July 2010

Paradoxes of Productivity: Trade liberalization and Morocco

Patricia Augier*

Michael Gasiorek[+]

Stefania Lovo[+]

Gonzalo Varela[+]

Abstract

Increased openness impacts on productivity through changes in inter-sectoral specialization, intra-industry compositional shifts, and firm-level productivity. We examine the impact on Moroccan over 1993-2002. Productivity growth from each of the above is very low. Controlling for export and import endogeneity, there is a modest positive impact of exporting on firm-level productivity, and a minimal impact from domestic liberalization - except on those furthest away from the productivity frontier. We decompose inter and intra-sectoral reallocation effects on productivity revealing low growth from inter-sectoral specialization and from firm-level changes; growth being driven by the exit of low-productivity firms rather than the expansion of the more productive; and with high levels of entry and exit lowering aggregate productivity.

Corresponding author: Michael Gasiorek
Department of Economics
School of Business, Management and Economics
University of Sussex, Falmer
Brighton, UK, BN1 9RF

Tel: 0044 1273 877101
Email: m.gasiorek@sussex.ac.uk

JEL Classification numbers: F2 O1 O2
Keywords: Productivity, Trade liberalization, Firm heterogeneity, North Africa, Morocco,

* DEFI, Universite de la Mediterranee, France
+ CARIS, University of Sussex, UK.

Our thanks go to Maximiliano Mendez Parra for excellent research assistance, to Marion Dovis for giving us access to her programs for the direct estimation procedure and general advice; and to Charles Lai-tong and Barry Reilly for advice on the econometrics; from useful feedback received from Alan Winters, Leonardo Iacovone and participants at various conferences. Any errors or omissions remain our responsibility.

Paradoxes of Productivity: Trade liberalization and Morocco

1. Introduction

There are three key channels by which trade is typically seen to impact.on productivity. First, there is the inter-industry reallocation of resources to relatively more productive sectors driven by comparative advantage considerations. Secondly, there may be within industry compositional shifts as inefficient firms exit, more productive firms enter and/or increase their share of the market. Finally, trade could lead to firms themselves becoming more productive either from economies of scale, technical progress/transfer or reductions in x-inefficiency.

These are important channels and understanding the transmission mechanisms underlying these channels is extremely significant for developing countries engaging in, or considering in engaging in more widespread trade liberalization. Much recent work on trade and productivity focuses on the impact of trade on firm-level productivity, and on within industry compositional shifts. The reason for this focus is partly because the sectoral reallocation story is considered to be, by and large, well understood; and partly because recent theory and empirics have shown the importance of considering firm-level heterogeneity

On the import side domestic liberalization leads to increased competition resulting in efficiency improvements at the firm level for example arising from increased innovation (Ederington and McCalman, 2008, Aghion et.al, 2005, 2007, 2009), and restructuring as less efficient firms exit and output is reallocated to more productive plants (cf. Melitz, 2003, Helpman, Melitz and Yeaple, 2004, Bernard, Redding & Schott, 2007 and others). Domestic liberalization can also lead to increased FDI and technology transfer (Smarzynska 2004, Blalock & Gertler 2008); improved access to intermediates of higher quality and more variety (Ethier, 1982), as well as lowering the price of intermediates, again leading to increases in firm-level productivity. On the export side productivity may increase through increased knowledge transfer, economies of scale from access to foreign markets, greater competition leading to incentives to increase efficiency, as well as an improved ability to absorb domestic demand shocks.

There is then considerable supporting empirical evidence on the positive impact of domestic liberalization on productivity (Pavcnik, 2002, Schor, 2004, Fernandes, 2007, Amiti and Konings, 2007, Greenaway & Kneller, 2007). The evidence on exports is more mixed with a number of authors (De Loecker, 2007, Baldwin & Gu, 2003, Castellani, 2002, Delgado, Fariñas & Ruano, 2002, Aw, Chung & Roberts, 2000), as well as Fafchamps et.al 2007 in their study of Morocco, arguing that the causality runs in the direction of more productive firms exporting, as opposed to vice versa.

In this paper we explore the impact of trade liberalization over the period 1993-2002 in Morocco on manufacturing sector productivity, but where we aim to shed light on *each* of the three key channels outlined above. In contrast to some of the existing literature, our results present a somewhat pessimistic and perhaps paradoxical picture, and this is true with respect to each of these channels.

In the spirit of recent work we use detailed firm-level data derived from the Moroccan Annual Census of production over the period 1993-2002, and consider the role of both imports and exports in impacting on firm level changes in productivity, as well as the role of inter and intra-sectoral reallocation effects. We use a three-fold methodology. First, and analogously to the work of Fernandes (2007), we utilise a *direct* approach for estimating the impact of trade variables – on both the export and the import side - on firm level productivity. As is now well known a key issue in the estimation of total factor productivity is the likely simultaneity bias arising from the fact that firms make input choices but with knowledge of their own productivity. Common ways of controlling for this are based on the Levinsohn & Petrin (2003) or Olley & Pakes (1996) methodologies. There exists a similar issue of possible endogeneity with regard to trade policy – inefficient firms / industries may be more likely to lobby and receive protection. In this paper, we utilise an extension of the Olley & Pakes methodology by allowing for trade policy variable on both the export and import side to be included as regressors, and control for simultaneity with regard to each of these.[1]

Secondly, partly as a means of comparison with previous studies, partly for comparison with our direct approach, but in addition because it provides corroboration for our examination of the differential impact of trade liberalization on firms with different underlying productivity levels, we use an indirect approach. In the first instance this requires the estimation of a production function (while controlling for input-endogoneity a la Olley and Pakes), where the residuals provide a measure of firm level productivity; and in the second stage we estimate a productivity equation where we explore the role of a number of variables, including trade policy variables, on productivity. Of central interest here is the relationship between firm level productivity and trade policy with the distance of firms from the TFP frontier.

Thirdly, in order to assess the extent to which changes in productivity may be driven by reallocation effects we provide decompositions of the sources of productivity growth over time, where we are interested in exploring the relative importance in aggregate productivity of both sectoral shares and sectoral level changes in productivity, as well firm-level changes.

What is particularly striking is that despite this being a period of both domestic liberalization and trade liberalization we find that there is almost no change in aggregate productivity. We find that the process of trade liberalization has not led to any significant increases in firm-level productivity, and indeed with some evidence suggesting the reverse. On the export side we control for the issue of reverse causality and show that exporting does lead to higher productivity, but that the impact is small. This is consistent with the results of Fafchamps et.al. who focus on the relationship between labor productivity and exports. Our results suggest that an increase in exports by ten percentage points leads to an increase in productivity of around 1%. On the import side the regressions suggest little evidence that domestic liberalization resulted in significantly increased productivity. For example we find that a reduction in tariffs by ten percentage points results in increases in firm-level productivity of the order of less than 0.5%. Finally, and in contrast to the work of Aghion et.al

(2005, 2009) and, on the face of it perhaps paradoxically, we find consistent evidence that trade liberalization has a bigger positive effect on firm level productivity the *greater* the distance of the firm from the productivity frontier.

Moreover, although there are significant changes in the shares of sectoral output over time these do not appear to have led to increases in aggregate productivity as might have been expected. Indeed the evidence suggests that the contribution of sectoral changes to aggregate productivity is very low. There is a long standing literature going back to the work of Hagen (1958), and Bhagwati & Ramaswami (1963) which shows that in the face of, for example, factor market distortions, trade liberalization may not yield the expected sectoral reallocation induced welfare gains. Our results are consistent with such considerations.

Finally, we show that within sector firm-level reallocations appear to be particularly important in understanding the low rate of productivity change. The Melitz inspired literature suggests that productivity improvements arise from selection effects driven by improved access to export markets and increased competition in import markets. While there is considerable entry and exit of highly heterogeneous firms in Morocco this process and the market shares changes of incumbents firms have not led to higher productivity as might be expected. Exiting firms are typically more productive than entering firms while both of these categories are less productive than incumbents. While entering firms increase their productivity and market share over time, their productivity remains inferior to the incumbents hence aggregate productivity does not rise.

From both an analytical and policy perspective these are important result. As is now well recognised the potential benefits for countries from trade liberalization depend on appropriate institutional, regulatory and infrastructure frameworks being in place. The results in this paper suggest that these frameworks do not appear to be adequately in place in Morocco, thus preventing the process of “creative destruction”, which in turn has important implications for the role of trade liberalization in the process of development. In turn it raises important questions as to the underlying causes such as labor or credit market distortions (see e.g. Augier, Dovis & Gasiorek, 2010).

In terms of the structure of the paper we first provide a brief overview of the Moroccan policy environment. We then turn to our regression analysis, which focuses on the determinants of the changes in firm-level productivity. We then present the results of the decompositions, allowing us to consider the importance of reallocation effects. The final section concludes.

2. Moroccan Policy Environment

Following independence in 1956, Moroccan policy was based on import-substituting industrialisation and agricultural self-sufficiency in a highly protected domestic market. Following a balance of payments crisis in 1983, Morocco virtually eliminated quantitative restrictions on imports and announced planned reductions in maximum tariffs from 165% to 45% over a 6-year period. Further impetus to liberalization has come from the multilateral and regional trade agreements, signed with different partners since the middle of 1990s, and following Morocco's joining the WTO in 1995. These include a quadrilateral FTA with Tunisia, Egypt and Jordan (1995), which expanded in following years to include other Arab states; a bilateral FTA with Turkey; the EU-Morocco Association Agreement (1996); an FTA with the US (2004); with Turkey (2006), and the Agadir Agreement with Jordan, Egypt and Tunisia (2004). Morocco has also signed further trade and investment agreements with a range of countries in Eastern Europe, Asia, Latin America and Africa.

A key objective of this liberalization process was to stimulate higher rates of economic growth and development, and to achieve this through closer links to the EU via the Barcelona process. Not surprisingly then, Moroccan trade is heavily dominated by Europe, which is the destination and origin of more than three-quarters of exports and imports. France is the main trading partner, taking over one-third of exports and providing over one-fifth of imports. Spain is the second trading partner, typically taking 16-18% of exports and providing 10-12% of imports. The UK, Italy and Germany are other important trading partners. It is important to note, that the process of liberalization with the EU is asymmetric – Morocco has duty free access to the EU for all manufactured goods (hence agriculture is excluded), while it is reducing its tariffs on the EU's exports. This process of closer integration is now moving to a new phase under the EU's Neighbourhood Policy.

Since the mid-1990s therefore Morocco has much more actively sought to integrate its economy in the world trading system, and this is reflected in the decline in tariffs over this period as given in Table 1. Data on nominal tariffs are available only for the years given. From the table we see substantial reductions in tariffs, especially following the entry of Morocco into the WTO in 1995. The increase in some tariffs after 2000 arises from the tarification of quotas and other non-tariff barriers. By 2002 tariffs remain high ranging from 24%-50%. The biggest declines in protection are in Textiles and Electrical where the reductions were 74% and 58% respectively, and the smallest declines were in Food products (28%) and in Leather goods (29%). It is worth noting however, that despite the reduction in tariffs there are other taxes in place on imports into Morocco. Hence the level of tariffs tends may understate the true extent of protection in the economy.

Table 1 here

While trade reform, primarily for manufactured goods was clearly seen as an important means of achieving improved economic performance, there was also a recognized need for this to be coupled with domestic institutional reform, where there have been a range of other reform initiatives, which include a privatization process launched in the late 1980s largely focussed on hotels, road transport, petroleum distribution, petrochemicals, housing, textiles, cement and subsequently power generation, oil refining and telecommunications; a reform of the business environment and the judiciary, as well as a modification of the labor code and the labor legislation in 2003.

3. Data and Methodology

The data used in this paper is based on the Moroccan Annual Census of Manufacturing for the period 1993-2002. The annual census in principle covers all manufacturing firms with no size limitation. It contains information on sales, added value, output, exports, employment, date of creation, location, investment and 4-digit industry code using the Moroccan Nomenclature of Economic Activities (NMAE). We have used 2-digit NMAE output and added value price indices to deflate production and added value. For a subset of firms we also have access to a much more detailed dataset, entitled FACS, for the years 1998-1999. The capital stock is only available from the FACS dataset for the subset of firms that are both contained in the census and in the FACS, and hence is only available for 1998 and 1999. To obtain the stock of capital for the remaining years of the sample, we used the available data on investment with the perpetual inventory method, and a depreciation rate of physical capital of 6%. In order to obtain a measure of the stock of capital of the remaining firms – those not included in the FACS, we used the 'uvis' imputation technique, introduced by Royston (2004). This technique consists of estimating a linear regression model for the missing variable (the stock of capital), as a function of a number of relevant covariates (the level of investment, and the level of output of the firm). The capital stock for those firms with missing data is imputed using the prediction of that model, based on the values of the relevant covariates. Data on imports was obtained from COMTRADE.

In the paper we focus on the seven key manufacturing sectors in the Moroccan economy for the period 1993-2002. The seven key sectors are: Textiles, Clothing, Leather, Food Processing, Chemicals, Electrical, and Rubber & Plastics. After some considerable cleaning of the dataset we end up with an unbalanced panel containing 44,258 observations and 7,352 firms.

The table below summarises some key statistics with regard to these sectors. We see that the most important sectors in terms of output are Food, and Chemical throughout this period, who account for 42% (42%) and 25% (22%) respectively of total output in 1993 (2002), with the former seeing a growth rate of output of 10% and the latter of 1%.

Table 2 here

In 1993 the third most significant sector was textiles with a share of output of 16%, which had declined to 9% in 2002. Concomitant with this was an increase in the import penetration rate from 17% to over 34%, which resulted in a decline in production of nearly 40%. The sector with the biggest rate of increase is clothing which sees output rise by 79%, and its share of output to rise from 9% to 14% and very low and declining rates of import penetration. The substantial increase in output in clothing is clearly being driven by a marked increase in exports which rise by over 80% in real terms over the period and with the share in total exports rising from 25% to 34%. We see that all other sectors witness an increase in import penetration, and all sectors except for textiles see their exports rise. The most dramatic rise is for electrical goods where exports increase by almost 2000% over the period.

4. Direct and indirect analysis of the determinants of productivity.

In this part of the paper we turn to the analysis of the determinants of firm-level productivity growth, and where we are particularly interested in the relationship between trade on both the import and export side and productivity. We pursue two empirical strategies – a direct method and an indirect method.

First we estimate the impact of trade variables – on both the export and the import side - on firm level productivity but where we control for the likely simultaneity biases which may arise because firms typically make input choices with knowledge of their own productivity, and because both import protection and exporting may also be endogeneous. The methodology employed here is an extension of the Olley & Pakes methodology (2003).

Under parametric and semi parametric methods TFP at firm level is normally obtained as the difference between the observed output and the estimated output function, assuming the technology of firm i is described by a log-linear Cobb-Douglas production function:

(1) $y_{it} = \beta_0 + \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + e_{it}$

where y_{it} represents firm output, l_{it} labor input, m_{it} intermediates, k_{it} capital and ε_{it} is the error term and all variables are in logs. The Olley and Pakes methodology takes into account that this error term has two components, ω_{it} a time varying productivity shock known by the firm but not by the econometrician and η_{it} white noise, ie unexpected productivity shocks. If firms can anticipate producitivity shocks and make input decisions on that basis of problem of simultaneity arises, yielding OLS estimates of (1) which are inconsistent. In the O&P approach the firm maximizes its profits and chooses its investment as a function of two state variables (capital and productivity), $I_{it} = i_{it}(k_{it}, w_{it})$. The investment function is monotonically increasing in productivity (Pakes, 1994). We can also use the inverse function and write productivity as a function of capital and investment, ie $w_{it} = h_{it}(I_{it}, k_{it})$.

We modify the O&P methodology by treating the trade variables as additional state variables as there may be simultaneity issues also with regard to these variables. We assume (i) that the firm's export share (ii) that tariffs and import penetration rate can be influenced by the firm also in period t-1. Hence:

(2)
$$w_{it} = \begin{cases} h_t(I_{it}, k_{it}, xr_{it}, tp_{jt}) \\ h_t(I_{it}, k_{it}, xr_{it}, ipr_{jt}) \\ h_t(I_{it}, k_{it}, tp_{jt}, ipr_{jt}) \end{cases}$$

with xr_{it} the firm export share, tp_{jt} the industry (4-digit) tariff and ipr_{jt} the industry (4-digit) import penetration rate.

By substituting (A2) into (A1) we test the three following equations:

(3)' $$y_{it} = \beta_t l_{it} + \beta_m m_{it} + \phi_{it}\left(I_{it}, k_{it}, xr_{it}, tp_{jt}\right) + \eta_i + \eta_t + \eta_j + \varepsilon_{it}$$

(3)' $$y_{it} = \beta_t l_{it} + \beta_m m_{it} + \phi_{it}\left(I_{it}, k_{it}, xr_{it}, ipr_{jt}\right) + \eta_i + \eta_t + \eta_j + \varepsilon_{it}$$

(3)'' $$y_{it} = \beta_t l_{it} + \beta_m m_{it} + \phi_{it}\left(I_{it}, k_{it}, ipr_{jt}, tp_{jt}\right) + \eta_i + \eta_t + \eta_j + \varepsilon_{it}$$

With η_i firm fixed effects, η_t year dummies, η_j industry dummies at 4-digit and ε_{it} the error term.

Secondly we utilise the indirect approach, which first requires the estimation of a production function, while controlling solely for input-endogeneity as above, and where the residuals provide a measure of firm level productivity; and secondly we estimate a productivity equation, where the explanatory power of a number of variables can be examined.

Table 3 below gives the results from the direct estimation approach, where we explore the implications of controlling for endogeneity on both the export and the import side. The table gives the results for several specifications, where we control for the endogeneity of tariffs and the import penetration ratio at the sectoral level, and the export ratio at the firm level, both with and without lags. The import penetration ratio is defined as total sectoral imports divided by total sectoral sales. The export share is defined at the firm level as the share of exports in each firm's total sales. All the regressions are run with firm level fixed effects and year dummies. We also include the firm-level market share, the degree of concentration (Herfindahl index), and the age of the firm as explanatory variables.

On the export side the key variable of interest is the firm's export share, and on the import side we have two possible variables, tariffs and the import penetration rate, each of which are defined at the 4-digit sectoral level. From the table it can be seen that the export share is always positive and significant. As we are controlling for simultaneity this suggests that exporting leads to increases in productivity albeit to a modest extent. This is also true where we consider the export share lagged by one period. This is an interesting result as a number of previous studies (have argued that the positive correlation between exporting and productivity is because it is the more productive firms which succeed in international markets and hence end up exporting. Here we find direct evidence that exporting itself leads to a growth in productivity, but that the effects are typically small. An increase in exports of ten percentage points leads to an increase in productivity of the order of 1%.

One would normally expect that reductions in tariffs, or an increase in import penetration would lead to increases in productivity as the economy is opened up to more competition and as firms also have improved access to intermediates. Hence, the expectation is that the coefficient on tariffs would be negative and that on import penetration positive, and this result is corroborated in a number of recent studies (eg. Fernandes, 2007). Our results also suggest that lower tariffs are associated with higher productivity levels, however the coefficients are very small – a ten percentage point reduction in tariff increases productivity by less than 0.5%.

There is also no evidence that increased import penetration is associated with higher levels of productivity. In most of the cases regressions the coefficient is statistically insignificant except for in one case where it is negative. This suggests that increases in import penetration may be associated with a decline in productivity. In terms of the pro-competitive and intermediate input story above this could appear counter-intuitive. It is of course possible that if firms produce under increasing returns to scale that an increase in import penetration can result in firms producing higher up their average cost curves and results in a decline in productivity. While this is possible, it is worth noting that our estimation results did not suggest the presence of increasing returns to scale. Other possible explanations are for example, as Rodrik has argued, that in the face or liberalization firms reduce their levels of investment and hence productivity growth declines; or finally that in imperfectly competitive markets the results reflect a decline in price-cost mark-ups as opposed to decreases in productivity.

Table 3 here

Finally, and consistent with other results in the literature there is also strong evidence that productivity rises with the age of the firm[2]; and that increases in market share are associated with higher levels of productivity. Here too it is hard to establish the direction of causality and we have not controlled for possible endogeneity.

Table 4 gives the results from an analogous set of regressions but this time using the indirect estimation procedure where once again our dependent variable is the log of productivity. A further issue which interests us here is the relationship between the changes in firm-level productivity and the position of the firm relative to the productivity frontier. In Table 4 we explore this by the addition of two additional variables to our regressions. First, we include a variable (frontier) which gives the lagged average productivity of the five most productive firms in each sector – these represent the productivity frontier (see also Griffith, Redding and Simpson, 2006; Iacovone, 2008). The purpose of including this variable is to examine how changes in the productivity frontier impact on firm level productivity. Secondly, we include a variable which gives each firm's productivity relative to the frontier (DFF).

Table 4 here

As was the case earlier the coefficient on tariffs is negative but here the size of the coefficient is somewhat larger. The results suggest that a 10 percentage point reduction in tariffs increases productivity by just under 1%. The export share is always positive and statistically significant, and the size of the coefficient is smaller than with the direct approach. The indirect approach also confirms the possible negative impact on productivity of increases in import penetration, though now with a much larger coefficient, which suggests that an increase in import penetration of ten percentage points could be associated with a reduction in productivity of just over 3% in all of the specifications. These results confirm the results obtained earlier concerning the relationship between trade and productivity

If we consider the relationship between firm level productivity and the productivity frontier, a positive coefficient would suggest productivity catch up: Firm productivity rises as the frontier grows and firms benefit from the increased productivity of those at the frontier. This could be a pro-competitive "Darwinian" effect of the sort mentioned by Melitz (2003), where if some firms are expanding the frontier the rest need to increase efficiency if they are to compete, or some form of spillover effect. While our coefficient is positive and statistically significant it is close to zero, hence suggesting little evidence of productivity catch-up. The coefficient on DFF is, not surprisingly, negative. As DFF gives the ratio of the frontier to each firm's level of productivity, and we are controlling for the location of the frontier, an increase in the distance (DFF) is associated with a decrease in productivity of the i-th firm.

There is an important theoretical and empirical literature on the effect of trade on technological diffusion and hence on firm-level productivity. For example Ederington and McCalman (2008) show that trade has a generally positive impact on the speed of technology diffusion. Aghion et.al (2009) suggests that the more productive firms will be able to respond more positively to the challenges posed by the threat of entry and to increase their productivity over time (the escape-entry effect). For the laggard firms, this threat discourages innovation and productivity decreases (the Schumpeterian effect). Hence the impact of trade depends on the initial efficiency of the firm relative to the productivity frontier. This issue is explored in Table 5. The dependent variable is now the change in productivity from one period to the next, so we are exploring the extent to which the change in lagged tariffs (in period *t-1)*, might have impacted on the change in productivity between *t* and *t-1*. We include a variable which gives each firm's productivity relative to the frontier (DFF), and in the regressions we explore the impact on the productivity of all the non-frontier firms.

There is here a potential issue of endogeneity, as we have the lagged value of firm level productivity on both sides of the regression equation. In order to be confident in our results we deal with this issue in several ways. The first two columns of Table 5 give the results for a standard pooled OLS regression, and where we include firm level fixed effects. It can be seen that here we include both DFF and the interaction between DFF and lagged tariffs. The purpose of the interaction is to see if the impact of tariffs varies depending on the firm's distance from the frontier. In the third column of the table we present the results where we have instrumented for the possible endogeneity of both the DFF and the DFF*lagged tariff variables, where we have used lagged values of each of these as instruments.

Of particular interest in these first three columns are the coefficients on lagged DFF and on the lagged DFF variable interacted with tariffs. The impact on lagged DFF is positive hence indicating that firms who lag behind tend to catch up with the more productive firms. In order to assess the impact of tariffs on firm-level productivity we now need to consider the coefficient on tariffs as well as the interacted variable[3]. The results for each of these first three regressions strongly indicate that changes in tariffs increase the productivity of those firms further away from the frontier, as opposed to those closer to the frontier. This is in contrast to much of the existing literature and suggests that alternative mechanisms to those suggested by Aghion et.al may be at work here, and we return to this later.

In the fourth column of the table we approach this issue somewhat differently. Here we have taken the DFF calculation, and we have divided the sample of firms into quartiles based on the DFF distribution, with those furthest away from the frontier being in the fourth quartile. We then construct a set of dummy variables for each of the quartiles, and run the regression with the dummy variables interacted with the tariff. By using quartile dummies we therefore avoid the problem of endogeneity. Finally, in the last column of the table we take the productivity level of each firm, and on the basis of this divide the firms into deciles, and then construct dummies on these deciles. The results by quartile and by decile corroborate those of earlier. In column 4 we see that that the impact of lagged tariffs on productivity is highest for the firms in the fourth quartile ie.for those firms furthest away from the frontier. In column 5 the deciles have been organised by the level of productivity so now the least productive firms are in the first decile, and the most productive in the last decile. Once again we find that changes in lagged tariffs impact most on the firms furthest away from the frontier. We also see a diminishing value of the coefficient on the DFF deciles, once again suggesting productivity catch-up.

Table 5 here

We have also run similar regressions to those above (not reported here) where we explore whether changes in tariffs impact differently on firms either by sector, by size or by age. Interestingly we find that there is no evidence that tariff reductions have a differential impact across sectors or by size. There is however some effect according to the age of the firm. The biggest positive impact on tariff reductions is on younger firms, defined as those less than 6 years old (which is once again consistent with Fafchamps et.al (2007)), followed by those aged between 11 and 20 years old. For those between 6 and 11 years old there appears to be no impact of tariff reductions on productivity.

5. Productivity growth and its decomposition

In order to understand better the evolution of productivity in Morocco, we now turn to considering the importance of inter-industry reallocations, as well as within industry compositional effects. We do this by decomposing productivity growth in two ways, but first we identify some key features of the productivity changes[4]. The first aspect to note is that overall productivity growth was extremely modest. If we compare 1993 with 2002 the change in weighted productivity over this period was just 1.76%, and the change in unweighted productivity was a modest 5.28%[5].

The comparison between the weighted and the unweighted is informative. Weighted productivity is greater than un-weighted implying that higher productivity firms have a higher share of the market, and as found in the regression analysis. The rise in unweighted productivity means that on average firm level productivity rose. However, as weighted productivity remained relatively constant this means that either the productivity of high-productivity firms rose but their share declined, or that the productivity and share of low-productivity firms rose while the converse took place for higher productivity firms. It turns out that it is the latter which occurred in Morocco[6]. This is interesting for two reasons. First because one might expect more productive firms to increase their share of the market, yet we do not find this. Secondly, we see that changes in TFP and market share do not always move in the same direction, suggesting that the issue of endogeneity between productivity and market share is less likely to be an issue in our preceding regressions.

Figures 1 and 2 then give the change in market share, by output, and the unweighted average productivity for four categories of firms – those who remain in the sample throughout the period (survivors); those who exit before the end of the period (exiters); those that enter and then remain during the period (entrants); and those that enter and leave within the period (short-stayers). Several features are interesting here. First we see that survivor firms increase their share of the market from 63% in 1993 to 76% in 2002. Secondly, there is considerable entry and exit over the period. Firms accounting for 37% of the market in 1993 have exited by 2002, while new entrants account for 24% of output by 2002. Short-stayers typically account for less than 5% of output. In terms of the underlying productivity levels we see that the average unweighted productivity of survivor firms is higher for each year of the sample than the productivity of each of the other categories, that the productivity of the entrants rises initially and then tails off, and that the productivity of the exiters is very similar to that of the entrants.

Figures 1 & 2 here

We now turn to examining the role of inter-industry reallocations, in order to address how much of the aggregate change occurs because of sectoral specialization and changes in sectoral shares (e.g. according to comparative advantage) for given levels of productivity; and how much takes place because of productivity change within sectors, for given sectoral shares. In principle, this can be done with the following decomposition.

(4) $\Delta P_t = \sum_i TFP_{it-k}\Delta S_{it} + \sum_i \Delta S_{it}\Delta TFP_{it} + \sum_i S_{it-k}\Delta TFP_{it}$

where ΔP_t gives the change in aggregate productivity between periods *t* and *t-k*; S_{it} gives the output share of sector *i* in period *t*, and TFP_{it} is the weighted average productivity of sector *i* at time *t*. ΔTFP_{it} and ΔS_{it} then give the change in productivity and the change in sectoral shares respectively between periods *t* and *t-k*.

Note, that the calculation of sectoral productivity is based on firm level data. Hence even with no changes in productivity, changes in firms' shares will impact on sectoral productivity. In the decomposition therefore we need to identify the changes in firm shares and firm productivity. Consider Table 6 and Figure 3, where we further decompose aggregate productivity, ΔP_t, into five elements. The first two of these identify the role of changing sectoral shares, and the last three the changes in productivity which could either arise from changes in firm level productivity, or changes in firm level shares. For each of the five elements the bottom line of Table 6 gives the contribution of each of the five elements as a % of the base level of productivity, where the decomposition is undertaken over the entire time period (1993-2002). In Figure 1 we give the yearly contribution of each of the five elements.

Table 6 and Fig 3 here

From Table 6 we see that the change in aggregate productivity arising from changes in sectoral specialization which is captured by the first two terms is minimal. The first focuses on the changes in sectoral shares for given levels of productivity, and the impact on productivity amounts to little more than 0.5% of the base level of aggregate productivity, and changes little over the time period. Similarly, the second term which gives the interaction between the changes in sectoral shares and changes in sectoral productivity is negative and extremely small, amounting to less than 1% of base productivity levels and also varies little over the time period.

Recall that the last three terms give the decomposition of the changes in sectoral productivity for given sectoral shares. The third term captures the contribution of the change in firm level productivity for a given share of the firm in the sector, and sectoral share in total output. The change in productivity arising from this element is negative, and is equal to just over 35% of the initial level of productivity. For this to be negative the within industry weighted average change in firm-level productivity, for at least some industries, must be negative, and/or that this is more pronounced in sectors with a higher share in total output. We see the growing importance of this element in the later years of the sample. This could be consistent with a change in sectoral specialization story where, for example, a large uncompetitive sector is seeing a decline in firm level productivity perhaps driven by lack of investment and or economies of scale. Indeed examining the sectoral breakdown (not reported here), we see a decline in productivity in textiles which as we saw Table 1 is an important sector which has seen a significant decline in its share in manufacturing output and exports. However, we also find that the net decline in productivity occurs in *all sectors,* including for example clothing which has seen a substantial rise in its share of output and exports.

The fourth term identifies the contribution to the change in productivity arising from changes in firms' shares in sectoral output, given initial levels of productivity and weighted by the importance of each sector in total output. The negative change in productivity amounts to just over 21% of the initial level of productivity, and we see a slight rise in its magnitude over time. This would appear to suggest that high productivity firms see a decline in their market share (or that low productivity firms see an increase in their share), and/or that there is exit of higher productivity firms and entry of lower productivity firms, and/or that these changes are more pronounced in sectors with a higher share of total output. Once again, when we look at the industry breakdown we find that this term is negative for every sector. This is contrary to what one would expect, and contrary to the mechanisms identified by the Melitz-inspired literature.

Finally, we turn to the fifth term which as can be seen is the most significant element of the decomposition, with the change in productivity from this element amounting to nearly 60% of 1993 productivity levels. This gives the interaction between the change in firm level shares and changes in firm level productivity. For this to be positive, the changes in the shares and in productivity have to move in the same direction – either positively or negatively. We do not report the details here but if we examine this term more closely by industry we clearly see that both mechanisms are present. In all sectors we see a process of creative destruction with firms increasing their productivity and their share, and we also see firms with declining shares and levels of productivity. However for all but two industries the share of the decline in productivity and output shares is greater than the share of those firms experiencing an increase. Note that even with no changes in sectoral shares, intra-sectoral reallocation would have only increased aggregate productivity by 2.12% (instead of 1.76%)[7].

The preceding was focussed on understanding the changes in productivity at the sectoral level. We now consider a decomposition which identifies firm level changes across manufacturing as a whole and allows us to consider the pattern of productivity changes across survivor firms, entrants and exiters, which is important given the high levels of firm turnover as seen earlier. The aggregate change in productivity will depend on the change in any given firm's productivity, on changes in a firm's share of the market given its productivity, and on changes in aggregate productivity arising from the entry and exit of firms. There are several possible decompositions which include Baily, Hulten and Campbell (1992), Foster, Haltiwanger & Krizan (2001), and Griliches and Regev (1995). Below we report on the results for Foster et.al[8]. Analagously to before aggregate productivity in year *t*, P_t is given by,

(5) $P_t = \sum_i \sigma_{it}\, tfp_{it}$

where σ_{it} is the output share of firm *i* in total output at time *t*, and as before tfp_{it} is the (log) firm productivity, the change in manufacturing ΔP_t, between periods t and τ is then:

(6) $$\Delta P_t = \sum_{i \in C} \sigma_{it-k}\, \Delta tfp_{it} + \sum_{i \in C} \left(tfp_{it-k} - TFP_{t-\tau} \right) \Delta \sigma_{it} + \sum_{i \in C} \Delta tfp_{it}\, \Delta \sigma_{it} +$$

$$\sum_{i \in N} \sigma_{it} \left(tfp_{it} - TFP_{t-k} \right) + \sum_{i \in X} \sigma_{it-\tau} \left(TFP_{t-k} - tfp_{it-k} \right)$$

With “N”, “X” and “C” representing entering, exiting and continuing firms respectively. The decomposition has five components. The first captures the firm-level changes in productivity for all firms who survive between periods t and k. This term is often referred to as the within effect and measures internal restructuring. The second captures the "between" or “reallocation” effect between survivor firms. This gives the change in the firms’ output shares multiplied by the difference between each firm’s productivity tfp_{it-k} and the average industry productivity in the base year TFP_{t-k}. In our results we further distinguish between those firms whose productivity was below the average, and those whose productivity was above average. The third term is an interaction term and measures the "compound effect" of the variation in firm-level productivity, and output shares changes. If its value is positive, this means that changes in productivity and changes in output shares were both positive or both negative; if this term is negative this means that productivity and output shares vary in opposite directions.

The fourth and fifth components represent the contribution of entering and exiting firms respectively. Entering (exiting) firms contribute positively (negatively) to the growth of aggregate industry productivity if their TPF is higher (lower) than the initial industry index. Once again we distinguish between those firms whose productivity is higher and lower than the average. The sum of the fourth and fifth terms measures the impact of net entry. The net entry effect will thus depend on the difference in the output shares between entrants and exiting firms and on the difference in the productivity of entering firms and exiting firms productivity from average productivity.

Table 7 gives the results for the decomposition. We present results for the change in productivity over the entire time-period (hence the comparison is between 1993 and 2002) and then for the yearly average; we also give the results over the entire time period but only for exporters. For the aggregate results, the numbers represent the contribution of each element of the decomposition to the aggregate productivity change as a percentage of the base aggregate productivity level in 1993. Where the figure is negative this indicates that this element of the decomposition decreased aggregate productivity. Consider the first column of the table. Here we see that over the period for survivor firms there is very little change in firm-level productivity – only 1.23% of 1990 productivity levels, and slightly higher for exporters (2.01%)[9].

In terms of reallocation effects, we see that survivor firms, both those whose productivity was below and above average, increased their share of output and this is also true of exporters. We also see a similar story in terms of the annual averages, though as these are annual averages the percentages are considerably smaller. However, the increase in the share of low productivity firms results in a net negative impact of this term on aggregate productivity, This is surprising as one might expect that higher productivity firms would be more competitive and would increase their share of output such that reallocation effects would be positive.

If we consider entry and exit we again distinguish between those firms whose productivity was higher than average and those whose productivity was lower than average. The entry of firms whose productivity is lower than average lowers average productivity, and conversely for the entry of firms whose productivity is higher than average. In the results we see that there is considerably more entry of less productive firms, both when considering all firms and also when considering exporters, hence, and in contrast to previous studies (Foster et al. (2001) for USA, Disney et al. (2003) for UK and Crespi (2006) for Chile), the net impact of entry on aggregate productivity is negative. It is surprising to find a negative net effect when the decomposition is calculated over the entire time-period (1998-2002) for 2 reasons. First entrants have an average life of four years and we might expect to that the learning effects to increase the productivity. Secondly firms who enter after 98 and exit before 2002 are not included in the calculation of contribution which given the lower productivity of entrants is likely to create a bias in the reverse direction.

Similar considerations apply to the contribution of exiters. The exit of firms whose productivity is less than average, raises average productivity, and the exit of firms whose productivity is higher than the average reduces average productivity. We find that the exiters are typically less productive than the average hence this offsets the decline in average productivity which arose because of the entry (on average) of firms less productive than the average. Once again, the middle panel indicates that these effects are not specific to the analysis being undertaken with a 9-year lag, and that the yearly average decompositions present a similar picture, and that there is little difference when considering exporters.

Table 7 here

6. Conclusions

Theory and much empirical evidence suggest that increased openness should lead to increases in aggregate productivity from changes in inter-sectoral specialization driven by changes in relative prices; by intra-industry compositional shifts resulting from the exit of inefficient firms and sectors and the increasing share of more productive firms in the market; and by changes in the underlying productivity of firms in turn driven by technology transfer and increases in competition.

Morocco in the 1990's saw a period of substantial trade policy reform and other domestic reforms, aimed at increasing rates of economic growth. However, the evidence in this paper indicates that productivity growth over 1993-2002 for key manufacturing sectors has been minimal. With regard to firm-level changes in productivity, we control for possible endogeneity bias on both the export and import side, and show that that increased exports leads only very slightly to higher levels of productivity; and there is only weak evidence that domestic liberalization increased productivity.

Contrary to much of the existing literature, our results also show that, when taking into account firm-level heterogeneity, tariffs tend to increase the productivity of those firms who are further away from the productivity frontier. From the decomposition analysis we also see high levels of firm entry and exit, with the productivity of entrants, who typically have a lower than average productivity profile, rising more rapidly. This suggests that the larger positive impact of trade liberalization on lower productivity firms may well be on the new entrants, who are taking advantage of the process of creative destruction and through greater exposure to trade see their productivity rise. While a potentially positive story, we find that the new entrants do not manage to attain the productivity levels of the incumbents.

The low levels of firm-level productivity change are corroborated by our decomposition analysis where we consider sectoral changes, changes in market share, as well as the role of entry and exit. The overall picture that emerges is that over the period productivity growth arising from sectoral specialization was very low, and productivity growth at the firm level was also very low, and this is particularly true of survivor firms. Although the net changes were low, this was a period of considerable entry and exit which on balance tends to lower aggregate productivity. In good part this is because of the entry of lower productivity firms, but who tend to have higher levels of productivity growth. Hence there is little evidence of productivity growth occurring because of changes in inter-sectoral specialization, or within industry reallocation effects a la the Melitz inspired literature.

All this suggests a somewhat pessimistic and paradoxical picture of the impact of trade liberalization and domestic reform on productivity growth. While the mechanisms driving trade and productivity linkages are well documented, perhaps in the spirit of Hagen (1958) and Bhagwati and Ramaswami (1963), these results reinforce the need to understand more fully the circumstances under which they may or may not arise, the constraints which firms may face, and the possible distortions – be they in factor markets or product markets (see for example, Greenaway et.al. 2007; Carluccio & Fally 2008, Augier, et.al 2010) which may prevent developing countries like Morocco take advantage of these policy changes.

References

Aghion, Ph., Blundell, R., Griffith, R., Howitt, P., Prantl, S., (2009). The Effects of Entry on Incumbent Innovation and Productivity, *Review of Economics and Statistics* 90, 1, 20-32.

Aghion, Ph., Braun, M,., & Fedderke, J, (2008). Competition and Productivity Growth in South Africa, *Economics of Transition*, Vol.16, No.4, pp.741-768

Aghion, Ph., Fally, T., & Scarpetta, S. (2007). Credit Constraints as a barrier to entry and post-entry growth of firms.

Aghion, Ph., Bloom, N., Blundell, R., Griffith, R., Howitt, P., (2005). Competition and Innovation: An Inverted-U Relationship, *Quarterly Journal of Economics*, May, 701-727.

Aghion, PH., Burgess, R., Redding, S., and Zilibotti, (2005), R. Entry Liberalization and inequality in Industrial performance, *Journal of the European Economic Association,* Vol. 3, No. 2-3, Pages 291-302

Amiti, M., Konings, J., (2007), Trade Liberalization, Intermediate Inputs and Productivity: Evidence from Indonesia, *American Economic Review* Vol.97, No.5, pp.1611-1638.

Anderson, M., Lööf , H., Johansson, S., (2008), Productivity and international trade: Firm level evidence from a small open economy, *Review of World Economics* 144, 4, 774-801.

Augier, P., Dovis, M., and Gasiorek, M., (2010), The Business Environment and Moroccan Firm Productivity", CARIS working paper, 2010-4

Baily, Hulten and Campbell (1992), Productivity Dynamics in Manufacturing Plants, *Brookings Papers on Economic Activity: Microeconomics*, Vol. 2

Baldwin, R., & Robert-Nicoud, F (2007). Trade and growth with heterogeneous firms, *Journal of International Economics,* Vol 74, No.1 pp. 21-34.

Baldwin & Gu, (2003), Export-market participation and productivity performance in Canadian manufacturing, *Canadian Journal of Economics,* Vol.36, No.3, pp.34-657

Bernard, A., Schott, P., Redding, S., (2007). Comparative Advantage and Heterogeneous Firms, *Review of Economic Studies* 74, 31-66.

Bhagwati, J., Ramaswami, V.K., (1963) "Domestic distortions, tariffs, and the theory of optimum subsidy." *Journal of Political Economy* 71 (1), 44–50, February

Blalock, G., Gertler, P., (2008), Welfare gains from foreign direct investment through technology transfer to local supplier, *Journal of International Economics*, 74(2), pp. 402-421.

Blalock, G., Veloso, F.M., (2007), Imports, Productivity Growth and Supply Chain Learning, *World Development* 35, 1134-1151.

Blundell, R., Costa Dias, M., (2000), Evaluation Methods For Non-Experimental Data, *Fiscal Studies* 21, 427-468.

Bottasso, A., Sembenelli, A., (2001), Market Power, Productivity and the EU Single Market Program: Evidence from a Panel of Italian Firms, *European Economic Review* 45, 167-186.

Carluccio, J., Fally, T., (2008), Global sourcing under imperfect capital markets, Paris School of Economics, Working Paper.

Castellani, D., Zanfei, A., (2003), Technology Gaps, Absorptive Capacity and the Impact of Inward Investments on Productivity of European Firms, *Economics of Innovation and New Technology* Vol. 12, No.6, 555-576.

Crespi (2006), Productivity and firm heterogeneity in Chile, PRUS working paper no.36, University of Sussex.

Delgado, M.A., Fariñas, J.C., Ruano, S., (2002), Firm Productivity and Exports Markets: A Non Parametric Approach, *Journal of International Economics* 57, 397-422.

De Loecker, J., 2007. Do Exporter Generate Higher Productivity? Evidence From Slovenia, *Journal of International Economics* 73, 69-98.

Disney, R., Haskel, J. & Heden, Y. (2003), Restructuring and productivity growth in UK manufacturing, *Economic Journal*, Vol. 113, No. 489,, pp. 666 - 694

Djankov, S., Hoekman, B., (2000), Market Discipline and Corporate Efficiency: Evidence From Bulgaria, *Canadian Journal of Economics* 33, 190-212.

Ederington, J., McCalman, Ph., (2008), Endogenous firm heterogeneity and the dynamics of trade liberalization, *Journal of International Economics* 74, 422-440.

Ethier, W., (1982), National and International Returns to Scale in the Model Theory of International Trade, *American Economic Review* 72, 3, 389-405.

Fafchamps, M., El Hamine, S., and Zeufack, A., (2007), Learning to Export: Evidence from Moroccan Manufacturing, *Journal of African Economies.*

Fernandes, A.M., (2007), Trade Policy, Trade Volumes and Plant-Level Productivity in Colombian Manufacturing Industries, *Journal of International Economics* 71, 52-71.

Foster, L., J.C. Haltiwanger and C.J. Krizan (2001), 'Aggregate productivity growth: Lessons from microeconomic evidence', in Edward Dean, Michael Harper, and Charles Hulten (eds.), New Developments in Productivity Analysis, Chicago: University of Chicago Press.

Greenaway, D & Kneller, R. (2007), Firm heterogeneity, exporting and foreign direct invesment, *Economic Journal*, 117, pp.F134-F161.

Greenaway D., Guariglia, A, Kneller, R. (2007), Financial factors and exporting decisions, *Journal of International economics*, Vo.73, pp. 377-395.

Greenaway D., Kneller, R. (2007), Industry Differences in the Effect of Export Market Entry: Learning by Exporting?, *Review of World Economics*, Vol.143, No.3, pp.416-432.

Griffith, Redding and Simpson, (2006),Technological catch-up and the role of multinationals, mimeograph

Griliches and Regev (1995) Firm productivity in Israeli industry 1979–1988, *Journal of Econometrics,* Vol.65, No.1, pp.175-203

Girma, S., Greenaway, D., Kneller, R., (2004), Does Exporting Increase Productivity? A Microeconometric Analysis of Matched Firms, *Review of International Economics* 12, 855-866.

Hagen, E., (1958), "An Economic Justification of Protectionism," *Quarterly Journal of Economics,* Vol. 72, November, pp. 496-514.

Helpman, Melitz and Yeaple, (2004), Export versus FDI with Heterogeneous Firms, *American Economic Review,* Vol. 94, No.1, pp.300-316

Kasahara, H., Rodrigue, J., (2008), Does The Use of Imported Intermediates Increase Productivity? Plant-Level Evidence, *Journal of Development Economics* 87, 106-118.

Levinsohn, J. & Petrin (1999), When Industries Become More Productive, Do Firms? *NBER Working Paper*, No. W6893.

Melitz, M., (2003), The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity, *Econometrica*, Vol. 71, pp.1695–1725.

Mündler, M., (2004), Trade, Technology, and Productivity: A Study of Brazilian Manufacturers, 1986-1998. Department of Economics, UC San Diego, University of California At San Diego, Economics Working Paper.

Olley, S., Pakes, A., (1996), The Dynamics Of Productivity in The Telecommunications Equipment Industry, *Econometrica,* Vol.64, pp.1263-1297.

Pavcnik, N., (2002), Trade Liberalization, Exit, and Productivity Improvements: Evidence From Chilean Plants, *Review of Economic Studies* Vol. 69, pp.245-276.

Rosenbaum, P., Rubin, D.B., (1983), The Central Role of The Propensity Score in Observational Studies For Causal Effects, *Biometrik,a* Vol.70, pp.41-55.

Schor, A., (2004), Heterogeneous Productivity Response To Tariff Reduction. Evidence From Brazilian Manufacturing Firms, *Journal of Development Economics* Vol.75, pp.373-396.

Sembenelli, A., Siotis, G., (2008), Foreign Direct Investment And Mark-Up Dynamics: Evidence From Spanish Firms, *Journal of International Economics* Vol.76, pp.107-115.

Smarzynska, B. (2004), Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkagee, *American Economic Review*, Vol. 94, No.3, 605-627.

Wagner, J., 2007. Exports and Productivity: A Survey of The Evidence From Firm Level Data, *World Economy* 30, 60-82.

Table 1: Moroccan Tariffs

	code	1993	1997	2000	2002
Food	15	72	61	52	50
Textiles	17	92	61	38	39
Clothing	18	99	71	50	50
Leather	19	60	50	43	46
Chemical	24	47	35	26	24
R&P	25	61	48	38	44
Electrical	31	65	37	17	26

Source: Trains database

Table 2: Output, Exports and Import Penetration by Sector

	Food, Beverages & Tobacco	Textiles	Clothing	Leather	Chemicals	Rubber & Plastic	Electrical
Sector	15	17	18	19	24	25	31
	Share of Output						
1993	0.42	0.16	0.09	0.02	0.25	0.04	0.03
2002	0.42	0.09	0.14	0.02	0.22	0.05	0.05
	Change in Real Output						
2002/1993	1.10	0.62	1.79	1.04	1.01	1.63	1.96
	Share of Exports						
1993	0.19	0.23	0.25	0.04	0.27	0.01	0.01
2002	0.20	0.08	0.34	0.03	0.27	0.01	0.07
	Change in Real Exports						
2002/1993	1.39	0.47	1.83	1.17	1.32	1.33	19.88
	Import Penetration Rate						
1993	0.05	0.17	0.02	0.11	0.31	0.29	
2002	0.09	0.34	0.01	0.17	0.36	0.32	

Note: The import penetration rate is defined as the ratio of sectoral imports divided by total sales.

Table 3. Results of direct approach

Dependent variable: $\ln(TFP_{it})$	(1)	(2)	(3)	(4)	(5)	(6)
Factors of production						
Labor	0.172***	0.170***	0.173***	0.174***	0.173***	0.173***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Materials	0.536***	0.539***	0.537***	0.535***	0.535***	0.535***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Capital	0.161***	0.157***	0.161***	0.160***	0.158***	0.157***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Trade variables included as regressors						
Tariffs	-0.043***	-0.031**			-0.025*	-0.007
	(0.014)	(0.014)			(0.014)	(0.013)
Import penetration rate			0.008	-0.007	-0.043**	-0.021
			(0.018)	(0.018)	(0.017)	(0.016)
Export share	0.097***	0.111***	0.104***	0.096***		
	(0.007)	(0.007)	(0.007)	(0.007)		
Trade variables not included as regressors						
Tariff at t			0.004			
			(0.037)			
Import penetration rate at t	-0.085					
	(0.078)					
Export share at t					0.067*	
					(0.067)	
Tariff at t-1				0.005		
				(0.030)		
Import penetration rate at t-1		0.003				
		(0.037)				
Export share at t-1						0.090***
						(0.033)
Variables of control						
Market share at t-1	0.002**	0.002**	0.002**	0.002**	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Herfindahl index	-0.082	-0.092	-0.079	-0.088	-0.077	-0.086
	(0.091)	(0.090)	(0.092)	(0.092)	(0.094)	(0.095)
Age	0.010***	0.011***	0.009***	0.005***	0.009***	0.009***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Firm fixed effects	yes	yes	yes	yes	yes	yes
Industry effects (4-digit)	yes	yes	yes	yes	yes	yes
Year effects	yes	yes	yes	yes	yes	yes
Observations	9 293	9 229	9 293	9 256	9 293	9 292
R-squared	0.506	0.501	0.514	0.516	0.513	0.516

Robust standard error in brackets.
* significant at 10%, ** significant at 5%, *** significant at 1%.
Tariff, export share and import penetration are in decimal.

Table 4. Effect of trade policy on productivity – indirect approach

Dependent variable: $\ln(TFP_{it})$

	(1)	(2)	(3)	(4)	(5)
Lagged tariff	-0.084		-0.102	-0.102	-0.087
	(0.034)**		(0.034)***	(0.034)***	(0.036)**
Lagged Export share	0.053	0.060	0.051	0.050	0.063
	(0.022)**	(0.021)***	(0.022)**	(0.022)**	(0.023)***
Lagged marketshare	0.151	0.287	0.225	0.223	0.225
	(0.136)	(0.121)**	(0.143)	(0.143)	(0.154)
Herfindal	0.183	0.301	0.230	0.236	0.254
	(0.137)	(0.128)**	(0.143)	(0.143)*	(0.150)*
Age	0.584	0.550	0.555	0.574	1.100
	(0.012)***	(0.013)***	(0.013)***	(0.014)***	(0.018)***
Import penetration		-0.344	-0.349	-0.352	-0.378
		(0.072)***	(0.075)***	(0.075)***	(0.081)***
Lagged frontier				0.000	
				(0.000)***	
Lagged DFF					-0.012
					(0.007)*
Observations	18434	21804	18068	18068	15687
Number of firm	3802	4859	3793	3793	3518
R-squared	0.01	0.02	0.02	0.02	0.02

Robust standard error in brackets.
* significant at 10%, ** significant at 5%, *** significant at 1%.
All regressions include firm fixed effect, year dummies, a constant, firm age. Frontier is in log.

Table 5: Changes in productivity and the distance from the frontier

Dependent variable: Δ ln(TFP_{it})

	OLS	**FE**	**FE-IV**	**Quartile**	**Decile**
Δ market share	0.770	0.760	0.518	0.831	0.788
	(0.266)***	(0.237)***	(0.341)	(0.408)**	(0.384)**
Δ herf	-0.203	-0.347	-0.973	-0.120	-0.087
	(0.098)**	(0.125)***	(0.387)**	(0.142)	(0.121)
Δ lagged tariff	0.502	0.610	2.618	0.139	0.235
	(0.080)***	(0.084)***	(1.139)**	(0.059)**	(0.073)***
Δ import penetration	-0.451	-0.450	-0.249	-0.491	-0.423
	(0.052)***	(0.061)***	(0.145)*	(0.069)***	(0.061)***
Δ Export share	-0.001	-0.004	0.008	-0.004	-0.003
	(0.020)	(0.024)	(0.031)	(0.029)	(0.024)
Lagged DFF	0.246	0.348	1.231		
	(0.009)***	(0.012)***	(0.501)**		
Lagged DFF* Δ lagged tariff	-0.265	-0.283	-1.164		
	(0.035)***	(0.038)***	(0.504)**		
Lagged Q2* Δ lagged tariff				-0.183	
				(0.040)***	
Lagged Q3* Δ lagged tariff				-0.300	
				(0.043)***	
Lagged Q4* Δ lagged tariff				-0.523	
				(0.051)***	
Lagged D1* Δ tariff					-0.693
					(0.088)***
Lagged D2* Δ tariff					-0.480
					(0.075)***
Lagged D3* Δ tariff					-0.467
					(0.071)***
Lagged D4* Δ tariff					-0.415
					(0.072)***
Lagged D5* Δ tariff					-0.306
					(0.069)***
Lagged D6* Δ tariff					-0.302
					(0.069)***
Lagged D7* Δ tariff					-0.235
					(0.068)***
Lagged D8* Δ tariff					-0.239
					(0.068)***
Lagged D9* Δ tariff					-0.209
					(0.072)***
Observations	12335	12335	11026	12021	13766
Number of firm		2916	2261	2890	3052
R-squared	0.17	0.26		0.10	0.09

Robust standard error in brackets.
* significant at 10%, ** significant at 5%, *** significant at 1%.
All regressions include a constant, firm age and age squarred. DFF is in log. Tariffs, Export share and import penetration are in decimal.

Figure 1; Market Shares by firm type

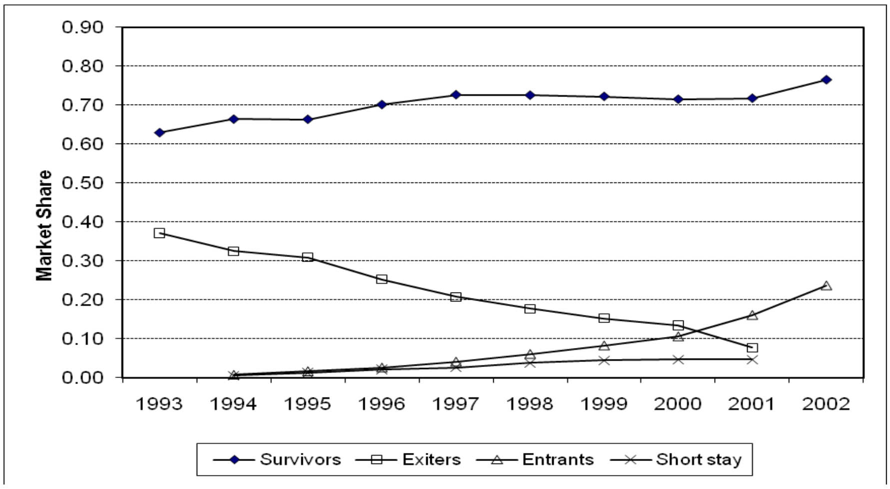

Figure 2; Unweighted productivity by firm type

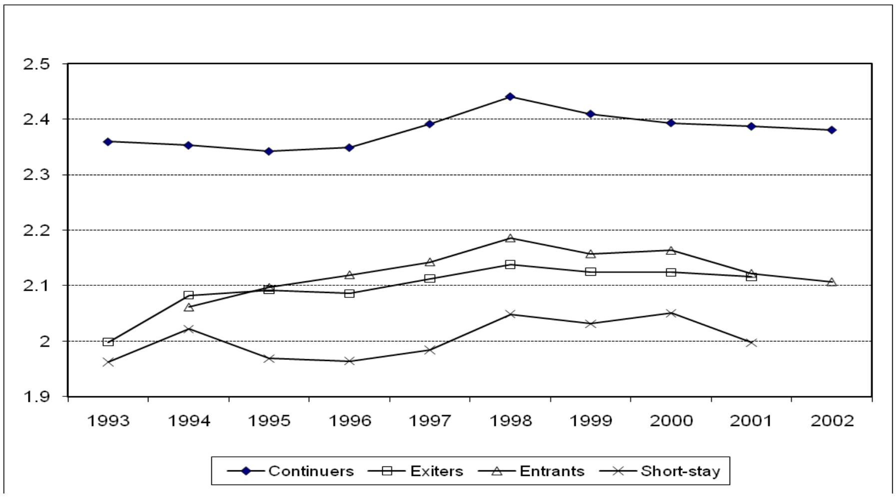

Table 6: Sectoral Decomposition of productivity change, 1993-2002[10]

1	2	3	4	5
$\sum_i TFP_i \Delta S_i +$	$\sum_i \Delta S_i \Delta TFP_i +$	$\sum_i S_i \sum_n s_{ni} \Delta tfp_{ni} +$	$\sum_i S_i \sum_n tfp_{ni} \Delta s_{ni}$	$+\sum_i S_i \sum_n \Delta s_{ni} \Delta tfp_n$
0.51%	-0.88%	-35.72%	-21.05%	58.89%

Figure 3: Sectoral decomposition of productivity change by year

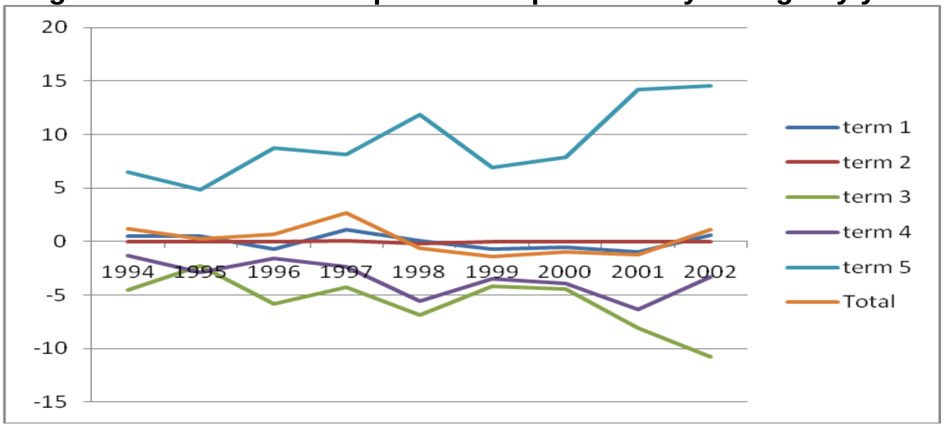

Table 7: Productivity Decompositions

	Plant level	Reallocation effects			Inter-action	Entry			Exit			
	Total	Below av.	Above av.	**Total**	**Total**	Below av.	Above av.	**Total**	Below av.	Above av.	**Total**	**Total**
9-year lag	**1.23**	-2.11	1.02	**-1.09**	**1.82**	-4.64	0.84	**-3.80**	6.01	-2.40	**3.61**	**1.76**
Yearly average	**0.12**	-0.58	0.17	**-0.41**	**0.37**	-0.58	0.04	**-0.54**	0.88	-0.28	**0.61**	**0.15**
Exporters	**2.01**	-2.05	1.12	**-0.94**	**1.83**	-4.00	0.53	**-3.46**	5.08	-1.76	**3.32**	**2.75**

---

[1] We gratefully acknowledge the help of Marian Dovis who supplied us with the programs for this procedure.
[2] Note Fafchamps et.al. suggest that this may be particularly true for new / young firms.
[3] As the coefficient on the interaction term is negative tariffs impact positively on firm level productivity where the distance from the frontier (log(DFF)) is lower than the ratio of the coefficient on tariffs with respect to the interaction term.
[4] The productivity levels are based on the (log) total factor productivity derived from the indirect approach as described above, and where we control for input endogeneity
[5] It is possible that the low reported growth in productivity is driven by price changes over time. While we cannot control for this perfectly, we do have sectoral level price indices for the Moroccan economy which we use to deflate all the relevant value series, and it is therefore unlikely that price effects are driving these results.
[6] This is also corroborated by the fifth term of the sectoral decomposition considered later on.
[7] The sum of the three last terms in Table 6.
[8] We have carried out the calculations using the other methodologies and they are fully consistent with the FHK results.
[9] The low growth in firm level productivity is also true by sector, and for two sectors there is a decline.
[10] Where S_i and TFP_i give the output share and weighted average productivity of sector *i* in the base period; and tfp_{ni} and s_{ni} give the productivity of firm *n* in sector *i* , and the share of firm *n* in sector *i* output in the base period.