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Abstract

The aim of this paper is to explore the determinants of productivity and productivity change in the Moroccan economy, with a particular interest in examining the role of international trade in impacting upon productivity levels. Methodologically this is achieved through a two-stage methodology. First we focus on productivity, and productivity change and its determinants at the micro (firm) level. The underlying data we have comprises both detailed cross section data, as well as slightly less detailed time series data. In the first stage then we derive estimates of firm and sectoral level productivity, and examine their evolution over time. For this first stage we derive the firm level productivity measures using both econometric and index number approaches. The second stage of the work is concerned with understanding and explaining the differences in productivity across the firms/sectors, and in particular of the role of trade liberalization in this. This involves regressing the differences in productivity on a range of key explanatory variables. This analysis is carried out at the firm level, and for different time periods.

Our results suggest that changes in firm level productivity are relatively modest (in particular in the latter half of the period), and that there are quite considerable changes in aggregate productivity arising from a relatively high degree of entry and exit of firms, and from changes in the shares of incumbent firms. This suggests clearly that it is changing market shares, and the entry and exit from the industry that are key to understanding the aggregate productivity changes. It also suggests that is important to consider carefully the institutitional, financial and regulatory framework within which firms operate, and thus the constraints they face. Central to the methodology and the results in this report is the need to recognize the importance of firm level heterogeneity. The results indicate that the relationship between key variables such as import or export openness can vary importantly according to the size (class) of the firm. It is thus important to understand the sources of these differences in these relationships better, and secondly to tailor policy accordingly. Hence, while overall we find a positive relationship between exports and productivity we also find that the relationship between exporting and productivity is weakest for large firms.

ملخص

يعد هدف هذه الدراسة هو اكتشاف محددات الإنتاجية و تغيرات الإنتاجية في الاقتصاد المصري والاقتصاد المغربي مع تركيز خاص على دور التجارة الدولية في التأثير على مستويات الإنتاج ويتحقق هذا الهدف من خلال تطبيق أسلوب متكون من مرحلتين. أولا، نقوم على التركيز على الإنتاجية، وتغير ومحددات الإنتاجية على مستوى محدود (الشركة). فان ما لدينا من البيانات الأساسية يتضمن كل من البيانات العرضية المقطعية التفصيلية بالإضافة إلى البيانات الزمنية المتتالية الأقل تفصيلا. ففي المرحلة الأولى، نقوم باكتشاف تقديرات الشركة ومستوى القطاع في الإنتاج وأيضا نقوم بدراسة التطور بمرور الوقت. ففي هذه المرحلة، نستكشف مستوى معايير الإنتاج لدى الشركة باستخدام كل من الاتجاه القياسي الاقتصادي واتجاه مؤشرات العدد. أما بالنسبة إلى المرحلة الثانية، فهي تركز على فهم وتفسير الاختلافات في الإنتاج حول الشركات/القطاعات، وتركز بشكل خاص على دور تحرير التجارة في ذلك. بالإضافة إلى ذلك، تتضمن هذه المرحلة حجم اختلافات الإنتاج في مجموعة من المتغيرات التفسيرية الأساسية ولقد تم هذا التحليل على كل من المستوى القطاعي ومستوى الشركة وفي فترات مختلفة من الزمن. هذا وأيضا ترجح نتائجنا أن التغيرات في مستوى إنتاج الشركة تعد ضئيلة نسبيا (خاصة في النصف الأخير من الفترة) وبأن هناك تغيرات كبيرة نحو تجميع الإنتاج الناتج عن النسبة العالية في دخول وخروج الشركات بالإضافة إلى التغيرات في حصص الشركات الهامة. فذلك يرجح بأن التغير في حصص السوق و الدخول والخروج من الصناعة هما الطريق الأساسي نحو فهم واستيعاب التغيرات الإنتاجية المتراكمة. علاوة على ذلك، فان ما سبق يرجح بأنه من الضروري أن نهتم مليا بإطار العمل المؤسسي، المالي والتنظيمي الذي تقوم على أساسه الشركات بالإضافة إلى القيود التي تواجهها. فان جوهر هذا المنهج والنتائج في هذا التقرير هو الحاجة إلى معرفة أهمية متغايرات المستوى بالشركة. فتشير النتائج بأن العلاقة بين المتغيرات الأساسية مثل انفتاح الاستيراد والتصدير من الممكن أن يتغير طبقا لحجم (نوعية) الشركة ومن ثم، فانه من الهام أن نتفهم بشكل أفضل مصادر هذه الاختلافات في هذه العلاقات أولا ثم نخلق سياسة مناسبة طبقا لذلك. من هنا، نجد أن في حين أن هناك بشكل عام علاقة إيجابية بين المصدرات والإنتاج، إلا أننا نجد أيضا أن العلاقة بين التصدير والإنتاج تعد الأضعف بالنسبة إلى الشركات الكبرى

Introduction

Since the Barcelona Declaration of 1995, the EU and the countries of the Southern Mediterranean have been engaged in a process of integration and trade liberalization. The Barcelona process envisaged trade relations becoming both more symmetric as well as deeper than heretofore, with each of the Mediterranean partner signing Association Agreements with the EU. The key feature of these agreements involved the gradual elimination of Mediterranean partner tariffs on EU exports. The ultimate objective here was to achieve a Euro-Mediterranean free trade area, and hence for the process of integration to include both EU-Med liberalization as well as integration between the Mediterranean partners themselves.

For the Mediterranean partners a key objective of this process was to stimulate higher rates of economic growth and development, and to achieve this through closer links to the EU. 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. This process of closer integration is now moving to a new phase with the introduction of the EU's Neighborhood Policy.

The objective of the research underlying this paper was to consider the micro-impact of these processes of trade liberalization on firms and sectors. In particular, the aim was to focus on understanding of the determinants of firm and sectoral level productivity, and the impact that trade liberalization may have had on this. We also shed some light on the transmission mechanisms driving changes in productivity.

First, we explore the relationship between productivity and trade liberalization by looking at data over time. Specifically, we focus on firm level data for Morocco over the 1990-2002 time period, and calculate the productivity of each firm over the time period. This allows us to consider the evolution of productivity over time in aggregate and by different categories of firms, as well as to consider some possible determinants of productivity. Secondly, we focus on a much more detailed firm level data set for Morocco for the years 1997-1999. Here again we calculate the productivity of each firm, but then have access to a much wider range of explanatory variables which help in understanding the determinants of those productivity levels. With regard to each of the above we are interested in examining the importance of trade and trade liberalization on productivity.

2. Trade and productivity: conceptual background

In considering growth in GDP per capita in a given economy one can distinguish between two channels of possible efficiency gain: First, improvements in allocative efficiency. Poor allocative efficiency may arise in two ways. First, it can arise purely domestically if either labor markets or goods markets function poorly. Secondly, trade barriers reduce international allocative efficiency. The gains from comparative advantage are precisely the gains from improved allocative efficiency across different national markets. Much of the existing literature on the impact of trade liberalization has focused on issues of allocative efficiency. Hence both theoretical and empirical models focusing on comparative advantage have as their principal concern the issue of international allocative efficiency. Equally, models, which allow for imperfect competition are typically also concerned, in good part, with allocative efficiency. The pro-competitive impact of trade liberalization, for example, results in an improvement in allocative efficiency.

Secondly improvement in output or technical efficiency, i.e.: productivity. Implicit (though not inherent) in the first channel is that the underlying technology of firms' is a given and is held constant. Hence the reallocation of resources occurs conditional upon the given levels of efficiency or productivity of firms across sectors. The pro-competitive effect on firms, or the

exploitation of economies of scale occurs holding the firm's production function technology constant. Trade liberalization can, however, potentially have a substantial impact on productivity and economic growth by also impacting on the efficiency of the firms themselves, as well as through the expansion of the workforce by drawing in unemployed resources.

There is by now a well-established literature on the relationship between trade or openness and economic growth. While there is not unanimity about this relationship, most commentators tend to accept that more open economies tend to grow faster. There is a wide range of empirical evidence on this, which tends to support this conclusion (eg. Dollar, 1992; Sachs & Warner 1995; Edwards, 1998; Frankel and Romer, 1999), though much of the preceding was heavily criticized by Rodriguez and Rodrik (2001) either on the grounds of poor econometrics, or weak underlying data. There are indeed a number of methodological difficulties in the literature. These include data related issues such as finding satisfactory measures of openness, and/or the trade stance of given economies, to more fundamentally establishing the direction of any causal link between trade liberalization or openness and growth. It is important here also to fully recognize that trade liberalization, in and of itself, is clearly not sufficient to result in higher growth rates. To the extent that greater openness may lead to higher growth this will depend to a high degree on the underlying economic, institutional and indeed socio-political environment. The conditions for successful growth are then likely to be highly economy-specific.

There is then broad acceptance of the view that "under the right conditions" more open economies are more likely to grow faster. Three key channels can be identified:

a) *Inter-sectoral compositional shifts:* Changes in trade policy are likely to lead to a reallocation of resources to relatively more productive sectors. If comparative advantage lies in those sectors in which an economy has higher productivity then aggregate productivity will rise. To the extent that the inter-sectoral reallocation is driven by differences in relative factor endowments across countries than there will be associated changes in real factor prices, and hence changes in the distribution of national income across groups within the economy.
b) *Intra-sectoral compositional shifts:* Here the changes take place within a given sector and are driven by more productive firms realizing a higher share of the market than less productive firms. These intra-sectoral compositional shifts can either take place through changes in the relative sizes of more and less productive firms, or through the entry and exit of firms. The entry and exit of firms, driven by different characteristics such as different underlying productivity levels emphasizes the importance of the presence of firm level heterogeneity, and the importance of addressing that heterogeneity in empirical work.
c) *Changes in firm-level productivity:* Here the channel is through existing firms increasing their levels of productivity. It is worth noting that much of the trade and growth literature tends to focus on this channel. Hence, that literature typically identifies the following possible mechanisms: technological progress e.g.: from increased R&D; technological transfer arising from increased exposure to technologies, ideas or even processes, or through importing higher quality intermediates; greater exploitation of economies of scale arising from access to larger markets; or reductions in firm-level inefficiency. These changes encompass both shifts in a given firm's production function, as well as moving firms closer to their respective frontiers.

Understanding these channels and the circumstances under which they occur is extremely important from a policy perspective. Firstly it is important to shed light on those policies that

may be more likely to stimulate higher rates of economic growth. Secondly, the different mechanisms have different implications for the distributional implications of any changes in policy.

Many of the mechanisms identified above imply heterogeneity at the firm level. It therefore follows, that in order to address these questions it is then important to work with firm level data. There has recently been a growth in the availability of firm level data sets, in particular for developing countries, and the emergence of a literature which thus focuses on decomposing and better understanding the source of productivity growth, and productivity differences across firms (eg. Bailey, Hulten & Campbell, 1992; Levinsohn & Petrin, 1999; Barnard and Jenson, 2002, 2004; Tybout & Liu, 1996; Roberts & Tybout, 1997; Clerides, Lach & Tybout, 1998;, Van Biesebroecke, 2003). There is also an emerging theoretical literature focusing on firm level heterogeneity simulated inter alia by the work of Melitz (2003).

In this literature there is then a link made between trade liberalization and productivity growth. Sectors may become more productive as a result of improved access to export markets. This may occur because of learning-by-doing, or because firms are required to produce to certain norms and standards which require investments in new technologies. Sectors may also become more productive because of the increased openness of import markets. This may occur because of increased competition from competing foreign suppliers which induces increased efficiency by local firms; it may occur because of spillovers between domestic and import competing firms; or it may occur because firms have access to higher quality intermediate input which improve their productivity (see, for example: Coe *et al* (1997, 1999)).

The evidence on whether trade liberalization increases firm-level efficiency is mixed. For some authors, the positive effect of opening on the productivity of the firms is confirmed (Tybout and Westbrook (95) for Mexico, Grosfeld and Tressel (2001) for Poland, Djankov and Hoekman (2000) for Bulgaria, Pavcnik (2002) for Chile, Schor (2004) for Brazil, Topalova (2004) for India, Fernandes (2006) for Colombia) - even if often the value of the coefficients obtained is very low. For others, the effect on the firm productivity is either insignificant (Tybout & al. (91)), or negative (Angelucci, & al. (2001) for Rumania, Warzynski (2001) for Ukraine). In the case of Morocco there is empirical work covering the period 1984-89 but the results are mixed. Haddad, De Melo and Horton (96) find no effect, while Haddad (93) observes productivity increases following liberalization.

3. Data and methodology:

Methodologically we undertake a two-stage approach. In the first stage we estimate productivity at the firm level. In the second stage we regress those estimates of productivity on a range of explanatory variables. In this work, where possible, we use both the econometric and the index number approaches for estimating productivity.[1] This allows us to compare the robustness of the results across the different methodologies.

The second stage of the work is concerned with understanding and explaining the differences in productivity across the firms/sectors, and of the role of trade liberalization in this. This involves regressing the differences in productivity on a range of key explanatory variables. This analysis is carried out at both the sectoral and the firm level, and for different time periods.

[1] Full details of the methodologies employed can be found in "Approaches to Productivity Measurement", G. Varela (2007), mimeograph which can be obtained from the authors on request.

- For the time-series analysis the variables that can be used include: openness (either with regard to export markets or domestically), the age of the firm, the size of the firm, and the firms' relative skill intensity.
- In contrast for the detailed FACS based firm level cross section analysis, the explanatory variables include both structural variables which capture the overall context within which firms make decisions, as well as variables which capture the choices that firms themselves make. Hence, in the former category we include variables such as the degree of openness (with respect to both exports but also imports), the degree of concentration, firm size, the region of production, extent of foreign participation, sectoral fixed effects etc. In the latter category we include information on the extent of capital investments made, as well as possibly the type of investments made, in the preceding periods, the extent of investment in human capital, the fact that the firm invests in research and development (R&D) in the preceding periods, the share of the workforce in R&D areas, etc. Clearly not all these are statistically significant, and in the results we focus on those that are.

A central variable of interest here concerns measures of openness and hence the impact of trade liberalization. For the sectoral level work the aim is to pick up on the time-series variation in trade policy in order to assess the direct impact of policy changes on sectors. Trade policy / trade liberalization here may also be relevant both with respect to export markets and import markets. Tariffs in Morocco are typically high ranging from an average of 47%-99% in 1993 to 17%-52% in the year 2000 (see Table 1). Secondly, the period has experienced a substantial decline in tariffs and this is true in all sectors. The biggest declines 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%)

Trade and tariff data was obtained from the COMTRADE and TRAINS databases respectively. We had access to two complementary data sets which provided detailed information at the firm level. These were the Moroccan Annual Industrial Inquiry for the period 1990-2002, and a detailed survey (FACS) undertaken over 1997-1999 in collaboration with the World Bank. From these data set we then included variables such as the extent of intermediate inputs imported, the extent of concentration in the industry, the presence of foreign capital in the firm, the extent of foreign participation in the industry, the shares of different types of labor employed, investment in human and physical capital. This enables us to build up a much more detailed picture of the possible determinants of firm level productivity, and of the role of trade policy in those determinants.

4. Determinants of Productivity – time series analysis

4.1 Understanding the evolution of productivity in Morocco

The data we have derives from the Moroccan Annual Industrial Inquiry. This is an annual census which covers 16 sectors. Partly because of data constraints, and partly to ensure comparability with the detailed cross section analysis in this report we have focused on seven sectors. These are: Textiles, Clothing, Leather, Food Processing, Chemicals, Electrical, and Rubber & Plastics. Figure 1 gives the aggregate change in weighted TFP over the period 1990-2000. It can immediately be seen that from 1990 to 1999 there was overall a steady rise in TFP, equal to just over 16.6% over the time period, followed by a decline in aggregate productivity until 2001, which is then followed by a small productivity improvement in the last year of the sample.

As discussed earlier this change in aggregate productivity can arise either because of intra or inter-sectoral reallocations, or because of existing firms becoming more productive. Figure 2, which gives the change in productivity by sector and by year, sheds more light on this, and

then the issue is subsequently explored more formally by decomposing the changes in productivity across these different categories. Three messages emerge from Figure 2 First, that the sector with the highest level of productivity throughout the period is that of Chemicals, and the sectors with the lowest productivity for most years are Leather and Clothing. Over the entire time period, all sectors experience a rise in productivity with the largest rise in productivity for Chemicals (31.1%), followed by Clothing (22.8%) and Food products (17.3%). Two sectors, Rubber and Plastic, and Electrical experience only very modest increases in productivity (4% and 8% respectively) over the 12 year period. It is also interesting to note that from 1998 onwards (ie. in the period following the launching of the Barcelona process) productivity rises are for most sectors extremely modest and in two cases there is a small decline in productivity (Clothing, and Rubber and Plastic). Once again the two sectors with the highest productivity growth over this period are Chemicals (4%) and Leather (8%).

It is also useful to consider the changes in productivity over the time period for different size classes of firms which are shown in Figure 3. In the figure the size categories are: small firms are those with less than 10 employees; medium sized firms with 10-100 employees, and large firms, with more than 100 employees. Immediately noticeable is that there is a direct correlation between the size of the firm, and the level of productivity. Hence large firms are significantly more productive than medium sized firms, who are in turn more productive than small firms. The pattern of changes over time is similar with all size categories showing an overall increase in productivity of between 13%-15%, and very little productivity growth if not productivity decline (for medium sized firms) from 1998 onwards.

As discussed earlier the changes in productivity can have a number of different underlying causes, and can be reflected in different forms of structural adjustment at the firm level. In particular the changes in productivity can arise because of (a) changes in the productivity level of existing firms; (b) changes in the share of existing firms in production at given levels of productivity; and (c) from the entry or exit of firms into the industry, where the productivity levels of those entering and exiting differs from existing firms.

Figure 4 gives the decomposition for all firms in aggregate, and where the four elements of the decomposition are labelled – firm level, share reallocation, entrants, and exits – respectively. The latter two components, that is to say entrants and exits, are often referred to in the literature as representing the "replacement effect". The graph also gives the total change in aggregate productivity from one period to the next. Note that each of the series give the *change* in productivity from one period to the next. Hence, any point above "0" represents an increase in productivity, and below this a decrease in productivity. The solid red line gives the change in total productivity and the message here is the same as that in Figure 2 earlier – for most of the early 1990's productivity increases, and from 1999-2001 there is a decrease in productivity.

The remaining four series decompose these changes in productivity. The decomposition of course, sums to the total change in productivity over each time period. Hence, consider first the changes in firm level productivity. This gives the change in productivity for those firms who survive from one period to the next. Looking at this series we can see that the pattern of changes is very similar to the total change in productivity discussed earlier – for most of the years incumbent firms increase their productivity, and this therefore contributes to the overall changes in productivity. The share reallocation component and the replacement effect (entrants + exits) are inevitably interrelated. This is because where there is net entry (exit) of more (less) productive firms, than this increases (decreases) aggregate productivity, hence the replacement effect is positive. At the same time the entry (exit) of firms decreases (increases) the share of incumbent firms, and tends to push the share reallocation effect downwards.

The effect of share reallocation appears to be largely dominated here by entry and exit of firms, as opposed to by changes in incumbent firms' levels of productivity. Indeed in the census data we have here for Morocco, there is considerable entry and exit of firms. This is then reflected in the contribution to the total productivity change of the entrants and those that exit. Note that by definition in the decomposition entrants must increase productivity, and firms that exit decrease productivity. This is because the decomposition is the weighted sum of each of the respective elements. Hence, a new firm enters positively, and a firm that leaves enters negatively. What is relevant therefore is the extent to which entrants and exits impact upon aggregate productivity.

From Figure 4 it can be readily seen that the contribution of new firms to aggregate productivity is fairly low up until 1997, and then starts to rise. There is then a fall between 2001-2002. At the beginning of the period, exits decrease productivity by only a small amount, and then other than 1999, there is a larger decrease in productivity arising from the exit of firms.

An interesting issue is whether the net replacement effect is positive or negative – in other words does the combined effect of entry and exit of firms lead to an increase or a decrease in productivity. This will depend on two factors. First, on the productivity level of those firms entering and exiting firm, and secondly on these firms' respective market shares. Table 2 below is comprised of two panels. In the top panel we give the net replacement effect, which as outlined earlier will depend on two factors. In the bottom panel we then give the difference in the unweighted average productivity level between entrants and those that exit. Hence the top panel indicates whether overall the replacement effect is positive or negative; and the bottom panel indicates whether the aggregate productivity level of entrants is higher or lower than those who exit the industry.

Consider the top panel first. What is striking is that this indicates that for most years, and for most industries the net replacement effect on the change in productivity was negative. In turn this means that in considering the change in productivity from one period to the next the impact of exiting firms in lowering this change in productivity was more significant that the impact of new firms on raising the change in productivity. Of course this could simply arise because the number of exiting firms was much larger than the number of new entrants, as opposed to any underlying differences in productivity between entrants and those that exit. Light is shed on this in the bottom panel of the table. Here, we compute the difference in the average unweighted productivity for the two groups of firms, by industry. A negative entry indicates that the average productivity of those that leave the industry was higher than the productivity of those entering the industry. Again, it is striking that the substantial majority of the entries are negative, and that a positive entry is exceptional.

4.2 Productivity determinants

We now turn to consider the results from our second stage regressions. Here we take the productivity measures derived in the first stage, and run panel regressions on key explanatory variables. Of course there are a large number of possible factors which could impact upon productivity – these include the openness of the economy, access to export markets and experience in exporting, extent of foreign direct investment, investment in human and physical capital, the underlying infrastructure, and the legal and regulatory environment. With respect to this data set information on all these variables is simply not available. However, some of these factors we are able consider below when we turn to our cross section estimates. The main variables of interest in this section, and upon which we do have information is the size of the firm, the export orientation of the firm, the age of the firm, and the degree of sectoral openness (measured by imports / output, and also by exports / output), and the relative skill intensity of the firm. Information on the latter variables was only

available from 1996-2000, hence we run two sets of regressions – one set on the entire time period and the second set from 1996-2000. Time dummies were included in all of the regressions but are not reported here to control for common shocks that could affect firms' total factor productivity.

For each of the time periods we run two regressions – one where we allow for sectoral level fixed effects (2nd and 4th columns), and one where we allow for fixed effects at the level of the firm. In terms of the fixed effects, the firm level effects control for characteristics specific to individuals firm over the time period; and the sectoral effects are designed to capture whether there any features which may be specific to a given sector over the time period in question (and thus common to firms within the sector) that may impact upon productivity levels. We report on these sectoral level fixed effects in columns 2 and 4 of Table 3. Over both time periods it can be seen that the sectoral fixed effects are statistically significant and show that there are indeed differences in productivity across the sectors. These results indicate that Chemicals is the most productive of the sectors, while Electrical and Leather Goods are the least productive sectors.

The first five rows of the results focus on the variables that are common across our two time periods. The first of these gives the ratio of exports to output at the firm level. This coefficient is positive and statistically significant across all the regressions, and indicates that increasing exports are associated with an increase in productivity. Interestingly the size of the coefficients is somewhat different over the two time periods. Hence over the period 1990-2002, the coefficient is 0.016 in both cases, which suggest that a 10 percentage points increase in the ratio of exports to output would lead to 0.16% increase in productivity, on average and ceteris paribus. While the coefficient is statistically significant the impact is relatively small. For the shorter and later time period – 1996-2000 – the coefficient ranges between 0.13 and 0.17. This suggests that a 10 percentage points increase in the ratio of exports to output leads to an increase in productivity of between 1.3%-1.7%, on average and ceteris paribus - which represents a non-negligible impact. The final column of the table gives the results for the regression in first differences. This too suggests that an increase in exports from one period to the next leads to an increase in productivity, though the size of the coefficient is somewhat smaller.

For the latter time period we also have information on the ratio of exports and imports to output at the sectoral level, and the results for these variables (expoutsec, and impoutsec) are given towards the bottom of the table. The level of sectoral export orientation does not appear to impact upon productivity, and there is some evidence from the firm level fixed effects regression, that increased openness on the domestic market leads to a decrease in productivity. This is an interesting result as it is often argued that opening up to international trade, and encouraging more competition in domestic markets should lead to increases in productivity. Those increases in productivity could arise as less efficient firms exit the industry, and also with the possible entry of more efficient firms. There is no clear evidence of this occurring here. Indeed in the decomposition earlier we showed that if anything it appeared the reverse was taking place - less efficient firms were entering the industry and more efficient firms were leaving. There are alternative explanations too - increases in competition may be forcing firms to produce less and with economies of scale this implies an increase in average costs and a decrease in efficiency. However, in principle the first stage regressions check for the presence of economies of scale, and the evidence suggested that firm produced under constant as opposed to increasing returns to scale. It is also possible that in a particular sector co-exist on the hand firms that are now exposed to foreign competition arising from trade reforms, and on the other, firms producing particular varieties of goods not facing foreign competition. If the former were initially more productive than the latter, and at the same time they reduced their market share vis-à-vis foreign suppliers into the domestic

market, then, an increase in the imports/output index would lead to a decrease of productivity.

We also explore the role of firm size in these regressions. Hence the variables size2 and size3, assess the likely impact of a firm being either a medium sized or a large sized firm respectively[2]. The variables in the model here are dummy variables (for each of the size classes) and therefore the percentage equivalent of these dummies can be found by taking [exp(dummy)-1]*100. The size variables are also positive and statistically significant indicating that larger firms are typically more productive. Here it is noticeable that there are substantial differences between the sectoral level, and the firm level fixed effects results with the latter being considerably smaller. It would seem plausible that there may well be size factors specific to firms over the time period which impact on productivity, and hence the controlling for these seems appropriate. With the firm level fixed effects, the results suggest that being a medium size firm in comparison to a small firm is likely to result in productivity being 21.6%-28.6% higher depending on the time period being considered, and being a large firm results in productivity being between 14.4%-19.6% higher. Once again this reinforces the discussion earlier in section 2.2.2.

Finally, we also explore the role of the age of the firm, and for the latter period of the relative skill intensity of the firm. In terms of the age of the firm, there is some evidence that older firms tend to be more productive, and while the coefficient is statistically significant, its size is relatively small. There is also some evidence that the higher the skill-intensity of the firm (measured as the ratio between skilled and unskilled workers) the higher is the productivity. Once again the coefficient is relatively small, and when we control for firm level fixed effects it becomes non-significant.

The preceding regressions were based on the entire sample. Tables 4 and 5 repeat these regressions but now do so separately for each of the sectors. The aim here is to see if the results are being driven by one particular sector, or if there are any significant differences in the key coefficients of interest - such as the trade variables, or the size variables – across the different sectors.

Table 4 gives the results for the period 1990-2002. The first line of the table gives the coefficient on the ratio of exports to output. As seen earlier this coefficient is positive and statistically significant, being the largest for Rubber and Plastics, and in Leather goods where a 10% increase in the ratio of export to output is associated respectively with a 1.6% and a 0.9% increase in productivity. The smallest impact appears with respect to Food Products and Textiles, where the change in productivity following a 10% increase in the exports to output ratio leads respectively to 0.1% and a 0.2% increase in productivity.

Once again size is also statistically significant in almost all cases (except for Leather goods) and this appears particularly true for Food Products, and for Textiles. For these two industries medium sized firms tend to be 34.2% and 17.6% more productive than small firms, and large firms tend to be 24.7% and 35.9% more productive, as well as 26.5% more productive in the Chemical industry. The age of the firm is also positively related to its productivity and once again this is the case for all of the sectors.

Table 5 then gives the results for the 1996-2000 time period. As with the aggregate results, we see that over this period the impact of exporting on productivity is much higher. The largest impact is on Leather, followed closely by Food products, Rubber and Plastic, and Electrical. For these sectors the impact of a 10% increase in the exports to output ratio is

[2] Size classes are defined based on the number of employees in the firm. A firm with less than 10 employees is classified as a small firm (Size Class 1), Between 10 and 99 the firm is classified as medium sized (Size Class 2). Firms with 100 or more employees are classified as Large (Size Class 3).

associated with productivity being respectively 3.2%, 1.3%, and 1.1% higher. The smallest impact is on Textiles, Clothing and Chemicals, where the impact of a 10% increase in the ratio is associated with 0.2%, 0.3% and 0.5% increases in productivity respectively. As before the size of the firm typically impacts positively on productivity. In most cases the coefficients are of a similar order of magnitude to that reported in Table 4. The exception to this is Electricals where the coefficients are statistically insignificant. Finally, there is little evidence that either the skill-intensity, or the age of the firm is statistically significant. The exceptions to the latter are in Food products and Chemicals where there is some evidence that older firms tend to be more productive.

In the preceding results a common feature was the role of exports/output as a significant positive variable, and also the interesting lack of significance of the import/output variable. In order to explore this further in Table 6, we repeat our 1996-2000 regression, but do so separately for each size class of firm. As was the case before the three size classes of firms are: less than 10 employees, 10-100 employees, and greater than 100 employees

These results are extremely interesting, as there are some important differences, which emerge between the different size classes. The first row captures the impact of changes in exports/output at the level of the firm. Here we see that increasing exports as a proportion of output does lead to higher productivity levels but that this is particularly true for small firms, to a lesser extent for medium sized firms, and the coefficient is not significant with regard to large firms. The second and third variable captures the degree of openness at the sectoral level. As before these represent exports/output, and imports/output at the sectoral as opposed to the firm level. With regard to export openness for small firms, where the coefficient at the firm level was positive, at the sectoral level the coefficient is now negative. This suggests that for individual firm's access to export markets leads to an increase in productivity, but that for those sectors which have a high proportion of exporting small firms that their productivity tends to be lower. For medium and large firms the sectoral export openness coefficient is not statistically significant. With regard to domestic market openness we see that for small firms an increase in openness tends to reduce their productivity, whereas for large firms it tends to increase their productivity. The coefficient for medium sized firms is again not significant. This could mildly reinforce the argument given before for the negative coefficient on imports/output at an aggregate level. It may be reasonable to think that it is large firms, which are more capable of reaping the gains of access to better quality intermediates or capital goods due to trade liberalization. Then, the differential impact we observe of imports/output at a sectoral level on productivity, according to size class would not surprise us.

Therefore, if it appears that the impact on small, medium and large firms both of access to foreign markets, as well as to domestic liberalisation are quite different, and therefore possibly call for quite different policy conclusions (see Section 3 for a more detailed discussion).

5. Determinants of productivity - cross-section analysis

In comparison to the preceding here the analysis is based on cross-section as apposed to time-series data. In addition in estimating the firm level productivity measures the data allows us to employ both parametric (as above) and non-parametric approaches in order to provide a broader basis of comparison. We also explore a wider range of parametric approaches. Finally with the cross section data we have considerably more information and detail with regard to possible explanatory variables and this enables us to build up a richer picture of the possible determinants of productivity.

The data for this paper derives from a detailed firm level survey (FACS) carried out jointly by the World Bank and the Ministry of Trade and Industry, Morocco. The survey covers 859

enterprises and contains data for seven sectors for 1997 to 1999[3]. The seven sectors covered are: clothing, textiles, food processing, plastics, chemicals, leather and electrical machines. One of the substantial advantages of this survey is that it contains extremely detailed information at the firm level. Hence, for example, for each firm we have information on the sales of each of the three principal products produced by the firm. We also have detailed information on labor supply and training within each firm, the use of intermediates both imported and domestically supplied, as well as a range of information concerning the underlying financial structure of each firm, the institutional environment within which it operates, as well as the view of the firm concerning issues such as trade barriers, degree of competition for its products etc. In contrast the key disadvantage of this data set as currently constituted is that the data is for two years only. This entails a focus on cross-section work as opposed to panel estimation, and therefore also means that we cannot easily address issues to do with the inter or intra-sectoral compositional changes that may be driving differences in productivity which were considered earlier.

As earlier, the first stage of the empirical methodology requires estimating or calculating a measure of productivity at the firm level. For this data we work with both the parametric approach, as well as the index number approach. The advantage of the latter concerns the ease of implementation, allowing for technology to vary across individual units, as well as being able to handle multiple outputs and inputs. The advantage of the former is that it is less prone to measurement error and generated statistical tests for the significance of the results.

For the first stage we undertake six different regressions from which we derive our firm level productivity estimates. The purpose of this is in part methodological – to explore the extent to which results may differ across different methodologies; and in part practical – as the different results allow us to see how consistent the picture that emerges is across the different measures. The six measures of productivity that we derive come from the application of the following methodologies:

1. OLS (referred to in the tables of results as OLS1) regression of the production, where the inputs are capital and labor. This is the simplest, "bare-bones" regression. In the literature there is considerable discussion about the limitations of this, in particular concerning the issue of endogeneity between productivity and firms' choice of inputs which serves to bias the results. In order to partially address this issue, and as is common in the literature we control for unobservable productivity shocks by including electricity as one of the inputs.
2. OLS (OLS2) regression of the production function, where the inputs are capital, and two different categories of labor – skilled and unskilled workers. Here we are exploring whether greater disaggregation of the labor supply improves the quality of the regressions and materially impacts upon the results. Here again, we control for unobservable productivity shocks by the usage of electricity.
3. OLS (OLS2 2 blocs) as in (2) above but where we divide our sample into two separate groups. One group of industries comprises Textiles, Clothing and Leather, and the second group comprises the remaining industries. The reason for this was that in examining the ratio of skilled-unskilled workers in the sample, the former group of industries appeared significantly the most skill-intensive. As this could be a result of sectors making the distinction between skilled and unskilled on the basis of quite different criteria, this was a way of controlling for this possibility. Here again, we control for unobservable productivity shocks by the using of electricity as an input.

[3] Richest information is found only for 1999.

4. Instrumental Variables (IV) estimation. Here we are using instrumental variables in order to control for the problem of endogeneity between a firm's productivity level and its choice of inputs.
5. Lev-Pet. Here we employ an alternative semi-parametric approach, which also provides a means of controlling for the problem of endogeneity, as suggested by Levinsohn and Petrin (1999).
6. Klette-Johansen (KJ). Unlike the preceding here we employ an index number approach to the measurement of productivity, which has the considerable advantage of allowing the technology to vary across the individual firms. In addition the Klette-Johanson approach also allows us to control for imperfect competition and economies of scale. In some of the results we report on two different variants of the Klette-Johanson model. This is because the model was run in both levels and in first differences.

Table 7 provides correlations of the results across the different methodologies. From this it can be seen that there is a high degree of correlation across the three parametric approaches employed, and a fairly high degree of correlation between the two Klette-Johansen indices (0.82). Across the two methodologies the correlation is generally lower, except for between the Levinsohn and Petrin approach, and the Klette-Johansen (levels) approach (0.93). Overall, this suggests a high degree of consistency across the results, though with some differences.

The underlying FACS survey is very rich in firm level detail. Hence the number of possible explanatory variables is potentially quite considerable. In the first instance we have focused on those variables which a priori one might expect to be important. Here we distinguish between those variables, which are related to international trade, institutional variables, and those, which relate to firm specific characteristics such as the age of the capital stock or information on R&D at the firm level. The results are given in Table 8, where we give the results for the estimations based on the six different productivity measures detailed earlier. In each case the model was run with both sectoral and regional dummies but these are not reported here. The explanatory variables we include here are:

1. Trade barrier variables:
- Tariff barriers on exports
- Non-tariff barriers on exports
- Average domestic tariffs

2. Intermediate trade variables:
- Share of imported intermediates
- Share of imported capital
- Share of imported raw materials
- Duty paid on imported capital

3. Other trade variables
- Share of production exported (calculated at the firm level)
- Share of production exported (calculated at the sectoral level)
- Preparation undertaken for trade liberalisation with the EU.

4. R&D variables
- Does the firm invest in R&D
- No of products less than 5 years old
- Share of workforce in R&D

5. Capital variables
- Age of capital less then 5 years old
- Age of capital between 5 & 10 years old
- Age of capital more than 10 years old
- Training by suppliers (of new machinery)

- Training undertaken abroad
- Training from manuals

6. Other

- Share of foreign ownership
- Has the firm experienced any infrastructure related difficulties in the preceding year?
- Is the firm multiplant?
- Has the firm applied for MEDA funding
- Are the firm's products ISO certified
- No. of employees.

In this first table of results we have included all the coefficients which a priori one might consider could be important or could play a role in explaining differences in productivity across firms. A number of these coefficients prove not to be statistically significant. We include them here however, partly to indicate that this was indeed the case, and partly because it is frequently worth reflecting on why this might arise. In the second table, we then run the same regressions but this time on much smaller sample of explanatory variables essentially largely on those which the first sets of regressions suggested are statistically significant.

The first column of the table gives a brief description of the variable. Several of the variables are dummy variables where the firm was, for example, asked to respond yes or no; some of the variables are dummy variables, some of the variables are shares, and some are absolute values. Hence if, for example, we take the second row of the results where we report on whether firms perceived non-tariff barriers to trade to be an obstacle in export markets. Those firms that do perceive there to be such an obstacle are ceteris paribus and on average 62% more productive, when the estimation is based on the Klette-Johansen productivity measures. Where a variable is a share or percentage, than the marginal effect is a semi-elasticity. It gives the percentage impact on productivity as a result of one percentage point increase in the variable. Finally, there are two variables in absolute values – the number of new products, and the total number of employees. These variables were logged and hence the coefficient on the variable gives the elasticity.

If we now turn to the results, the first shaded panel of the table focuses on the trade related variables. Here we look at variables with respect to both firms' export markets as well as the domestic market. With respect to the export market the firms report on whether they experienced any difficulties in exporting either arising from high tariffs or from non-tariff barriers in export markets. Here we might expect that high tariffs impede exports and thus reduce the incentives for firms to improve productivity levels. If this were true we might expect a negative coefficient on this variable. However, it is equally possible that successful, exporting firms face higher barriers precisely because they are more productive and thus more successful. In this case we could find a positive coefficient. Interestingly the coefficient on tariff barriers is significant and negative for three of the estimations and suggests that firms that experience higher barriers in export markets are approximately 25% less productive. In contrast the coefficient on non-tariff barriers is positive across all the models, and significant in three cases. The size of the coefficient suggests that firms with perceived non-tariff barrier obstacles to trade are on average between 61% and 78% more productive. It is worth noting, however, that this applies to 10 firms in the sample.

With respect to protection in the domestic market the variable here represents, *average domestic tariffs*. Here we have computed the average tariff based on each firm's three principal products exported. Hence this measure captures the degree of domestic protection for the firm's principal products. High domestic protection could again reduce the incentives

for firms to improve their productivity, and if this were the case we would expect a negative coefficient on this variable. Again, there could be reverse-causality here whereby inefficient firms seek greater protection. The coefficient here is negative and statistically significant in all cases. Hence, if we take the coefficient arising from the OLS2 procedure this suggest that a 1% point increase in tariff protection corresponds with a decrease in productivity by 0.39%. Overall the impact of domestic tariffs on productivity is negative across all the regressions and significant for all but one. The impact of a 1% increase in domestic tariff protection on productivity ranges from 0.38-0.49%. There is clear evidence then that protected domestic industries tend to be less productive.

Looking at the second bloc of results, the intermediate trade variables, we see that in none of the cases are any of the variables statistically significant. The aim here was to seek to establish whether there is any evidence if the presence of imported and possibly higher quality intermediates might be related to higher productivity levels (see for example Amiti, 2004). There appears to be little direct evidence of this here.

In the third panel of the table we examine other trade related variables. The first two of these look at the relationship between exporting and productivity, as there is some evidence in other studies that exporting firms tend to be more productive. There are important issues of causality here, but the aim in the first instance is to investigate whether such a relationship exists or not. The first of our variable here does so at the level of the firm and the second at the sectoral level. At the firm level there is limited evidence of a relationship between exports and productivity, and at the sectoral level none of the coefficients are significant.

The fourth panel of the table considers three different R&D variables. The hypothesis here is that higher efforts in terms of R&D done by the firm should lead to higher levels of productivity and we try and capture this by looking at whether the firm has invested in R&D, the number of new products, and the share of the workforce in R&D. Again, almost all of the variables are statistically significant here, hence indicating little evidence of such a relationship. This is interesting and it is worth reflecting back on the results in the descriptive statistical discussion earlier. There we saw that the picture with regard to the relationship between productivity and the R&D status of the firm was mixed. It was mixed in the sense that it appeared to hold for certain industries and not for others. It is perhaps therefore not surprising that in these regressions the coefficient is insignificant. Ideally, we would like to run these regressions separately by sector, but the number of observations in most cases simply becomes too small.

We next turn to looking at the role of capital, and the training involved in the use of new machines. We have divided up the information on the age of capital into three – capital less then five years old, capital between 5 & 10 years old, and capital greater than 10 years old. The purpose of this was to see if we could distinguish any differential role of capital according to its age. Hence, there is some evidence and theory that when introducing new capital for an initial period productivity may decline. This occurs partly because in the transition period firms may be using both new and old capital simultaneously, and partly because there is a learning by doing process in using new capital most efficiently. Although the results do lend support to this hypothesis, the coefficients here are not statistically significant and therefore clear conclusions cannot be drawn. With regard to the training variables, the only one which is significant here is the one relating to training abroad, when using the Klette-Johansen measures of productivity. The result here suggests that where firm's workers have undergone training abroad, firms tend to be up to 49% more productive.

Finally, in the last panel of the table we explore the role of other firm specific variables. The first of these focuses on the share of foreign ownership by firm. Here we are interested in exploring whether high rates of foreign ownership lead to firms being more productive, for

example through the introduction of techniques and technologies from abroad. If this were the case we would expect the coefficient here to be positive. Interestingly the coefficient is negative and in several of the parametric approaches statistically significant. This suggests that firms with a higher degree of foreign ownership tend to be less productive. This is an interesting and possibly counter-intuitive result.

For the second variable (*infrastructure problems)* firms reported on a number of possible problems which may have impacted on their production in the preceding year. These include electricity cuts, water shortages, days lost as a result of strikes or disputes with workers etc. Here we have aggregated all these into a single dummy whenever a firm has reported on the presence of such a problem in the preceding year. Production problems such as these are likely to impact negatively on productivity, and hence we would expect to find a negative coefficient. However, the coefficient is negative and statistically significant only when using the Klette-Johansen measures, and suggests that where firms did experience such difficulties on average firms were 0.3% less productive.

The following two variables deal with the extent of competitive interaction firms face. The first of these gives each firm's domestic market share, and the second of these gives the number of competitors each firm perceives itself to have for its principal product. There is evidence here that a higher domestic market share leads to higher levels of productivity and this is true of all the parametric based results. The coefficient is also positive for the Klette-Johansen index, but not statistically significant. There little evidence that an increased number of competitors tends to decrease productivity. In terms of the remaining variables two appear significant in certain cases. For the first of these firms were asked whether they had applied for any MEDA funding. Eleven firms replied in the affirmative, and these firms are on average between 19% (OLS1) and 57% (Klette-Johansen) more productive, ceteris paribus. Again, it is important to be careful with interpretation here, as there could be reverse causality at work. Hence it is just as likely that it is the more productive firms that apply for MEDA funding, as it is that MEDA funding helped to boost firms productivity. In order to answer this question we would need panel data. Finally, we also have information on whether the firm's products are ISO certified or not. Using the Klette-Johansen measure it appears that ISO certified firms tend to be on average 51% more productive. This is an interesting result, which could have several interpretations. One possible interpretation is that ISO certification itself cannot lead to higher productivity, and therefore this is simply a reflection of that in order to be ISO certified firms are required to produce higher quality goods and therefore in order to do so (competitively) they need to be more productive. This in turn however raises questions about the motives and processes underlying the ISO certification process. Alternatively it is possible that ISO certification because it provides a guaranteed mark of quality allows firms to charge higher prices, and this is being picked up by our productivity measures. Finally the last row of the table gives the number of employees which can be seen as a proxy for size. There appears to be no evidence that larger firms are more productive, and therefore no evidence of economies of scale.

Given the lack of significance of a number of the preceding variables, in the next table we turn to a similar set of estimations but this time run on a reduced set of explanatory variables. The first row of the Table 9, thus gives the significance of the extent of average domestic tariffs. Once again this clearly indicates that domestic tariff protection is negatively correlated with productivity levels where a 1% increase in domestic tariffs is associated with approximately a 0.4% decrease in productivity. In the second row we include the ratio of skilled to unskilled workers for each firm. Here we are interested in exploring whether there is any evidence that firms, which employ a higher proportion of skilled workers may be more or less productive. The coefficient here is positive, hence indicating that the greater the skill intensity the higher the productivity, but is only statistically significant for two of the

productivity measures (OLS2 and OLS2 Blocs). Once again the share of foreign ownership is negatively related to productivity, although the coefficients remain statistically insignificant. Productivity is also positively related to the share of production exported at the firm level, as well as the share of the workforce involved in R&D activity. There is a negative coefficient with regard to this latter variable for the Klette-Johansen measure of productivity but this is not statistically significant.

The role of market share remains positive and statistically significant, and where the impact of market size on productivity is substantial. A 1 percentage point increase in market share is associated with an increase in productivity in the order of 0.3%. This is an interesting results. In principle one could imagine the role of market share is operating in either direction. Firms, with more substantial market shares are likely to yield more market power. In those circumstances the need to be more efficient may be lessened. The presence of what is commonly referred to as x-inefficiency could thus lead to lower levels of productivity. Conversely, it is perhaps more likely that more productive firms are likely to be more successful and thus would have a higher market share. It would appear that this is the effect we are observing here. Of course the two effects are not mutually exclusive. Ceteris paribus more efficient firms could well have a higher market share, but could be less efficient than they would be if the environment was more competitive. In order to test this proposition one would need time series data to explore whether changes in market share are associated with changes in productivity. We also see from the table that there appears to be no association between the level of productivity and whether the firm is multiplant or not. Finally, the coefficient on sales, which proxies for the size of the firm, is now positive and statistically significant but the overall size of the coefficient is extremely small.

There are a number of conclusions, which emerge from this section of the report. First, we have explored the use of different approaches to measuring productivity. Those different approaches each yield highly comparable and consistent results. Secondly, our results suggest that the seven sectors covered in this data set all produce under constant returns to scale, and except for food have similar capital-labor ratios. We then explored the possible determinants of productivity, though bearing in mind the issue of reverse causality, which is present with respect to a number of our variables. The key results indicate that more productive firms tend to face lower domestic tariffs, export more, have a larger domestic market share, and have a higher proportion of workers engaged in R&D activity. It also appears to be the case that firms which are more productive may have applied for MEDA funding, and may have products which are ISO certifies. In contrast there appears to be little evidence to suggest that imported intermediates, training in the use of equipment, foreign ownership or size appear significant determinants of productivity. All these are factors that a priori one might expect to influence the level of productivity.

5. Summary and Conclusions:

The decomposition of the sources of productivity growth over time for Morocco indicated that in aggregate the contribution of changes in firm level productivity to aggregate productivity was small, and appeared to be declining over time. Thus the evidence appears to suggest that changes in firm level productivity were relatively modest, and this was true of most sectors.. Our results also appeared to suggest little evidence of economies of scale which could enable productivity improvement to occur via scale effects.

To the extent then that changes in productivity are driven more by sectoral reallocation effects and by the entry and exit of firms, this also suggests considerable churning in the labor market. This is reinforced when we look at the proportion of new firms and exiting firm in any given year as a proportion of the total number of firms for that year. On average over

1990-2002 the proportion of exiting firms was 10.4%, and the proportion of new firms 9.5%. This is a high figure, which indicates considerable turnover amongst firms, and consequently in the labor market[4]. There is also some evidence in our analysis that changes in the skill-composition of the workforce at the firm level impacts positively upon productivity – however the evidence is slight.

From the descriptive statistical discussion of the productivity estimates there were some key sectoral patterns which emerged. These include differential changes in productivity across sectors with certain sectors experiencing large and positive changes in productivity while other sectors witnessed a decline. Another important result which emerges from the preceding analysis is that there are important differences in productivity levels, and in productivity changes by sector and by size class. The diverse relationship between size class of firms and productivity highlights the importance of recognizing the heterogeneity of firms in both analyzing productivity and structural change but also with respect to policy.

There is clear evidence that trade and openness do interact in important ways with productivity. The results suggest that exporting activity tends to lead to higher levels of productivity, and not surprisingly the extent of that impact differs across sectors, but also across different size classes of firms. One has to bear in mind that there is an issue of endogeneity here in that it could be that higher levels of productivity may lead to higher export levels, as opposed to higher export levels leading to higher productivity. With regard to import openness the results suggest mixed evidence on the impact of increased domestic openness on productivity. In the panel data analysis we saw that increased openness in aggregate was negatively associated with productivity. When we distinguished between small and large firms however, this appeared to apply to the small firms and for the large firms there was a positive relationship.. In contrast, for the cross-section analysis (1998-1999), we saw a negative coefficient on the average level of domestic protection. This indicates that a reduction in domestic tariffs is associated with an increase in productivity.

Overall the results in this paper suggest that engaging in a process of trade liberalization via the Barcelona process is likely to lead to changes in the productivity of Moroccan firms, and thus have a positive impact on GDP per capita. However, the impact on productivity will vary both by sector and by firm type, which in turn suggests that there will be distributional considerations for policy makers to bear in mind. Where in this research we have shown the importance of dealing with firm level heterogeneity in understanding productivity change – future research needs to focus more directly on the transmission mechanisms. This is important for better understanding the conditions under which firms are more likely to be successful, and the constraints they face.

[4] It is of course possible and likely that to some extent these figures overstate the extent of entry and exit of firms. Although the data is based on a census it is clearly possible and likely that firms simply may not report in any given year, and thus appear as exiters, and then choose to report in a subsequent year and then would appear as entrants. To some extent we have attempted to control for this. Hence, in the data where a firm disappears from the data set, but the reappears either a year or two years later, we have interpolated the missing data, and thus the firm is then treated as being an incumbent throughout the time period.

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Figure 1: Aggregate Productivity: Morocco

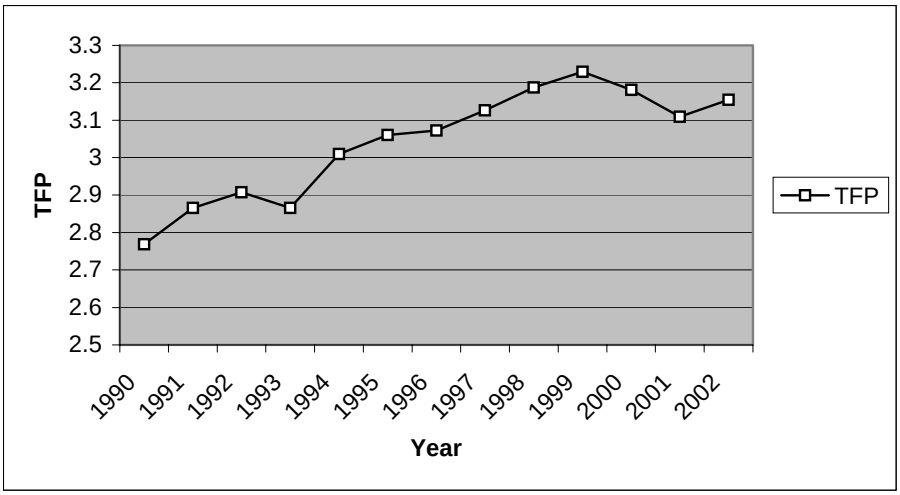

Figure 1: Aggregate Productivity: Morocco

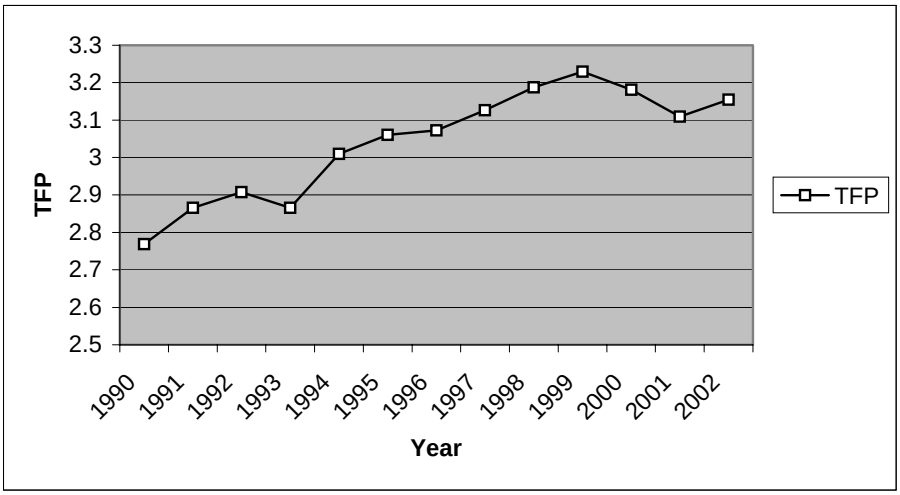

Figure 2: Productivity by sector and by year: Morocco

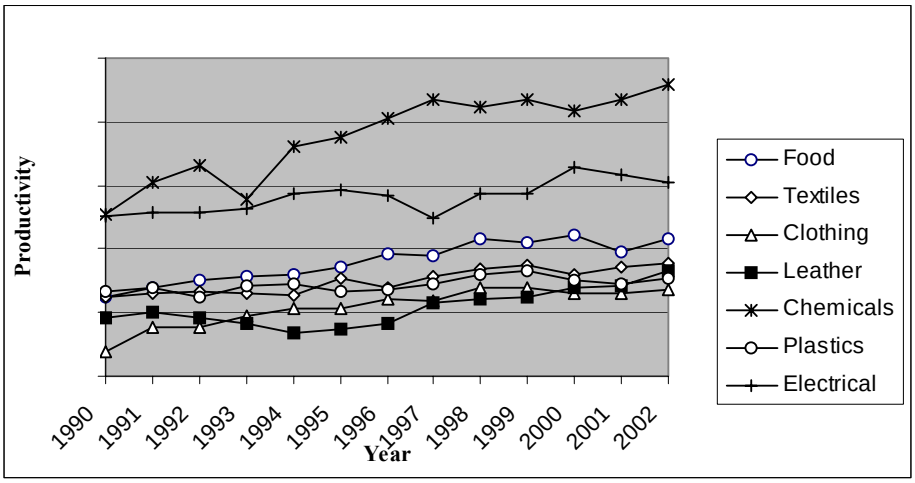

Figure 3: Changes in productivity by size of firms

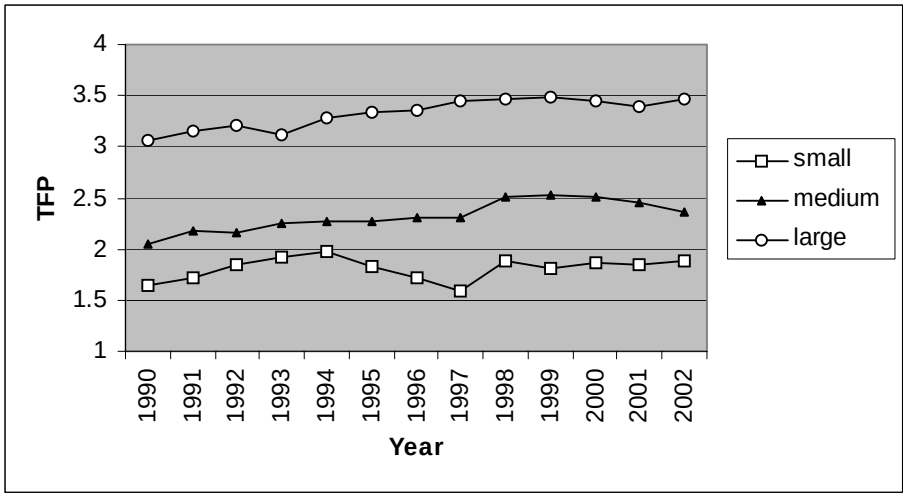

Figure 4: Aggregate Decomposition of Productivity Changes

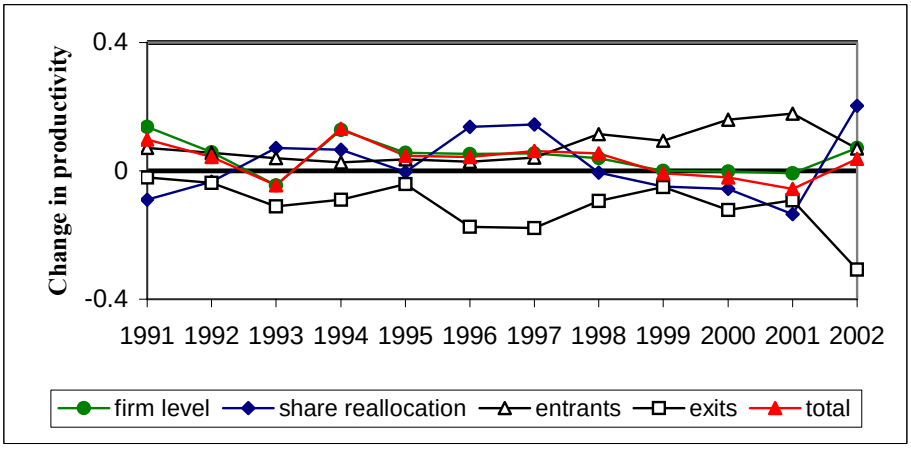

Table 1: Moroccan Tariffs

	1993	1997	2000
Food	72	61	52
Textiles	92	61	38
Clothing	99	71	50
Leather	60	50	43
Chemical	47	35	26
R&P	61	48	38
Electrical	65	37	17

Source: Trains database.

Table 2: Differences in Productivity between Entrants and Exits

Difference in average productivity for entrants & exits - weighted by shares

	Food	Textiles	Clothing	Leather	Chem.	R&P	Elec.
	15	**17**	**18**	**19**	**24**	**25**	**31**
1991	0.0080	0.0164	-0.0893	-0.0006	-0.0048	-0.0035	-0.0486
1992	-0.0272	-0.0379	-0.0996	-0.0617	-0.0118	-0.0166	-0.1913
1993	-0.1944	-0.1044	-0.0760	-0.0265	-0.0227	-0.0378	-0.0123
1994	-0.0429	-0.1594	-0.1624	-0.1111	-0.0066	-0.0747	-0.3187
1995	-0.0151	-0.0417	-0.0556	-0.0983	-0.0151	-0.0209	-0.1770
1996	-0.1242	-0.0178	-0.0908	-0.1255	-0.3832	-0.0726	-0.0560
1997	-0.1475	-0.1381	-0.1142	-0.3221	-0.1111	-0.0799	-1.6433
1998	-0.0925	0.0226	-0.1399	-0.0424	-0.0795	-0.0571	0.3858
1999	-0.0023	0.0149	-0.1207	-0.1048	-0.0304	0.0258	0.4541
2000	0.0082	-0.0017	-0.1118	0.2454	-0.0726	-0.0161	1.4677
2001	0.0091	-0.0466	-0.0350	0.0255	-0.1053	-0.4256	-0.0525
2002	-0.2382	-0.2464	-0.0640	-0.0967	-0.2806	-0.0509	-0.5411

Difference in average productivity for entrants & exits - unweighted by shares

	15	**17**	**18**	**19**	**24**	**25**	**31**
1991	-0.0052	-0.0012	-0.0111	-0.0012	-0.0026	0.0000	-0.0015
1992	-0.0142	-0.0106	-0.0203	-0.0063	-0.0023	-0.0025	-0.0019
1993	-0.0076	-0.0116	-0.0180	-0.0043	-0.0048	-0.0011	-0.0009
1994	-0.0886	-0.0292	-0.0273	-0.0085	-0.0041	-0.0056	-0.0034
1995	-0.0037	-0.0064	-0.0084	-0.0031	-0.0019	-0.0009	-0.0015
1996	-0.0069	-0.0054	-0.0076	-0.0037	-0.0058	-0.0033	-0.0022
1997	0.0211	-0.0063	-0.0093	-0.0023	-0.0029	-0.0008	-0.0025
1998	-0.0012	-0.0067	-0.0063	-0.0023	-0.0084	-0.0026	0.0005
1999	-0.0067	-0.0042	-0.0065	-0.0039	-0.0031	0.0000	0.0003
2000	-0.0021	-0.0018	-0.0046	-0.0030	0.0016	-0.0008	0.0010
2001	-0.0067	-0.0038	-0.0028	-0.0012	-0.0007	-0.0014	-0.0006
2002	-0.0185	-0.0112	-0.0065	-0.0023	-0.0031	-0.0020	-0.0019

Table 3: Firm Level Productivity – Estimation Results

	1990-2002		1996-2000	
	Sectoral FE	**Firm level FE**	**Sectoral FE**	**Firm level FE**
expout1	0.016	0.016	0.138	0.17
	(3.05)**	(10.43)**	(8.03)**	(6.42)**
size2	0.494	0.196	0.503	0.179
	(52.39)**	(15.65)**	(27.78)**	(6.15)**
size3	1.007	0.252	0.944	0.137
	(86.86)**	(12.43)**	(41.82)**	(2.78)**
Size				
age	0.007	0.029	0.006	0.033
	(8.23)**	(16.15)**	(3.33)**	(3.79)**
sqage	0	0	0	0
	(1.47)	(6.79)**	(0.05)	(3.79)**
Food	-0.471		-0.83	
	(19.66)**		(16.29)**	
Textiles	-0.34		-0.596	
	(14.01)**		(12.73)**	
Clothing	-0.376		-0.714	
	(15.51)**		(12.25)**	
Leather	-0.26		-0.583	
	(9.70)**		(10.26)**	
Chemicals	0.324		0	
	(10.73)**		(.)	
Rubber & Plastic	-0.492		-0.828	
	(18.54)**		(15.61)**	
Electrical	0		-0.256	
	(.)		(4.22)**	
skunsk1			0.023	0.003
			(1.77)+	(0.46)
Expoutsec			-0.195	-0.08
			(1.03)	(-0.65)
Impoutsec			-0.034	-0.143
			(0.8)	(-1.06)*
Constant	1.777	1.582	2.398	1.548
	(63.36)**	(68.71)**	(34.12)**	(16.64)**

+ significant at 10%; * significant at 5%; ** significant at 1%

Table 4: Sectoral Regressions 1990-2002

	Food	Textiles	Clothing	Leather	Chemicals	R & P	Electrical
	15	**17**	**18**	**19**	**24**	**25**	**31**
expout1	0.01	0.02	0.046	0.093	0.041	0.163	0.087
	(4.80)**	(7.30)**	(7.09)**	-1.51	(4.00)**	(1.69)+	(1.70)+
size2	0.294	0.16	0.141	0.049	0.143	0.164	0.047
	(13.90)**	(5.59)**	(5.54)**	-1.08	(2.51)*	(3.44)**	-0.55
size3	0.221	0.307	0.136	0.097	0.21	0.028	0.235
	(4.38)**	(6.96)**	(4.51)**	-1.12	(2.36)*	-0.26	(1.67)+
Age	0.021	0.036	0.034	0.012	0.076	0.018	0.023
	(6.67)**	(7.84)**	(9.51)**	-1.57	(8.67)**	(2.34)*	(1.73)+
Sqage	0	0	0	0	-0.001	0	0
	(3.18)**	(4.76)**	(2.87)**	-0.49	(4.23)**	-0.53	-1.24
Constant	1.971	1.391	1.053	1.546	2.416	1.149	4.12
	(46.44)**	(25.70)**	(29.20)**	(16.94)**	(16.44)**	(13.16)**	(24.25)**

Table 5: Sectoral Regressions – 1996-2000

	Food	Textiles	Clothing	Leather	Chemicals	R & P	Electrical
	15	17	18	19	24	25	31
expout1	0.129	0.027	0.039	0.322	0.05	0.126	0.113
	(2.20)*	(4.65)**	(6.02)**	(2.74)**	-0.8	-0.54	(2.21)*
size2	0.265	0.111	0.21	0.04	0.313	0.114	-0.142
	(7.32)**	(1.72)+	(4.67)**	-0.4	(2.66)**	-1.09	-0.99
size3	0.043	0.282	0.174	0.012	0.358	-0.224	-0.318
	-0.45	(2.70)**	(3.23)**	-0.06	(1.70)+	-0.83	-1.4
skunsk1	-0.007	-0.006	0.004	0.005	0.06	0.019	0.086
	-0.26	-0.13	-0.8	-0.09	-1.24	-0.33	-1.35
age	0.055	0.02	0.016	-0.028	0.053	0.022	0.014
	(5.43)**	-1.24	-1.48	-1.01	(1.89)+	-0.88	-0.36
sqage	0	0	0	0.001	0	0	-0.001
	(2.55)*	-0.66	-1.1	-1.32	-0.65	-0.67	-0.78
Constant	1.547	1.689	1.298	1.829	2.644	1.06	4.605
	(12.41)**	(9.58)**	(14.63)**	(6.25)**	(6.20)**	(4.23)**	(10.37)**

Table 6: Productivity by size class - Morocco

	Small Firms	Medium Firms	Large Firms
expout1	0.281	0.1	0.047
	(4.01)**	(2.76)**	-0.71
expoutsec1	-0.859	0.123	0.269
	(2.81)**	-0.71	-1.42
impoutsec1	-1.055	-0.05	0.418
	(2.69)**	-0.27	(2.13)*
skunsk1	-0.103	0.003	-0.02
	(1.83)+	-0.41	-0.2
age	0.034	0.049	0.002
	(1.65)+	(3.63)**	-0.13
sqage	0	-0.001	0
	-0.45	(1.92)+	-1.56
Constant	1.62	1.621	2.29
	(8.87)**	(11.43)**	(14.11)**

Absolute value of t statistics in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

Table 7: Correlation of productivity estimates across methodologies

		Parametric			Index No.	
		L&P	**IV**	**OLS**	**K-J (levels)**	**K-J (F D)**
Parametric	**L&P**	1				
	IV	0.9694	1			
	OLS	0.9771	0.9934	1		
Index No.	**K-J (levels)**	0.9342	0.8763	0.9079	1	
	K-J (FD)	0.7678	0.7323	0.78	0.8201	1

Table 8: Determinants of Productivity – cross section

	OLS 2	OLS 2 Blocs	LevPet	IV	OLS 1	K-J
Tariff obstacles on exports	-0.138	-0.133	-0.242	-0.202	-0.209	0.040
	(1.23)	(1.17)	(2.24)*	(1.87)+	(1.93)+	(0.23)
NTB obstacles on exports	0.582	0.538	0.394	0.430	0.424	0.480
	(2.39)*	(2.20)*	(1.50)	(1.52)	(1.50)	(2.30)*
Ave domestic tariffs	-0.392	-0.381	-0.478	-0.487	-0.492	-0.276
	(2.87)**	(2.95)**	(3.41)**	(3.69)**	(3.70)**	(1.30)
Share of imported interm.	0.003	0.003	0.002	0.002	0.002	0.002
	(1.40)	(1.47)	(1.11)	(1.20)	(1.17)	(0.89)
Share of imported raw mats	-0.243	-0.230	-0.148	-0.131	-0.131	-0.202
	(0.97)	(0.97)	(0.70)	(0.63)	(0.63)	(0.72)
Share of imported capital	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001
	(0.47)	(0.43)	(0.61)	(0.35)	(0.39)	(0.81)
Share of prod exported	0.002	0.002	0.002	0.002	0.002	0.006
	(2.61)**	(2.77)**	(2.44)*	(2.01)*	(2.02)*	(4.21)**
Exp penetration (sector)	-0.002	-0.002	-0.003	-0.003	-0.003	0.001
	(0.34)	(0.30)	(0.38)	(0.46)	(0.45)	(0.14)
Does the firm invest in RD	0.057	0.081	0.015	0.045	0.039	-0.165
	(0.46)	(0.64)	(0.13)	(0.39)	(0.34)	(0.55)
Number of new products	-0.000	-0.000	-0.000	-0.000	-0.000	0.004
	(0.19)	(0.19)	(0.28)	(0.18)	(0.19)	(2.00)*
Share of workforce in R&D	0.996	1.002	1.492	1.256	1.284	-1.575
	(1.19)	(1.11)	(2.02)*	(1.80)+	(1.82)+	(0.49)
Age of capital < 5 years	0.094	0.050	0.024	0.284	0.278	-0.429
	(0.56)	(0.30)	(0.16)	(1.44)	(1.41)	(1.42)
Age of capital: 5-10 years	0.152	0.097	0.130	0.369	0.365	0.133
	(0.93)	(0.59)	(0.85)	(1.85)+	(1.83)+	(0.51)
Age of capital > 10 years	0.063	0.033	0.033	0.229	0.228	-0.182
	(0.35)	(0.18)	(0.19)	(1.04)	(1.04)	(0.53)
Training by suppliers	0.088	0.075	0.119	0.136	0.132	-0.181
	(0.92)	(0.78)	(1.25)	(1.44)	(1.39)	(0.57)
Training abroad	0.026	0.030	0.057	0.072	0.069	0.396
	(0.22)	(0.24)	(0.50)	(0.68)	(0.64)	(1.82)+
Training from manuals	-0.106	-0.141	-0.016	-0.026	-0.028	-0.134
	(0.85)	(1.12)	(0.14)	(0.23)	(0.24)	(0.39)
Share of for. Ownership	-0.109	-0.103	-0.200	-0.188	-0.191	-0.312
	(1.18)	(1.13)	(2.20)*	(2.13)*	(2.16)*	(1.53)
Infrastructure problems	0.000	0.000	-0.000	-0.000	-0.000	-0.003
	(0.23)	(0.08)	(0.19)	(0.67)	(0.62)	(1.82)+
market share	0.420	0.411	0.496	0.518	0.508	0.326
	(2.41)*	(2.34)*	(3.21)**	(3.24)**	(3.17)**	(0.82)
No. of competitors	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(1.52)	(1.50)	(0.70)	(0.83)	(0.82)	(1.08)
multiplant firms	-0.009	-0.008	-0.047	-0.036	-0.037	0.042
	(0.23)	(0.19)	(1.35)	(1.04)	(1.07)	(0.61)
Meda funding applied for	0.119	0.156	0.143	0.174	0.172	0.453
	(1.03)	(1.37)	(1.36)	(1.79)+	(1.75)+	(2.19)*
iso	0.106	0.082	0.100	0.140	0.130	0.413
	(0.75)	(0.57)	(0.77)	(1.08)	(0.99)	(2.26)*
Number of employees	0.000	0.000	-0.000	-0.000	-0.000	0.000
	(0.59)	(1.30)	(1.06)	(0.13)	(0.46)	(1.47)
Constant	1.053	1.041	0.556	0.534	0.477	0.004
	(3.26)**	(3.17)**	(1.84)+	(1.65)+	(1.47)	(0.00)

Note: +, *, ** indicate significance at the 10%, 5%, and 1% levels respectively.

Table 9: Determinants of productivity – key variables

	OLS 2	OLS 2 Blocs	LevPet	IV	OLS 1	K-J
Ave domestic tariffs	-0.391	-0.380	-0.409	-0.408	-0.414	-0.282
	(3.09)**	(3.19)**	(3.06)**	(3.27)**	(3.29)**	(1.47)
skilled/unskilled ratio	0.012	0.011	0.001	0.001	0.001	0.004
	(7.94)**	(7.33)**	(0.70)	(0.59)	(0.58)	(1.64)
share of for. Ownership	-0.105	-0.096	-0.098	-0.065	-0.071	-0.029
	(1.38)	(1.27)	(1.08)	(0.72)	(0.79)	(0.18)
Share of prod exported	0.002	0.002	0.002	0.002	0.002	0.006
	(3.08)**	(3.31)**	(2.39)*	(2.42)*	(2.33)*	(4.33)**
Share of workforce in R&D	1.248	1.319	1.386	1.283	1.290	-1.991
	(1.40)	(1.36)	(1.87)+	(1.68)+	(1.69)+	(0.64)
market share	0.314	0.308	0.305	0.284	0.277	0.101
	(1.88)+	(1.84)+	(2.05)*	(1.87)+	(1.83)+	(0.27)
Multiplant	0.045	0.050	-0.005	-0.000	-0.002	0.120
	(0.90)	(1.04)	(0.09)	(0.01)	(0.04)	(1.45)
Sales	0.000	0.000	0.000	0.000	0.000	0.000
	(2.11)*	(2.26)*	(1.52)	(2.21)*	(2.05)*	(2.48)*
Constant	1.295	1.189	0.830	1.065	0.999	0.219
	(6.01)**	(5.61)**	(3.94)**	(5.23)**	(4.89)**	(0.51)