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Learning by Exporting or Self Selection? Which Way for the Kenyan Manufacturing Firms? *(Pp. 25-43)*

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Abstract
In this paper, firm level panel data for Kenyan manufacturing sector is used to investigate whether exporters are different from non exporters and the causal relationship between exporting and productivity. The paper uses a production function which is complemented by firm level characteristics and business environment factors. The Generalized Least Squares (GLS) regression is used to estimate whether exporters are different from non-exporters while the causal relationship between exporting and productivity is determined using the concept of Granger causality test. The results obtained show some significant differences between exporters and non exporters. The results also show some evidence for learning-by-doing hypothesis and evidence for self-selection of more efficient firms into exporting. On the policy front the paper calls for more focus on improving exports in order for Kenya to industrialize

Introduction

It is known from economic development of newly industrialized countries (NIC) in East Asia that until a certain stage of maturity is reached, growth is driven largely by industrialization. In most other countries as well, the need for a buoyant manufacturing sector is acknowledged to be an important means to increase overall welfare (Isaksson, 2002). Manufacturing is considered instrumental for economic growth and development. The special interest in manufacturing stems from the fact that this sector is among other

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things, a dynamic engine of modernization and accelerated growth, a creator of jobs and a generator of several positive spillover-effects (Tybout, 2000).

In spite of its importance, the development of manufacturing sector in sub-Saharan Africa (SSA) has seriously stagnated except in several countries in recent times. The share of manufacturing in value added in Gross Domestic Product (GDP) in SSA is 13 percent which is the lowest share in the world paralleling South Asia (Fukunishi, 2004). Like many other countries in the sub-Saharan Africa (SSA), the Kenyan economy remains predominantly agricultural. Industrialization, however, has been an integral part of the country's development strategies both in the colonial and post-colonial period.

The productivity of the Kenyan manufacturing sector has not only been low but also stagnant since independence. Average productivity growth from 1964-1994 was -0.12 percent per annum (Gerdin, 1997). The total factor productivity (TFP) grew by 2.5 percent a year during 1981-90 and -0.5 percent in 1991-1998. During the 1999-2003, only a slight improvement in productivity that took place on average firm (Soderbom, 2004).

The relationship between productivity and exporting at the firm level can be explained by two broad strands, each of which emphasizes one of the causal relationships. The first strand stresses the self-selection of more productive firms into export market. Robert and Tybou., (1997), Bernard and Jensen, (1999) and Bernard and Wagner, (2001) have found evidence for the existence of sunk costs in exporting. According to this approach, above-average performers are likely to be the ones that are able to cope with sunk costs associated with the entry into a distant market, and make positive net profits abroad. That is firms must first be productive before moving into export market.

The second strand, on the other hand, points to the role of learning-by-exporting. Economists have recognized that learning-by-doing is a significant factor in industrial revolution and an important source of economic growth (see Grossman et al. 1991, Lucas 1993, Spence 1981, Jermin 1994, Arrow 1962, Krugman 1979 and Jovanovic and Lach, 1991). That is firms learn through exporting in order to become more productive.

Manufacturing for exports has become a major element in strategies for expanding industrial production and for overall growth in developing world. Likewise, the productivity of manufacturing firms is important in

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establishing competitive strength in the world market. It is within this context that this paper seeks to establish, first, the extent and the cause of productivity differentials between exporters and non exporters and secondly, whether there exists any causal relationship between exporting and productivity in the Kenyan manufacturing sector.

Methodology

Measurement of Productivity

There exist two approaches in measuring of total factor productivity:

1. the explicit use of an aggregate production function for econometric estimation, and;
2. the national income or growth accounting approach which uses discrete data and assumes an aggregate production function implicitly.

The stand point of econometric approach to productivity measurement is the estimation of explicit production function with a view to establishing the direct linkage of productivity growth to key characteristics or parameters of either of the function. The approach begins with the specification of a production function, say of Cobb-Douglas constant returns to scale type

$$Y_t = A_t K_t^{\beta} L_t^{1-\beta}, \qquad (1)$$

where: Y_t, K_t and L_t are output, capital input and labor input at time t respectively. A_t is the technology parameter governing the shift of the production function. β is the output elasticity of capital and $(1-\beta)$ that of labor.

A simple starting point is to define A_t as

$$A_t = A_o e^{\lambda t}, \qquad (2)$$

which means that technology grows at a constant exponential rate of λ. Then

$$Y_t = A_o e^{\lambda t} K_t^{\beta} L_t^{1-\beta} \qquad (3).$$

Taking the logarithm on both sides of (3), the following estimation equation is obtained

$$\ln Y_t = \ln A_o + \lambda_t + \beta \ln K_t + (1-\beta) \ln L_t, \qquad (4)$$

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λ and output elasticities can be estimated if time series data for *Y, K* and *L* are given.

Knowing λ, the contribution of technological change to the growth of output can be ascertained. λ is disembodied, exogenous and Hicks neutral. Disembodied technological change means that it takes place like manna from heaven in the form of better methods and organization that improve the efficiency of both new and old factor inputs. Time is the only factor in this case. On the other hand, endogenous models specify that technological change is related to research and development (R&D) expenditure, learning by doing (experience), education, investment activities etc. Hicks-neutral technological change has the effect of increasing the efficiency of both capital and labor to the same extent i.e., λ, which is a narrow concept of technological change.

The growth accounting approach of measuring TFP was first undertaken by Stigler (1947), Abramovitz (1956) and Kendrick (1956). With the aid of marginal productivity theory, growth accounting decomposes the growth of output into growth of labor, land, capital, education, technical knowledge and any other source. Growth accounting represents a technique for estimating the contribution of different factors of economic growth.

A general neo-classical production function is assumed.

$$Y = F(K, L, t)\,. \tag{5}$$

Differentiating (5) with respect to time and rearranging yields

$$\frac{dY/dt}{Y} = \frac{(\delta F/\delta K)K}{Y}.\frac{(dK/dt)}{K} + \frac{(\delta F/\delta L)L}{Y}.\frac{(dL/dt)}{L} + \frac{(\delta F/\delta t)}{Y} \tag{6}$$

$(\delta F/\delta t)/Y$ is the proportional rate of shift of the production function. It is therefore technological change (disembodied, exogenous and Hicks neutral) or TFP. Under neo-classical assumption $(\delta F/\delta K)K/Y$ and $(\delta F/\delta L)L/Y$ are factor share of capital and labor respectively. Denoting the growth rates of Y, K and L respectively by y, *k* and *l,* equation (6) becomes

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$$y = S_K k + S_L l + TFP\,, \qquad (7)$$

where, S_K and S_L are capital and labor shares in income respectively.

$$TFP = y - S_K k - S_L l \qquad (8)$$

Equation (8) can therefore be used to calculate the source of growth by capital, labor and *TFP*. It is important to note that the *TFP* as calculated from (8) is a "residual", a catch up sum indicating that part of the output growth that cannot be explained by increases in factor inputs.

Denoting *TFP* by A, then equation (8) is the same as the Solow index;

$$\frac{\delta A_t}{A_t} = \frac{\delta Y_t}{Y_t} - (\beta_l \frac{\delta L_t}{L_t} + \beta_k \frac{\delta K_t}{K_t})\,, \qquad (9)$$

where, $\frac{\delta Y_t}{Y_t}$ is the rate of change of real value added,

$\frac{\delta L_t}{L_t}$ is the rate of change of labor,

$\frac{\delta K_t}{K_t}$ is the rate of change of real gross fixed capital,

β_k is the share of capital in value added in year t and β_l is the share of labor in value added in year t.

The Determinants of Productivity for Exporting and Non-exporting Firms

To establish the determinants of productivity, the production function which is complemented by firm level characteristics and business environment factors is used. The production function is assumed to exhibit constant returns to scale (CRS). The use of production function is justified by its flexibility and transparency: A simple production function may easily be complemented with explanatory variables to explore the determinants of productivity and it also provides parameter coefficients which are directly

interpretable and usually accommodates statistical noise (Lundvall et al., 1999).

The analysis is conducted using Generalized Least Squares (GLS) regression with total factor productivity as the dependent variable and inputs and determinants as explanatory variables. The models estimated in this study is specified as,

$$TFP_{EXPit} = \alpha_0 + \alpha_1 PF_{it} + \alpha_2 FC_{it} + \alpha_3 BI_{it} + \varepsilon_t , \qquad (10a)$$

$$TFP_{NEXPit} = \alpha_0 + \alpha_1 PF_{it} + \alpha_2 FC_{it} + \alpha_3 BI_{it} + \varepsilon_t , \qquad (10b)$$

where,

EXP and NEXP stands for exporting and non exporting firms respectively.

TFP = productivity measured as value added i.e. total output minus value of inputs excluding capital and labor. The inputs considered here are the value of raw materials plus intermediate inputs and energy.

PF = a vector of production function variables. This includes capital and labor.

FC = a set of firm level characteristics. Variables considered here include age, foreign ownership, capacity, skill, geographical location, sector and exporting.

BI = a vector of infrastructure and business environment factors in terms of perception. Factors considered here include government efficiency, infrastructure, access to credit etc. ε is the error term and the coefficients $\alpha_0, \alpha_1, \alpha_2, \alpha_3$ represent the parameters to be estimated. *t* is the time variable.

Equation (10) is used to determine the factors affecting productivity by manufacturing firms in Kenya. The direction of causality of these determinants is not always obvious. For some it may go either way. For example, are firms more productive because they export, have access to credit, and are foreign owned or it is the other way around, so that they possess all these characteristics because they are productive? Or can both statements be true? Because of this the estimated relationships are regarded as associations rather than causal link. (see Lundvall et al., 1999 and Soderbom, 2004).

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The Causal Relationship between Exporting and Productivity

In order to examine the causal link between productivity and exporting, the Granger causality test is used.

Variable *X* is said to granger-cause variable *Y*, if the lagged values of *X* can help to predict current values of *Y* significantly better than own lagged values of *Y* (see Arnold and Hussinger, 2005). For this reason two separate equations of exporting and productivity are estimated,

$$TFP_{it} = \gamma^1 TFP_{it-1} + \psi^1 EXP_{it-1} + \varepsilon_{it}^1 \qquad (11)$$

$$EXP_{it} = \gamma^2 TFP_{it-1} + \psi^2 EXP_{it-1} + \varepsilon_{it}^2 \qquad (12)$$

In other words, a linear model of the influence of lagged values of productivity and export status on current firm productivity and a linear model of the export status on its lagged values and those of productivity is estimated.

In this case two continuous variables (export intensity and productivity) with two binary variables (above average productivity and export status) are used. For productivity, firms having below average productivity are represented by zero while those with above average are represented by one. Because of the binary nature of the dependent variable, probit model is used. For exporting, the dependent variable ranges between zero and one and so the tobit model is used.

Empirical Results

Descriptive Statistics

In this section, labor productivity, capital intensity, capital productivity and total factor productivity are considered. The total factor productivity is constructed from the residual of each observation after estimating a two factor logarithmic Cobb-Douglas production function containing labor and capital as production factors. This is expressed as:

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

where *V, L, A, K* denote value added, labor, *TFP*, and capital respectively and β is the capital elasticity. The change in *TFP* can therefore be expressed as:

$\Delta lnA = \Delta ln\,(V/L) - \Delta\, \beta ln\,(K/L)$.

In this case, assume $\beta = 0.3$ (see Soderbom, 2004). The results obtained according to the size of the firm for the years 2000 and 2003 are given in Table 1. The table reports the sample means of log value added per employee, log physical capital per employee, log value added per unit of capital and log total factor productivity.

One key observation made from these descriptive statistics is that size does matter when considering productivity for manufacturing firms. For the two samples, 2000 and 2003, large firms are found to have the highest average labor productivity, capital productivity, capital intensity and TFP. This is in line with other studies, (see Lundvall et al., 1999, and Soderbom and Teal. 2000). One of the reason given here 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 (Greenaway et al., 2004).

Overall, the statistics show that the average labor productivity has increased since 2000 by 12.3 percent while the average capital intensity has increased by a lower percentage of 8.2 over the same period. As a result of these two effects, the overall average *TFP* growth rate during the period 2000 to 2003 was 14 percent which translates to about 5 percent per year.

A comparison of the labor productivity, capital intensity, capital productivity, size and growth estimates of *TFP* between exporters and non- exporters for the period 2000 and 2003 is given in Table 2. For the two years, labor productivity is higher for exporting firms than non exporting firms. During this period, the average labor productivity for the exporting firms increased by 13 percent, compared to 12 percent for the non exporting firms. For the average capital intensity, it is higher for the exporting firms over the period; however the growth rate for the non exporting firms seems to be higher at 14 percent compared to 7 percent for the exporting firms. Capital productivity is also higher for the non exporting firms.

Overall, the average change in *TFP* is highest among the exporting firms at 17 percent compared to 10 percent for the non exporting firms. This result supports the argument that exporting firms are more productive than the non-exporting firms.

On size, the exporting firms are larger than the non-exporting firms. On average, they have almost four times as many employees for 2000 sample and two times for the 2003 sample. This seems to support the argument that

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size does matter for the decision to export and may be associated with lower average or marginal costs and hence a likelihood of being more productive.

Regression Results

Determinants of Productivity-Exporters and Non-exporters

This section reports the regression results on the determinants of productivity after running equation (10) using Generalized Least Squares (GLS) technique. The use of GLS here is justified in that the usual standard errors of OLS estimators are incorrect and likely to give inefficient estimators. The GLS is used to correct heteroskedasticity and autocorrelation in the case of random effect (see Hausman, 1978). The Hausman specification test is used in order to decide whether to use FEM or REM. The results show that REM provides better specification of the model relative to FEM. The regression results for 2000 sample for exporting and non-exporting firms are summarized in Table 3.

A productivity differences across sectors is considered with food sector being the bench mark. For the two cases, food sector is the most productive followed by metal, textile and garments and lastly, wood and furniture. All sectors considered are highly statistically significant at 1 percent level. On geographical productivity differences, Nairobi is used as a reference point (omitted category). The only statistically significant difference is between Nairobi and Eldoret for the exporting firms at 5 percent significant level. For the two samples, firms located in Nairobi are the most productive followed by those in Mombasa, Nakuru and Eldoret.

Age and age squared are found to be statistically significant for the two samples and have the expected signs. This gives support for the Robert et al., argument that productivity increases with age until certain threshold, after which it starts decreasing. For labor, it is highly statistically significant for the two samples where a one percentage increase in labor yields an increase in value added by 30 and 25 percent on average. Sunk cost is highly significant for the exporting firms and this supports the theory that for a firm to enter into the export market it must first meet the sunk cost. (Bernard et al, 1999). Infrastructure and business environmental factors considered include access to credit, electricity and water. Of all these only access to credit is found to be statistically significant.

For the 2003 sample, the results are summarized in Table 4.

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Capital stock is highly significant for the two samples. The coefficients are large and positively related to productivity. A one percent increases in capital stock yields an increase in value added by 28 percent and 36 percent for exporting and non exporting firms respectively. This underscores the importance of capital in productivity. On the productivity differences across sectors, food is used as a reference point. Food sector is the most productive followed by textile and garments, metal, chemical and paints. On geographical productivity differences, the results are the same as the one for 2000 sample.

In summary, it can be observed that several variables are statistically significant for both exporting and non-exporting firms. These include capital, age, Nakuru, Eldoret and skill. Metal, chemical and paints, paper, printing and publishing sectors are statistically significant at 1 percent level for non-exporting firms. This is not the case with exporting firms. This is because most products from these sectors are consumed in the domestic market.

Likewise, access to credit and business environment factors are statistically significant for non-exporting firms and not for exporting firms. Business environment factors are more important for non-exporting firms than for exporting firms. The reason is that most exporting firms are located in EPZ where they enjoy good infrastructural facilities and other benefits.

The general conclusion reached from the 2003 and 2000 samples is that factors determining productivity for exporters and non-exporters are different from one sample to the other. The only variable which is common for all samples is skill implying that whether exporting or not, qualified personnel are important for increased productivity. Age is equally important for the firm to establish itself in the domestic or foreign market.

From the above results, it is difficult to make a clear distinction between factors that determine productivity for exporting and non-exporting firms with certainty. To make a clear distinction on the determinants of productivity for exporting and non-exporting firms for the period 1998-2003, the data for the two samples is pooled together and a production function with a common slope is estimated. Pooling the data for the whole period also makes it easier to determine whether productivity growth was different for exporters and non-exporters over the period. The results are summarized in Table 5.

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For exporters and non-exporters, capital, employees, skill, and age are statistically significant. In terms of location, Nakuru and Eldoret are found to be statistically significant, while for the sector, only textile and garments is statistically significant for the exporting firms. Sunk cost is not statistically significant for non exporting firms. Business environment and infrastructure are found to be insignificant in both cases apart from access to credit which is significant at 5 percent level for non-exporting firms. On productivity growth, time dummy is considered. For exporting and non-exporting firms, productivity is shown to have increased by 17 percent and 9 percent respectively. These results support the earlier prediction that exporting firms are more productive than non-exporting firms.

In conclusion, it can be said that factors affecting productivity for exporters and non-exporters are different over this period. This is because the two types of firms focus on different markets.

The Causal Relationship between Exporting and Productivity

In order to make a formal test of the causal relationship between exporting and productivity, the concept of Granger causation is used. The results obtained using 2003 sample is summarized in Table 6.

The results show that there exists a causal relationship from productivity to export status and from export status to productivity. There is a positive relationship between exporting and productivity (and vice versa) and both are statistically significant. These results supports the learning-by-doing hypothesis, that is exporting firms learn more from exporting and hence are likely to be more productive. Likewise the results are in support of the self selection hypothesis that is more productive firms are likely to self select into exporting. The results are in conformity with those obtained by Bigsten et al., (2002), on relationship between productivity and exporting in SSA.

Conclusions

In this paper two issues have been examined as regards to productivity: are factors determining productivity for exporters different from those affecting non-exporters and do Kenyan firms self select into export market or they learn-by-exporting. The results obtained shows that firm level characteristics determining productivity for exporting firms are different from non-exporting firms. Overall, labor productivity, capital productivity and total factor productivity are highest among the exporting firms than for non-exporting firms. Sunk cost is found to be highly significant for exporting firms, supporting the idea that for firms to enter into export market it must meet the

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costs of advertising, marketing and improvement on the quality of the products.

On the causal relationship between exporting and productivity, the results obtained are consistent with the learning-by-doing hypothesis, exporting impacts positively on productivity. The results also give some evidence for self-selection into the export market. Conclusion reached here is that causality runs both from exporting to productivity and form productivity to exporting.

On the policy perspective, the result that there is learning by exporting is important in that for Kenya to industrialize and develop, it has to emphasize on improving its exports in order to reach the world market. Relying on the small domestic market will not give them incentive to industrialize. The results also suggest that learning by exporting is possible in Africa hence the need for Kenya to orient its manufacturing sector towards exporting. There is need to broaden the products being exported in order to increase the scope for export externalities for growth in manufacturing sector

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Appendices

Table 1: Average Labor productivity, Capital productivity, Capital intensity and Total Factor Productivity-2000 and 2003 in terms of Size

	Small-10-49 Employees		Medium-50-99 Employees		Large-100+ Employees		All Categories	
	2003	2000	2003	2000	2003	2000	2003	2000
log value-added per employee	13.74	11.17	13.63	12.17	13.81	12.3	13.5	12.02
Log phy capital per employee	14.67	13.00	14.49	13.34	14.82	13.7	14.42	13.32
log value-added per capital	-0.13	0.017	-0.64	-0.02	-0.023	0.15	-0.27	0.151
log total factor productivity	9.32	7.84	9.02	8.20	9.55	8.21	9.17	8.04
No. of firms	61	61	32	26	73	56	166	143

Source: *Own computation from the survey data (RPED).*

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Table 2: Average Labor productivity, Capital productivity, Capital intensity and Total Factor Productivity for Exporters and Non-Exporters

	Exporting firms		Non-exporting firms	
	2003	2000	2003	2000
log value-added per employee	13.91	12.24	12.65	11.24
log physical capital per employee	14.75	13.78	13.68	11.90
log value-added per capital	-0.45	-0.15	-0.177	0.72
log total factor productivity	9.36	8.00	8.54	7.74
Average number of employees	265	212	180	49
Number of firms	84	74	83	145

Notice, the figures represent sample means.

Source: *Own computation from the survey data (RPED).*

Table 3: Determinants of Total Factor Productivity for Exporting and Non-exporting Firms 2000

	Exporting		Non-exporting	
	coefficient	z-value	coefficient	z-value
Factor inputs				
Log physical capital	0.08	1.84*	0.04	1.11
Log employment	0.30	6.49***	0.25	3.52***
Sectors				
Food	Bench mark (omitted) Category			
Metal	-0.71	-2.51**	-1.08	-3.47***
Textile and garments	-0.72	-2.93***	-1.12	-3.73***
Wood & furniture	-0.82	-1.91*	-1.61	-5.55***
Location				
Nairobi	Bench mark (omitted) Category			
Mombasa	-0.16	- 0.59	-0.12	-1.24
Nakuru	-0.18	-0.40	- 0.15	-0.05
Eldoret	-1.02	-2.51**	- 0.54	- 0.15
Firm level characteristics				

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Age	0.03	1.08	0.04	3.36***
$Age^2/100$	- 0.09	-1.90*	-0.06	-2.98***
Foreign ownership	0.00	0.01	-0.34	-1.56
log sunk cost	0.04	3.07***	0.08	0.77
log average wage(skill)	0.14	3.14***	0.53	9.42***
Infrastructure and Business environ				
Access to credit	0.73	2.11**	0.41	1.94*
Electricity			-0.02	-0.09
Water			0.05	0.27
Constant	11.8	12.42	7.23	9.22
Number of observation	196		322	
R-sq: Within	0.115		0.19	
Between	0.769		0.88	
Overall	0.762		0.87	

Significance at 1, 5 and 10 percent level is indicated by ***, ** and * respectively

Table 4: Determinants of Total factor Productivity for Exporting and Non-exporting Firms 2003

	Exporting		Non-Exporting	
	coefficient	z-value	coefficient	z-value
Factor inputs				
Log physical capital	0.28	5.61***	0.36	4.01***
Log employment	0.05	0.57	0.81	2.57**
Sectors				
Food	Bench mark (omitted) category			
Metal	-0.17	-0.40	-2.18	-2.81***
Chemical & paints	-0.24	-0.54	-4.33	-3.79***
Textile and garments	-0.16	-0.70	-0.58	-1.49
Paper, printing & publ	-0.00	-0.01	-7.08	-2.63***
Location				
Nairobi	Bench mark (omitted) category			
Mombasa	-0.42	-0.70	(dropped)	
Nakuru	-0.83	-1.82*	6.07	4.61***
Eldoret	-2.11	-2.96**	-3.62	-3.19***
Kisumu	-0.62	0.22	(dropped)	
Firm level characteristics				
Age	0.06	2.77***	0.29	2.96***
$Age^2/100$	-0.07	-2.86***	-0.29	-2.98***
Foreign ownership	0.06	0.22	-2.73	-4.42***
log sunk cost	0.29	3.31***	0.09	1.71*
log average wage(skill)	0.37	3.82***	0.36	1.92*
Infrastructure and Business environment				
Access to credit	-0.22	-0.78	1.87	2.80***
Electricity			-5.01	-3.32***
Transportation			0.84	1.18

Tax rates			1.79	2.18**
Corruption			2.25	2.45**
Constant	4.99	3.67	6.95	2.74
Number of observation	158		58	
R-sq: Within	0.00		0.00	
Between	0.88		0.99	
Overall	0.83		0.91	

Significance at 1, 5 and 10 percent level is indicated by ***, ** and * respectively

Table 5: GLS estimates on Pooled data for Exporting and Non-Exporting firms-1998-2003

	Exporting		Non-exporting	
	coefficient	z-value	coefficient	z-value
Factor inputs				
Log physical capital	0.22	5.41***	0.11	2.49*
Log employment	0.24	3.77***	0.46	5.82***
Time dummy	0. 17	1.36	0.09	0.44
Sectors				
Food	Bench mark (omitted) category			
Metal	-0.37	-1.62	-0.08	-0.35
Textile and garments	-0.52	-2.27*	0.08	0.32
Location				
Nairobi	Bench mark (omitted) category			
Mombasa	0.14	0.52	-0.21	-0.79
Nakuru	-0.71	-2.07*	0.18	0.57
Eldoret	-1.09	-2.83**	0.02	0.08
Firm level Characteristics				
Age	.04	2.84**	0.03	2.01*
$Age^2/100$	- 0.08	-4.00***	-0.03	-1.64
Foreign ownership	-0.01	-0.03	-0.21	-0.92
log sunk cost	0.23	3.42***	0.07	0.08
log average wage(skill)	0.39	7.34***	0.42	7.73***
Infrastructure and Business environment				
Access to credit	0.16	0.74	0.44	2.03**
Electricity	0.08	0.41	-0.06	-0.31
Transportation	0.01	0.04	-0.16	-1.07
Constant	7.14	8.07	6.46	9.42
Number of observation	406		380	
R-sq: Within	0.01		0.06	
Between	0.79		0.85	
Overall	0.76		0.84	

Significance at 1, 5 and 10 percent level is indicated by ***, ** and * respectively

Table 6: Probit and Tobit Model for Causality Test

	Probit Model	
	marginal effect	z-value
Total Factor Productivity (t-1)	0.24	0.24
Exporting (t-1)	0.49	2.42**
Dependent variable = TFP (t)		
Pseudo R^2 = 0.042		
Prob>chi 2 = 0.03		
LR chi 2 (2) = 6.52		
No. of Observation = 112		
	Tobit Model	
	marginal effect	z-value
Total Factor Productivity (t-1)	0.100	1.76*
Exporting (t-1)	0. 115	1.15
Dependent variable = Exporting (t)		
Pseudo R^2 = 0.039		
Prob>chi = 0.062		
LR chi 2 (2) = 5.55		
No. of Observation = 157		

**and * indicate significance at 5 and 10 percent level respectively

Explaining the Variables

Total factor productivity–This is measured by the value added defined as the total sales of the firm less cost of inputs.

Labor is proxied by the total number of full time workers including casuals. Firms are classified in three groups, small (0-49), medium (50-99) and large (100+).

Capital is defined as the replacement value of the machinery and equipment.

Sunk costs are defined as the expenses related to establishing a distribution channel, expenses on research and development or production costs to modify domestic products to foreign tastes.

Firm age is measured in years since operation started.

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Skill variable is proxied by average wage-defined as the total wage bill divided by the number of employees. In a competitive factor markets, the quality of labor force is positively related to the wage.

Foreign Ownership-This variable is represented by a dummy, taking value 1 if foreigners own fifty percent or more of a firm and zero otherwise.

Export participation-This variable is captured by a dummy, taking value 1 if the firm exports and zero otherwise.

Access to credit-This is captured by a dummy variable, taking the value one if a firm has access to an overdraft facility at the bank and zero otherwise.

Geographical location-It is defined as a dummy variable taking the value of unity if the firm is located in Nairobi and zero otherwise.

Sector-Productivity is different across sectors. Five sectors are considered with food sector being the bench mark (omitted) category.

Business Environment and Infrastructure variables - are captured by ratings (on a 1-5 scale) of the stimuli or barriers of infrastructure and business variables. Factors considered include, availability of water and electricity, transportation and communication, corruption, tax rates etc.

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