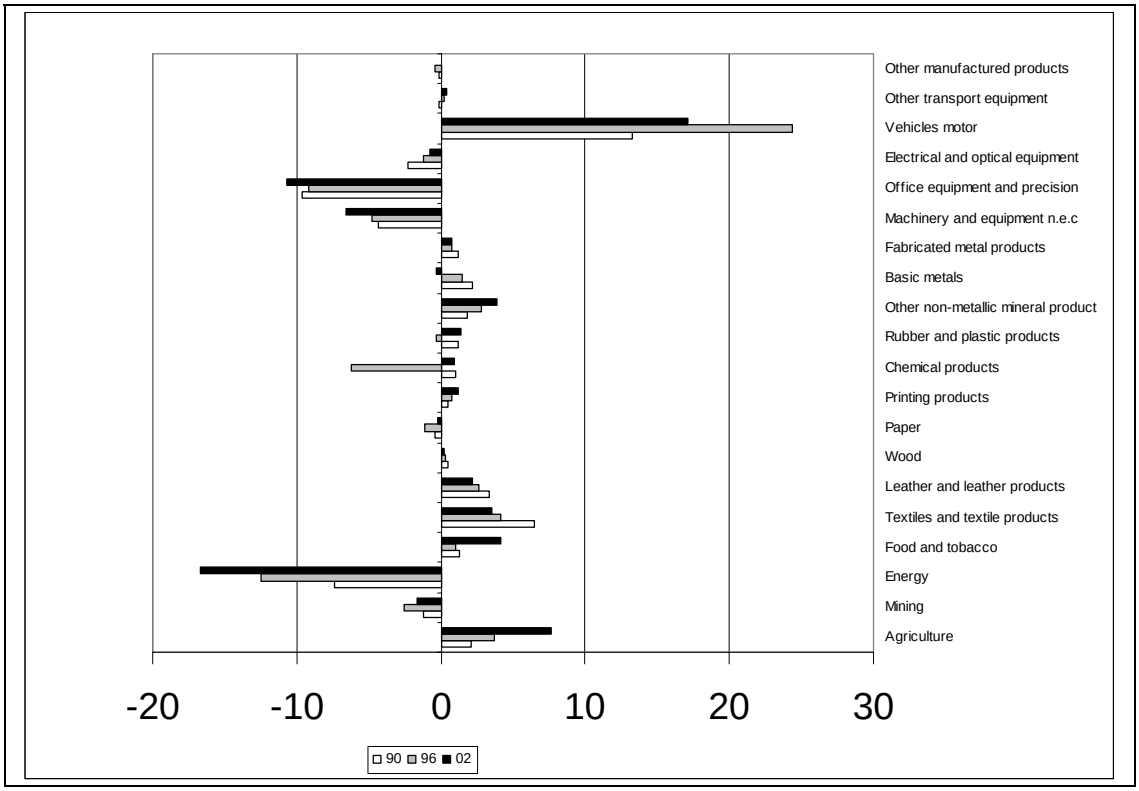
Source: Authors calculation based on CHELEM, CEPII

Table 9 Spain: Import and Export by stage of production (% of Spanish PIB), 1990, 2002



Source: Authors calculation based on CHELEM, CEPII

Table 10 Spain: Comparative advantage of Spain by industry



Source: Authors calculation based on CHELEM, CEPII

Table 11 Spain: Tariffs on TFP (1991-2002) Fixed-effect

Tariff	0.211***		0.239***
	[0.038]		[0.044]
Tariff (t-1)		0.074*	-0.057
		[0.040]	[0.046]
TFP (t-1)	0.215***	0.217***	0.216***
	[0.007]	[0.007]	[0.007]
year dummies	yes	yes	yes
Constant	-0.023***	-0.012**	-0.021***
	[0.005]	[0.005]	[0.005]
Observations	15772	15772	15772
R-squared	0.83	0.83	0.83

Table 12 Spain: Average effect of IPR and tariffs on TFP (1991-2002)

GMM (t-2)	TFP	TFP
Import penetration rate	0.118***	0.118***
	[0.044]	[0.044]
Sector export output ratio (t-1)	0.022	0.023
	[0.021]	[0.021]
Foreign owned share	0.082***	0.082***
	[0.022]	[0.022]
Herfindahl	-0.062	-0.066*
	[0.039]	[0.039]
Entry (t-1)	-0.011	-0.010
	[0.010]	[0.010]
Exit	-0.008	-0.009
	[0.007]	[0.007]
Agglomeration	0.140***	0.141***
	[0.030]	[0.030]
TFP (t-1)	0.329***	0.329***
	[0.017]	[0.017]
Tariff		-0.102***
		[0.021]
Tariff (t-1)	-0.104***	
	[0.021]	
Exporter dummy		
Constant	-0.020*	-0.022**
	[0.010]	[0.010]
year dummies	yes	yes
Observations	15772	15772
sargan	0.105	0.097
m1	0.000	0.000
m2	0.259	0.256

Source : Authors' calculation
Stand. dev in brackets * significant at 10%, **at 5%; ***at 1% and For each test, we report the p-value.

Table 13 Spain: Interaction of IPR and tariff and imports, exports and K

GMM (t-2)	TFP	TFP	TFP	TFP
Import penet.*X	0.149***			
	[0.045]			
Import penet.*(1-X)	0.056			
	[0.044]			
Import penet.*K		0.130**		
		[0.057]		
Import penet.*(1-K)		0.115***		
		[0.043]		
Import penet.*large			0.171***	
			[0.047]	
Import penet.*small			0.080*	
			[0.044]	
Import penet.*M				0.140***
				[0.043]
Import penet.*(1-M)				-0.003
				[0.048]
Tariff(t-1)*X	-0.034			
	[0.031]			
Tariff(t-1)*(1-X)	-0.112***			
	[0.024]			
Tariff(t-1)*K		0.044		
		[0.044]		
Tariff(t-1)*(1-K)		-0.144***		
		[0.024]		
Tariff(t-1)*large			0.035	
			[0.027]	
Tariff(t-1)*small			-0.216***	
			[0.026]	
Tariff(t-1)*M				-0.028
				[0.024]
Tariff(t-1)*(1-M)				-0.199***
				[0.030]
Sector export output ratio (t-1)	0.025	0.018	0.018	0.025
	[0.021]	[0.021]	[0.021]	[0.021]
Foreign owned share	0.068***	0.091***	0.071***	0.073***
	[0.022]	[0.024]	[0.024]	[0.023]
Herfindahl	-0.087**	-0.069*	-0.099**	-0.083**
	[0.039]	[0.039]	[0.039]	[0.039]
Agglomeration	0.155***	0.139***	0.146***	-0.008
	[0.030]	[0.030]	[0.030]	[0.010]
Entry (t-1)	-0.008	-0.009	-0.008	-0.002
	[0.010]	[0.010]	[0.010]	[0.007]
Exit	-0.004	-0.008	-0.007	0.145***
	[0.007]	[0.007]	[0.007]	[0.030]

TFP (t-1)	0.337***	0.335***	0.337***	0.333***
	[0.017]	[0.017]	[0.017]	[0.017]
Constant	-0.020*	-0.021*	-0.018*	-0.019*
	[0.010]	[0.011]	[0.010]	[0.010]
year dummies	yes	yes	yes	yes
Observations	15772	15772	15772	15772
Sargan	0.034	0.355	0.054	0.108
m1	0.000	0.000	0.000	0.000
m2	0.224	0.256	0.229	0.241

Where : X=1 if exports/production of firms >10% 0 otherwise M=1 if imports/production of firms >0% 0 otherwise K=1 if foreign capital of firms >10% 0 otherwise.
Source : Authors' calculation
Stand. dev in brackets * significant at 10%, **at 5%; ***at 1% and For each test, we report the p-value.

Table 14 Spain: Interaction of IPR and tariff and size

GMM-System (t-2)				
Import penetration rate	0.199***			0.174***
	[0.047]			[0.048]
Import penet*size1	-0.172***			-0.146***
	[0.036]			[0.036]
Import penet*size2	-0.021			0.004
	[0.036]			[0.037]
Import penet*size3	0.008			-0.004
	[0.036]			[0.037]
Import penet*size4	-0.039			-0.045
	[0.027]			[0.030]
Sector export output ratio (t-1)	0.016	0.074***	0.074***	0.017
	[0.020]	[0.011]	[0.011]	[0.020]
Foreign owned share	0.083***	0.080***	0.078***	0.078***
	[0.022]	[0.025]	[0.025]	[0.022]
Herfindahl	-0.116***	-0.062	-0.058	-0.090**
	[0.039]	[0.039]	[0.040]	[0.039]
Agglomeration	0.150***	0.147***	0.148***	0.145***
	[0.029]	[0.033]	[0.032]	[0.029]
Entry (t-1)	-0.008	-0.008	-0.007	-0.008
	[0.010]	[0.011]	[0.011]	[0.010]
Exit	-0.007	-0.008	-0.008	-0.007
	[0.007]	[0.007]	[0.007]	[0.007]
TFP (t-1)	0.343***	0.318***	0.319***	0.341***
	[0.016]	[0.017]	[0.017]	[0.016]
Tariff		0.042		
		[0.037]		
Tariff*size1		-0.349***		
		[0.053]		
Tariff*size2		-0.235***		
		[0.061]		
Tariff*size3		0.114		
		[0.074]		
Tariff*size4		-0.018		
		[0.049]		
Tariff (t-1)			0.044	0.012
			[0.036]	[0.032]
Tariff (t-1)*size1			-0.352***	-0.224***
			[0.052]	[0.041]
Tariff (t-1)*size2			-0.235***	-0.229***
			[0.059]	[0.052]
Tariff (t-1)*size3			0.113	0.106
			[0.074]	[0.072]
Tariff (t-1)*size4			-0.016	0.024
			[0.048]	[0.053]

Constant	-0.028***	-0.008	-0.007	-0.018*
	[0.009]	[0.010]	[0.010]	[0.010]
year dummies	yes	yes	yes	yes
Observations	15772	15772	15772	15772
sargan	0.934	0.081	0.090	0.947
m1	0.000	0.000	0.000	0.000
m2	0.210	0.299	0.328	0.222

Source : Authors' calculation
Stand. dev in brackets * significant at 10%, **at 5%; ***at 1% and For each test, we report the p-value.

Table 15 Spain: Export: a probit estimation

	1	2	3	4	5	6
	Export	Export	Export	Export	Export	Export
Export (t-1)	2.784***	2.787***	2.802***			
	[0.045]	[0.041]	[0.041]			
TFP	0.373*	0.289	0.308	1.512***	1.339***	1.352***
	[0.200]	[0.190]	[0.189]	[0.504]	[0.470]	[0.474]
Tariff	-0.049**	-0.050***	-0.051***	-0.244***	-0.221***	-0.234***
	[0.021]	[0.019]	[0.019]	[0.067]	[0.064]	[0.064]
Tariff*TFP	0.072	0.049	0.048	0.196	0.144	0.123
	[0.057]	[0.053]	[0.053]	[0.138]	[0.128]	[0.129]
Age	-0.016	-0.009	-0.009	0.270***	0.260***	0.267***
	[0.026]	[0.024]	[0.024]	[0.075]	[0.070]	[0.071]
Size	0.256***	0.250***	0.267***	1.373***	1.373***	1.478***
	[0.020]	[0.018]	[0.017]	[0.062]	[0.058]	[0.057]
Growth rate of import from developed countries	0.270*			0.291		
	[0.139]			[0.182]		
Growth rate of import from developing countries	-0.000			0.003		
	[0.001]			[0.002]		
Growth rate of exports to developed countries	-0.230**			-0.263**		
	[0.096]			[0.129]		
Growth rate of exports to developing countries	0.016			0.009		
	[0.022]			[0.017]		
Foreign capital	0.290***	0.281***		1.510***	1.505***	
	[0.103]	[0.095]		[0.238]	[0.223]	
Herfindahl	-0.087	-0.348		-0.164	-0.982	
	[0.495]	[0.444]		[1.099]	[1.019]	
Constant	-2.312***	-2.431***	-2.506***	-6.284***	-6.155***	-6.919***
	[0.153]	[0.127]	[0.123]	[0.441]	[0.413]	[0.348]
Observations	10277	11879	11879	10277	11879	11879
Number of ident	2213	2383	2383	2213	2383	2383

Source : Authors' calculation
Stand. dev in brackets * significant at 10%, **at 5%; ***at 1% and For each test, we report the p-value.

Table 16 Spain: Export: a probit estimation for different type of firms

	1	2	3	4	5	6	7
	Export	Export	Export	Export	Export	Export	Export
	Size <50	50<size<200	size>200	Foreign capital >10%	Foreign capital <10%	Importer	Non-Importer
Export (t-1)	2.712***	2.843***	2.967***	2.666***	2.805***	2.632***	2.805***
	[0.059]	[0.101]	[0.106]	[0.121]	[0.049]	[0.060]	[0.082]
TFP	0.226	0.187	1.100**	0.443	0.314	0.680*	0.112
	[0.243]	[0.554]	[0.550]	[0.661]	[0.213]	[0.375]	[0.324]
Tariff	-0.036	-0.054	-0.118***	-0.117**	-0.046**	-0.043	-0.043
	[0.028]	[0.049]	[0.045]	[0.058]	[0.023]	[0.029]	[0.036]
Tariff*TFP	-0.003	-0.008	0.459***	0.313*	0.021	0.124	0.033
	[0.073]	[0.148]	[0.151]	[0.178]	[0.062]	[0.102]	[0.092]
Age	0.010	-0.092*	0.010	-0.075	-0.007	-0.029	-0.060
	[0.037]	[0.054]	[0.056]	[0.060]	[0.030]	[0.035]	[0.047]
Size	0.312***	0.120	0.159**	0.244***	0.259***	0.217***	0.140***
	[0.061]	[0.116]	[0.080]	[0.054]	[0.022]	[0.027]	[0.042]
Growth rate of import from developed countries	0.120	0.644**	0.064	0.193	0.292*	0.428**	0.049
	[0.195]	[0.302]	[0.299]	[0.356]	[0.153]	[0.183]	[0.252]
Growth rate of import from developing countries	-0.001	-0.000	0.002	0.001	-0.000	-0.001	0.002
	[0.002]	[0.003]	[0.004]	[0.004]	[0.002]	[0.002]	[0.002]
Growth rate of exports to developed countries	-0.223*	-0.361	-0.048	-0.150	-0.256**	-0.301**	-0.162
	[0.130]	[0.220]	[0.213]	[0.257]	[0.105]	[0.128]	[0.170]
Growth rate of exports to developing countries	0.042	0.110*	-0.007	-0.013	0.017	0.001	0.066
	[0.035]	[0.061]	[0.010]	[0.061]	[0.023]	[0.016]	[0.044]
Foreign capital	0.469*	0.338*	0.205	0.281	-6.429	0.161	-0.165
	[0.253]	[0.188]	[0.157]	[0.338]	[4.220]	[0.117]	[0.315]
Herfindahl	-0.061	-0.401	1.448	-1.057	0.176	-0.461	-0.943
	[0.711]	[0.960]	[1.194]	[1.099]	[0.558]	[0.598]	[1.066]
Constant	-2.506***	-1.473**	-2.390***	-2.346***	-2.360***	-1.682***	-2.155***
	[0.274]	[0.590]	[0.548]	[0.435]	[0.167]	[0.211]	[0.294]
Observations	4202	2087	3928	2806	7471	7239	3038
Number of ident	1103	558	800	610	1765	1583	999

Source : Authors' calculation
Stand. dev in brackets * significant at 10%, **at 5%; ***at 1% and For each test, we report the p-value.

D. The Turkish case

I. Introduction

Turkey is a good case-study for students of economic development interested in the impact of trade policy reforms on the productivity and export behaviour of firms in DCs. Indeed, after having pursued an import-substitution based development strategy from the early 1950s until 1980, Turkey switched to a more outward-oriented one from 1980 onward. Liberalization policies introduced included measures aimed at export promotion and import liberalization, and at a later stage, at deregulation of the financial sector. This transition to a more liberalized economy is likely to influence innovation activities carried out by firms in the Turkish economy.

Therefore, it is astonishing that although more than a quarter century elapsed since the onward on trade policy reforms a handful studies addressed the aforementioned crucial issues in the case of Turkey[14]. The aim of this study is to fill the gap in this field. We use firm/plant–level data[15] for the Turkish manufacturing sector in order to analyze on the one hand the effect of trade liberalization on the productivity of firms and on their survival patterns and exports decisions on the other hand. Furthermore, this comprehensive firm/plant-level data set is available over the period 1982-2001. By developing countries' standards, our database is highly "unusual" for its coverage (see section III.2) as well as for the length of the time period to which it refers.

The remaining part of this report is organized as follows. In section II, a survey of the empirical studies using firm-level data and dealing with the impact of trade policy reforms on the Turkish economy will be carried out. We are especially interested in the effects of the aforementioned policies on firm-level performance indicators such as the productivity, export decision and survival patterns. Section III will be devoted to the identification of major changes that occurred in foreign trade policies but as well as other changes in economic polices that are relevant for our study. In sections IV and V, after calculation of the unobserved total factor productivity at the firm-level by a semi-parametric method and construction of

[14] One well-known exception is Levinsohn (1993).

[15] See section III.2 for more details on data.

import taxes at the four-digit sector level, appropriate econometric techniques are used in order to verify whether reduction in tariffs led to an increase in productivity levels over the period 1982-2001. In section VI, the same firm-level database is used over the period 1990-2001 in order to examine first the effect of trade liberalization – i.e. reductions in tariff rates –on the entry decision of Turkish firms on export markets, which is an imported subject since the –assumed – advantages for a firm of being present on export market[16]. Second, the impact of these reforms on the survival patterns – exiting the market – of firms will be investigated. Section VII will conclude with a summary of the main findings.

II. Survey of Empirical Studies on the Turkish Economy

It should be noted that only those studies that make use of firm-level data and quantitative techniques in order to investigate the relationship between trade reforms and performance-related firm-level indicators are succinctly discussed here.

Taymaz and Saatçi (1997) investigate determinants of technical efficiency of firms in the Turkish manufacturing industry. They estimate the total factor productivity of firms in the textile, cement and motor vehicles industries to determine the extent and the nature of technical progress. They find significant inter-sectoral differences in the rates of technical change and the factors influencing technical efficiency. The type of ownership and the source of technology are important determinants of plant-level efficiency.

Pamukçu (2003) uses a logit model and by matching firm-level data from manufacturing surveys and from an innovation survey, examines the determinants of innovation decisions of Turkish manufacturing firms over the period 1989-1993. Therefore, the "performance" variable retained in this study is the innovation decisions of firms A number of firm-level (size, skill level, profits, being a foreign firm) and industry-level (market structure, international knowledge spillovers) control variables are used in conjunction with indicators of trade liberalization (use of imported capital equipment, export intensity, tariff protection, import penetration, FDI spillovers) to test for the impact of this last factor on innovation. The results tend to show that the positive

[16] Such as strong competitive pressures present on the export market as well as on formal and informal technology transfers that goes together with the exporting activity.

impact of trade liberalization on innovation decisions of Turkish manufacturing firms occurs mainly through the use of more imported capital goods.

An interesting finding is that exporters use more imported capital goods and are *more likely to innovate than non-exporters*. However, using a simultaneous probit model, it is shown that although more innovative firms are more likely to become exporters, being an exporter does not significantly increase probability to introduce innovations on the market. Consequently, even on cross-sectional data, findings indicate an ongoing self selection process.

Yasar, Rejessus and Mintemur (2004) decompose and analyse total factor productivity growth at the aggregate industry-level for the textile, apparel and motor vehicles and parts industries. They seek to find evidence of the Schumpeterian creative destruction process. Their estimations show that productivity improvements in existing firms are the main source of productivity growth in these industries. In contrast, exiting firms do not seem to be less productive than entering firms.

Yasar and Rejessus (2005) use plant-level data over the period 1990-1996 to determine whether *self-selection* (due to the existence of fixed and irrecoverable sunk costs of exporting, only the most productive firms become exporter)or *learning-by-exporting* (existence of learning effects associated with exporting due to firms' exposure to strong competition on export markets and to useful embodies/disembodied technological innovations due to international contacts) is the more plausible explanation for the observed link between exporting status and plant performance in Turkish manufacturing plants.

Since the direction of causation can be examined either by looking at the performance of firms entering the export market or by looking at the performance of firms exiting the export market, authors use a propensity score matching technique to match entrants with similar non-exporting firms and exiters with similar continuous exporting firms. This method is used since the productivity level exporters would have had if they had hot entered the export market is not known. Similarly, the productivity level exiters would have had they not exited can not be known.

Using a difference-in-difference estimator, authors find that upon entry, the productivity of exporting plants is higher than that of matched non-exporters, with a productivity differential significant two years after entry. As well, productivity of firms that exit the export market is statistically lower than the matched

continuous exporters during the year of exit and two years after exit. Therefore, these results point out that a robust learning-by-exporting effect is verified.

Ozler and Yilmaz (2006) examine the effects of trade policy changes on the evolution of plant productivity. Plant level productivities are estimated for the 1983-96 period following the semi-parametric method of Olley and Pakes. Industry averages indicate that productivity gains are largest in import competing industries with highest gains reaching to 8% per year during periods of rapid decline in protection rates. A decomposition of industry level productivity gains also suggests important differences across sectors by trade orientation. Though reallocation of market shares to more productive plants are important in both export oriented, and import competing sectors, within plant productivity improvements are significant only in export-oriented sectors. They also investigate the effects of changes in protection rates on plant level productivities using regressions that control for endogeneity of protection rates (tariff and non-tariff). They also find that productivity improvements resulting from declining protection levels are statistically significant and economically important, especially in import competing sectors. This analysis also suggests that there is a huge degree of heterogeneity, measured by plant size, in response to changes in protection rates.

Ozler, Taymaz and Yilmaz (2007), using a dynamic panel data framework, and the same firm-level database as in the present report, investigate the factors influencing the export decision of the Turkish manufacturing plants over the 1990-2001 period. Their results support the presence of high sunk costs of entry to export markets, as well as the hypothesis that the full history of export participation matters for the current export decision. They further show that the effect of the past export experience on current export decision rapidly depreciates over time: Recent export market participation matters more than the participation further in the past. Finally, they show that while persistence in exporting helps lower the costs of re-entry today, there are diminishing returns to export experience. These results are robust to plant characteristics (plant size, technology, composition of the employment), the spillovers from the presence of exporters in the same industry, as well as industry and year effects.

III. Changes to the Turkish Trade Regime and Data

III.1. Changes to the Trade Regime

The onset of structural reforms in Turkey dates back to January 1980. An important component of the reform package consisted of policy changes to achieve greater trade openness. In the first couple of years of the program export increase was targeted through measures such as export tax rebates, preferential export credits, foreign exchange allocations and the duty-free access to imports. During this period (1980-1983) the total subsidy rate received by manufactured goods exporters was around 20-23% (Milanovic, 1986).

Though some steps were undertaken towards elimination of import barriers during 1980-83 period it was not until 1984 that major changes to the import regime were announced. These changes entailed elimination of both tariffs and quantitative restrictions. The import regime was based on classification of commodities into three groups: 'prohibited' list, 'imports subject to permission' list, and 'liberalized' list. With the changes announced in 1984 around 60% of 1983 imports were no longer subject to restrictions or approvals by authorities. The number of commodities in the 'prohibited' list, which was around 500 in 1984, was reduced to almost zero by 1985. The commodities in the 'subject to permission' list, which accounted for 46% of manufactured imports in 1984, were reduced to 22% in 1986 and 6% in 1988. Quantitative restrictions were completely phased out by 1990 (Togan 1994). Changes in quantitative restrictions are argued to have resulted in considerable elimination of trade barriers. It is suggested that the wedge between the domestic and international price of imports imposed by quantitative restrictions was 50% in 1980, and that it declined by 10% every year, falling down to 20% in 1984, and 10% in 1985, and finally to zero by 1986 (Krueger and Aktan 1992).

In addition to the relaxation of quantitative restrictions, the 1984 import program entailed significant changes in the tariff structure. Tariffs on imports of intermediate and capital goods were reduced. Though tariffs on imports of consumer goods and on imports of goods that would compete with domestically produced goods were increased this did not lead to an increase in overall nominal protection rates, because imports of the goods in these categories were severely restricted before 1984. The output-weighted average nominal tariff rate for the manufacturing industry stood almost unchanged from 75.8% in 1983 to 76.9% in 1984, however, declined to 40% in 1990 and to 20.7% in 1994.

III.2. Data

The Turkish Statistical Institute (TurkStat) collects the plant level dataset used in this study. TurkStat periodically conducts Census of Industry and Business Establishments (CIBE).[17] In addition, the TurkStat conducts Annual Surveys of Manufacturing Industries (ASMI) at establishments with 10 or more employees.[18] The set of addresses used during ASMI are those obtained during CIBE years. In addition, every non-census year, addresses of newly opened private establishments with 10 or more employees are obtained from the chamber of industry.[19] For this study we use a sample that matches plants from CIBE and ASMI for the 1983-2000 period.[20]

The data is well suited for our purposes because it contains information on variables that are commonly used in estimation of firm level production functions. Specifically, the data includes value of sales, number of employees, values of material inputs, electricity, fuels and investment (details of variable construction are relegated to the Appendix). Since the CIBE does not include plant with less than 10 employees. Even though, not all the key variables needed for this study have been collected for establishments in the 10-24-size group. Thus our sample consists of plants with 10 or more employees.[21]

We limit the sample to only on *private establishments*.[22] In the resulting sample we have 152,240 plant years for 23,815 plants in 56 four-digit ISIC industries. We do not select the plants that were in the sample period through the entire period and hence use an unbalanced data set. However, entry or exit each constitutes a small percentage of total number of plants within each year as can be seen in Table A1 of the Appendix. In 1993, following the CIBE year 1992, the number of entering plants shows a dramatic increase indicating the concerted effort by TurkStat to identify new plants. Even in that year continuing plants constitute about 60% of the total number of plants.

When we turn to explaining plant level total factor productivity (in Section V below) in addition to the plant level data set we use some sector level and economy wide variables. First, sectors are classified into three groups as import competing, export oriented and non-tradable sectors based on sector level import,

[17] Since the formation of the Turkish Republic CIBE has been conducted 7 times (in 1927, 1950, 1963, 1970, 1980, 1985, and 1992).

[18]TurkStat also collects data on establishments with less than 10 employees. However, up to 1992 data on these establishments were collected only during CIBE years. Since then TurkStat collects annual data for a small sample of establishments with less than 10 employees.

[19] Thus plant entry can be observed in every year of the sample. Though not reported here, in the CIBE years we observe a larger number of new plants, and a higher fraction of smaller plants. Both of these observations reflect the concerted effort by the TurkStat to include all establishments in the CIBE years.

[20] The ASMI and CIBE data are available in a machine-readable form starting from 1980. For this study we limited the sample for the post 82 period primarily because in the years prior to 1983 the quality of data is less reliable and much work is needed for its improvement.

[21] During the 1983-92 period 10-24 size group, and 24+ group were administered different survey forms.

[22] The unit observed in the data is a plant, not a firm. However, in Turkish manufacturing sector almost entirety of the plants is single plant establishments.

export and sales values. Second, trade protection rates are calculated by incorporating information on tariff and non-tariff barriers (see Appendix for details). As can be seen in Table 38A2 of the Appendix output weighted nominal protection rates show a declining trend.[23] Despite the general declining pattern of the tariff rates, however, sub-periods can be identified with significantly different behaviour of the tariff rates. Specifically, the decline in manufacturing wide tariff rates is about 30% during 1982-85, with no decline from 1986 to 1990, 65% during from 1990 to 1993, followed with a slight upward trend between 1994 and 1996.

Real wages is another sector level variable included in this study. It is important to note here that during the sample period real wages were primarily policy driven rather than market determined. After the coup d'etat in September 1980 real wages in Turkey were suppressed until the last two years of the decade. In the late 1980s and early 1990s, on the other hand, real wages increased reflecting government's shift towards populist policies.[24] As can be seen in the Appendix (**¡Error! No se encuentra el origen de la referencia.**A3) there is a significant increase in real wages during the sample period.

The final sector level variable is 4-firm *concentration ratios (CR4).* Average concentration ratios for the whole manufacturing sector as well as the trade-orientation groups are presented in Appendix **¡Error! No se encuentra el origen de la referencia.**A4 (though they are used at 3-digit level in our analysis). An inspection of the table indicates that as would be expected non-tradable has the highest concentration ratio, followed by import competing and exports oriented sectors respectively. In both the non-tradeable and export oriented sectors there is a significant decline by 1990. The import competing sectors on the other hand experienced an increase in the concentration ratios in the late 1980s followed by a decline in the 1990s.

Lastly we use r*eal exchange rate (RER)* as a macroeconomic variable that indicates the competitiveness of Turkish economy with respect to the "rest of the world". In Figure A1 of the Appendix RER is presented for the period. The figure indicates that the Turkish Lira's had a considerable real appreciation during the late 1980s is followed with significant depreciation in the early 1990s.

[23] Though the series reported is yearly, as described in the Appendix some of these years contain imputed values. We use such values in our discussion of descriptive statistic but do not in our regression analysis.

[24] Following the opening of the political competition in 1987 the Prime Minister Turgut Ozal and his government switched to economic policies that were expected to increase their chances of winning the general election. This was meant to give in the demands of various segments of the society, including the labor. Real wages in the public sector companies increased by more than the double between 1988 and 1991, and continued with steep hikes into the mid-nineties. The public sector wage hikes were followed by similar increases in the private sector.

IV. Plant Level Productivity Estimation

IV.1 Estimation

Estimates of plant level productivity in this study are obtained by an implementation of Olley and Pakes (1996) (OP from here on). As is well known the method is developed to address potential simultaneity biases that arise in production function estimations. This is illustrated by considering a Cobb-Douglas production function in log-levels as described below (at time *t* for firm *i* (suppressing the firm index *i*):

$$y_t = \beta_0 + \beta_l \cdot l_t + \beta_k \cdot k_t + \beta_\iota \cdot \iota_t + \omega_t + \eta_t \qquad (1)$$

where y_t is output, l_t is the variable input and k_t is the capital stock and, ι_t is intermediate inputs. Plant specific error term, ε_t is composed of a plant-specific productivity component, ω_t, and an i.i.d. component, η_t. The latter term has no impact on the firm's decisions. The productivity term, ω_t, which is not observed by the econometrician, is known by the firm, and it impacts the firm's decision rules. A simultaneity problem arises when there is contemporaneous correlation both within firm *i* and across time *t* between ε_t and the firm's inputs in the firm specific sequences.[25]

To address the simultaneity problem OP use investment to proxy for the part of the error correlated with inputs where investment demand function is then written as follows:

$i_t = i_t(\omega_t, k_t)$.

For positive values of investment $i_t(\omega_t, k_t)$ is inverted to yield ω_t as a function of capital and investment $\omega_t = (i_t, k_t)$. Even though we leave the firm's exit decision in this exposition, OP account for exit; we present results that estimate OP with and without exit for comparisons with other methods.) Substituting this expression into equation (1) yields output in terms of observable variables:

$$y_t = l_t \cdot \beta_l + \beta_\iota \cdot \iota_t + \phi_t(i_t, k_t) + \eta_t, \qquad (2)$$

[25] In the case of a two input production function, when both capital and labor are correlated with the productivity shock, but labor's correlation is significantly higher, and that labor and capital are correlated with each other, the parameter estimate of the labor coefficient will tend to be overestimated and the parameter estimate of capital will be underestimated. It is generally not possible to sign the biases of the coefficients when there are many inputs all of which potentially have varying degrees of correlation with the error term ε_t.

where $\phi_t(i_t, k_t) = \beta_0 + \beta_k \cdot k_t + \omega_t(i_t, k_t)$. Consistent parameter estimates of the coefficients on the variable inputs can then be obtained using a semi-parametric estimator (for example by modelling ϕ_t as a polynomial series expansion in capital and investment as in OP)[26].

A separate effect of capital on output from its effect on a plant's investment is obtained in a second stage by assuming that ω_t follows a first order Markov process and capital does not immediately respond to the innovations in productivity, where the innovation in productivity is defined as:

$$\xi_t = \omega_t - E[\omega_t \mid \omega_{t-1}].$$

Under these assumptions consistent estimates of β_k is obtained from the estimation of the following equation:

$$y_t^* = y_t - l_t \cdot \beta_l - \beta_t \cdot \iota_t = \beta_0 + \beta_k \cdot k_t + E[\omega_t \mid \omega_{t-1}] + \eta_t^* \qquad (3)$$

where, y_t^* is output net of labour's contribution and $\eta_t^* = \xi_t + \eta_t$. Since a by-product of the first stage is an estimate of ω_t a consistent estimate of $E[\omega_t \mid \omega_{t-1}]$ can be obtained and estimation of equation (3) yields consistent estimates of β_k.[27]

The production function estimates are presented in Table 19. As can be seen in Table 1 the coefficient estimates of material inputs are the largest in all industries (averaging about 0.70 across industries). The next largest is the labour coefficient, followed by the elasticity of energy. Note also that with the exception of capital stock elasticity almost all of the coefficients are estimated statistically significantly at standard levels of confidence and are of expected sign. Scale elasticity estimates exceed one in several industries (food miscellaneous, footwear, furniture, other chemicals, glass, nonferrous metals, fabricated metals, non-electrical machinery, and transport equipment).

In the next section we present comparisons of total factor productivity estimates obtained from OP with other estimators that have been commonly used in the literature such as OLS, fixed effects and instrumental variables. As an alternative to OP estimates we have also conducted estimations based on the method developed by Levinsohn and Petrin (2003). The method, which is built upon OP, relies on

[26] An important feature of the Turkish economy relevant to our undertaking is presence of macroeconomic cycles during the period under consideration as reflected in the cyclical pattern of real GNP growth rate. In our estimations we take these cycles into account by using dummies for the periods of expansion and contraction. More specifically we distinguish between for time periods: 1984-1987 (expansion); 1988, 1989 and 1991 (contraction); 1990, 1992, 1993, 1995, 1996 (expansion); and 1994 economic crisis.

[27] Olley and Pakes (1996) use a series expansion as well as kernel estimator for this stage. Also note that a constant can not be identified separately from the polynomial expansion in investment and capital.

employing intermediate inputs, instead of investment as the proxy variable to solve the simultaneity problem. Since in many data sets, including ours, the investment variable is zero for a large fraction of the observations (presumably due to adjustment costs) LP has a practical advantage of not truncating the observations with zero investment values. However, the LP method also requires that productivity shock is monotonically increasing in capital stock and the proxy input. In our data this condition does not hold for many industries, independent of whether we use intermediate inputs, or energy as a proxy input. Furthermore, when the monotonicity condition holds for more than one variable input LP method has an inherent inconsistency. In several industries we observe that monotonicity condition holds for more than one variable input. Thus comparisons based on LP estimates are not presented below.

IV.2 Stylised facts: Total Factor Productivity at the industry level

Before turning to plant level estimations of the next section we first compute and analyze industry level total factor productivity (calculated as output share weighted plant level productivities) to gain some insights into stylized facts of the period. Total factor productivity for plant *i*, in year *t* is

$$TFP_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_t t_{it} - \hat{\beta}_e e_{it} - \hat{\beta}_k k_{it} \qquad (4)$$

where TFP_{it} is the logarithm of the total factor productivity, y_{it} is the log level of real output for plant *i* at time *t.* Omitting the subscripts, l, t, e and k represent log of labour, intermediate inputs and energy used in the production process in year *t* and capital stock as of the beginning of year at time *t.* $\hat{\beta}$s with the appropriate subscripts are parameter estimates obtained from production function estimates.

Sector level productivity in year *t* is defined as output share weighted average of plant level productivities:

$$TFP_t = \sum_i \theta_{it} \cdot TFP_{it}$$

where, θ_{it} is output share of plant *i* in total industry output in year *t.*

TFP level for the manufacturing sector as well as the trade-orientation industry groups are presented in Figure 3. In **¡Error! No se encuentra el origen de la referencia.** and **¡Error! No se encuentra el origen de la referencia.**, we present the comparisons for the manufacturing sector as a whole and by trade orientation of manufacturing industries. The results for the manufacturing sector as a whole indicates that on average the Turkish manufacturing industry attained 1.77 % TFP growth per annum between 1982 and 2000. There is, however, a substantial difference across sub-periods. The comparisons presented in Table 16 indicate that large productivity gains take place during periods of large decreases in protection rates (during 1982-85, and 1989-93 productivity gains are 5.24% and 5.06% per annum, respectively). While

the 1982-85 coincides with the period of substantial reduction in tariff rates, 1985-88 is the period during which the import liberalization process came to a halt. Starting in 1988, the rapid TFP growth process was revived but not necessarily due to further tariff cuts. As we have seen in Figures 1 and 2, tariff cuts restarted in 1990 and lasted until 1993 in earnest. In five years from 1988 to 1993, manufacturing productivity growth was close to 25%, which implies 5% per annum. Following the reversal during the 1994 economic crisis the productivity growth resumed in 1995. However, it slowed down substantially. In the next 6 years following the 1994 economic crisis, productivity grew by less than 1% per annum.

Sub-period comparisons by industry trade orientations yields the largest productivity gains in import competing sectors irrespective of the method of averaging. As can be seen in **¡Error! No se encuentra el origen de la referencia.**, the productivity growth in import-competing sectors (2.96%) is more than four times that of the productivity growth in the export-oriented sectors (0.70%). Also note that even though the average productivity growth in non-traded sectors is 1.04% throughout 1982-2000, its contribution to the manufacturing industry productivity growth is less than 0.1%.

To gain insights into whether changes in industry level TFP growth result from within plant changes of productivity growth or between plant shifts we decompose changes in log productivity levels as in Haltiwanger (1997)[28]:

$$\Delta TFP_t = TFP_t - TFP_{t-1}$$

$$\Delta TFP_t = \sum_{i \in C} \theta_{i,t-1} \Delta TFP_{it} + \sum_{i \in C} \Delta\theta_{it} \left(TFP_{i,t-1} - TFP_{t-1}\right) + \sum_{i \in C} \Delta\theta_{it} \Delta TFP_{it} + \sum_{i \in Ent} \theta_{it} \left(TFP_{it} - TFP_{t-1}\right) - \sum_{i \in Ext} \theta_{i,t-1} \left(TFP_{i,t-1} - TFP_{t-1}\right) \quad (5)$$

The first term, the *within-plant* component of productivity growth is based on plant level productivity changes, weighed by preceding year's output shares in the industry. The second term is the *between-plant* component. It reflects the changing output shares of firms from one year to the next, weighed by the the firms' productivity level relative to the industry average in the previous year. As such, an increase in a plant's output share contributes positively to the between-plant component only if the plant is relatively more productive than the industry average in the previous year. The third term is the covariance term, which allows the plant's output share to change along with its productivity from one period to another. The last two terms in equation (5) capture the effect of net entry by subtracting the productivity of exiting plants from the productivity of entering plants.

The results of this decomposition are presented in **¡Error! No se encuentra el origen de la referencia.**.

[28] Pavcnik (2002) decomposes the deviation of plant productivity from a reference plant in the base year as in Olley and Pakes (1996). Since we decompose the *changes* in productivity levels the reference plant drops out.

Several important results emerge. First,. the within component is negative in all sub-periods except for the 1988-93 period, during which a country-wide rapid wage hikes took place forcing all plants to reduce slack at the plant-level.

Second , the *between component* of productivity growth is also negative throughout the sample period, while the covariance term is uniformly positive and large The negative value for the between component implies that, other things being equal, the plants that performed relatively better (worse) in the previous year lost (gained) market shares. This result may look strange, but becomes less so once we look at the contribution from the covariance-component. The large positive contribution from the covariance-component implies that the plants that succeeded in increasing their output shares along with their productivity accounts for the most important contribution to the industry-level productivity growth. The positive covariance-component is also consistent with the output share losses of plants suffering from productivity declines. When analyzed together the negative between-component and with the large positive covariance component of productivity growth imply that in the Turkish manufacturing industry it's the productivity improvement over time that counts for plants' success in increasing their output shares over time.

Finally, the contribution of net entry is quite large in the 1982-85 period, however, turns into negative declines in magnitude over time in comparison to the contribution of continuing plants. The message of these results is that though the relative contribution of productivity improvements resulting from within plant improvements and those resulting from reallocation of output across plants vary over the years, overall they both appear equally important.

As can be seen from **¡Error! No se encuentra el origen de la referencia.**, the results for the whole manufacturing sector largely hold for different sub-periods or different industry groups by trade orientation. Only during the 1988-93 period significant within productivity improvements are observed for import competing, and non-traded industries.

Overall, the results of the productivity decomposition exercise help us depict the productivity dynamics in the Turkish manufacturing industry. While two-thirds of the average productivity growth during the 1982-2000 period was contributed by the continuing plants, the entry of new plants and the exit of some of the exisiting plants accounted one-third of the productivity growth during the period. Among the continuing plants the industry-level productivity gains are mostly due to the firms that increase both productivity and output share over time. Both of these features highligh the dynamism of the Turkish manufacturing industry.

V. Explaining Productivity at the Plant-Level

V.1 Empirical model

The results in the previous section suggest that high productivity growth in the manufacturing sector took place during periods of decline in tariff rates and increased sector-wide real wage rates. There are obviously other factors that can affect the total factor productivity growth at the plant level. In this section, we focus on all possible factors that we can account for TFP growth at the plant-level.

Among other factors we include for macroeconomic, sector level and plant level characteristics that are expected to condition plant productivity. Specifically, we use year dummies to control for macroeconomic factors. Our sample period, 1982-2000, also includes a period of rapid increase in both public and private sector *real wages* (see Table A3 in the Appendix for the average real wage rates in the manufacturing industry and its subcategories). Evidence suggests that these increases were not a consequence of productivity increases of the previous years as one might expect[29]. On the contrary, productivity increases appear to have followed policy induced increases in wages. After the coup d'etat in September 1980 real wages in Turkey were suppressed until the last two years of the decade. In the late 1980s and early 1990s, on the other hand, real wages increased reflecting government's shift towards populist policies.[30] It is likely that faced with the rapid increase in wages, many firms were forced to undertake replacement investment in order to keep the unit labour costs under control. In addition, managerial and organizational changes that took place might have reduced X-inefficiencies. Thus, we include lagged sector average real wage rate (obtained at the four-digit SIC level).

We also include the Herfindahl index *(H)* in our productivity equation. This variable is introduced so as to capture the possible impact of domestic competition separately from impetus of imports as a source of competitive pressure on domestic plant productivity. In an imperfectly competitive market, where a small number of firms can effectively grab rather large shares of domestic sales of domestically produced output the smaller firms' ability to attain higher levels of productivity will be curtailed. Even if smaller plants can increase productivity, the market power of large plants will limit their ability to expand their market shares and hence returns to increased productivity will not be realized fully. In addition, as shown by Hopenhayn (1992) an increase in the market power of the largest plants can be a result of increased entry costs which

[29] The results of one of our ongoing projects show that in the Turkish manufacturing industry wages Granger-cause productivity during the 1983-1996.

[30] Following the opening of the political competition in 1987 the Prime Minister Turgut Ozal and his government switched to economic policies that were expected to increase their chances of winning the general election. This was meant to give in the demands of various segments of the society, including the labor. Real wages in the public sector companies increased by more than the double between 1988 and 1991, and continued with steep hikes into the mid-nineties. The public sector wage hikes were followed by similar increases in the private sector. (see Appendix Table A8)

is also expected to have an adverse impact on productivity of incumbent plants. As a result, one would expect the plant level productivity to be inversely related to the intensity of domestic market competition.

To capture the impact of trade policy changes we use current or lagged values of tariff rates. A concern with estimations of productivity on measures of trade policy is the endogeneity of trade policy. In other words, government authorities may increase trade protection in response to pressures from industries with productivity disadvantage. The choice of which industry should be more protected is far from random. However, the political economy of trade protection appears to have changed very little during the period under consideration. The year by year Spearman rank correlation of tariff rates among the 23 industries during the period is above 80. These numbers suggest that the structure of protection did not change much during the period. Thus, using industry dummy variables that control for these time-invariant characteristics of political economy of trade reforms can significantly reduce any potential biases.

Turning to plant level variables that are expected to have an impact on plant level productivity, *plant size* (measured by number of employees) is found to be an important variable in the existing literature (see Tybout 2000). Several studies suggest that larger plants are more productive than the smaller ones, thanks to the presence of scale economies. Since plant size may be influenced by increased exposure to trade (see Roberts and Tybout, 1991), and thus correlated with tariff rates, we use the plant size measured at the beginning of the sample observations for each plant (i.e. measured in the entry year of the plant).[31] Using these measures we create five size groups: size group 1 (10-24 employees), size group 2 (25-49 employees), size group 3 (50-99 employees), size group 4 (100-249 employees) and size group 5 (250+ employees). In our fixed-effect regressions, we do not include the plant size indicator as a separate explanatory variable. Instead, we use the interaction of the size indicators with the tariff rate as an explanatory variable, in order to gauge possible differences in the responses of plants with different size.

Other plant level variables are plants' entry and exit indicators, exporter status, share of skilled production workers, foreign shareholding. Findings in the literature largely suggest that plants that cannot attain a minimum level of productivity tend to exit. On the other hand, there is no definitive reason for entering plants to have higher productivity in their first year in the industry compared to the continuing plants. With respect to these variables, we expect the productivity to be higher in plants that export, plants that employ a larger fraction of skilled production workers, and owned wholly or partially by foreigners.

[31] The use of initial size may not solve the potential collinearity problem entirely as it is possible that in a market that is subject to trade regime openness the prospect of increasing import competition may result in increasing the size of entering plants. A cursory inspection of the data, however, does not yield support for this concern. In particular, a regression of log initial employment level on lagged log nominal protection rate does not yield statistically significant parameter estimates.

With the above considerations the productivity equation we estimate is as follows [32]:

$$TFP_{i,t} = \lambda_0 + \lambda_1 TFP_{i,t-1} + \lambda_2 NPR_{j,t-1} + \lambda_3 S_{i,t-1} NPR_{j,t-1} + \lambda_4 H_{j,t} + \lambda_5 A_{j,t} + \lambda_6 w_{i,t-1} + \lambda_7 Z_{i,t-1} + \lambda_8 Ent_{i,t-1} + \lambda_9 Ext_{i,t} + \mu_{i,t} \quad (6)$$

where

TFP_{it}^{j} = Total factor productivity of plant *i* in sector *j* and year *t* (log),

$\tau_{j,t-1}$ = Tariff rate for industry j in year *t-1*,

$S_{i,t-1}$ = plant size indicator

$w_{j,t-1}$ = Real wage rate in year t-1 (log),

$H_{j,t}$ = Herfindahl index at the 4-digit sectoral level,

$A_{j,t}$ = agglomeration at the province and 4-digit sectoral level,

Ent_i = entering plant indicator (at *t-1*),

Ext_i = exiting plant indicator (at the end of *t*),

$Z_{j,t-1}$ = Other plant characteristics (such as exporter status, skilled labour share in production, foreign shareholding)

$\mu_{i,t}$ = error term.

As can be observed in Figure 2 output-weighted average productivity levels differ substantially among industry group with import competing industry (IC) showing the highest productivity improvement through the period.

Using fixed-effects method we estimate equation (6) for the manufacturing industry as a whole as well as separately for industry groups by their trade orientations. As we discuss below in detail, we divide the manufacturing industry into three groups by their trade-orientation: Export oriented (EO); import competing (IC); and Non-traded (NT). In all fixed-effects regressions of the productivity equation, we also

[32] We should also remind here that as was discussed in the data section we run these regressions only for those years for which we have data available on lagged protection rates (1984, 1985, 1989-1992 and 1995).

include 4-digit sector and year dummies. We estimate the productivity equation both in levels and growth rates. In the equation with the level of productivity as the dependent variable we always include the lagged productivity level as a right hand side variable. All variables except for dummies and those with many zero values (such as the percentage of share held by foreigners) are in logarithms.

V.2 Results

We follow a stepwise approach in our empirical analysis. We first include sectoral tariff rates (current or lagged) as the only explanatory variable; then we include real wage rate (lagged median sectoral wage rate and lagged plant-level real wage rate) in the productivity equation.

Our first set of estimates is presented in Table 208. We estimate the effect of the lagged and/or current sectoral tariff rate on plant-level productivity alone with or without the lagged plant-level productivity. In order to see whether the tariff reduction have similar effects on plant productivity in different sectors, we report the estimates for the whole manufacturing industry as well as for the 2-digit ISIC industries. Irrespective of the use of the current or lagged tariff rate and irrespective of the inclusion of the lagged productivity as an explanatory variable, tariff cuts lead to higher productivity in manufacturing plants. Only when we include the current and lagged values of the tariff rate then the coefficient on the lagged coefficient turns out to be positive for three industry groups, namely 34, 36 and 38. However, given the high degree of correlation between these two variables it makes sense to consider only one of them at a time.

As expected the adjusted R^2 is quite high for the manufacturing industry as well as for the 2-digit ISIC industries. Obviously, such a high goodness of fit is expected when the number of observations used is in the tens of thousands and the productivity equation is estimated in levels rather than the growth rates.

The results for the whole manufacturing industry shows that a one percentage point decline in the tariff rates today leads to a 0.51-0.53 percent increase in productivity next period; a ten percentage point decline in the tariff rate leads to close to 5 percent increase in productivity. The inclusion of the lagged productivity term in the equation reduces the coefficient on the lagged tariff rate from 0.51 to 0.42 in absolute value. The coefficient on lagged productivity (in logs) is around 0.15, much less than unit value, indicating that it would not be correct to estimate an equation where the productivity growth rather the productivity in logs is the dependent variable.

The coefficient estimates on tariff rates differ substantially across two-digit industries. In general, it is lower in import competing and non-traded sectors such as 38, 31, 35, and 36, but much higher in export-oriented sectors such as 32, 33, 34.

Showing the effect of tariff rates on plant-level productivity to be negative for the two-digit industry groups, we do not continue our empirical analysis with the for the same industry groups. Instead, we prefer to continue our separate empirical analyses for trade-oriented industry groups. In addition to the whole manufacturing industry, we estimate the productivity equation for export-oriented, import-competing and non-traded sectors as we described above (see Table 19). Along with the tariff rate now we include the log real wage rate at the sectoral and plant level, in order to control for the productivity response to the rapid wage hikes of the late 1980s and early 1990s**. In the whole manufacturing industry, import-competing and export-oriented industries, irrespective of using the current or lagged values of the tariff rate and/or the real wage rate, the plant-level productivity increases in response to a decline in tariff rates and to an increase in the real wage rate**. Only in the case of non-traded industries the plant level productivity decreases in response to an decrease n tariff rates. However, this positive response of the productivity of plants to tariff rates in non-traded sectors is statistically significant when the sector's median real wage rate is used rather than the plant level real wage rate. The coefficient estimates on the real wage rate is much smaller when we use the plant-level wage data rather than the median wage rate for the four-digit ISIC sector.

A one percent increase in the plant's real wage rate today leads to an increase of only 0.04% increase in the plant's productivity in the next period, whereas a one percent increase in the sector's median real wage rate leads to an increase of 0.22% in plant's productivity. The respective magnitudes of the coefficient estimates clearly show that when the median wage rate for the 4-digit industry is affected then the productivity response was larger. The median real wage rate for the all manufacturing plants in our dataset increased from 715 thousand 1990 Liras in 1988 to 1468 thousand Lira in 1993. This implies that the productivity increased by close to 23% during the 1988-1993 period. The coefficient on the plant's real wage rate is low most likely because of the simultaneity bias. The results reported in Table 21 clearly show that we need to use the sectoral median wage rate as the explanatory variable rather than the plant-level real wage rate.

The sectoral median real wage effect on productivity is larger in the import-competing and non-traded goods sectors and smaller in the export-oriented sectors. This is expected even though EO sectors are more labour intensive. This is so, perhaps because the EO sectors also tend to have more informal employment and employees are not members of labour unions. Furthermore, wage rates tend to be higher in import competing and non-traded sectors, and hence its impact on cost of production can be more significant. These phenomena help explain why the impact of real wage increases on productivity tend to be more important in the IC and NT sectors.

Before incorporating plant characteristics as explanatory variables, we allow for the **interaction of the tariff rate with plant size** to observe whether the productivity response to the movements in tariffs differ across plants in different size groups. The coefficient estimates for this regression are presented in Table 22. For the manufacturing industry as a whole, the coefficient estimates on the plant size and the tariff rate interactions are all negative and significantly different from zero, indicating that plants with 25 plus employees respond more significantly to a reduction in tariff rates compared to plants with 10-24 workers. Furthermore, **the coefficient estimates increase in absolute value with the plant siz**e. Even though, the coefficient on the largest plant size group is smaller than the size group 4 (plants with the number of employees between 250 and 499), this is an artefact of the fact that the number of plants with 250 to 499 employees far exceed the number of plants with 500 plus employees. In any case, this result implies that for the manufacturing industry as a whole plant size matters for the impact of tariff cuts. The larger the plant size the larger will be the productivity improvement as a result of a tariff cut. The coefficient estimates for different trade-orientation groups clearly shows, however, that this result is only partially carried to the trade-orientation groups. While some coefficients on interaction terms are negative and statistically significant, there is no clear pattern to claim that the results for the whole manufacturing industry apply when we classify manufacturing sub-sector into three trade-orientation groups.

Next, in Table 23 we present the productivity equation estimates with **quadratic tariff effects**. For the manufacturing industry, the EO and the IC groups, the estimate of the coefficient on the tariff rate is negative whereas the one on the quadratic term is positive and statistically significant. It is the other way around in the case of NT group. While the coefficient estimate on the tariff rate is positive for the NT group, the one on the quadratic term is negative. The coefficient estimates for the manufacturing industry, EO and IC groups show that the elasticity of the productivity with respect to the tariff rate (in absolute value) decreases with the level of the tariff rate. For example, in the case of manufacturing industry with the sector median real wage rate included on the RHS, the corresponding elasticity w.r.t. the lagged tariff rate decreases from 0.075, to 0.049, 0.034 and 0.018 for the tariff rates 25, 15, 10 and 5 percent, respectively. As the tariff rate is reduced by 10%, from 25% to 22.5%, the productivity grows by 0.75%, whereas if the tariff rate is reduced from 10% to 9% (again by 10%) the productivity grows by only 0.34%. This result is consistent with the theory. **As the trade liberalization takes a hold and the economy becomes more and more open to import competition, the impact of further tariff reduction on productivity will become less important**.

In Table 24, we present the fixed-effect regression estimates of the productivity equation including the **sector and plant characteristics**. The first set of results cover the 1982-2000 and the second set of results cover 1990-2000 period. While we include the sectoral export-output ratios in the first panel, the time

period considered is shorter in the second panel because the export status indicator is available only after 1990.

Let us first focus on the 1982-2000 period. Aside from the tariff rate and its quadratic term and the sectoral real wage rate, we include the Herfindahl index and the export-output ratio are the sector level explanatory variables. The coefficient estimate on the Herfindahl index is negative and statistically meaningful for the manufacturing industry and for the non-traded sectors indicating that **plants in less competitive market have lower level of TFP**. Herfindahl index is the sum of the square of the output shares across all plants. In the case of a monopoly it is equal to one. As the economy becomes closer to full competition, the Herfindahl index converges to zero. The coefficient estimate for the manufacturing industry (-0.154) implies that a one percentage point increase in the Herfindahl index contributes to -0.15% decline in productivity. Economically this impact is not very small. The negative impact of a move away from competition is even larger in the case of non-traded sectors.

With an expected positive sign, the coefficient estimate for the sectoral export-output ratio indicates that holding other variables constant **productivity of a plant tends to be higher in 4-digit ISIC sectors with higher export-output ratios** and it increases as the sectoral export-output ratio increases over time. The result holds when we include those plants in EO industry groups, but the coefficient estimate for the IC group is negative. This negative sign could be a result of 1994 crisis. When the economy was hit by the crisis domestic demand collapsed and all industries had to try export markets. As a result, in many sectors the export-output ratio increased after the 1994 crisis. During the same period, however, total factor productivity declined because plants had to lower their production below full capacity.

Moving from sector characteristics to plant characteristics let's start with the **entry and** exit. The coefficient estimates for the lagged entering plant dummy show that the entering plants are on average 1.2% less productive compared to other plants. The entering plants tend to be close to 2% less productive in export-oriented and imported-competing sectors. **As expected the productivity disadvantage of the entering plants is not very large. The productivity deficit of the exiting plants, on the other hand, is almost twice as big.** A plant that exits at the end of year *t* is 3% less productive compared to the continuing plants.

Next, we focus on the effect of the foreign ownership on productivity. As the foreign share ownership of the plant increases by 10 percentage points, the productivity of the plant increases by 0.53%. **The positive impact of the foreign ownership on productivity seems to be more valid for the IC group of industries** (at the ten percent significance level).

Share of skilled production workers matters for the plants in IC sectors and not in other trade-orientation groups. When all manufacturing plants are considered the impact of the skilled production worker share on productivity becomes less significant.

Location specific externalities in production, measured by the **agglomeration variable**, also help improve productivity for all manufacturing sectors as well as plants in the EO and NT sector groups. When the 4-digit ISIC sectoral output share of the province where the plant is located (excluding the output of the plant) increases by 1 percentage points, this enables the plant to improve its productivity by 0.4%. While the agglomeration effect is not present in the IC sectors, with coefficient estimates of 0.77 and 0.52, it is much stronger in the export-oriented and non-traded goods sectors, respectively. This result is quite important from a policy perspective. It helps us explain the successes of the provinces such as Denizli, Gaziantep, Kayseri and Konya, beyond the industrial heartland of the country, the Marmara region. Furthermore, this result clearly indicates that if Turkey wants to consider an industrial policy it has to exploit the external scale economies at the province level through encouraging clustering.

The coefficient estimate on the sectoral export-output ratio is positive for the whole manufacturing, export-oriented and non-traded goods industries, but negative for the import-competing sectors. When we include the exporter dummy (which available only after 1990) rather than the sector's export-output ratio the coefficient for the IC sector becomes positive but insignificant. The reason for the inverse impact of the export-output ratio could be related to the crisis years. When the domestic demand shrinks rapidly during the crisis and bust years, the import-competing sectors look for export markets and the export-output ratio which is already quite low tends to increase during the crisis years. At the same time, during these periods as their output declines with rather a slow decline in employment, labour productivity and the total factor productivity decline significantly. As a result it is possible to obtain an inverse relation between the export-output ratio and the productivity.

We have already discussed above the possible **influence of the plant size on the plant's productivity** response to tariff cuts. In Table 253, we include the interaction of the plant size with the tariff rate as an explanatory variable for five plant size groups along with other plant characteristics. Obviously, in order to simplify the estimations we exclude the quadratic tariff term outside the regression when we are focusing on the plant size effect. When we focus on the 1982-2000 period and hence using the sectoral export-output ratio rather than the exporter status of the plant, the fixed effect regression results are quite similar to the ones obtained in Table 22. When we consider all manufacturing plants together, **the productivity response of a plant to tariff cut increases in magnitude with plant's size**, measured by the employment level. Furthermore, including the interaction term does not any significant change in the coefficient estimates for other plant characteristics. When we include the exporter status of the plant on

the right hand side and therefore focus on 1990-2000 period, the interaction terms turn out to have no impact on the productivity response (see Table 24). Actually, when considered together with the interaction terms, the coefficient on the tariff rate turns to be insignificant. To be discussed

In the final part of our analysis, we focus on **explaining the productivity growth rather than the level.** The results of the fixed regressions are presented in Tables 25 through 27. Results for productivity growth equation are very much in the spirit of the results for productivity level equation. Again, a cut in tariff rates generate a significant response in the form of higher productivity growth. A one percentage point increase in the magnitude of the tariff cuts leads to 0.38 percentage point increase in the productivity growth when we pool all manufacturing plants. When pool only the plants in the IC group of industries, the response to a one percentage point increase in the size of the tariff cut increases further to 0.75 percentage point increase in the productivity growth. The plant size does not seem to matter for the response of the productivity growth to a change in the magnitude of tariff cuts. Furthermore, the coefficient estimates on changes in sector and plant characteristics are not as statistically significant as in the productivity level equation. However, **overall the productivity growth equation estimates support the results we obtain from the level equations**: throughout the 1982-2000 period tariff liberalization decisions by the government reduction led to significant productivity improvements in the Turkish manufacturing plants.

VI. Impact of trade liberalization on firm survival and export decision

The analysis of the plant-level data showed that the process of trade liberalization that Turkey experienced throughout the 1980s and 1990s led to significant productivity gains by Turkish manufacturing plants. In addition, the rapid wage hikes of the late-1980s and early-1990s did also have a major impact on the productivity of the manufacturing plants. The results showed that plant characteristics are also quite crucial for the productivity performance at the plant level.

In this part of our study, we shift gears and focus on the impact of trade liberalization from a different angle. More specifically, we analyze whether and how much trade liberalization affects plants' decisions to export and the probability of plant survival in the marketplace.

VI.1 Firm survival

Model

In order to test the effects of export status and trade liberalization on survival prospects, we estimated a Cox proportional hazard model

$$h_{ij}(t) = h_j(t)e^{X_{ijt}\beta} \qquad (7)$$

where $h_{ij}(t)$ is the probability of exit at time t of firm i operating in industry j conditional on surviving until time t, $h_j(t)$ is the industry-specific baseline hazard function defined at the ISIC (Rev. 2) 3-digit level, X is a vector of explanatory variables, and β is a corresponding vector of coefficients. Subscripts i, j, and t denote "firm", "industry", and "time", respectively. The β parameters are estimated by the maximization of the partial likelihood function that does not require the specification of $h_j(t)$. The industry-specific baseline hazard rates, $h_j(t)$, are estimated nonparametrically, and they account for changes in hazard rates by the age of the firm.

The following variables are used as explanatory variables:

- **Export status (*expdum*):** This is a dummy variable that is equal to 1 if the firm exported any product at time *t*, 0 otherwise. It is used to test if exporters are less likely to exit than non-exporters. If exporters are less likely to exit than non-exporters with similar firm and industry characteristics, the export status variables will have a negative coefficient in the Cox proportional hazards model in which the dependent variable is the event of a firm's *exit* at a particular time *t.*
- **Import tariffs (*mtax*)[33]:** The level of import tariffs at the ISIC 4-digit level is used to analyze the effects of import protection on survival prospects. If domestic firms live longer in protected markets, the coefficient of the **mtax** variable will have a negative coefficient.
- **Relative labour productivity (*rellp*):** Relative labour productivity is defined as the (log) labour productivity of the firm divided by the sector average (sector is defined at the ISIC 4-digit level). Since less productive firms are likely to exit first, the coefficient of the **rellp** variable is expected to be negative.

[33] As for the construction of this variable which is not readily available, see Appendix.

- We also include into our model ***interactions terms*** (**expdum*mtax**, **rellp*mtax** and **rellp*mtax*expdum**) to test if import protection has different effects on exporters/non-exporters and more productive/less productive firms.
- The **effect of foreign competition on survival** is also tested by four sector-specific variables: the annual growth rate of imports from developed (**grm_dc**) and developing countries (**grm_ldc**), and the annual growth of real exports to developed (**grx_dc**) and developing countries (**grx_ldc**).

There is a number of **control variables** included in the model:

- **Firm size (*size*).** Firm size is measured by the (log) number of employees. There are numerous empirical studies that show that large firms are more likely to survive. Therefore, a negative coefficient is expected for the size variable.
- **Foreign ownership (*fdi*).** This is a dummy variable that is equal to 1 if at least 10 % of the stocks of the firm are held by foreign agents, 0 otherwise. This variable is used to test if foreign-owned firms have a different survival oprobability than the domestic ones. If foreign firms are footloose, the **fdi** variable will have a positive coefficient. However, if foreign ownership increases the survival probability of foreign firms, its coefficient will be negative.
- **The market share of foreign firms** (***fdimsh***). The market share of foreign firms is defined as the share of all foreign firms in total industry output where the industry is defined at 4-digit ISIC level (Rev. 2). If foreign firms intensify competition in the domestic market, and reduce survival prospects (for domestic firms), the coefficient of the **fdimsh** variable will be positive.
- **The market share of the firm** (***msh***). The market share of the firm is equal to thefirm's share in total industry output (at the ISIC 4-digit level), and is included in the model to control for the effects of market power on survival. Since the model includes the **size** variable as well, the market share variable controls the effects of relative market power.
- **The level of concentration** (***hhi***). The level of concentration in the market (at the ISIC 4-digit level) is measured by the Herfindahl index. If it is more difficult to survive in concentrated markets, the **hhi** variable will have a positive coefficient.
- **Capital intensity** (***kl***). Capital intensity of the firm is defined by (log) capital-labor ratio where "capital" is proxied by the (real) value of depreciation allowances. If sunk costs are important, the capital intensive firms will have higher survival propabilities.
- **Average wage rate paid** (***lw***). Finally, the model includes the (log) average real wage rate as a control for the quality of the labor force. Since the average wage rate increases with the

qualification of the labor employed by the firm, this variable reflects the effects of employing skilled labor on survival.

Data

We use the data obtained from the Annual Survey of Manufacturing Industries as explained in Section III.2. Since one of the main variables of interest is the export status variable which is available after 1990, the model is estimated for the 1990-2001 period. The exit event of those firms that survived until the end of 2001 is not observed; i.e., the distribution of the dependent variable is censored at year 2001. Since the time for event is the age of the firm, the data used in estimating the Cox proportional hazards function includes only new firms established in this time period.

Estimation results

Estimation results for all sectors are presented in Table 28. Most of the variables have expected effects on survival: productivity, size, capital intensity and skilled labor are all conducive to survival whereas those firms operating in concentrated industries are more likely to exit. It is also found that, with all characteristics being the same, foreign firms are more likely to exit, i.e., foreign firms are footloose.[34] The market share of foreign firms does not have any significant impact on the survival of domestic (and other foreign) firms, i.e. foreign competition in the domestic market does not matter for survival. Moreover, market share of the firms does not have any statistically significant effect on survival once the firm size is controlled for.

Among the trade-related variables, the effect of export status on survival appears to be a robust one. Exporter firms, even after controlling for their productivity and size, have higher survival probabilities than non-exporter firms. Although exporter firms tend to be more productive and larger than non-exporters, export status itself is one of the main determinants of survival. It seems that exporters can enhance their survival prospects by market diversification, reducing their risks by participating in foreign markets, anticipating market and technology trends, etc. Moreover, high sunk costs of entry into foreign markets may also lead to a difference in survival prospects of exporters and non-exporters.

[34] Note that foreign firms are, on average larger and more productive than domestic firms. Therefore, foreign firms have higher survival probabilities when other variables like size and productivity, are not controlled for.

The coefficient of the **mtax** variable (import tariffs) is negative in all models, i.e., firms operating in protected markets have higher survival probabilities, but this effect is not statistically significant at the conventional 10 % level. Therefore, our empirical findings do not provide a strong evidence for the hypothesis that domestic firms are protected by high import tariffs.

The interaction between exporter status and import tariffs (**expdum*mtax**) provides an interesting piece of evidence on the impact of trade restrictions. The coefficient of the **expdum*mtax** interaction is positive and it is statistically significant at the 5 % level in all models. It seems that high level of foreign trade protection is harmful for exporters, i.e., high import tariffs reduce survival probabilities of exporter firms. This effect could arise if foreign trade protection enhances competitiveness of non-exporters vis-à-vis exporters.

Last, but not least, the growth rate of exports to developed countries seems to be important for survival. A firm operating in an industry that improves its competitiveness in developed country markets has a higher survival probability. The coefficient of the growth rate of exports to developing countries is also negative, but it is not significant at even the 10% level.

The determinants of survival are estimated for three sub-groups of industries classified by their trade orientation: export-oriented industries, import-competing industries, and non-trading industries. Estimation results are presented in Tables 30, 31, and 32, respectively. The results for sub-groups of industries are rather similar. In all sub-groups, relative labor productivity, size and exporter status are among the most important determinants of survival. In export-oriented and non-trading sectors, import protection has a negative impact on the survival prospects of *exporters*, whereas in import-competing sectors (**expdum*mtax** interaction), *more productive exporters* are negatively affected by trade protection (**expdum*mtax*rellp)**. Since these two variables are highly correlated, we can conclude that there is not much difference between sectors in that respect.

Last, but not least, the growth rate of exports to developed countries seems to be important for survival.

Regarding foreign firms, sectoral findings suggest that foreign firms in import-competing industries are footloose but in other sectors, especially in export-oriented industries, foreign ownership does not matter for survival. Finally, the wage rate, as a proxy for skilled labor, does not have any impact on survival in import-competing industries, whereas the capital intensity, as a measure of sunk costs, has an insignificant coefficient in non-trading sectors.

To summarize, we can conclude that export status is one of the main determinants of survival. Even when labor productivity and size are controlled for, exporter firms have higher survival probabilities than non-exporter firms. However, exporters are negatively affected by foreign trade protection, i.e., import tariffs

discriminate against exporters. Since exporter status is very important in determining the survival prospect, we will analyze the determinants of export decision in the next section.

VI.2 Export decision

Model

The determinants of export decision are analyzed in an export decision model which is estimed by random effects logit method. Export decision is a dynamic discrete choice problem. However, following the practice in the empirical literature, a reduced form model is estimated in which it is assumed that the expected gross profits from exporting depend on exogenous firm characteristics and macro conditions.The firm exports in a given time period if the value of expected profits is positive. Thus, the model of export decision is defined by the following equation

$$I_{it} = \begin{cases} 1 & if\ 0 \le \mu_t + \beta X_{it} + \gamma . I_{it-1} + \varepsilon_{it} \\ 0 & otherwise \end{cases} \qquad (8)$$

where I_{it} is the export decision (it takes the value 1 if the firm i exports at time t, 0 otherwise), μ_t are time dummy variables used to capture the effects of macroeconomic shocks, the vector X_{it} is a set of characteristics of the firm including unobservable firm-specific effects, and ε is the error term. The lagged value of the dependent variable, I_{it-1}, is included in the model to capture the dynamics of adjustment.

We use the following variables in the export decision model:

- **Lagged export status (*L.expdum*):** The lagged value of the dependent variables is included in some models to capture the dynamics of adjustment and persistence in export behavior.
- **Import tariffs (*mtax*):** The level of import tariffs at the ISIC 4-digit level is used to analyze the effects of import protection on export decision. If firms tend to be exporters in protected markets, the **mtax** variable will have a positive coefficient.
- **Relative labour productivity (*rellp*):** Relative labour productivity is defined as the (log) labour productivity of the firm divided by the sector average (sector is defined at the ISIC 4-digit level). The self-selection hypothesis suggests that only more productive firms can overcome the fixed costs of exporting, and participate in foreign markets. If this is the case, then the coefficient of the **rellp** variable is expected to be positive.

- The interaction between relative labor productivity and import tariffs (**rellp*mtax**) is used to test if import protection has a different effect on the export decision of more productive firms.
- **Firm age (*age*)**: The (log) firm age is used to check the effects of experience on export decision. If its coefficient turns to be positive, we can conclude that olders firms are more likely to participate in foreign markets.
- **Firm size (*size*):** Firm size is measured by the (log) number of employees. A positive coefficient is expected for the size variable because large firms are more likely to export.
- The **effect of foreign competition on export behavior** is also tested by four sector-specific variables: the annual growth rate of imports from developed (**grm_dc**) and developing countries (**grm_ldc**), and the annual growth of real exports to developed (**grx_dc**) and developing countries (**grx_ldc**).
- **Foreign ownership** (***fdi*).**This is a dummy variable that is equal to 1 if at least 10 % of the stocks of the firm are held by foreign agents, 0 otherwise. If foreign firms are more likely to be exporters, the coefficient of this variable will be positive.
- **Investment expenditures (*linvest*):** We also use the (log) value of real investment expenditures to look at the relations between investment and exporting. If firms tend to make investment to grow to enter foreign markets, the coefficient of the **linvest** variable will be positive.

Data

We use the data obtained from the Annual Survey of Manufacturing Industries as explained in Section III.2. Since the export status variable is available only after 1990, the model is estimated for the 1990-2001 period. The dataset used in the econometric analysis covers only new firms established after 1990 because we would like to analyze the determinants of export decision over the life-cycle of firms.

Estimation results

Estimation results of the random effects logit model for all sectors are shown in Table 29. We first estimate static models (models 1-3), then the dynamic models that include the lagged dependent variable is included are estimated (models 4-6). In all models we find **strong support for the hypothesis that more productive firms self-select into foreign markets**. Moreover, even after controlling for productivity, large firms are found to have higher probability of participating in foreign markets.

The firm age has also a positive coefficient in static models, i.e., old firms are more likely to be exporters. But the coefficient of the firm age variable becomes negative (and significant) in dynamic models, i.e., conditional on past export status, *older firms are less likely to be exporters* than are younger firms.

Among the trade-related variables, **the import tariffs seem to have no significant impact on export decision**. The coefficients of the **mtax** variable are statistically insignificant in all static models, and statistically significant at only 10 % level in two dynamic models. Surprisingly, estimation results for sub-groups of industries reveal that import tariffs do matter in only non-trading industries (see Tables 33-35). The interaction between relative labor productivity and import tariffs has also statistically insignificant coefficients.

The coefficient of foreign ownership variable is positive but statistically significant only in static models. Therefore, the findings suggest that foreign firms are more likely to participate in foreign markets, but foreign ownership itself has only a weak impact on export decision. Investment expenditures, however, have positive and significant coefficients in both models. This result shows that firms tend to speed up investment when they decide to enter into foreign markets.

The lagged export status has invariably very significant and positive coefficients. These results provide additional strong support for the hypothesis that sunk costs in entering foreign markets are important. Once a firm commits itself into foreign markets by covering the sunk costs at the time of entry, the firm tends to stay in foreign markets. Therefore, sunk costs create persistence in export behavior, i.e., exporters tend to remain as exporters.

The export decision model is estimated for three categories of industries by trade orientation (see Table 33-35). The results for export-oriented sectors are almost same as the results for all sectors but there are two curious discrepancies. First, growth rate of exports to developing countries (and, to some extent, growth rate of exports to developed countries) has a positive impact on exporting probability in export-oriented industries. Moreover, the investment variable has a positive but statistically insignificant coefficient. In other words, firms in export-oriented industries seem to react more to export opportunities in developing countries, but they do not speed up their investment in that process.

The results for import-competing industries are also very similar, but the interaction term between relative labor productivity and import tariffs has now a positive and significant coefficient in the dynamic model (see Model 6 in Table 34). More productive firms are more likely to be exporters when tariffs are higher in import-oriented industries. This finding supports earlier findings on export decision in import-competing industries, because in import-competing industries, high tariffs provide a shelter for less

productive firms. Under these conditions, more productive firms may tend to go abroad (higher export intensity) and enhance survival prospects.

Foreign firms operating in non-trading sectors seem to have a stronger tendency to be exporter (see Models 3 and 6 in Table 35). Interestingly, exports to developing countries in non-trading sectors have a negative impact on export decision. All other variables have similar effects on export behavior as discussed before.

VII. Conclusions

In this section, after an introduction part and a section devoted to the survey of empirical studies about the Turkish economy, we examined the response of plant productivity to trade policy changes in sections 4 and 5. Using an unbalanced panel of 152,240 plant year observations for the 1983-2001 period we estimate plant productivities. The estimation is undertaken following the procedure of Olley and Pakes so as to eliminate potential simultaneity biases that are present in OLS estimations.

We analyse plant productivities in several different ways. First we create industry averages and inspect their evolution over time, and across sectors by trade orientation. We observe that productivity gains are largest in import competing industries with highest gains reaching to 8% per year during periods of rapid decline in protection rates. Next we decompose the productivity gains to those resulting from reshuffling among plants and those resulting from within plant productivity improvements. We find again that there are important differences across sectors by trade orientation. Though reallocation of market shares to more productive plants are important in both export oriented, and import competing sectors, within plant productivity improvements are significant only in export oriented sectors. Finally we investigate the effects of changes in protection rates on plant level productivities using fixed-effect estimations that include the lagged level of productivity. In these regressions we control for endogeneity of protection rates (tariff and non-tariff) as well as other potential important determinants of productivity improvements during the period under consideration, such as intensity of domestic competition, government induces wage changes and real exchange rate changes.

We find that productivity improvements resulting from declining protection levels are statistically significant and economically important, especially in import competing sectors. Plants in less competitive

market have lower level of TFP. he positive impact of the foreign ownership on productivity seems to be more valid in the import competing sector. Finally, we find evidence of positive effect of agglomeration at the province level for productivity. As a consequence, industrial policy should favor external scale economies by encouraging clustering.

As expected the productivity disadvantage of the entering plants is not very large. The productivity deficit of the exiting plants, on the other hand, is almost twice as big. Our analysis also suggests that there is a huge degree of heterogeneity, measured by plant size, in response to changes in protection rates. The larger the plant size, the larger will be the productivity improvement as a result of a tariff cut. In the case of Turkey, the small firms are more likely to face credit constraints than the large ones. Consequently, their response to trade liberalization is constrained by their limited access to credit. The reason why this is so, is directly related to the large government budget deficits and the macroeconomic uncertainty at the time. As a result, during the period of analysis the real interest rates never went below 10% and much of the time closer to 20% and rarely at times reached to the levels of 30%. Therefore, even if the small firms are willing to respond to trade liberalization, they cannot undertake needed investment/rationalization projects due to high financing costs. During this period Turkish Small and medium enterprises (SMEs) mostly use bank credit to satisfy their short-term working capital needs.

In section VI, we use the same firm-level database over the period 1990-2001 in order to examine the effect of trade liberalization – i.e. reductions in tariff rates on the entry decision of firms on export markets as well as the impact of these reforms on the survival patterns– of firms.

As for the entry decision of firms in export markets, estimation results are strongly in favor of the hypothesis that more productive firms self-select into foreign markets. Moreover, even after controlling for productivity, large firms are found to have higher probability of participating in foreign markets. The import tariffs seem to have no significant impact on export decision. Thus, import duties seem to exert positive and sometimes significant effects in non-trading industries. Our results provide strong support for the hypothesis that sunk costs in entering foreign markets are important. Once a firm commits itself into foreign markets by covering the sunk costs at the time of entry, the firm tends to stay in foreign markets. Therefore, sunk costs create persistence in export behavior, i.e., exporters tend to remain as exporters.

Export status and size are the main determinants of survival. Consistent with previous results, we find that small firms are more willing to exit the market. Even when labor productivity and size are controlled for, exporter firms have higher survival probabilities than non-exporter firms. As for the impact of trade reforms on the survival patterns of firms, results provide some evidence for the hypothesis that exporters

are less likely to survive in protected markets. This result may be explained by the fact that foreign trade protection increases the relative competitiveness of non-exporters in relation to the one of exporters.

VIII Tables

Figure 1Turkey: Output-weighted Average Tariff Rates, Manufacturing Industry and Trade-based Industry Groups

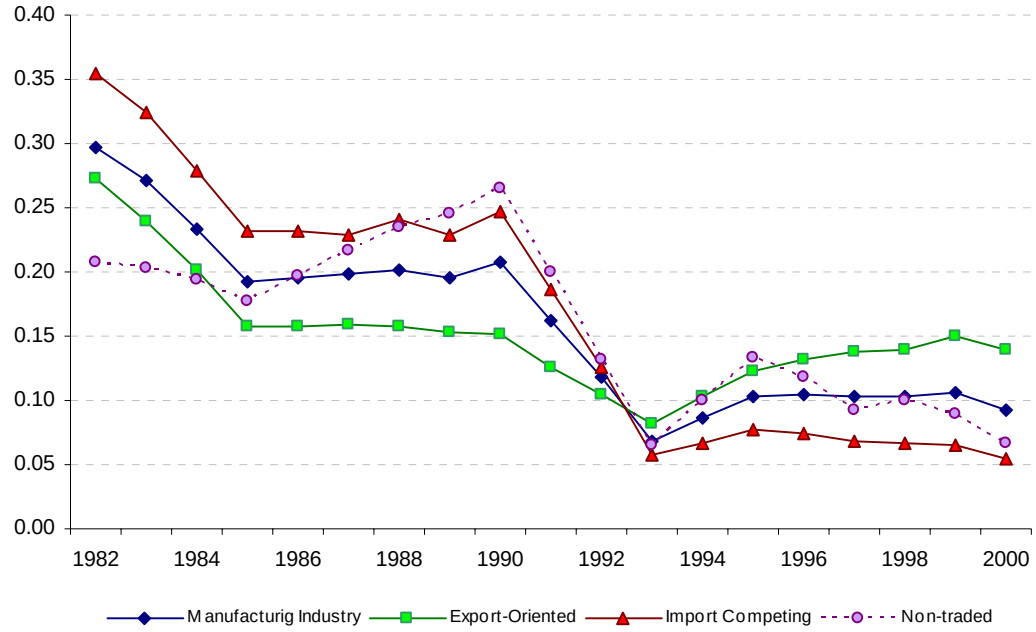


Figure 2 Turkey: Unweighted Average Tariff Rates, Manufacturing Industry and Trade-based Industry Groups

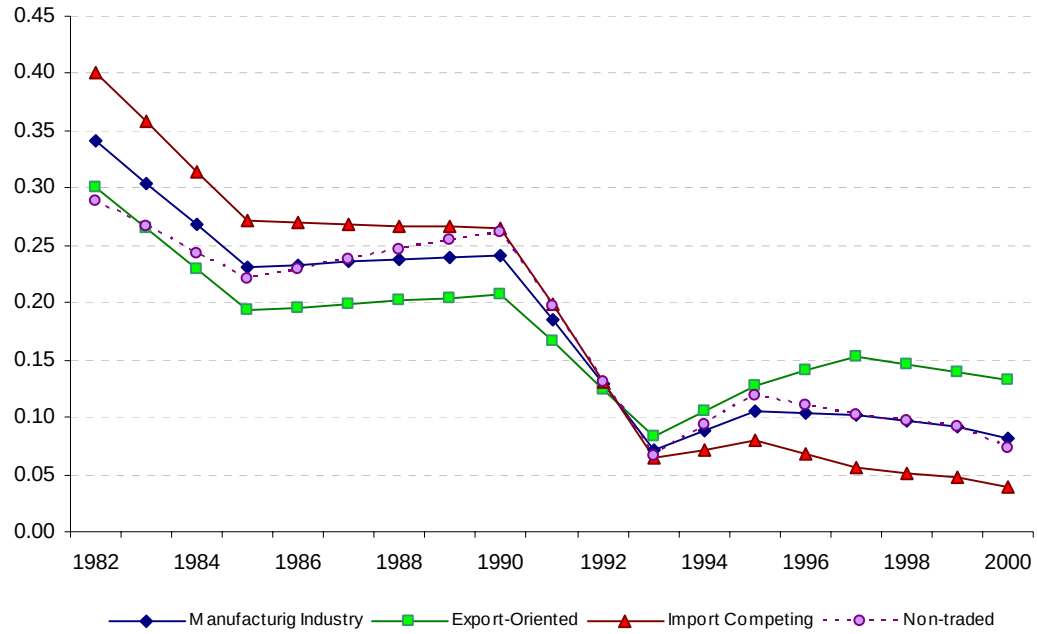


Figure 3Turkey: Olley-Pakes Estimates of TFP, Manufacturing Industry and Trade-based Industry Groups

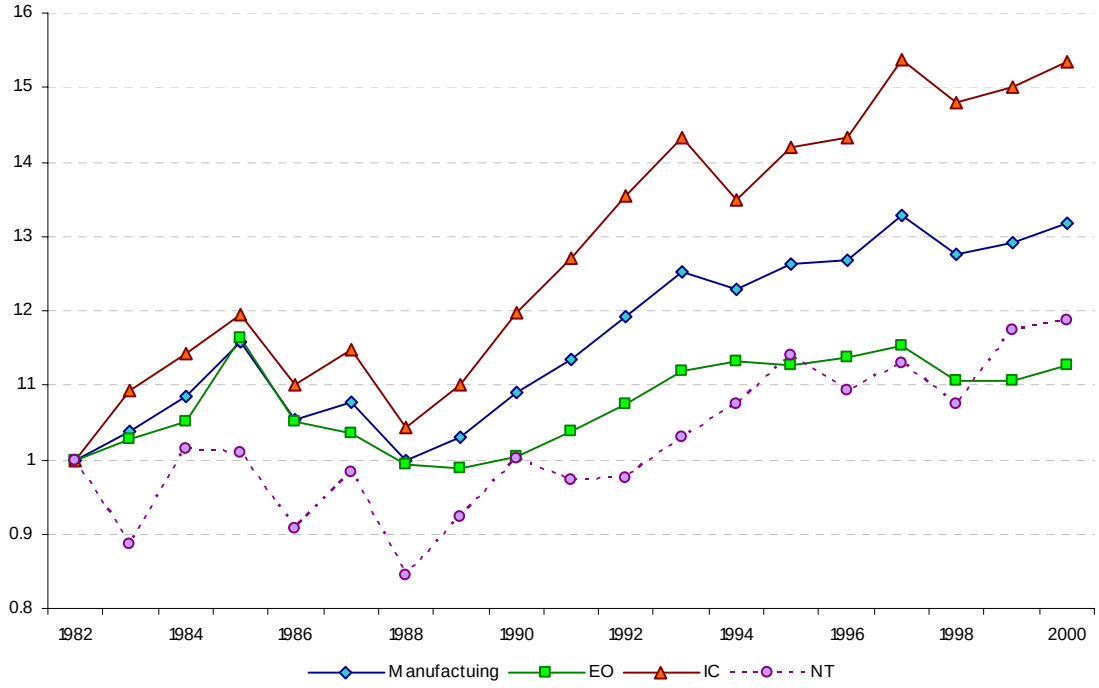


Table 17 Turkey: Total Factor Productivity Growth in the Manufacturing sector

	All	EO	IC	NT
1982-2000	1.77	0.70	2.96	1.04
1982-1985	5.24	5.46	6.50	0.32
1986-1988	-5.26	-5.69	-5.04	-5.47
1989-1993	5.06	2.53	7.78	3.69
1994-2000	0.94	0.09	1.44	2.24

Table 18 Turkey: Total factor productivity growth in the manufacturing sector and its decomposition (%)

	Total	Within	Between	Covariance	Continuing Total	Net Entry	Entry	Exit
Manufacturing								
1982-2000	1.77	-1.8	-2.9	5.9	1.2	0.6	0.9	0.3
1982-1985	5.24	-3.6	-6.5	11.1	1.0	4.2	4.1	-0.1
1985-1988	-5.26	-6.5	-2.8	5.3	-4.0	-1.2	-0.7	0.5
1988-1993	5.06	2.4	-1.5	3.8	4.8	0.3	0.5	0.2
1993-2000	0.94	-2.0	-2.4	5.3	0.9	0.0	0.5	0.4
Export Oriented								
1982-2000	0.70	-2.4	-2.7	5.8	0.7	0.0	0.3	0.3
1982-1985	5.46	-1.9	-4.8	9.9	3.2	2.2	2.3	0.0
1985-1988	-5.69	-6.5	-2.2	4.6	-4.0	-1.7	-1.0	0.7
1988-1993	2.53	0.0	-1.9	4.7	2.8	-0.2	-0.1	0.2
1993-2000	0.09	-2.6	-2.5	5.3	0.2	-0.1	0.3	0.3
Import Competing								
1982-2000	2.96	-1.2	-3.3	6.1	1.7	1.3	1.7	0.4
1982-1985	6.50	-4.5	-8.4	12.4	-0.4	6.9	6.8	-0.1
1985-1988	-5.04	-6.3	-4.0	6.4	-3.8	-1.3	-0.4	0.8
1988-1993	7.78	4.9	-1.2	3.2	6.8	0.9	1.3	0.4
1993-2000	1.44	-1.9	-2.3	5.4	1.2	0.2	0.7	0.5
Non-Traded								
1982-2000	1.04	-2.0	-2.4	5.3	0.9	0.2	0.0	-0.2
1982-1985	0.33	-6.4	-5.6	10.4	-1.6	1.9	1.4	-0.5
1985-1988	-5.48	-7.7	-1.3	3.4	-5.6	0.2	-0.7	-0.8
1988-1993	3.69	1.3	-0.8	3.3	3.8	-0.1	-0.7	-0.6
1993-2000	2.24	0.0	-2.7	5.3	2.6	-0.3	0.2	0.6

Table 19 Turkey: Plant-level Productivity and Nominal Tariff rates – Two-digit ISIC industries (1982-2000)

Dependent var: Log TFP(t)	Manufacturing Industry					31					32				
Tariff rate (t)	-0.528**		-0.493**		-0.414**	-0.176**		-0.166**		-0.115**	-2.742**		-2.268**		-1.443**
	[0.009]		[0.010]		[0.029]	[0.017]		[0.017]		[0.040]	[0.136]		[0.138]		[0.205]
Tariff rate (t-1)		-0.508**		-0.429**	-0.080**		-0.186**		-0.160**	-0.057		-2.651**		-2.044**	-1.135**
		[0.010]		[0.010]	[0.027]		[0.017]		[0.017]	[0.040]		[0.147]		[0.137]	[0.194]
Log TFP (t-1)			0.152**	0.152**	0.152**			0.160**	0.159**	0.159**			0.255**	0.253**	0.252**
			[0.005]	[0.005]	[0.005]			[0.014]	[0.014]	[0.014]			[0.013]	[0.013]	[0.013]
Observations	152240	124424	124423	124423	124423	27951	22929	22929	22929	22929	41577	33288	33287	33287	33287
Adjusted R^2	0.952	0.957	0.959	0.959	0.959	0.88	0.902	0.905	0.905	0.905	0.64	0.661	0.685	0.685	0.686
Log likelihood	-22556	-14120	-10775	-10932	-10768	3368	4999	5373	5368	5374	-4714	-1860	-640	-653	-606
	33					34					35				
Tariff rate (t)	-1.420**		-1.686**		0.413	-5.028**		-5.333**		-6.016**	-0.596**		-0.728**		-0.911**
	[0.100]		[0.120]		[0.542]	[0.157]		[0.204]		[0.406]	[0.026]		[0.036]		[0.131]
Tariff rate (t-1)		-1.851**		-1.608**	-1.944**		-3.476**		-3.221**	0.625*		-0.652**		-0.532**	0.151
		[0.109]		[0.109]	[0.476]		[0.202]		[0.200]	[0.307]		[0.028]		[0.028]	[0.102]
Log TFP (t-1)			0.187**	0.181**	0.181**			0.085**	0.107**	0.084**			0.189**	0.191**	0.190**
			[0.028]	[0.029]	[0.029]			[0.013]	[0.014]	[0.013]			[0.019]	[0.019]	[0.019]
Observations	5462	4226	4226	4226	4226	5919	4903	4903	4903	4903	13783	11344	11344	11344	11344
Adjusted R^2	0.91	0.913	0.916	0.917	0.917	0.922	0.917	0.927	0.921	0.927	0.936	0.94	0.943	0.943	0.943
Log likelihood	-298	-155	-84	-58	-57	-1882	-1721	-1413	-1611	-1409	-1275	-797	-462	-499	-460
	36					37					38				
Tariff rate (t)	-0.041		-0.01		1.068**	-0.639		-0.585		-0.724	-0.026		-0.069		-0.208**
	[0.074]		[0.078]		[0.346]	[0.465]		[0.520]		[0.582]	[0.042]		[0.044]		[0.062]
Tariff rate (t-1)		-0.109		-0.210*	-1.129**		0.049		-0.045	0.199		-0.036		0.049	0.177**
		[0.083]		[0.083]	[0.339]		[0.300]		[0.304]	[0.333]		[0.041]		[0.040]	[0.056]
Log TFP (t-1)			0.107**	0.109**	0.116**			0.110**	0.111**	0.109**			0.093**	0.093**	0.094**
			[0.014]	[0.014]	[0.014]			[0.019]	[0.019]	[0.019]			[0.006]	[0.006]	[0.006]
Observations	12049	10239	10239	10239	10239	6709	5567	5567	5567	5567	37466	30850	30850	30850	30850
Adjusted R^2	0.987	0.987	0.988	0.988	0.988	0.51	0.541	0.541	0.541	0.541	0.942	0.944	0.946	0.946	0.946
Log likelihood	-3268	-2607	-2409	-2404	-2382	368	474	538	536	538	-5765	-4002	-3553	-3554	-3546

Table 20 Turkey: Productivity, Tariff rates, plant- and sector-level real wages - Trade-orientation groups (1982-2000)

Dep. Var: Log TFP	All	EO	IC	NT	All	EO	IC	NT
Tariff rate (t)	-0.431**	-0.273**	-0.368**	0.114**	---	---	---	---
	[0.010]	[0.017]	[0.019]	[0.036]				
Log real wage	0.085**	0.059**	0.081**	0.119**	---	---	---	---
rate (t)	[0.002]	[0.003]	[0.004]	[0.006]				
Tariff rate (t-1)	---	---	---	---	-0.398**	-0.264**	-0.296**	0.018
					[0.010]	[0.017]	[0.016]	[0.035]
Log real wage	---	---	---	---	0.043**	0.021**	0.041**	0.073**
rate (t-1)					[0.002]	[0.003]	[0.003]	[0.006]
Log TFP (t-1)	0.143**	0.168**	0.109**	0.188**	0.146**	0.172**	0.110**	0.191**
	[0.005]	[0.010]	[0.005]	[0.013]	[0.005]	[0.010]	[0.006]	[0.013]
Observations	124129	53096	51573	19460	124152	53103	51583	19466
Adjusted R^2	0.96	0.893	0.976	0.938	0.959	0.892	0.975	0.936
Log likelihood	-9080	-339	-5200	704	-10333	-682	-5601	340
	All	EO	IC	NT	All	EO	IC	NT
Tariff (t)	-0.215**	-0.152**	-0.083**	0.350**	---	---	---	---
	[0.011]	[0.017]	[0.020]	[0.037]				
Log sector median	0.355**	0.271**	0.398**	0.473**	---	---	---	---
real wage rate (t)	[0.005]	[0.008]	[0.009]	[0.012]				
Tariff (t-1)	---	---	---	---	-0.261**	-0.187**	-0.168**	0.173**
					[0.010]	[0.016]	[0.017]	[0.035]
Log sector median	---	---	---	---	0.221**	0.151**	0.224**	0.331**
real wage rate (t-1)					[0.005]	[0.007]	[0.008]	[0.013]
Log TFP (t-1)	0.126**	0.149**	0.098**	0.147**	0.136**	0.160**	0.106**	0.161**
	[0.005]	[0.010]	[0.005]	[0.011]	[0.005]	[0.010]	[0.005]	[0.012]
Observations	124423	53210	51693	19520	124423	53210	51693	19520
Adjusted R^2	0.962	0.896	0.977	0.942	0.96	0.893	0.976	0.938
Log likelihood	-6643	396	-4234	1446	-9163	-384	-5264	791

Notes: Plant, four-digit ISIC sector and year indicators are included. Standard errors are in square brackets. Plant's employment in the first year in the sample is used to determine plant size (10-24; 25-49; 50-99; 100-249; 250+). Median wage rate for the 4-digit ISIC sectors are used as the wage variable. **, * and $^{+}$ indicate statistically significant coefficient estimates at the 1%, 5% and 10% level, respectively.

Table 21 Turkey: Productivity, Tariff rates, real wages and plant size (1982-2000)

Dependent variable: Log TFP (t)	All	EO	IC	NT
Tariff rate (t-1)	-0.204**	-0.191**	-0.154**	0.281**
	[0.016]	[0.028]	[0.024]	[0.047]
Tariff rate*Size 2 (t-1)	-0.057**	0.080*	0.006	-0.234**
	[0.021]	[0.040]	[0.027]	[0.069]
Tariff rate*Size 3 (t-1)	-0.098**	0.067	-0.061+	-0.136
	[0.026]	[0.048]	[0.033]	[0.090]
Tariff rate*Size 4 (t-1)	-0.122**	-0.029	-0.071*	-0.066
	[0.028]	[0.054]	[0.034]	[0.137]
Tariff rate*Size 5 (t-1)	-0.087*	-0.207**	0.052	-0.316*
	[0.035]	[0.050]	[0.049]	[0.136]
Log sector median real wage rate (t-1)	0.221**	0.153**	0.224**	0.334**
	[0.005]	[0.007]	[0.008]	[0.013]
Log TFP (t-1)	0.136**	0.160**	0.106**	0.160**
	[0.005]	[0.010]	[0.005]	[0.012]
Observations	124423	53210	51693	19520
Adjusted R^2	0.960	0.893	0.976	0.939
Log likelihood	-9146	-361	-5256	803

Table 22 Turkey: Productivity and Tariff Rates – Controlling for sector and plant characteristics

Dep. Var: Log TFP	All	EO	IC	NT	All	EO	IC	NT
Tariff rate (t)	-0.692**	-0.753**	-0.607**	3.222**	---	---	---	---
	[0.021]	[0.039]	[0.040]	[0.150]				
Tariff rate squared (t)	0.308**	0.738**	0.217**	-7.719**	---	---	---	---
	[0.027]	[0.050]	[0.038]	[0.353]				
Tariff rate (t-1)	---	---	---	---	-0.575**	-0.693**	-0.437**	1.578**
					[0.018]	[0.038]	[0.035]	[0.189]
Tariff rate Squared (t-1)	---	---	---	---	0.191**	0.703**	0.103**	-3.777**
					[0.018]	[0.050]	[0.025]	[0.470]
Log TFP (t-1)	0.152**	0.174**	0.114**	0.180**	0.151**	0.175**	0.113**	0.193**
	[0.005]	[0.010]	[0.006]	[0.012]	[0.005]	[0.010]	[0.006]	[0.013]
Observations	124423	53210	51693	19520	124423	53210	51693	19520
Adjusted R^2	0.959	0.892	0.975	0.938	0.959	0.892	0.975	0.935
Log likelihood	-10704	-614	-5790	640	-10870	-647	-5850	308
	All	**EO**	**IC**	**NT**	**All**	**EO**	**IC**	**NT**
Tariff rate (t)	-0.353**	-0.438**	-0.227**	2.779**	---	---	---	---
	[0.021]	[0.039]	[0.040]	[0.133]				
Tariff rate squared t)	0.212**	0.455**	0.169**	-5.925**	---	---	---	---
	[0.026]	[0.050]	[0.037]	[0.312]				
Tariff rate (t-1)	---	---	---	---	-0.368**	-0.509**	-0.226**	1.401**
					[0.018]	[0.038]	[0.036]	[0.152]
Tariff rate Squared (t-1)	---	---	---	---	0.138**	0.529**	0.051*	-2.890**
					[0.017]	[0.050]	[0.025]	[0.369]
Log sector median real wage rate (t)	0.354**	0.264**	0.398**	0.435**	---	---	---	---
	[0.005]	[0.008]	[0.009]	[0.012]				
Log sector median real wage rate (t-1)	---	---	---	---	0.219**	0.142**	0.223**	0.313**
					[0.005]	[0.007]	[0.008]	[0.013]
Log TFP (t-1)	0.126**	0.149**	0.098**	0.130**	0.135**	0.160**	0.106**	0.150**
	[0.005]	[0.010]	[0.005]	[0.010]	[0.005]	[0.010]	[0.005]	[0.011]
Observations	124423	53210	51693	19520	124423	53210	51693	19520
Adjusted R^2	0.962	0.897	0.977	0.944	0.960	0.893	0.976	0.939
Log likelihood	-6608	443	-4222	1787	-9130	-322	-5262	908

Table 23 Turkey Productivity and Tariff Rates - Controlling for sector and plant characteristics and allowing for quadratic tariff term

Dependent variable: Log TFP (t)	All	EO	IC	NT	All	EO	IC	NT
Tariff rate	-0.550**	-0.518**	-0.418**	0.698**	-0.723**	-0.565**	-1.214**	0.392
	[0.027]	[0.048]	[0.049]	[0.194]	[0.050]	[0.077]	[0.115]	[0.312]
Tariff rate Squared	0.379**	0.523**	0.300**	-1.829**	0.831**	0.598**	2.196**	-0.735
	[0.034]	[0.059]	[0.048]	[0.445]	[0.069]	[0.090]	[0.202]	[0.668]
Log sector median	0.220**	0.134**	0.233**	0.354**	0.174**	0.100**	0.197**	0.309**
real wage rate	[0.006]	[0.008]	[0.010]	[0.016]	[0.009]	[0.012]	[0.016]	[0.024]
Herfindahl Index	-0.154**	0.083	0.096	-0.895**	0.035	-0.023	0.242*	-0.188
	[0.046]	[0.078]	[0.062]	[0.097]	[0.068]	[0.112]	[0.111]	[0.127]
Sector export-	0.023**	0.022**	-0.067**	0.018	---	---	---	---
output ratio	[0.005]	[0.005]	[0.018]	[0.018]				
Plant level export	---	---	---	---	0.024**	0.025**	0.012	0.011
dummy					[0.005]	[0.006]	[0.008]	[0.017]
Foreign-owned share	0.053*	0.023	0.057+	-0.022	0.017	-0.031	0.069	-0.096
	[0.021]	[0.028]	[0.031]	[0.086]	[0.031]	[0.040]	[0.044]	[0.163]
Agglomeration	0.410**	0.771**	0.070	0.516**	0.469**	0.710**	0.261**	0.138
- province level	[0.049]	[0.074]	[0.072]	[0.186]	[0.058]	[0.091]	[0.081]	[0.212]
Entering plant dummy	-0.012**	-0.017**	-0.018*	-0.002	-0.020**	-0.029**	-0.016	-0.008
	[0.004]	[0.006]	[0.007]	[0.011]	[0.006]	[0.008]	[0.011]	[0.018]
Exiting plant dummy	-0.030**	-0.027**	-0.029**	-0.025	-0.027**	-0.029**	-0.019	-0.011
(t)	[0.006]	[0.008]	[0.010]	[0.015]	[0.008]	[0.010]	[0.014]	[0.034]
Skilled production	0.017+	-0.000	0.036*	-0.026	0.047**	0.023	0.053*	0.058
worker share	[0.010]	[0.014]	[0.015]	[0.023]	[0.016]	[0.023]	[0.025]	[0.043]
Log TFP (t-1)	0.126**	0.149**	0.102**	0.119**	0.095**	0.115**	0.077**	0.061**
	[0.005]	[0.011]	[0.006]	[0.012]	[0.006]	[0.011]	[0.008]	[0.012]
Observations	91824	41534	38772	11518	48581	23457	19977	5147
Adjusted R^2	0.970	0.912	0.982	0.958	0.967	0.890	0.980	0.957
Log likelihood	-6454	185	-3622	293	-880	1211	-806	332

Notes: All explanatory variables are lagged one year unless denoted otherwise.

Table 24 Turkey Productivity and Tariff Rates - Controlling for size, sector and plant characteristics (1982-2000)

Dependent variable: Log TFP (t)	All	EO	IC	NT	All	EO	IC	NT
Tariff rate	-0.309**	-0.178**	-0.188**	-0.106+	-0.231**	-0.096*	-0.163*	-0.212*
	[0.013]	[0.020]	[0.025]	[0.055]	[0.033]	[0.039]	[0.064]	[0.106]
Tariff rate*Size 2	---	---	---	---	-0.045	-0.011	0.023	0.069
					[0.038]	[0.051]	[0.064]	[0.119]
Tariff rate*Size 3	---	---	---	---	-0.114**	-0.046	-0.080	0.151
					[0.040]	[0.056]	[0.067]	[0.128]
Tariff rate*Size 4	---	---	---	---	-0.141**	-0.129*	-0.086	0.258
					[0.042]	[0.062]	[0.068]	[0.169]
Tariff rate*Size 5	---	---	---	---	-0.105*	-0.305**	0.012	0.099
					[0.048]	[0.059]	[0.078]	[0.175]
Log sector median real wage rate	0.221**	0.140**	0.234**	0.367**	0.221**	0.143**	0.233**	0.367**
	[0.006]	[0.008]	[0.010]	[0.016]	[0.006]	[0.008]	[0.010]	[0.016]
Herfindahl Index	-0.156**	0.019	0.094	-0.950**	-0.153**	0.029	0.096	-0.948**
	[0.046]	[0.078]	[0.063]	[0.098]	[0.046]	[0.078]	[0.062]	[0.098]
Sector export-output ratio	0.023**	0.020**	-0.057**	0.023	0.024**	0.020**	-0.055**	0.023
	[0.005]	[0.005]	[0.018]	[0.018]	[0.005]	[0.005]	[0.018]	[0.018]
Foreign-owned share	0.055*	0.029	0.055+	-0.034	0.052*	0.027	0.052+	-0.033
	[0.021]	[0.028]	[0.031]	[0.086]	[0.021]	[0.028]	[0.031]	[0.087]
Agglomeration - province level	0.417**	0.787**	0.071	0.579**	0.418**	0.790**	0.074	0.578**
	[0.049]	[0.075]	[0.072]	[0.189]	[0.049]	[0.075]	[0.072]	[0.189]
Entering plant dummy	-0.011**	-0.016**	-0.018*	-0.000	-0.011**	-0.016**	-0.019*	-0.001
	[0.004]	[0.006]	[0.007]	[0.011]	[0.004]	[0.006]	[0.007]	[0.011]
Exiting plant dummy (t)	-0.031**	-0.027**	-0.029**	-0.025+	-0.030**	-0.027**	-0.028**	-0.026+
	[0.006]	[0.008]	[0.010]	[0.015]	[0.006]	[0.008]	[0.010]	[0.015]
Skilled production worker share	0.016+	-0.000	0.035*	-0.027	0.016+	0.001	0.035*	-0.028
	[0.010]	[0.014]	[0.015]	[0.023]	[0.010]	[0.014]	[0.015]	[0.023]
Log TFP (t-1)	0.127**	0.149**	0.102**	0.123**	0.127**	0.149**	0.102**	0.123**
	[0.005]	[0.011]	[0.006]	[0.012]	[0.005]	[0.011]	[0.006]	[0.012]
Observations	91824	41534	38772	11518	91824	41534	38772	11518
Adjusted R^2	0.970	0.912	0.982	0.957	0.970	0.912	0.982	0.957
Log likelihood	-6519	140	-3642	268	-6507	162	-3634	271

Notes: All explanatory variables are lagged one year unless denoted otherwise.

Table 25 Turkey Productivity and Tariff Rates - Controlling for size, sector and plant characteristics (1990-2000)

Dependent variable: Log TFP (t)	All	EO	IC	NT	All	EO	IC	NT
Tariff rate	-0.240**	-0.145**	-0.131**	0.079	-0.111	-0.231	0.060	-0.402
	[0.021]	[0.029]	[0.050]	[0.129]	[0.123]	[0.145]	[0.194]	[0.332]
Tariff rate*Size 2	---	---	---	---	-0.114	0.126	-0.184	0.535
					[0.126]	[0.152]	[0.194]	[0.331]
Tariff rate*Size 3	---	---	---	---	-0.132	0.127	-0.234	0.764*
					[0.128]	[0.154]	[0.197]	[0.359]
Tariff rate*Size 4	---	---	---	---	-0.168	0.067	-0.195	0.283
					[0.129]	[0.156]	[0.197]	[0.377]
Tariff rate*Size 5	---	---	---	---	-0.131	-0.020	-0.146	0.397
					[0.134]	[0.160]	[0.209]	[0.363]
Log sector median	0.177**	0.100**	0.229**	0.317**	0.177**	0.100**	0.229**	0.315**
real wage rate	[0.009]	[0.012]	[0.016]	[0.024]	[0.009]	[0.012]	[0.016]	[0.024]
Herfindal Index	0.031	-0.066	0.311**	-0.202	0.032	-0.061	0.311**	-0.204
	[0.068]	[0.112]	[0.112]	[0.127]	[0.068]	[0.112]	[0.112]	[0.128]
Exporter dummy	0.025**	0.026**	0.015+	0.011	0.025**	0.026**	0.014+	0.011
	[0.005]	[0.006]	[0.008]	[0.017]	[0.005]	[0.006]	[0.008]	[0.017]
Foreign-owned share	0.023	-0.025	0.070	-0.097	0.022	-0.024	0.070	-0.094
	[0.031]	[0.040]	[0.044]	[0.164]	[0.031]	[0.040]	[0.044]	[0.164]
Agglomeration	0.484**	0.739**	0.227**	0.154	0.485**	0.742**	0.229**	0.154
- province level	[0.058]	[0.091]	[0.082]	[0.212]	[0.058]	[0.091]	[0.082]	[0.215]
Entering plant dummy	-0.018**	-0.027**	-0.016	-0.008	-0.018**	-0.027**	-0.016	-0.007
	[0.006]	[0.008]	[0.011]	[0.018]	[0.006]	[0.008]	[0.011]	[0.018]
Exiting plant dummy (t)	-0.028**	-0.030**	-0.020	-0.011	-0.028**	-0.029**	-0.020	-0.010
	[0.008]	[0.010]	[0.014]	[0.034]	[0.008]	[0.010]	[0.014]	[0.034]
Skilled production	0.048**	0.024	0.053*	0.058	0.048**	0.024	0.053*	0.058
worker share	[0.016]	[0.023]	[0.026]	[0.043]	[0.016]	[0.023]	[0.026]	[0.043]
Log TFP (t-1)	0.096**	0.116**	0.082**	0.062**	0.096**	0.116**	0.082**	0.061**
	[0.006]	[0.011]	[0.008]	[0.012]	[0.006]	[0.011]	[0.008]	[0.012]
Observations	48581	23457	19977	5147	48581	23457	19977	5147
Adjusted R^2	0.967	0.890	0.980	0.957	0.967	0.890	0.980	0.957
Log likelihood	-964	1182	-892	331	-963	1184	-891	336

Notes: All explanatory variables are lagged one year unless denoted otherwise.

Table 26 Turkey Productivity growth, Tariff rate, Real wage and plant size (1982-2000)

Dependent variable: Δ Log TFP (t)	**All**	**EO**	**IC**	**NT**	**All**	**EO**	**IC**	**NT**
Δ Tariff rate	-0.381**	0.007	-0.754**	0.179	-0.442**	0.034	-0.890**	0.078
	[0.069]	[0.110]	[0.096]	[0.203]	[0.084]	[0.130]	[0.126]	[0.218]
Δ Tariff*size 2	---	---	---	---	0.053	-0.190	0.272+	0.164
					[0.109]	[0.165]	[0.159]	[0.268]
Δ Tariff*size 3	---	---	---	---	0.146	-0.180	0.404*	0.399
					[0.149]	[0.252]	[0.205]	[0.325]
Δ Tariff*size 4	---	---	---	---	0.100	-0.087	0.101	0.797
					[0.233]	[0.444]	[0.246]	[0.897]
Δ Tariff*size 5	---	---	---	---	0.134	0.806	-0.495	-0.816
					[0.400]	[0.581]	[0.355]	[0.749]
Δ Log sector median real wage rate	0.134**	0.166**	0.069*	0.260**	0.134**	0.165**	0.068*	0.258**
	[0.018]	[0.028]	[0.028]	[0.043]	[0.018]	[0.028]	[0.028]	[0.043]
Observations	124423	53210	51693	19520	124423	53210	51693	19520
Adjusted R^2	0.096	0.075	0.191	0.143	0.096	0.075	0.191	0.143
Log likelihood	-71075	-20492	-35674	-7955	-71073	-20471	-35662	-7945

Note: All explanatory variables are current year.

Table 27 Turkey Explaining Productivity Growth – Controlling for sector and plant characteristics

Dependent variable: Δ Log TFP (t)	All	EO	IC	NT	All	EO	IC	NT
Δ Tariff rate	-0.403**	0.063	-1.055**	0.418	-0.458**	0.027	-2.237**	0.600+
	[0.087]	[0.128]	[0.125]	[0.254]	[0.131]	[0.126]	[0.371]	[0.359]
Δ Tariff rate*Size 2					0.003	-0.131	1.272**	-0.171
					[0.155]	[0.171]	[0.381]	[0.464]
Δ Tariff rate*Size 3					0.103	-0.098	1.468**	-0.026
					[0.188]	[0.257]	[0.403]	[0.484]
Δ Tariff rate*Size 4					0.152	-0.026	1.288**	0.307
					[0.269]	[0.463]	[0.422]	[1.058]
Δ Tariff rate*Size 5					0.059	0.919	0.743	-1,311
					[0.412]	[0.615]	[0.509]	[0.854]
Δ Log sector median	0.131**	0.163**	0.056+	0.198**	0.131**	0.162**	0.055	0.197**
real wage rate	[0.021]	[0.031]	[0.034]	[0.061]	[0.021]	[0.031]	[0.034]	[0.061]
Δ Herfindahl Index	-0.199*	0.278	-0.283*	-0.336+	-0.198*	0.281	-0.284*	-0.337+
	[0.096]	[0.237]	[0.121]	[0.178]	[0.096]	[0.236]	[0.121]	[0.178]
Δ Sector export-	-0.017*	-0.052**	0.306**	-0.048*	-0.017*	-0.052**	0.308**	-0.051*
output ratio	[0.008]	[0.008]	[0.044]	[0.023]	[0.008]	[0.008]	[0.044]	[0.023]
Δ Foreign capital share	-0.034	-0.202	0.059	0.392*	-0.034	-0.204	0.061	0.392*
	[0.081]	[0.138]	[0.088]	[0.156]	[0.081]	[0.139]	[0.088]	[0.156]
Δ Agglomeration	0.245*	0.113	0.278	0.416	0.246*	0.110	0.278	0.409
- province level	[0.120]	[0.115]	[0.213]	[0.325]	[0.121]	[0.115]	[0.213]	[0.323]
Entering plant dummy	-0.007	-0.017*	0.000	0.007	-0.007	-0.017*	0.002	0.008
(t-1)	[0.007]	[0.008]	[0.014]	[0.019]	[0.007]	[0.008]	[0.014]	[0.019]
Exiting plant dummy	-0.013	-0.013	-0.001	-0.025	-0.013	-0.012	-0.001	-0.025
	[0.009]	[0.010]	[0.016]	[0.020]	[0.009]	[0.010]	[0.016]	[0.020]
Δ Skilled production	0.018	0.035+	0.001	0.048+	0.018	0.034+	0.001	0.048+
worker share	[0.015]	[0.020]	[0.026]	[0.028]	[0.015]	[0.020]	[0.026]	[0.029]
Observations	89711	40629	37833	11249	89711	40629	37833	11249
Adjusted R^2	0.101	0.079	0.203	0.164	0.101	0.080	0.204	0.165
Log likelihood	-53190	-15711	-26418	-5767	-53189	-15689	-26402	-5759

Table 28 Turkey Explaining Productivity Growth – Controlling for sector and plant characteristics

Dependent variable: Δ Log TFP	All	EO	IC	NT	All	EO	IC	NT
Δ Tariff rate	-0.314**	-0.009	-1.206**	1.190**	-0.392	-0.177	-1.865*	1,213
	[0.093]	[0.119]	[0.195]	[0.414]	[0.307]	[0.253]	[0.832]	[1.755]
Δ Tariff rate*Size 2	---	---	---	---	0.066	0.113	0.679	0.207
					[0.321]	[0.285]	[0.832]	[1.783]
Δ Tariff rate*Size 3	---	---	---	---	0.119	0.169	0.787	0.005
					[0.325]	[0.280]	[0.841]	[1.815]
Δ Tariff rate*Size 4	---	---	---	---	0.209	0.202	0.752	0.702
					[0.396]	[0.467]	[0.861]	[2.121]
Δ Tariff rate*Size 5	---	---	---	---	-0.133	0.312	0.290	-1,362
					[0.394]	[0.360]	[0.938]	[1.957]
Δ Log sector median	0.135**	0.200**	0.011	0.182*	0.135**	0.200**	0.011	0.174*
real wage rate	[0.022]	[0.023]	[0.045]	[0.084]	[0.022]	[0.023]	[0.045]	[0.084]
Δ Herfindahl Index	-0.501**	0.420	-1.071**	-0.291	-0.500**	0.419	-1.067**	-0.291
	[0.144]	[0.371]	[0.212]	[0.257]	[0.144]	[0.370]	[0.211]	[0.257]
Exporter dummy	0.010	0.012	-0.005	0.016	0.010	0.012	-0.006	0.011
	[0.008]	[0.008]	[0.014]	[0.036]	[0.008]	[0.008]	[0.014]	[0.036]
Δ Foreign share	-0.046	-0.226	0.068	0.495*	-0.046	-0.227	0.069	0.490*
	[0.106]	[0.176]	[0.117]	[0.212]	[0.106]	[0.176]	[0.117]	[0.210]
Δ Log agglomeration	0.095	0.156	0.047	-0.040	0.097	0.156	0.045	-0.034
	[0.102]	[0.126]	[0.177]	[0.314]	[0.102]	[0.126]	[0.176]	[0.308]
Entering plant dummy (t-1)	-0.003	-0.021*	0.019	0.031	-0.003	-0.021*	0.019	0.031
	[0.010]	[0.011]	[0.020]	[0.036]	[0.010]	[0.011]	[0.020]	[0.036]
Exiting plant dummy	-0.017	-0.024+	0.009	-0.099*	-0.017	-0.024+	0.009	-0.098*
	[0.012]	[0.014]	[0.023]	[0.046]	[0.012]	[0.014]	[0.023]	[0.047]
Δ Skilled production	0.038+	0.050+	-0.005	0.135*	0.038+	0.050+	-0.005	0.135*
worker share	[0.022]	[0.026]	[0.039]	[0.056]	[0.022]	[0.026]	[0.039]	[0.055]
Observations	51718	24873	21352	5493	51718	24873	21352	5493
Adjusted R^2	0.118	0.073	0.211	0.126	0.117	0.073	0.211	0.128
Log likelihood	-29157	-8303	-14512	-3439	-29154	-8302	-14510	-3432

Table 29 Turkey: Determinants of survival

(Cox proprotional hazard model – All sectors)

	Model 1	Model 2	Model 3	Model 4	Model 5
Relative labor productivity	-0.226***	-0.239***	-0.243***	-0.243***	-0.217***
(LP)	[0.019]	[0.025]	[0.025]	[0.025]	[0.026]
Import tariff	-0.139	-0.184	-0.18	-0.186	-0.223
	[0.18]	[0.21]	[0.21]	[0.21]	[0.22]
Exporter status	-0.318***	-0.451***	-0.460***	-0.471***	-0.469***
	[0.069]	[0.090]	[0.090]	[0.091]	[0.092]
Firm size	-0.717***	-0.719***	-0.726***	-0.725***	-0.701***
	[0.033]	[0.033]	[0.033]	[0.033]	[0.033]
Exporter status * Import		1.188**	1.157**	1.217**	1.269**
tariff		[0.50]	[0.50]	[0.50]	[0.50]
Relative LP * Import tariff		0.136	0.143	0.133	0.13
		[0.20]	[0.20]	[0.20]	[0.20]
Exporter status * Relative		0.0884	0.00888	-0.0176	0.0412
LP * Import tariff		[0.49]	[0.48]	[0.48]	[0.48]
Foreign firm			0.337**	0.340**	0.464***
			[0.14]	[0.14]	[0.14]
Growth rate of import from				-0.0398	-0.048
developed countries				[0.059]	[0.060]
Growth rate of import from				0.016	0.0126
developing countries				[0.019]	[0.019]
Growth rate of exports to				-0.114***	-0.102**
developed countries				[0.041]	[0.041]
Growth rate of exports to				-0.0228	-0.0146
developing countries				[0.043]	[0.043]
Market share of foreign					-0.176
firms					[0.17]
Firm's market share					0.717
					[0.65]
Herfindahl index					0.876**
					[0.36]
Capital/labor ratio (log)					-0.032***
					[0.011]
Real wage rate (log)					-0.129***
					[0.042]
Number of observations	33977	33977	33977	33950	33619
Number of firms	8644	8644	8644	8643	8630
Number of exits	3482	3482	3482	3481	3438
All models are stratified by ISIC (Rev. 2) 3-digit sectors					
Standard errors in parentheses. ***, ** and * indicate that the p-value is less than 0.01, 0.05, and 0.1, respectively					

Table 30 Turkey: Determinants of export decision (Random effects logit model – All sectors)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Lagged export status				3.504***	3.512***	3.630***
				[0.060]	[0.060]	[0.070]
Relative labor productivity	0.529***	0.538***	0.593***	0.387***	0.391***	0.328***
(LP)	[0.041]	[0.041]	[0.055]	[0.037]	[0.037]	[0.048]
Import tariff	0.473	0.452	-0.0656	0.495*	0.547*	-0.128
	[0.34]	[0.34]	[0.42]	[0.29]	[0.29]	[0.29]
Relative LP * Import tariff	-0.143	-0.236	-0.559*	0.0624	0.000996	-0.00988
	[0.24]	[0.25]	[0.32]	[0.23]	[0.23]	[0.28]
Firm age (log)	0.277***	0.272***	0.411***	-0.274***	-0.275***	-0.180***
	[0.050]	[0.050]	[0.063]	[0.053]	[0.053]	[0.064]
Firm size	1.371***	1.376***	1.219***	0.652***	0.652***	0.468***
	[0.043]	[0.043]	[0.058]	[0.032]	[0.032]	[0.043]
Growth rate of import from		-0.066	-0.089		-0.141	-0.133
developed countries		[0.086]	[0.11]		[0.095]	[0.11]
Growth rate of import from		0.0676*	0.0539		0.0354	0.0371
developing countries		[0.035]	[0.045]		[0.037]	[0.046]
Growth rate of exports to		-0.0202	-0.0106		0.0436	0.00549
developed countries		[0.067]	[0.092]		[0.071]	[0.086]
Growth rate of exports to		0.152**	0.128		0.0705	0.0115
developing countries		[0.065]	[0.084]		[0.067]	[0.079]
Foreign firm			0.858***			0.13
			[0.20]			[0.14]
Investment expenditures			0.057***			0.057***
(log)			[0.020]			[0.019]
Number of observations	44243	44195	21916	32118	32098	16178
Number of firms	10886	10885	7312	8428	8426	5651
All models include dummy variables for year and sector (ISIC 3-digit level)						
Standard errors in parentheses. ***, ** and * indicate that the p-value is less than 0.01, 0.05, and 0.1, respectively						

Table 31 Turkey: Determinants of survival

(Cox proprotional hazard model - Export-oriented sectors)

	Model 1	Model 2	Model 3	Model 4	Model 5
Relative labor productivity	-0.233***	-0.240***	-0.239***	-0.238***	-0.203***
(LP)	[0.027]	[0.036]	[0.036]	[0.036]	[0.037]
Import tariff	-0.173	-0.216	-0.217	-0.24	-0.317
	[0.23]	[0.27]	[0.27]	[0.27]	[0.27]
Exporter status	-0.404***	-0.557***	-0.556***	-0.559***	-0.563***
	[0.099]	[0.13]	[0.13]	[0.13]	[0.13]
Firm size	-0.599***	-0.599***	-0.597***	-0.596***	-0.560***
	[0.044]	[0.044]	[0.045]	[0.045]	[0.045]
Exporter status * Import		1.061*	1.077*	1.089*	1.110**
tariff		[0.56]	[0.56]	[0.57]	[0.56]
Relative LP * Import tariff		0.101	0.101	0.0831	0.0844
		[0.21]	[0.21]	[0.22]	[0.22]
Exporter status * Relative		-0.597	-0.577	-0.533	-0.467
LP * Import tariff		[0.50]	[0.51]	[0.51]	[0.50]
Foreign firm			-0.143	-0.145	-0.0235
			[0.26]	[0.26]	[0.26]
Growth rate of import from				0.104	0.0978
developed countries				[0.097]	[0.099]
Growth rate of import from				0.0188	0.00904
developing countries				[0.040]	[0.041]
Growth rate of exports to				-0.0526	-0.0491
developed countries				[0.097]	[0.098]
Growth rate of exports to				-0.0972	-0.0614
developing countries				[0.092]	[0.092]
Market share of foreign					0.159
firms					[0.50]
Firm's market share					1.761
					[2.53]
Herfindahl index					0.262
					[0.71]
Capital/labor ratio (log)					-0.041***
					[0.016]
Real wage rate (log)					-0.235***
					[0.069]
Number of observations	14850	14850	14850	14830	14688
Number of firms	3815	3815	3815	3815	3812
Number of exits	1470	1470	1470	1470	1455
All models are stratified by ISIC (Rev. 2) 3-digit sectors					
Standard errors in parentheses. ***, ** and * indicate that the p-value is less than 0.01, 0.05, and 0.1, respectively					

Table 32 Turkey: Determinants of survival (Cox proprotional hazard model - Import-competing sectors)

	Model 1	Model 2	Model 3	Model 4	Model 5
Relative labor productivity	-0.192***	-0.256***	-0.264***	-0.265***	-0.246***
(LP)	[0.029]	[0.046]	[0.046]	[0.046]	[0.048]
Import tariff	-1.226	-1.168	-1.154	-1.135	-1.107
	[0.87]	[0.85]	[0.85]	[0.85]	[0.89]
Exporter status	-0.318***	-0.393**	-0.424**	-0.425**	-0.407**
	[0.11]	[0.19]	[0.18]	[0.18]	[0.19]
Firm size	-0.843***	-0.856***	-0.870***	-0.869***	-0.860***
	[0.056]	[0.055]	[0.055]	[0.055]	[0.056]
Exporter status * Import		0.139	0.274	0.281	0.179
tariff		[2.35]	[2.27]	[2.23]	[2.29]
Relative LP * Import tariff		0.699	0.711	0.714	0.78
		[0.58]	[0.57]	[0.58]	[0.59]
Exporter status * Relative		4.371***	3.883***	3.827***	3.878***
LP * Import tariff		[1.26]	[1.27]	[1.25]	[1.27]
Foreign firm			0.556***	0.551***	0.645***
			[0.19]	[0.19]	[0.20]
Growth rate of import from				-0.115	-0.113
developed countries				[0.13]	[0.13]
Growth rate of import from				0.0275	0.0302
developing countries				[0.054]	[0.054]
Growth rate of exports to				-0.270***	-0.211**
developed countries				[0.100]	[0.097]
Growth rate of exports to				0.178*	0.147
developing countries				[0.099]	[0.095]
Market share of foreign					-0.324
firms					[0.24]
Firm's market share					-0.0281
					[0.87]
Herfindahl index					1.183*
					[0.69]
Capital/labor ratio (log)					-0.0292*
					[0.017]
Real wage rate (log)					-0.0629
					[0.065]
Number of observations	14524	14524	14524	14524	14398
Number of firms	3697	3697	3697	3697	3601
Number of exits	1446	1446	1446	1446	1430
All models are stratified by ISIC (Rev. 2) 3-digit sectors					
Standard errors in parentheses. ***, ** and * indicate that the p-value is less than 0.01, 0.05, and 0.1, respectively					

Table 33 Turkey: Determinants of survival **(Cox proprotional hazard model - Non-trading sectors)**

	NT				
	Model 1	Model 2	Model 3	Model 4	Model 5
Relative labor productivity	-0.247***	-0.199**	-0.206**	-0.202**	-0.166
(LP)	[0.051]	[0.098]	[0.099]	[0.098]	[0.10]
Import tariff	-2.21	-2.965	-2.966	-1.935	-1.282
	[1.86]	[2.00]	[2.01]	[2.10]	[2.06]
Exporter status	0.0266	-0.941**	-1.007**	-0.880**	-0.879*
	[0.21]	[0.41]	[0.42]	[0.44]	[0.45]
Firm size	-0.884***	-0.899***	-0.911***	-0.909***	-0.924***
	[0.097]	[0.097]	[0.099]	[0.099]	[0.10]
Exporter status * Import		9.348***	9.568***	7.881**	8.180**
tariff		[3.14]	[3.21]	[3.62]	[3.71]
Relative LP * Import tariff		-0.484	-0.443	-0.505	-0.536
		[0.92]	[0.92]	[0.91]	[0.90]
Exporter status * Relative		-0.104	-0.365	-0.863	-0.865
LP * Import tariff		[1.18]	[1.12]	[1.15]	[1.16]
Foreign firm			0.758	0.804*	0.940*
			[0.48]	[0.47]	[0.48]
Growth rate of import from				-0.222	-0.294*
developed countries				[0.15]	[0.15]
Growth rate of import from				-0.00879	0.0148
developing countries				[0.038]	[0.040]
Growth rate of exports to				-0.088	-0.0814
developed countries				[0.071]	[0.075]
Growth rate of exports to				-0.185**	-0.146*
developing countries				[0.074]	[0.075]
Market share of foreign					0.997*
firms					[0.54]
Firm's market share					4.819
					[4.73]
Herfindahl index					3.269
					[2.36]
Capital/labor ratio (log)					-0.04
					[0.031]
Real wage rate (log)					-0.199**
					[0.094]
Number of observations	4565	4565	4565	4558	4495
Number of firms	1215	1215	1215	1214	1210
Number of exits	563	563	563	562	550
All models are stratified by ISIC (Rev. 2) 3-digit sectors					
Standard errors in parentheses. ***, ** and * indicate that the p-value is less than 0.01, 0.05, and 0.1, respectively					

Table 34 Turkey: Determinants of export decision (Random effects logit model - Export-oriented sectors)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Lagged export status				3.406***	3.428***	3.513***
				[0.084]	[0.084]	[0.10]
Relative labor productivity	0.448***	0.461***	0.540***	0.342***	0.350***	0.317***
(LP)	[0.057]	[0.057]	[0.078]	[0.052]	[0.052]	[0.069]
Import tariff	0.376	0.24	0.196	0.276	0.317	0.546
	[0.40]	[0.40]	[0.41]	[0.35]	[0.36]	[0.44]
Relative LP * Import tariff	0.0697	-0.0397	-0.57	0.219	0.126	-0.148
	[0.27]	[0.27]	[0.36]	[0.26]	[0.26]	[0.31]
Firm age (log)	0.326***	0.323***	0.423***	-0.270***	-0.272***	-0.188**
	[0.071]	[0.071]	[0.090]	[0.076]	[0.076]	[0.095]
Firm size	1.240***	1.246***	1.188***	0.606***	0.604***	0.455***
	[0.057]	[0.058]	[0.079]	[0.044]	[0.044]	[0.061]
Growth rate of import from		-0.0334	-0.0939		-0.151	-0.183
developed countries		[0.11]	[0.15]		[0.13]	[0.16]
Growth rate of import from		0.112**	0.0984		0.0987*	0.140*
developing countries		[0.053]	[0.069]		[0.057]	[0.073]
Growth rate of exports to		0.17	0.132		0.369**	0.338
developed countries		[0.16]	[0.20]		[0.18]	[0.24]
Growth rate of exports to		0.364***	0.277*		0.228*	0.317**
developing countries		[0.12]	[0.15]		[0.12]	[0.15]
Foreign firm			0.416			0.0383
			[0.32]			[0.23]
Investment expenditures			0.0376			0.0427
(log)			[0.027]			[0.026]
Number of observations	19365	19338	9794	14097	14083	7248
Number of firms	4808	4808	3266	3727	3726	2539
All models include dummy variables for year and sector (ISIC 3-digit level)						
Standard errors in parentheses. ***, ** and * indicate that the p-value is less than 0.01, 0.05, and 0.1, respectively						

Table 35 Turkey: Determinants of export decision (Random effects logit model -Import-competing sectors)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Lagged export status				3.519***	3.524***	3.667***
				[0.095]	[0.095]	[0.11]
Relative labor productivity	0.590***	0.579***	0.529***	0.414***	0.415***	0.191**
(LP)	[0.071]	[0.071]	[0.094]	[0.068]	[0.068]	[0.088]
Import tariff	0.965	1.036	0.161	-0.248	-0.00395	-0.757
	[1.05]	[0.91]	[1.38]	[1.37]	[1.38]	[1.71]
Relative LP * Import tariff	-0.486	-0.345	0.831	-0.131	-0.139	1.933**
	[0.69]	[0.69]	[0.90]	[0.76]	[0.76]	[0.96]
Firm age (log)	0.297***	0.189**	0.377***	-0.165**	-0.167**	-0.0309
	[0.078]	[0.078]	[0.098]	[0.083]	[0.083]	[0.100]
Firm size	1.447***	1.468***	1.328***	0.631***	0.632***	0.421***
	[0.071]	[0.073]	[0.097]	[0.054]	[0.054]	[0.073]
Growth rate of import from		-0.244	-0.206		-0.222	-0.15
developed countries		[0.17]	[0.23]		[0.19]	[0.24]
Growth rate of import from		0.00371	-0.0582		-0.0945	-0.0906
developing countries		[0.074]	[0.10]		[0.083]	[0.11]
Growth rate of exports to		-0.0732	-0.0626		-0.0562	-0.0609
developed countries		[0.12]	[0.15]		[0.13]	[0.16]
Growth rate of exports to		0.145	0.14		0.0932	-0.131
developing countries		[0.13]	[0.18]		[0.15]	[0.19]
Foreign firm			0.603**			-0.0129
			[0.28]			[0.19]
Investment expenditures			0.0552*			0.0751**
(log)			[0.033]			[0.031]
Number of observations	18817	18809	9506	13754	13754	7010
Number of firms	4525	4525	3119	3532	3532	2404
All models include dummy variables for year and sector (ISIC 3-digit level)						
Standard errors in parentheses. ***, ** and * indicate that the p-value is less than 0.01, 0.05, and 0.1, respectively						

Table 36 Turkey: Determinants of export decision (Random effects logit model - Non-trading sectors)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Lagged export status				3.597***	3.571***	3.666***
				[0.21]	[0.21]	[0.24]
Relative labor productivity	0.649***	0.719***	0.626***	0.802***	0.831***	0.808***
(LP)	[0.21]	[0.21]	[0.29]	[0.19]	[0.19]	[0.25]
Import tariff	-3.427	-2.494	-11.40**	7.753**	8.585**	6.407
	[3.31]	[3.47]	[5.03]	[3.31]	[3.42]	[4.61]
Relative LP * Import tariff	-0.607	-1.298	0.437	-3.785**	-4.106**	-3.12
	[1.86]	[1.91]	[2.66]	[1.57]	[1.61]	[2.23]
Firm age (log)	0.331*	0.300*	0.637***	-0.453**	-0.466**	-0.115
	[0.17]	[0.17]	[0.22]	[0.18]	[0.18]	[0.23]
Firm size	1.611***	1.635***	1.332***	0.845***	0.863***	0.611***
	[0.15]	[0.15]	[0.21]	[0.11]	[0.11]	[0.16]
Growth rate of import from		0.223	0.381		0.161	0.24
developed countries		[0.26]	[0.34]		[0.31]	[0.39]
Growth rate of import from		0.0454	0.025		0.0469	0.0571
developing countries		[0.071]	[0.094]		[0.078]	[0.10]
Growth rate of exports to		-0.207	-0.13		-0.0674	0.0842
developed countries		[0.14]	[0.20]		[0.16]	[0.21]
Growth rate of exports to		-0.112	-0.356*		-0.116	-0.451**
developing countries		[0.17]	[0.21]		[0.17]	[0.23]
Foreign firm			2.531***			0.884*
			[0.70]			[0.48]
Investment expenditures			0.0546			0.0186
(log)			[0.071]			[0.069]
Number of observations	6014	6004	2584	4229	4223	1894
Number of firms	1544	1543	918	1162	1161	701
All models include dummy variables for year and sector (ISIC 3-digit level)						
Standard errors in parentheses. ***, ** and * indicate that the p-value is less than 0.01, 0.05, and 0.1, respectively						

IX Appendix

I. Data construction

a) Variables used in production function estimations:

- *Real value of output* is obtained by deflating the total annual sales revenues of a firm with a three-digit price deflator constructed by State Institute of Statistics (SIS). This construction has the usual problems of having "one price" for all firms, and relies on price-taking behaviour at the firm level.[35] As such the deflator controls for changes due to industry level demand shocks and changes arising from inflation.
- *Material inputs* include all purchases of intermediate inputs. The nominal value of firm level annual inputs are deflated using a three-digit material input price deflator constructed by SIS.
- *Energy* series is the sum of electricity usage and fuel consumption. Real value of *electricity* and *fuel* consumed is obtained by deflating the nominal values with the respective price deflators obtained from the SIS.
- *Labour* is the number of paid employees in a given year.
- *Capital stock* series are constructed by using perpetual inventory method. The database contains only information on investment. Detailed subcategories of investment are aggregated to buildings and structure, transportation equipment, and machinery. Since the data does not contain information on capital stock in any year we construct initial capital stock series for each establishment. Initial capital stock series (for the year before a plant enters the sample) is computed by assuming that average real investment undertaken in the first seven years of a plant represent its average investment behaviour in the seven years before the plant is included in the database. Using 5%, 10%, and 20% as the depreciation rates for buildings, machinery and transportation equipment, respectively, we calculate the initial capital stock. For those establishments that are not in the data for seven years we imputed initial capital stock series. Using initial capital stocks of establishments in the same four-digit SIC activity in that year generates the imputed values, which have similar attributes (such as similar usage of energy per worker). We assume that investment occurring in the previous year enters the capital stock this year.

b) Trade Orientation

The trade orientation of an industry is determined at a three-digit SIC level, on the basis of sector level export, import and sales values.

- Sectors that export more than 15% of their sales are classified as export oriented, sectors that have import penetration rate above 15% are classified as import competing, and others are classified as non-traded. If a sector's export-output ratio and import penetration rate are above 15%, then the sector is classified as import competing or export oriented depending on whether import penetration rate is above export-output ratio or not. Since the definition of trade orientation involves a potential endogeneity we inspected its stability over time. In other words, we computed the ratios using alternative sub samples. Interestingly, trade orientation of the three digit industries does not change much over time. In addition, we compared our classification with that of Erlat (1998) which is based on Krueger *et al.* (1981)'s criterion. [36] The two classification schemes yield remarkably similar

[35] See Griliches and Mairesse (1995) for a discussion of problems arising from use of one price.

[36] The criterion is based on the difference between domestic consumption C, and production Q, per unit of consumption: T= (C-Q)/C. Using C≡Q-X+M, T is calculated as T= (M-X)/(Q-X+M), where M is imports, X is exports. Obviously, if a sector is a net exporter, then T is less than 0.

results. As in our classification, this alternative is also stable over time, as reported in Erlat (1988). Classification based on 1983 values is reported in Table A4 in the Appendix.

c) Calculation of Tariffs

The calculation of import tariff rates at the sectoral level is plagued with a number of problems.

First, one can use either simple average or weighted average of product level tariff rates. In the case of weighted average, values of imports are generally used as weights.

Second, one can use wither the most favoured nation (MFN) rates, or (weighted) average of all rates applied to different country categories.

Finally, one can simple use nominal rates, or take into account exemptions.

There are a number of studies in which sectoral level tariff rates are calculated by using different methods. However, there are substantial differences between these calculations. After a careful examination of various studies, we concluded to use the import value and import tax revenue data provided in input-output (IO) tables complied by the Statistical Institute of Turkey, the because the IO data takes into account exemptions, provides estimates for weighted tax rates, and are consistent with national accounts. We used 1979, 1985 and 1990 IO tables to calculate sectoral level tariff rates. Since the IO sectoral classification is somewhat more aggregated than sectors defined at the ISIC 4-digit level, we prepared a correspondence table to match IO and ISIC sectors. For 1990s (1993, 1995, 1997, 1999, and 2003), we used UNCTAD TRAINS database at the ISIC 4-digit level (the weighted average of actual tariff rates). The tariff rates for other years were calculated by simple linear interpolation. In all econometric models, we include dummy variables for time to compensate for the errors in interpolating the data. In other words, time dummies account for, to some extent, aggregate changes in tariff rates.

The analysis carried in Erlat (1998) leads her to use 0.40 as a cutoff value to separate non-tradeable from import competing sectors. The sectors with T values between 0 and 0.40 are classified as import competing and those with T values greater than 0.40 as non-tradeable.

II. Appendix tables

Table 37 Turkey Appendix: Panel information – Number of Plants

	(1)	(2)	(3)	(4)
Year	Total	Entry	Exit	Continuing
1982	7,338	7338	852	---
1983	7,383	1074	654	5,655
1984	7,320	663	654	6,003
1985	6,873	361	663	5,849
1986	8,289	1947	695	5,647
1987	7,892	379	760	6,753
1988	7,721	510	648	6,563
1989	7,626	517	833	6,276
1990	7,418	694	853	5,871
1991	6,877	455	757	5,665
1992	6,666	409	713	5,544
1993	8,596	2599	980	5,017
1994	8,368	793	716	6,859
1995	8,194	702	772	6,720
1996	8,260	836	905	6,519
1997	8,694	1125	669	6,900
1998	9,552	1420	1,151	6,981
1999	9,706	1407	1,071	7,228
2000	9,469	586	1,011	---
Total	152,242	23,815	23,815	106,050

Notes:
Entry: plant that was not in the sample in the previous years
Exit: plants that were in the sample in the previous year but are no longer in the sample.
Sum of the columns (2), (3) and (4) is not necessarily equal to column (1) because the plants with one observation enter and exit in the same year (1,438 plants). The sum of the totals for column 2, 3, and 4 is equal to 153,680 which is exactly 1,438 more than 152,242.

Table 38 Turkey Appendix: Output-weighted average nominal protection rates (percent)

	Manuf.	IC	EO	NT
83	147.8	102.3	190.3	256.4
84	116.5	93.7	134.4	203.5
85	74.5	74.2	73.7	89.6
86	63.5	63.1	63.1	74.3
87	69.7	58.0	79.4	96.8
88	70.4	60.2	79.2	82.8
89	51.7	47.1	53.1	83.6
90	41.5	33.3	44.3	93.3
91	39.6	30.6	44.2	89.7
92	34.5	27.3	39.1	75.3
93	25.0	20.3	28.2	50.7
94	20.7	16.8	22.7	38.2
95	18.2	14.2	20.8	32.2
96	15.5	11.6	18.9	26.7

Note: Some years (85-87, 92, 93, 95 and 96) have imputed values. See Appendix I for sources and computation method. Manuf. indicated manufacturing as a whole. IC, EO and NT indicate import competing, export oriented and non-tradeable sectors, respectively.

Table 39 Turkey Appendix: Median real wages (mil. 1990 TLs)

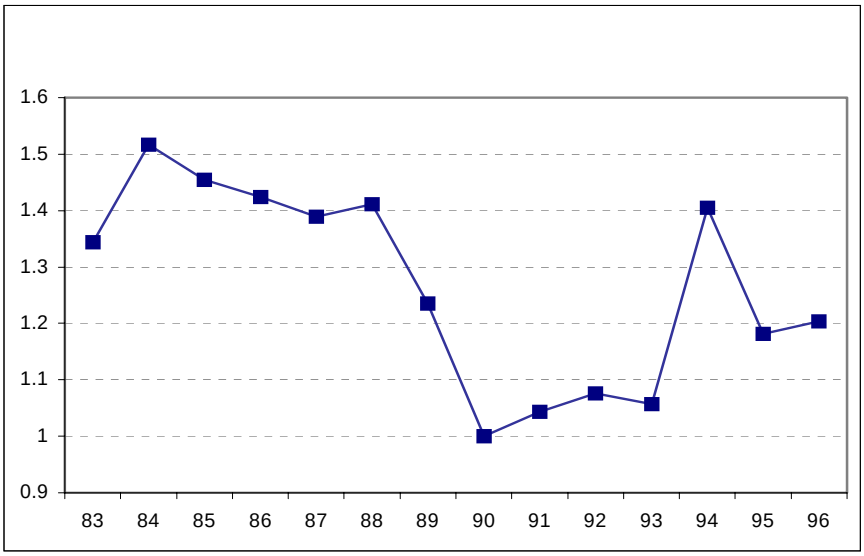
(Manufacturing Sector and 1982-based Trade-orientation groups)

Year	All	IC	EO	NT
1982	740.3	772.0	610.9	893.5
1983	747.5	769.4	669.1	829.5
1984	702.7	774.0	674.0	677.7
1985	748.1	824.6	720.2	688.2
1986	678.0	712.0	681.3	643.8
1987	759.7	804.9	752.7	685.1
1988	715.4	854.8	695.1	529.5
1989	789.4	923.2	772.2	602.8
1990	1184.3	1284.3	1284.9	825.9
1991	1448.3	1524.7	1552.8	1024.9
1992	1552.2	1620.8	1739.2	990.1
1993	1468.7	1447.8	1728.0	928.0
1994	997.0	1042.0	1084.0	714.5
1995	1123.7	1154.1	1247.3	746.2
1996	1523.3	1581.7	1746.3	880.6
1997	1958.4	1985.1	2206.8	1233.8
1998	2040.6	2025.0	2333.6	1352.3
1999	2356.2	2386.5	2590.9	1673.4
2000	2473.0	2533.7	2677.2	1789.9

Table 40 Turkey Appendix: 4-firm Concentration Ratios

	1984	1990	1996	Max	Min	Mean	Variance
Manuf	27.2	27.6	24.1	28.0	24.1	26.6	1.6
IC	32.1	37.9	30.7	38.8	30.7	35.5	7.5
EO	21.4	17.7	16.2	21.4	15.7	17.6	2.3
NT	47.8	39.4	39.6	47.8	34.7	40.2	13.9

Figure 4 Turkey Appendix: Real exchange rate



Note: Real exchange rate is defined as the U.S. consumer price index converted to Turkish Lira divided by the domestic consumer price index, 1990=1.

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