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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

Productivity, Exports and Firm Dynamics in Kenya 1999-2002*

Måns Söderbom**
Centre for the Study of African Economies
Department of Economics
University of Oxford

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**UNIDO Research Fellow at the Centre for the Study of African Economies, Department of Economics, University of Oxford. Correspondence: Mans.Soderbom@economics.ox.ac.uk.

This paper uses survey data on Kenyan manufacturing firms collected in 2003 to document key aspects of firm performance and dynamics in the sector over the period 1999-2002. To investigate this, we analyze the 2003 data, collected as part of a World Bank RPED survey, in conjunction with data from 2000 collected by a team from Oxford University as part of a research program funded by UNIDO. Because the questionnaire and the survey design in 2003 were similar to what was used in 2000, the two data sets are comparable. Unlike the 2003 survey, micro firms were covered in 2000 and so, in the interest of comparability, we exclude these firms from the 2000 data set. Furthermore, RPED 2003 covered some sectors that were not included in 2000, and we control below for such differences in sector composition across the two data sets. All financial variables are expressed in constant USD 2002. Unless stated otherwise, the data used below refer to 2002 and 1999.

1. Productivity and Firm Growth

1.1 *Labor Productivity and Capital Intensity*

We begin by looking at how labor productivity and capital-intensity vary over the firm size range and if there are differences over time. Table 1 shows sample averages of value-added per employee and capital per employee, both in natural logarithms, for the two periods.[1] To highlight the role of firm size we distinguish between three size categories: small (10-49 employees); medium (50-99 employees); and large (100+ employees). It is clear from these data that labor productivity increases with firm size, a rather general finding for African manufacturing (see e.g. Lundvall, 1999, for evidence on Kenya 1992-94; Söderbom and Teal, 2004, for evidence on Ghana). One frequently cited reason for this result is that large firms are much more capital-intensive than small firms, so that each worker in large firms has access to more machinery than do workers in small firms. The data in Table 1 are clearly consistent with this explanation. The

[1] Value-added is defined as the value of output minus the value of inputs excluding labor and capital.

figures for 2002, for instance, imply that the capital-labor ratio among large firms is about 80 per cent higher than among small ones.[2]

The data also suggest that the average (log of) value-added per employee has increased somewhat since 1999, at least among the large firms. The average differential based on all firms is equal to 0.09 corresponding to an increase of about 10 per cent. In contrast, the average capital intensity appears to have fallen slightly over the period. For all categories, the differential of -0.19 corresponds to a decrease of about 17 per cent.[3] These two findings – that labor productivity has increased while capital intensity has fallen – suggest that efficiency, or total factor productivity, has increased over the period. We investigate this more in detail below, but it is worth taking stock at this point of what the raw data imply for TFP growth. Suppose the technology can be approximated by a constant returns to scale Cobb-Douglas production function, expressed in per capital terms as

$$\ln(V/L) = \ln A + \beta \ln(K/L),$$

where *V*,*L*,*A*,*K* denote value-added, labor, TFP and capital, respectively, and β is the capital elasticity. Consequently, growth in TFP is equal to

$$\Delta \ln A = \Delta \ln(V/L) - \beta \Delta \ln(K/L)$$

where Δ is the difference operator. Assuming $\beta = 0.3$ the growth rates of value-added per employee and capital per employee for all size groups combined imply $\Delta \ln A = 0.14$. In other words, the simple summary statistics in Table 1 imply that TFP has grown by about 15 per cent, or about 5 per cent per year, during 1999-2002. Below we probe the data further to see how robust this result is. Our main tool for this is regression analysis of the production function.

[2] Calculation: exp(9.54-8.94) - 1 = 0.82.
[3] Calculation: exp(9.26-9.45)-1=0.17.

1.2 *Regression Analysis: Estimating the Production Function*

Following most authors in this area we assume that the production function is Cobb-Douglas with two factor inputs, physical capital and labor. We begin by investigating how the production function estimates compare across the two periods. Table 2 shows OLS results. The results are remarkably similar across the two periods. In both cases we obtain a larger coefficient on labor than on capital. The estimated capital coefficient is slightly higher in the 2002 data than in the earlier data, although the difference is not statistically significant. The labor coefficient is virtually the same in the two periods. The estimates imply that a one percentage increase of the capital stock yields an increase in value-added by 0.35-0.42 per cent, whereas a one percentage increase of the labor force increases output by 0.69 per cent, on average. Similarly, if both capital and labor are being increased by one percent, then value-added is expected to increase by 1.02-1.11 per cent, indicating mildly increasing returns to scale. When tested for, however, constant returns to scale can easily be accepted for both periods. These results are very similar to what has been found for other African countries (see e.g. Bigsten et al. 2000; Söderbom and Teal, 2004).

Now consider differences in total factor productivity. The coefficient on firm age is negative in both regressions, suggesting that young firms have higher productivity than old firms, conditional on the level of factor inputs and other explanatory variables. Quantitatively, however, the effect is small and not significantly different from zero. We also tested for non-linear age effects by adding a squared age term to the model. This turned out to be wholly insignificant and so we dropped the squared term in the preferred model.

The second dimension of potential productivity differences with which we are concerned is geographical. In 2003 five areas were included in the survey: Nairobi, Mombasa, Kisumu, Nakuru and Eldoret. The survey in 2000 covered all these areas except Kisumu. To test for geographical productivity differences, we include location dummy variables in the regression, using Nairobi as the benchmark (omitted) category. In 1999 Nairobi was the most productive area, followed by Mombasa, Nakuru and Eldoret. The only statistically significant difference is between Nairobi and Eldoret. The point estimate of -0.70 implies that firms located in Nakuru are only half as productive as firms in Nairobi.[4] By 2002 there is some evidence that firms in Mombasa had fallen quite far behind the Nairobi firms in terms of productivity. The point estimate on the Mombasa dummy of -0.50, significant at the 10 per cent level, implies that the firms based in Mombasa are on average about 40 per cent less productive than firms in Nairobi. Firms in Eldoret and Kisumu have even lower productivity levels, on average.

Finally we look at productivity differences across sectors. The classification of sectors was less aggregated in 2002 than in 1999, and so for the most recent wave we can distinguish between more sub-sectors. In both regressions we use the food sector as the benchmark (omitted) category. Previous work on Kenyan manufacturing has shown that the food sector has a relatively high level of productivity. This is confirmed by the regressions in Table 2. In 1999 the productivity of the food sector was significantly higher than in any of the other three sectors covered. The least productive sector then was textiles and garments. By 2002 there was only one sector more productive than the food sector, namely the chemical sector. The difference, however, is not significant. The least productive sectors are leather, wood and textiles. Notice however that there are some signs that the textiles sector has recovered somewhat relative to the food sector over the period considered. It seems reasonable to assume that this is at least partly due to better export opportunities.

We now proceed and analyze how productivity has changed over the 1999-2002 period. Given the similarity of the results across the two waves, documented in Table 2, we pool the data and estimate a production function imposing common slope coefficients across the two periods. This is potentially restrictive and so we test for the validity of pooling. We add to the specification a dummy variable for 2002, thus the coefficient on this dummy is interpretable as the change in productivity between 1999 and 2002. Table 3 reports OLS results. The first column shows results based on the largest sample available, while the second column reports results

[4] Calculation: exp(-0.69) = 0.50.

based on a sample excluding firms in Kisumu and firms in the chemical, construction, paper and plastic sectors (i.e. sectors only covered in 2002). We do this to assess how robust the results are to the difference in sector composition.

Focusing on the first column, we see that the estimated labor coefficient is 0.70 and the capital coefficient is 0.36. Both are highly significant. We cannot reject the hypothesis that these coefficients sum to one, i.e. we accept constant returns to scale. Further, we can easily accept the hypothesis that the production function pools over the two periods and, because the results in column 2 are very similar to those in column 1, the findings appear robust to the difference in sector composition across the two sample periods. Nairobi is the area associated with the highest average productivity over the period, followed by Mombasa. It is worth keeping in mind, however, the result discussed earlier that firms in Mombasa appear to have become less productive relative to firms in Nairobi over the sample period. Eldoret is associated with by far the lowest average productivity. Food and the chemical sector have the highest levels of productivity, and textiles and garments the lowest. The estimated coefficient on the 2002 dummy is equal to 0.07, implying a modest rise in average productivity over 1999-2002 by about 7 per cent. This is lower than what was implied by the summary statistics shown in Table 1. Further, the coefficient on the time dummy is not significantly different from zero, so we do not reject the hypothesis that there has been no productivity growth over this period. Thus there are no signs that the generally poor productivity performance of Kenyan manufacturing over the last two decades (see Chapter 1) has been reversed.

1.3 *Firm Growth*

The results reported in Section 1.2 suggest that the 1999-2002 was a relatively static period for the Kenyan manufacturing sector: summary statistics show only modest changes in labor productivity and there has been at best very modest productivity growth over the period. In this section we take a more direct look at firm dynamics and document patterns of firm growth.

We begin by looking at the rates of capital formation. Recent investment theory emphasizes that investment often is irreversible, and that as a result firms may be reluctant to invest if uncertainty is high. Other models predict that firms expand their capital stocks in periods of productivity growth. Because as we have seen productivity has not grown much, it would therefore seem reasonable to anticipate that investment has remained low over this period. This is indeed the case. Figure 1 shows the frequency distribution of investment rates in the 2002 data, defined as gross investment in plant and equipment divided by the replacement value of plant and equipment. These calculations are based on 202 observations for which we have complete information. More than 30 per cent of the firms report zero investment, and more than 70 per cent of the firms report investment rates lower than 0.05. Only 15 per cent of the firms have gross investment rates exceeding 10 per cent. The median gross investment rate is less than 2 per cent. Hence, even with modest depreciation rates most of the firms saw their stock of physical capital decrease in 2002.

Has these modest investment rates been accompanied by slow growth in terms of employment? Using retrospective information on permanent employment, provided by 202 firms in the most recent data, we compute the changes in log employment between 1999 and 2002. Column 1 in Table 4 shows that the average change in log permanent employment is -0.03, corresponding to a fall in permanent employment of about 3 per cent. The median change is -0.004. Thus, the data indicate a modest rate of downsizing among the firms included in the 2002 sample. One potential problem is that the retrospective data excludes *casual* employment, which is a significant part of the labor force in many firms. There are 39 firms that were covered in both surveys – i.e. for which we have panel data - and for which we have complete data on total employment i.e. including casual workers. Column 2 in Table 4 shows the mean and median change in log employment based on this sample. The average change is -0.03, i.e. the same figure as for permanent employment based on the larger sample. The median change is 0.03.

These findings that employment is approximately constant while capital investment is not high enough to prevent a net decline in the capital stock is wholly consistent with the result shown in Table 1 that the capital-labor ratio has fallen somewhat during 1999-2002. Taken together with low productivity growth, the evidence is thus quite clear that 1999-2002 has been a static period for the manufacturing sector.

2. Exports

In this section we investigate exports. We analyze the decision to export, and the decision to export outside Africa, by means of regression analysis. Central to this part of the analysis is whether there is any evidence that firms have become more export-oriented during the 1999-2002 period, perhaps as a result of recent policy measures designed to spur exports.

Because the exports variables with which we are concerned here are binary, the standard linear regression is not the ideal analytical tool. Instead, and following many authors in this area, we model the export decisions using probit models. We use as explanatory variables firm size, measured as the natural logarithm of total employment, firm age and dummy variables for location, sector and foreign ownership. To facilitate interpretation we report for continuous variables (size and age) marginal effects and for each dummy variable the discrete change in the estimated probability of exports as the dummy variable changes from 0 to 1. This is a standard procedure in the literature.

2.1 *The Propensity to Export*

We begin by looking into the factors that determine whether the firm does any exporting at all, regionally or internationally. Table 5 shows results based on the 2003 and the 2000 sample. Both regressions indicate an important role for firm size. The effect is highly significant, both from a statistical and economical point of view. The estimated marginal effects of log employment are interpretable as a semi-elasticity: that is, an increase of employment by one per cent is associated with an increase in the estimated likelihood of exporting by 0.17 percentage points, based on the 2003 sample. At first glance this does not seem a large effect, however the sample variation in firm size is large. To give one specific example, the predicted probability of exporting for a firm with 10 employees is 0.24 while for a firm with 100 employees it is 0.63. This shows that the size effect is economically important. One commonly proposed explanation for the positive association between firm size and exporting is that firms face significant fixed costs to entering the exports market, due to bureaucratic procedures, the establishment of new marketing channels, and the need for a certain minimal size to meet export orders (Söderbom and Teal, 2000).

Now consider the role of firm age. One of the issues central to the policy debate on how to stimulate exports is whether breaking into exports markets takes time, perhaps because firms need to learn about marketing strategies, distribution channels etc., or whether firms can export soon after inception. In the models shown in Table 5 we allow for a quadratic effect of firm age by means of a squared age term. In both models the point estimates on firm age and its square imply an inverse u relationship between exporting and firm age. That is, when firms are young, the likelihood of exporting increases relatively rapidly with firm age. As firms get older, the exports-age profile flattens out, and at a certain point the likelihood of exporting will peak and then start to fall with age. Based on the results in Table 5, this happens at 42 years and 22 years, for 2003 and 2000, respectively. The age effect is significantly different from zero in the most recent sample, but not in the regression based on the data from 2000. One possible reason for this is that the sample size is smaller in the latter model. Focusing on the 2003 results, the results imply that the estimated probability of exporting for a new firm (whose age is one year) is 0.43 while that for a firm that has been in operation for ten years is 0.68. This provides some evidence that breaking into exports markets takes time.

Now consider geographical differences in the propensity to export. In 2003 five areas were included in the survey: Nairobi, Mombasa, Kisumu, Nakuru and Eldoret. The survey in 2000 covered all these areas except Kisumu. To test for geographical productivity differences, we include location dummy variables in the regressions, using Nairobi as the benchmark (omitted) category. In both sets of regression results shown in Table 5 the coefficients on the location dummies are negative, suggesting that firms located in Nairobi have a higher export propensity than firms located elsewhere. In the 2000 sample the location effects are small and insignificant and so, based on these results, we would not reject the hypothesis that the propensity to export is invariant to location. The location effects based on the most recent sample, however, are highly jointly significant, so we reject the hypothesis that exporting does not vary across the areas considered. The likelihood of exporting is highest in Nairobi, followed by Nakuru, Mombasa, Eldoret and lastly Kisumu. The large differential in the likelihood of exporting between Nairobi and Mombasa (26 percentage points, evaluated at the sample means of the regressors) provides further evidence that Mombasa has yet to take advantage of its coastal location in this context.

In Kenya manufacturing exporting is reasonably well diversified across industries, at least compared to many other African countries (Söderbom and Teal, 2003). We now consider the sector effects in the export probits. The classification of sectors was less aggregated in 2003 than in 2000, and so for the most recent wave we can distinguish between more sub-sectors. In both regressions we use the food sector as the benchmark (omitted) category. Clearly both sets of results indicate significant differences in the propensity to export across different industries. In 2002 the likelihood of exporting is highest among firms in the textiles, furniture and paper, all other factors held constant. Quantitatively the sector effects are quite large. For example, the difference in the probability of exporting between the textiles sector and the wood sector is 38 percentage points. It is interesting to note that the results for the most recent wave of data are somewhat different from what we find based on the 2000 sample. In particular, since 1999 the textiles sector appears to have strengthened its position somewhat with respect to exporting relative to the other industries. We will look into this more in detail in Section 2.3 where we analyze changes in exporting.

Foreign ownership is associated with a positive coefficient in both regressions, suggesting a higher propensity to export among firms that have some foreign ownership. It seems possible that access to foreign markets and technology play a role in driving this result. The effect is stronger, and more significant, in the most recent data where the estimated probability of exporting among firms with some foreign ownership is 34 percentage points higher than among firms under domestic ownership. We also added the percentage of foreign ownership to the specifications, but found no significant effect.

2.2 *Exports to Non-African Countries*

Most of the exports from the firms in the 2003 sample go to the neighboring countries Uganda and Tanzania. One of the advantages of exporting commonly cited in the literature, and discussed in the introduction to this chapter, is that firms learn from exporting through, for instance, exposure to new ideas and international competition. It seems likely that the scope for such learning is larger if firms export relatively developed countries, and in this sub-section we investigate whether the factors determining exports to non-African countries are similar to those driving regional exports. We use a similar modeling framework as in the previous section. Thus, the dependent variable in the probit analysis now takes the value one if the firm exports to non-African countries and zero if it does not. Results are shown in Table 6.

Again, the most significant factor impacting on international exports is firm size. The marginal effects of size are virtually identical across the two periods, and of similar order of magnitude as for any exports (Table 5). In both specifications the effect of firm age is insignificant, thus providing no evidence for learning-to-export mechanisms. Notice here a difference to what was found in the previous sub-section. This result that firms become more prone to exporting regionally, but not internationally, as they get older can be interpreted as evidence that general experience gained in the Kenyan market is more useful for regional than for international exports. This seems plausible given the relative similarity of the East African economies.

Looking at the sector effects we also see a somewhat different pattern. The results for 2002 indicate rather strikingly that firms in the textiles sector are much more likely to export internationally than firms in other sectors. In fact we can accept the hypothesis that all sectors *except* textiles have the same underlying propensity to export, which is significantly lower than for the textiles sector. In 1999 the likelihood of international exports from the textile sector was not significantly different from that in the food and the wood sectors, suggesting that the textile sector has advanced its position in terms of international exports during the period under study. We return to this issue in the next sub-section.

For non-African exports we find no systematic geographical differences. That is, for both periods considered here we can accept the hypothesis that the location dummies are jointly zero. Again, this finding is different from what we get when we include regional exports. That is, while regional exporting tends to be more widespread among firms in Nairobi than elsewhere, international exporting appears unconnected to location. An analogous conclusion holds for foreign ownership, which is insignificant in both regressions shown in Table 6 but highly significant in Table 5.

2.3 *Changes in Exporting*

We now proceed and analyze whether firms have become more inclined to export over the period. We pool the data from the two time periods and estimate export probits imposing common slope coefficients across the two periods. This is potentially restrictive and so we test for the validity of pooling. We add to the specification a dummy variable for 2002, thus the coefficient on this dummy is interpretable as the change in the likelihood of exporting between 1999 and 2002, holding all other factors constant. We model any exports and exports to non-African countries. Results are shown in Table 7.

Column 1 shows the results from a regression where we model exports to any destination. As expected we are now able to estimate some of the coefficients with better precision than before. Size, age and foreign ownership are all highly significant and with the same signs as discussed in Section 3.1. Firms in Eldoret and Kisumu are significantly less likely to export than otherwise similar firms in Nairobi. There are also significant differences across the sectors in the propensity to export. We can reject at the five per cent level (but not at the one per cent level) the hypothesis that the export probit pools over the two periods.

Turning now to the main variable of interest in this sub-section, we see that the time effect is very small and far from significant. In other words, we can easily accept the hypothesis that the propensity to export has not changed between 1999 and 2002, holding all other factors constant. Further probing of this result reveals that there is some evidence that among firms in the textiles sector the propensity to export has in fact increased while for firms in other sector it has decreased over the period considered.[5] It would seem reasonable to assume that this positive effect observed for the textile firms is related to AGOA and other policy measures designed to spur exports from firms in this sector.

Column 2 shows a pooled specification modeling exports outside of Africa. Again firm size is associated with the most significant effect while the effects of firm age, foreign ownership and location are all insignificant at conventional levels. Firms in the textiles and garments sector are more likely to export to the international market than firms in other sectors. The pooling test indicates that we can easily accept the hypothesis that the equation pools across the two time periods.

We obtain a positive and significant (at the five per cent level) time effect for non-African exports. The result implies that a firm with the "average" characteristics was seven

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[5] This is tested for by means of adding to the specification a cross term between the textiles and garments sector and the dummy for 2003. The coefficient on the resulting interaction term is positive and significant at the five per cent level, while the time dummy is negative (but not quite significant at the ten per cent level). It is this result that drives the rejection of pooling at the five per cent level, referred to earlier in the text.

percentage points more likely to export to non-African countries in 2002 than a firm with the same characteristics in 1999. This is an encouraging result, suggesting that firms are responding to policy measures designed to spur exports. Further probing of the data suggests that a large part of this increase is played by more firms in the textiles and garments sector becoming export oriented during the 1999-2002 period.

3. Earnings

We now proceed by investigating the trends in real earnings. Central to this part of the analysis is whether there is any evidence that real earnings in the manufacturing sector have changed significantly during the 2000-2003 period. Our point of departure is the standard Mincerian framework stating that differences in individual log earnings are driven by differences in human capital, $\ln w = \psi h + \eta$, where w denotes real monthly earnings, h is a vector of observed human capital variables, ψ is a vector of coefficients to be estimated and η captures all unobserved factors affecting earnings including measurement errors in the earnings variable.[6] We assume that the vector h consists of years of education, tenure, age and age squared. In addition, we include in the model a gender dummy to test for systematic earnings differences between males and females and location dummies to control for geographical differences in the cost of living. This yields our baseline model, which we analyze in the next sub-section. We then extend this model and consider the role of firm level variables. Specifically, we add to the baseline model firm size (measured as the log of total employment), firm age and dummy variables for industry. We estimate all models using OLS.[7]

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[6] Throughout the analysis wages are expressed in real 2002 USD, using the New Kenya Overall CPI (Central Bureau of Statistics and Ministry of Finance and Planning, 2003) to deflate the data.

[7] It is possible that the residual is in fact correlated with some of the explanatory variables. For instance, it is a common concern in the literature on returns to education that education is positively correlated with unobserved ability. Addressing this problem requires the use of instrumental variable (IV) techniques which is beyond the scope of this study (see Söderbom, Teal, Wambugu and Kayharara, 2003, for an IV analysis of the returns to education in Kenyan and Tanzanian manufacturing). In our application the coefficient on education can be interpreted as the combined return to education and unobserved skills.

3.1 *The Baseline Model*

Table 8 shows the results for the baseline model. Columns 1 and 2 present results for 2003 and 2000, respectively, while column 3 shows a pooled specification which includes a time dummy for 2003. In all specifications the coefficient on education is positive and highly significant. The point estimate ranges between 0.13 and 0.16, indicating that an additional year of education is associated with an earnings premium of about 15 per cent, on average. Compared to results for other regions, this is a relatively high estimate. The coefficient on age is positive while that on age squared is negative. This is a common result in the literature. The results for 2003 imply that the expected wage increases with age over the entire age interval.[8] The tenure variable, measuring the number of years the individual has been working for the firm, is meant to be capturing a firm-specific dimension of human capital. For example, if there is 'learning by doing' so that an employee gradually becomes more efficient in carrying out certain firm-specific tasks, then, according to standard human capital theory, he will be paid more as a result. In our data, we find no evidence of any effect of length of tenure on earnings, as the tenure coefficient is very close to zero and totally insignificant in all regressions shown in Table 8. It should be noted, however, that tenure is strongly correlated with age, which as we have seen is highly significant. It is possible that this makes it difficult to tease out both a tenure effect and an age effect from the data.

As for our control variables, we obtain a positive coefficient on the gender dummy and negative coefficients on the dummies for Nakuru and Eldoret. The point estimates of the gender coefficient imply that the expected earnings of males are between four and six per cent higher than the earnings on females, holding human capital constant. Compared to what has been found in other studies, this is quite a small differential and we cannot reject the hypothesis that it is in fact zero. Earnings are substantially lower in Eldoret and Nakuru than in Mombasa, Kisumu and

[8] The point estimates imply that earnings increase until the age of 82.

Nairobi (the latter is the omitted category). In 2000 the average wage of an employee based in Nakuru was about 44 per cent lower than that of workers in Nairobi, conditional on human capital.[9] The effect is statistically significant from zero at the one per cent level. By 2003 this differential was somewhat smaller, but still substantial. The pattern is similar for workers in Eldoret.

There is evidence in Kenya that real wages have been rising over the 1990s, despite modest growth rates and the apparent lack of productivity gains (Bigsten and Durevall, 2001). The coefficient on the time dummy, shown in column 3, suggests that real wages in the manufacturing sector increased by about nine percent between 2000 and 2003. This increase, which corresponds to an annual growth rate in real earnings of about three per cent, is significant at the five per cent level. We should interpret this result with caution, however, as we know from previous research that firm level variables, which are not included in the specifications shown in Table 8, tend to have quite a lot of explanatory power in earnings regressions. If this is so and these firm-level characteristics have changed over time, then we would expect the coefficient on the time dummy to change once we estimate the extended model. In particular, it is possible that the positive time effect is an artifact of sampling differences across the two surveys. We return to this issue in the next section. Finally we report in column 3 the outcome of pooling test. The null hypothesis is that the coefficients on the human capital variables, gender and the location dummies are constant across the two time periods. The result shows that we can comfortably accept the hypothesis that the data from the two time periods pool.

3.2 *Firm-Level Variables*

Numerous previous studies, both on developed and developing countries, have documented significant firm-level variables in earnings regressions. In this section we focus on sector, firm size and firm age. If the assumption that the labor market is competitive and that the vector *h*

[9] Calculation: exp(-0.579)-1=-0.44.

contains all variables measuring productive skills is true, none of the firm-level variables should be significant in earnings regressions. In this scenario human capital is all that matters for earnings. There are many reasons why this may be an incorrect assumption, e.g. imperfections in the labor market (e.g. in the form of unionization leading to rent-sharing; see Blanchflower, Oswald and Sanfey, 1999), problems with respect to labor management (Fafchamps and Söderbom, 2004) or simply that the relevant vector of productive skills is only partially observed. In the latter case firm-level variables may be correlated with some of the unobserved skills, in which case they may turn out to be significant in the earnings regression. Oi and Idson (1999) argue that this is the main reason for earnings differentials across firms of differing size.

Table 9 shows results, where columns 1 and 2 refer to 2003 and 2000, respectively, and column 3 shows a pooled specification. Compared to the results in Table 8, the coefficients on the human capital variables change very little. The education coefficient is still relatively high and significant at the one per cent level. There is quadratic age-earnings profile, while the tenure effect is very close to zero and wholly insignificant. The male coefficients positive but insignificant, and the location differentials are similar to what we obtained in the previous sub-section.

Now consider the firm-level variables. As discussed in Chapter 2 the classification of sectors was less aggregated in the survey fielded in 2003 than that in 2000, and so for the most recent wave we can distinguish between more sub-sectors. We use food and bakery as the omitted (benchmark) sector. Table 9 shows large and significant differences in earnings across sectors. In the 2003 sample earnings are highest in the chemical sector and lowest in the textiles sector. Conditional on human capital and the other explanatory variables in the model, earnings are on average about 39 per cent higher in the chemical sector than in the food sector, and 81 per cent higher than in the textiles sector.[10] This result that workers in the textile sector receive lower

[10] Calculations: exp(0.327)-1=0.39; exp(0.327-(-0.265)) – 1 = 0.81.

wages than employees in other sub-sector is also obtained for the 2000 sample (chemical firms were not included in the 2000 survey).

The coefficient on firm size, interpretable as an elasticity, is positive and highly significant in all models shown in Table 9. The result for 2003 implies that as firm size increases by one per cent earnings rise by about 0.1 per cent, on average. Given the large variation in firm size within the sample, this implies that relatively large earnings differentials can be attributed to size differences. For instance, the wage of a worker in a firm with 200 employees is about 30 per cent higher, on average, than that of worker employed by a firm with 10 employees, conditional on all other explanatory variables in the model.[11] It is possible that this partly reflects differences in unobserved skills. However, Söderbom, Teal and Wambugu (2002) use panel data on employees in Ghana and Kenya and find significant size effects on earnings even after controlling for unobserved time invariant worker effects. This suggests that not all of the size effect can be attributed to unobserved skills.

A recent literature has focused on the role of firm age in determining earnings. Troske (1999) uses U.S. data and finds that after controlling for observed worker and plant characteristics, plant age is not significantly correlated with wages. Similarly, Brown and Medoff (2003) examine the employer age-wage effect in much detail and find that observable worker characteristics fully explain the higher wages observed in older firms. We obtain a similar result for Kenya: the effect of firm age is very small and not significantly different from zero.

Finally, we see that as a result of including the firm-level variables the coefficient on the time dummy becomes totally insignificant, column 3. The point estimate is actually negative but the size of the coefficient is very small, corresponding to a fall in real earnings by less than one per cent per year. Mechanically, the main reason for the fall in the time coefficient is the inclusion of firm size in the model. The average firm size in the 2003 survey is somewhat larger than that of 2000, which is why when we exclude size from the model (Table 8) we get a positive

[11] Calculation: exp(0.091*ln(200))/exp(0.091*ln(10))-1 = 0.31.

time coefficient (as size is positively associated with earnings). Whether the average size of firms in the population has increased between 2000 and 2003 is in fact unclear (the survey data do not provide information about this). If, as seems likely, the average size of firms in the population has not increased, then we would conclude that earnings, conditional on the other explanatory variables in the model, have remained approximately constant over the period considered.

4. Conclusions

This paper has documented key trends in productivity, capital intensity, firm growth, exports and earnings in Kenyan manufacturing over 1999-2002. Significant productivity differences exist across sectors, the most productive sectors being chemical and food while the least productive ones are leather, wood and textiles. There are, however, some signs that the textiles sector has recovered somewhat relative to the food sector over the period considered. There are significant productivity advantages to being located in Nairobi, possibly due to external factors such as relatively good infrastructure.

There is some evidence that the manufacturing sector has recovered somewhat since the end of the 1990s, indicated by a modest rise in average productivity over 1999-2002. However, investment remains low: less than 30 per cent of the firms report investment rates higher than 5 per cent. Similarly, in terms of employment, the data indicate a modest rate of downsizing.

In line with most other studies we find a strong size effect on the decision to export, supporting the notion that firms face significant fixed costs to entering the exports market. Thus, if firms could grow – which as we have seen the currently do not – exports would too. Further, we find that general experience gained in the domestic market increases the likelihood that firms enter the regional exports market, but does not affect the likelihood that firms export outside Africa. Thus, for Kenyan firms to be able to break into the international export market, they may have to adopt a different business strategy from that used in the domestic market. Policy measures designed to support firms in such a process can reasonably be assumed to have a positive effect on international exports. As part of a policy package designed to increase international manufacturing exports from Kenya it would be important to take a closer look at Mombasa, where firms are much less export oriented than in Nairobi. Why Mombasa has yet to take advantage of its coastal location in this context, and what can be done about it, would be important to establish.

On the positive side, there is a positive and significant time trend for international exports: a firm with the "average" characteristics was seven percentage points more likely to export internationally in 2003 than a firm with the same characteristics in 2000. This is an encouraging result, suggesting that firms are responding to policy measures designed to spur exports (e.g. AGOA). Further probing of the data suggests that a large part of this increase is played by more firms in the textiles and garments sector becoming export oriented during the period.

As shown in Section 3, there have been no significant change in real earnings over the period studied. This stands in contrast to the 1990s when real wages rose despite poor economic performance, resulting in deteriorating competitiveness due to rising labor costs. If the trends over the last few years of rising exports and productivity (the latter not by much though) and slow changing labor costs are not reversed over the next few years, Kenyan manufacturing is in a position to move in the right direction. However, for manufacturing to play a significant role in reducing poverty in Kenya over the next few decades, a high rate of progress is required. If the positive signs discussed above merely reflect a recovery process following upon a few atypically bad years at the end of the 1990s, then the outlook does not look encouraging in this context. But if what we have seen in the last few years is the beginning of something new – and the strongest indicator that this may be so is arguably the increase in international exports – then there are reasons to be cautiously optimistic.

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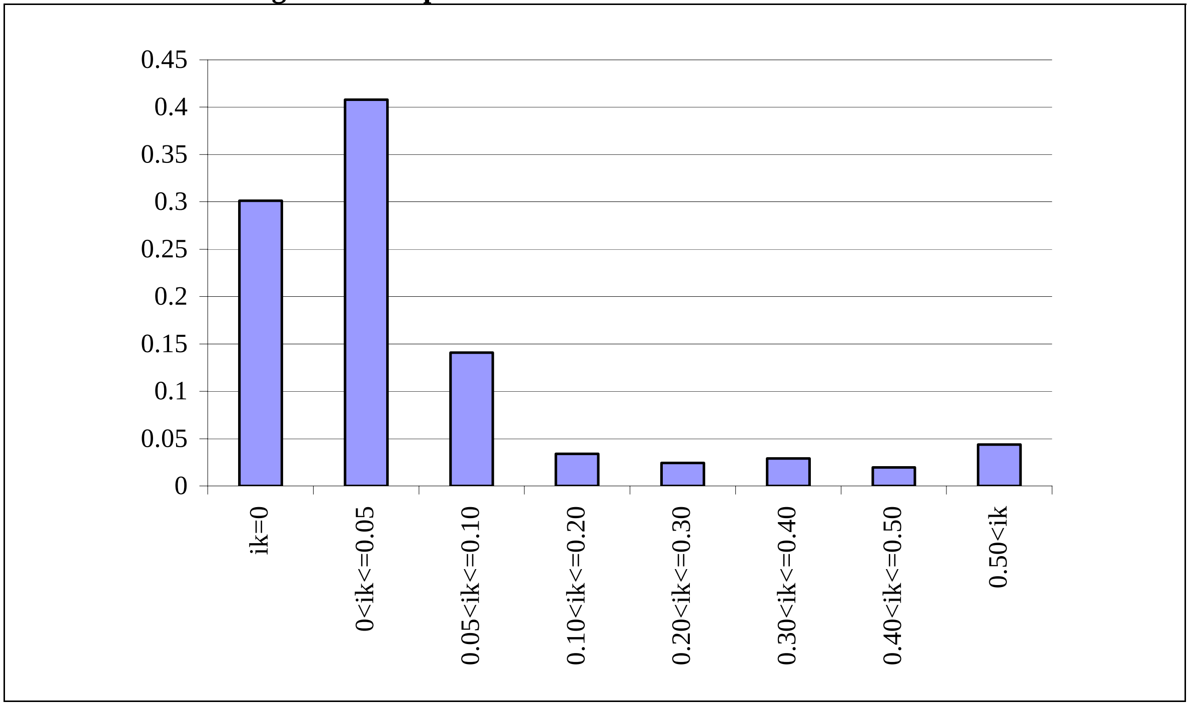
Figure 1: Sample Distribution of Investment Rates 2002



Note: The figure shows the frequency distribution of investment rates, denoted *ik* and defined as gross investment in plant and equipment divided by the replacement value of plant and equipment.

Table 1: Average Labor Productivity and Capital Intensity 2002 & 1999

	log Value-Added per Employee		log Physical Capital per Employee	
	2002	1999	2002	1999
Small - 10-49 Emp.	8.13 [49]	8.12 [56]	8.94 [49]	8.97 [56]
Medium - 50-99 Emp.	8.58 [27]	8.62 [22]	9.20 [27]	9.58 [22]
Large 100+ Emp.	8.90 [60]	8.79 [53]	9.54 [60]	9.90 [53]
All Categories	8.56 [136]	8.47 [131]	9.26 [136]	9.45 [131]

Note: The table reports sample means of log value-added per employee and log physical capital per employee. The figures in [ ] show the numbers of observations.

Table 2: Value-Added Production Functions for 2002 & 1999

	2002		1999	
	Coefficient	Abs. t-value	Coefficient	Abs. t-value
Factor Inputs				
log Physical Capital	0.415	6.97**	0.336	6.11**
log Employment	0.692	7.82**	0.687	6.69**
Firm Age	-0.003	0.73	-0.002	0.38
Location				
Mombasa	-0.502	1.96+	-0.043	0.27
Nakuru	-0.220	0.76	-0.377	1.18
Eldoret	-1.379	8.18**	-0.697	2.52*
Kisumu	-1.244	3.20**		
Industry (2003 classification)				
Chemical	0.431	1.23		
Construction	-0.108	0.20		
Furniture	-0.382	0.78		
Metal & Machinery	-0.130	0.60		
Paper	0.000	0.00		
Plastic	-0.308	1.17		
Textiles	-0.617	2.77**		
Garments	-0.148	0.39		
Leather	-0.932	2.95**		
Wood	-0.754	1.66		
Industry (2000 classification)				
Wood			-0.424	1.96+
Textiles & Garments			-0.803	4.31**
Metal, Machinery and Furniture			-0.661	3.22**
Specification Tests (*p*-values)				
Constant Returns to Scale	0.10		0.72	
Towns	0.00		0.07	
Sectors	0.03		0.00	
R-squared	0.79		0.81	
Observations	136		131	

Regressions include an intercept. Omitted category: Nairobi, Food & Bakery. Robust standard errors. Significance at the 1,5 and 10 per cent level is indicated by **,* and +, respectively.

Table 3: Pooled Value-Added Production Functions

	(1) Full Sample		(2) Sub-sample	
	Coefficient	Abs. t-value	Coefficient	Abs. t-value
Factor Inputs				
log Physical Capital	0.359**	8.89	0.361	8.24**
log Employment	0.696**	10.13	0.685	8.86**
Firm Age				
Firm Age (years)	-0.003	0.87	-0.005	1.57
Time				
Year Dummy 2002	0.067	0.52	0.099	0.77
Location				
Mombasa	-0.233	1.53	-0.213	1.31
Nakuru	-0.378^{+}	1.81	-0.328	1.60
Eldoret	-1.056**	5.97	-1.052	5.36**
Kisumu	-1.184**	3.09		
Industry				
Chemical	0.378	1.18		
Construction	-0.184	0.36		
Paper	-0.110	0.43		
Plastic	-0.469*	2.18		
Metal, Machinery and Furniture	-0.448**	2.93	-0.473	3.08**
Textiles & Garments	-0.663**	4.28	-0.692	4.51**
Wood	-0.368^{+}	1.82	-0.393	1.95^{+}
Specification Tests (*p*-values)				
Pooling over time	0.16		0.14	
Constant Returns to Scale	0.23		0.37	
Towns	0.00		0.00	
Sectors	0.00		0.00	
R-squared	0.79		0.81	
Observations	267		219	

Regressions include an intercept. Omitted category: Nairobi, Food & Bakery. Robust standard errors. Significance at the 1,5 and 10 per cent level is indicated by **,* and $^{+}$, respectively.

Table 4: Employment Growth 1999-2002

	Δ log Permanent Employment[1]	Δ log Total Employment[2]
Mean	-0.03	-0.03
Median	-0.004	0.03
Observations	202	39

[1] Based on recall data provided by the firms in the 2003 survey.
[2] Based on a sub-sample of firms for which panel data are available.

Table 5: Probit Models of Exports to Any Destination

	2003		2000	
	Coefficient	Abs. t-value	Coefficient	Abs. t-value
Firm Characteristics				
log Employment	0.168	4.94**	0.174	3.94**
Firm Age	0.014	2.78**	0.009	0.93
Firm Age Squared / 100	-0.045	2.87**	0.000	1.53
Any Foreign Ownership	0.336	4.52**	0.172	1.73^{+}
Location				
Mombasa	-0.260	2.46*	-0.019	0.18
Nakuru	-0.219	1.74^{+}	-0.025	0.14
Eldoret	-0.337	2.37*	-0.112	0.69
Kisumu	-0.574	7.19**		
Industry (2003 classification)				
Chemical	0.206	1.73^{+}		
Construction	0.245	2.45*		
Furniture	0.315	4.03**		
Metal & Machinery	0.046	0.44		
Paper	0.303	3.85**		
Plastic	0.190	1.53		
Textiles & Leather	0.337	4.77**		
Garments	0.108	0.85		
Wood	-0.048	0.28		
Industry (2000 classification)				
Wood			-0.028	0.19
Textiles & Garments			0.099	0.83
Metal, Machinery and Furniture			0.303	2.99**
Specification Tests (*p*-values)				
Towns (joint significance)	0.00		0.92	
Sectors (joint significance)	0.00		0.02	
Log Likelihood	-114.8		-78.8	
Pseudo R-squared	0.30		0.19	
Observations	244		141	

Note: For continuous variables (size and age) marginal effects are reported; for dummy variable we report the discrete change in the estimated probability of exports as the dummy variable changes from 0 to 1. Regressions include an intercept. Omitted category: Nairobi, Food & Bakery. Robust standard errors. Significance at the 1,5 and 10 per cent level is indicated by **,* and $^{+}$, respectively.

Table 6: Probit Models of Exports to Non-African Countries

	2003		2000	
	Coefficient	Abs. t-value	Coefficient	Abs. t-value
Firm Characteristics				
log Employment	0.087	4.26**	0.065	2.84**
Firm Age	0.004	1.14	-0.003	0.51
Firm Age Squared / 100	-0.005	1.18	0.006	0.69
Any Foreign Ownership	0.094	1.18	0.053	0.82
Location				
Mombasa	-0.032	0.5	-0.086	2.06*
Nakuru	-0.025	0.36	0.039	0.47
Eldoret	0.009	0.09		
Kisumu	-0.120	1.94+		
Industry (2003 classification)				
Chemical	-0.009	0.1		
Construction	-0.108	1.57		
Furniture	0.009	0.06		
Metal & Machinery	-0.057	0.84		
Paper	-0.054	0.66		
Plastic	-0.035	0.4		
Textiles & Leather	0.325	2.44*		
Garments	0.147	1.13		
Wood	-0.088	1.24		
Industry (2000 classification)				
Wood			-0.086	1.79+
Textiles & Garments			0.006	0.1
Metal, Machinery and Furniture			-0.136	2.98**
Specification Tests (*p*-values)				
Towns (joint significance)	0.81		0.21	
Sectors (joint significance)	0.04		0.01	
Log Likelihood	-94.2		-42.2	
Pseudo R-squared	0.20		0.21	
Observations	234		126	

Note: For continuous variables (size and age) marginal effects are reported; for dummy variable we report the discrete change in the estimated probability of exports as the dummy variable changes from 0 to 1. Regressions include an intercept. Omitted category: Nairobi, Food & Bakery. Robust standard errors. Significance at the 1,5 and 10 per cent level is indicated by **,* and $^{+}$, respectively.

Table 7: Pooled Probit Models: 2000-2003

	Any Exports		Exports to Non-African Countries	
	Coefficient	Abs. t-value	Coefficient	Abs. t-value
Firm Characteristics				
log Employment	0.169	6.16**	0.075	4.9**
Firm Age	0.011	2.5*	0.003	1.03
Firm Age Squared / 100	-0.038	2.71**	-0.016	1.01
Any Foreign Ownership	0.235	3.69**	0.069	1.3
Location				
Mombasa	-0.128	1.64	-0.063	1.63
Nakuru	-0.113	1.05	-0.009	0.17
Eldoret	-0.213	1.92^{+}	-0.049	0.89
Kisumu	-0.519	6.7**	-0.108	2.7
Industry				
Wood	-0.049	0.44	-0.087	1.83^{+}
Textiles, Garments & Leather	0.165	2.05*	0.121	1.8^{+}
Metal, Furniture & Machinery	0.187	2.55*	-0.091	2.16*
Chemical	0.219	2.0*	-0.041	0.69
Plastic	0.192	1.64	-0.053	0.83
Construction	0.257	2.7**	-0.105	2.35*
Paper	0.302	3.83**	-0.068	1.2
Time				
Year Dummy 2003	0.007	0.13	0.070	2.1*
Specification Tests (*p*-values)				
Towns (joint significance)	0.00		0.44	
Sectors (joint significance)	0.03		0.00	
Pooling over time	0.04		0.25	
Log Likelihood	-204.7		-141.1	
Pseudo R-squared	0.22		0.19	
Observations	385		376	

Note: For continuous variables (size and age) marginal effects are reported; for dummy variable we report the discrete change in the estimated probability of exports as the dummy variable changes from 0 to 1. Regressions include an intercept. Omitted category: Nairobi, Food & Bakery. Robust standard errors. Significance at the 1,5 and 10 per cent level is indicated by **,* and $^{+}$, respectively.

Table 8: Baseline Earnings Regressions

	2003		2000		2003 & 2000 Pooled	
	Coef.	t-val.	Coef.	t-val.	Coef.	t-val.
Human Capital	0.157	15.82**	0.129	11.61**	0.149	19.13**
Education	0.062	4.82**	0.046	2.37*	0.056	5.39**
Age (years)	-0.038	2.40*	-0.024	0.99	-0.032	2.51*
Age squared / 100	0.003	0.85	0.000	0.00	0.002	0.81
Tenure (years)						
Gender	0.059	1.47	0.038	0.61	0.056	1.52
Male worker						
Location	0.013	0.12	0.004	0.06	0.006	0.08
Mombasa	-0.441	4.94**	-0.579	4.62**	-0.471	5.89**
Nakuru	-0.418	6.61**	-0.507	5.15**	-0.453	7.59**
Eldoret	-0.004	0.04			-0.007	0.06
Kisumu						
Time						
Year Dummy 2003					0.086	2.02*
Specification Tests (*p*-values)						
Towns (joint significance)	0.00		0.00		0.00	
Pooling over time					0.52	
R-squared	0.37		0.35		0.36	
Observations	1706		848		2554	

Note: The dependent variable is the natural logarithm of monthly earnings, expressed in constant 2002 USD. Reported t-values are robust to heteroscedasticity and intra-firm correlation of the residuals. Regressions include an intercept. Omitted category: Nairobi, Food & Bakery. * significant at 5% level; ** significant at 1% level; $^{+}$ significant at the 10% level.

Table 9: Earnings Regressions with Controls for Firm-Level Variables

	2003		2000		2003 & 2000 Pooled	
	Coef.	t-val.	Coef.	t-val.	Coef.	t-val.
Human Capital						
Education	0.142	14.15**	0.119	10.08**	0.135	16.95**
Age (years)	0.055	4.37**	0.045	2.35*	0.051	4.90**
Age squared / 100	-0.029	1.91+	-0.022	0.96	-0.026	2.04*
Tenure (years)	0.001	0.15	-0.001	0.10	0.001	0.20
Gender						
Male worker	0.058	1.47	0.010	0.17	0.043	1.22
Location						
Mombasa	0.017	0.17	-0.034	0.44	-0.006	0.09
Nakuru	-0.394	4.40**	-0.608	4.32**	-0.449	5.49**
Eldoret	-0.371	4.80**	-0.543	5.59**	-0.432	6.35**
Kisumu	-0.085	0.84			-0.089	0.86
Industry (2003 classification)						
Chemical	0.326	2.55*			0.332	2.61*
Construction	0.116	0.80			0.113	0.79
Furniture	0.030	0.20				
Metal & Machinery	0.049	0.61				
Paper	0.188	2.14*			0.194	2.41*
Plastic	0.109	1.08			0.103	1.06
Textiles & Leather	-0.266	2.73**				
Garments	-0.177	2.13*				
Wood	0.045	0.42				
Industry (2000 classification)						
Wood			0.026	0.22	0.020	0.24
Textiles & Garments			-0.219	2.49*	-0.225	3.45**
Metal, Machinery and Furniture			0.108	1.15	0.055	0.84
Firm Characteristics						
log Employment	0.090	4.05**	0.067	2.42*	0.083	4.49**
Firm Age	0.002	1.49	0.000	0.00	0.002	1.28
Time						
Year Dummy 2003					-0.025	0.60
Specification Tests (*p*-values)						
Towns (joint significance)	0.00		0.00		0.00	
Sectors (joint significance)	0.00		0.00		0.00	
Pooling over time					0.72	
R-squared	0.41		0.39		0.41	
Observations	1706		823		2529	

Note: The dependent variable is the natural logarithm of monthly earnings, expressed in constant 2002 USD. Reported t-values are robust to heteroscedasticity and intra-firm correlation of the residuals. Regressions include an intercept. Omitted category: Nairobi, Food & Bakery. * significant at 5% level; ** significant at 1% level; + significant at the 10% level.