

Human Capital and Labor Productivity in East African Manufacturing Firms

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Abstract: The study uses firm level panel data to investigate relevant importance of human capital variables in explaining labor productivity in East African manufacturing firms. The study used generalized least squares to estimate the human capital model. Results indicate that proportion of skilled workers and average education in Uganda, training, proportion of skilled workers and education of the manager in Tanzania and average education and training in Kenya were positively associated with labour productivity. These results have important policy implications for the targeting policy prescriptions to increase manufacturing competitiveness.

Key words: Human capital, labor productivity, training, manufacturing

INTRODUCTION

The important role of human capital in productivity growth is widely recognized in the economic literature since the seminal contributions of Schultz (1961), Becker (1964), Welch (1970) and Mincer (1974). Human capital has always been considered as a major source of growth by economic theory. Human capital theory rests upon the assumption that education raises the marginal physical product of workers. However, the introduction of human capital input in growth models wasn't made until the 1980's in the works of Lucas (1988), Romer (1990), Stokey (1988) and Mankiw *et al.* (1992), among others. These studies have shown that the accumulation of human capital can sustain long-term growth.

According to the human capital theory, human capital contributes to output just like other factors of production and also through technological change by driving both innovation and imitation. Bartel and Lichtenberg (1987) show that firms with new capital stock have a higher demand for educated workers relative to uneducated workers because skilled workers are able to implement innovations more quickly and thereby reduce a firm's costs of adjustment. Corvers (1997) argues that human capital contributes to productivity level through allocative and worker effect, and productivity growth through diffusion and research effects.

With increased globalization, developing countries are under pressure to promote competitiveness. Definitions of competitiveness are based on a variety of indicators such as labor productivity, cost advantages, product quality, or export or import ratios (Francis and Tharakan, 1989; Niosi, 1991; Carves, 1996). This study asks whether the factor input of human capital at firm level matters for the international competitiveness of East

African manufacturing firms. Human capital is here regarded as an important source of international competitiveness, because human capital is supposed to increase the productivity of workers.

The existing theoretical literature seems to suggest that when human capital is successfully utilized there is a positive effect on firm performance although this is not always confirmed with empirical evidence. Microeconomic evidence on the impact of human capital on labor productivity in Sub Saharan Africa is varied (Goedhuys *et al.*, 2006; Soderbom and Teal, 2003; Wagner *et al.*, 1995; Corvers, 1994; Black and Lynch, 1996; Lundvall, 1999). These mixed results could be due to differences in, sample selection, model specifications, and time frames of the analyses, measurement problems and human capital variables used. Black and Lynch (1996) used an augmented Cobb-Douglas production function to analyze the effects of various aspects of human capital and training on labor productivity. They found productivity to be higher in firms that have a higher average employee education level. With respect to training they found a mixed story. A study by Lundvall and Battesse (2000) found mixed evidence across sectors compared to a study by Soderblom and Teal (2003), which found minor effects of human capital on labor productivity. A study by Goedhuys *et al.* (2006) found no impact of human capital indicators on labor productivity in Tanzanian manufacturing except the education level of the manager. It is to this emerging literature on the impact of human capital on labor productivity that the present paper contributes. The hypothesis of this study is that by positively influencing the organization of work in a firm (allocative effect) and also through worker effect, human capital would improve the efficacy of labor, and hence increase the output level by employees.

MATERIALS AND METHODS

This study was conducted in 2009 at the University of Dar es Salaam, Tanzania to analyze the contribution of human capital variables to labor productivity; we began by focusing on the functional form of the production function. Functional forms are specific to both model and data. If the choice of a functional form is incorrect, the model will potentially predict responses in a biased and inaccurate way (Griffin *et al.*, 1987). The consequences of this error may include, among others, misleading policy implications (Giannakas *et al.*, 2003). There are two commonly used functional forms; translog and Cobb-Douglas. Translog functional form provides a second order approximation to an arbitrary twice-differentiable linearly homogenous function. The translog specification is attractive because of its flexibility, in the sense that, it nests or approximates a number of popular models in the literature. However, the translog functional form is susceptible to multicollinearity and potential problem of insufficient degrees of freedom due to the presence of interaction terms (Coelli, 1995).

The Cobb-Douglas form is derived from the translog form by restricting the coefficients of the second order terms of the translog to zero. In this study, value added Cobb-Douglas production function was specified and estimated. We used both the fixed and random effect techniques to estimate the Cobb-Douglas equation. All input and output variables were deflated to real values. Three different deflators were used, including a capital deflator, a wage deflator and an output deflator (CPI). The output deflator was also used for the intermediate inputs. A Hausman test in all the estimations led to non-rejection of the null hypothesis. All the tests showed a P-value greater than 10 percent, implying that there was insufficient evidence to reject the null hypothesis. We therefore chose random effects model estimations to test for constant returns to scale. The last rows in Table 1 report the results of tests for Cobb-Douglas functional form. In all models, the null hypotheses $H_0: \delta_i = 1$ for all i , that is, the coefficients of parameters of the estimated equations for the factors of production are equal to one, could not be rejected because there was no sufficient evidence. The p-value was greater than 10% in all the tests.

We focus on the Cobb-Douglas form considered as a special case of the translog frontier. In addition to being the most commonly used functional form; this form allows comparisons to be made between the findings of the current study relative to previous studies that have analyzed the relationship between human capital variables and labor productivity. The Cobb-Douglas form is used mainly because of its simplicity and parsimony. In addition, when the model is transformed into logarithms, one obtains a model that is linear in inputs and

Table 1: Cobb-Douglas Model: GLS Random Effects estimates
Variable: Ln(Value Added)

Parameter	Kenya Coefficient	Tanzania Coefficient	Uganda Coefficient
Constant	.645 (1.49)	9.704 (12.8)***	.479 (1.2)
Ln (capital)	.240 (6.3)***	.274 (7.2)***	.172 (4.32)***
Ln (Labour)	.753 (14.4)***	.753 (10.3)***	.858 (17.9)***
R ² : Within	.76	.55	.70
R ² : Between	.56	.83	.99
R ² : Overall	.70	.53	.70
Number of observations	489	393	675
Constant Returns to Scale test($H_0: \delta_i = 1$)			
Chi ²	.08	.24	1.19
Prob>Chi ²	.78	.63	.27

***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively. Values in brackets are robust Z-statistics.

is thus straightforward to estimate. However, Cobb-Douglas functional form has limitations. The Cobb-Douglas form is restrictive with respect to returns to scale, which take the same value across all firms in the sample and are constant across output levels. The Cobb-Douglas form assumes that all inputs are technical compliments. It is also inflexible in that it provides only a first order approximation to a function, which limits its ability to approximate other functions.

Two approaches are commonly used in analyzing the relationship between human capital and labor productivity. Most empirical studies, which have examined the effect of education on production, have used an earnings function framework (Becker, 1964; Mincer, 1974). The conventional approach has been that earnings are used as a proxy for productivity and then earnings functions are used to estimate the effect of education on productivity.

The second approach developed and applied by Corvers (1997) estimates the relationship between human capital variables and labor productivity using production analysis. The use of production analysis has advantages compared to the earnings function framework. First, when estimating production functions, there is no need to make any assumptions about the equivalence of wages and marginal product so the possibility of screening does not cloud any interpretation of the results (Jones, 2001). Second, the production function approach permits the inclusion of nonwage workers, like apprentices or family members, who contribute to firm output but receive zero wages. Such workers are difficult to incorporate into a conventional, semi-logarithmic earnings function. Lastly, the production function estimates makes it possible to characterize the technology with which firms operate. However, empirical tests which use production function analysis to estimate the effect of human capital on firm output have been impossible because of data constraints, despite the advantages to a production function approach.

To analyze the effect of human capital variables on labor productivity, we adopt a human capital model

developed and empirically tested by Corvers (1997) because of its advantages over the earnings function approach. This human capital model is based on the Nelson-Phelps (1966) approach and describes the effects of initial education on labor productivity. Corves human capital model exhibits strong similarity with the model of Lucas (1988), except that the Lucas' model reflects both static and dynamic effects. The human capital model as developed by Corvers (1997), assuming an exogenously given labor, starts with a standard Cobb-Douglas function:

$$Y_i = AK_i^\alpha L_i^{*\beta} \quad (1)$$

Where production Y of an individual firm is the result of the production factors physical capital K , and efficiency units of labor L^* . A represents the state of firm technology. Labor efficiency units are presumed to consist of the number of workers in a firm, or the number of hours worked, and three levels of initial education. These levels are lower, intermediate and higher education. This specification hence allows explicitly for the labor augmenting aspect of human capital on labor input. An equation for efficiency units of labor is of the following form;

$$L_i^* = L_i \cdot L_{1i}^{\theta_1} L_{2i}^{\theta_2} L_{3i}^{\theta_3} \quad (2)$$

In this equation, L_i is the number of employees in firm i and $L_{si}^{\theta_s}$ is the number of employees with education level $s=1, 2$ and 3 , respectively. Parameters θ_s reflect the contribution of the respective education levels to the efficiency units of labor. Substituting Eq. (2) into (1) and dividing by labor gives the following labor productivity expression;

$$\frac{Y}{L} = A \left(\frac{K}{L} \right)^\alpha L_i^{\alpha+\beta-1} (1 - L_2 - L_3)^{\beta(1-\theta_2-\theta_3)} L_2^{\beta\theta_2} L_3^{\beta\theta_3} \quad (3)$$

According to this equation, the level of labor productivity depends on relative shares of the three educational levels in the labor force of the firm. The equation thus illustrates the worker effect, i.e., more labor can produce more output as long as the marginal product is positive, and the allocation effect, i.e., better qualified labor is able to use available inputs and techniques more efficiently. This production function can be used to calculate the static effects of human capital on labor productivity. We modify and extend Corvers (1997) model by including more additional human capital variables to minimize the overestimation of the relative

significance of human capital components that were originally specified in the original model. This modification allows explicitly for the labor augmenting aspect of different forms of human capital on labor input. The human capital variables we include in the model are; weighted average education, training of workers, education of the manager, skill intensity, and weighted average age of workers as a proxy for workers experience.

The modified and extended human capital model is of the following form;

$$\frac{Y_i}{L_i} = A \left(\frac{K_i}{L_i} \right)^\alpha L_i^{\alpha+\beta-1} L_{1,i}^{\beta\theta_1} L_{2,i}^{\beta\theta_2} L_{3,i}^{\beta\theta_3} L_{4,i}^{\beta\theta_4} L_{5,i}^{\beta\theta_5} \quad (4)$$

In logarithmic form;

$$\ln \frac{Y_{it}}{L_{it}} = \ln A + \alpha \ln \left(\frac{K_{it}}{L_{it}} \right) + (\alpha + \beta - 1) \ln L_{it} + \beta\theta_1 \ln L_{1,it} + \beta\theta_2 \ln L_{2,it} + \beta\theta_3 \ln L_{3,it} + \beta\theta_4 \ln L_{4,it} + \beta\theta_5 \ln L_{5,it} + v_i + u_{it} \quad (5)$$

Where L_1 , L_2 , L_3 , L_4 and L_5 were the average weighted education level, training dummy, proportion of skilled workers, education of the manager, and workers experience proxied by weighted average age of workers respectively.

The basic framework of Eq. (5) relies on a modified Cobb-Douglas production function whose residual includes the effect of numerous omitted variables. Such factors are well known in the literature on labor productivity and include; unionization (Jones, 2001), ownership structure (Soderblom and Teal, 2003) and sector specific variation in technologies (Lundavall, 1999). To control for the effects of these factors, the labor productivity equation is extended to include the following variables; foreign direct ownership, firms with union members and sector dummies. Some studies include a lagged dependent variable in the production function to capture the fact that whenever factors of production are changed it may take time for output to reach its new long-run level (Nickell, 1996) for a similar specification. However the introduction of lagged dependent variable introduces a Nickell bias. To deal with the Nickell bias, the lagged dependent variable is treated as endogenous but that would reduce tremendously our sample size. Consequently, we have decided to estimate the production function without the lagged dependent variable directly to avoid the Nickell bias.

A potential problem associated with this production analysis approach concerns the endogeneity of some explanatory variables. In such a case, the parameter estimates may be subject to some simultaneity bias if some of the explanatory variables are not truly exogenous variables. Indeed, the micro-economic theory of the firm rests on the belief that inputs are controlled by the decision-maker in order to achieve some objective. The conventional way to solve this endogeneity problem is to apply some type of instrumental variable estimation technique, but for production functions, finding appropriate instruments is a challenging endeavor. To address this problem, we used an instrumental variables approach, where we exploited the panel dimension of the data and used the first lagged values of the potentially endogenous explanatory variables as instruments.

The addition of control variables to Eq. (5) gives us the final estimating equation:

$$\ln \frac{Y_{it}}{L_{it}} = \ln \alpha_0 + \alpha_1 \ln \frac{K_{it-1}}{L_{it-1}} + \alpha_2 \ln L_{it-1} + \alpha_3 \ln \text{aveduc}_{it-1} + \alpha_4 \ln \text{aveduc}_{it-1} + \alpha_5 \text{train}_{it-1} + \alpha_6 \text{skill}_{it-1} + \alpha_7 \ln \text{exp}_{it-1} + \alpha_8 \text{union}_{it} + \alpha_9 \text{fdi}_{it} + \alpha_{10} \text{other sectors}_{it} + \alpha_{11} \text{text}_{it} + \alpha_{12} \text{metal}_{it} + \alpha_{13} \text{chem}_{it} + v_i + u_{it} \quad (6)$$

Where, $\ln \frac{Y_{it}}{L_{it}}$ represents labor productivity, measured as a ratio of gross value added to labor. Value added is measured as the total sales of the firm less cost of intermediate inputs. Intermediate inputs include; costs for raw materials, solid and liquid fuel, electricity and water.

$\frac{K_{it-1}}{L_{it-1}}$ represents capital-labor ratio, defined as a ratio of

the replacement value of the machinery and equipment adjusted for capacity utilization to labor. Since values of machinery were available only for one year, an annual depreciation of the capital stock of 4.5% that is commonly used in empirical literature was assumed (Chapelle and Plane, 2005). This percentage corresponds to a mean machinery life of 22 years. L_{it-1} represents labor, proxied by the total number of employees, being the average number of permanent workers and temporary workers employed. *aveduc* represents the weighted average education where weights are average schooling years. *Skill* represents the proportion of firm's skilled workers (i.e., managers, proprietors, engineers, physical scientists, accountants, economists, technicians, foremen, supervisors, and specifically skilled production workers) to the total number of workers. *educman* represents education of the manager measured in terms average

schooling years. *train* represents a dummy variable that equals one for firms that train their workers. *exp* represents average experience of workers proxied by the weighted average age of workers in a firm. *fdi* represents the ratio of foreign ownership. *union* represents a dummy variable that equals one if firm has union members. *Othersectors* represents a dummy variable that equals one if firm engages in manufacture of construction materials, plastics and paper. *text* represents a dummy variable that equals one if firm engages in manufacture of textiles. *chem* represents a dummy variable that equals one if firm engages in manufacture of chemicals. *metal* represents a dummy variable that equals one if firm engages in manufacture of fabricated metal products. The agro-based sector was used as a base category. All continuous variables are in logarithms.

Data sources: The analysis contained in this study was based on a sample of agricultural manufacturing firms across Kenya, Tanzania and Uganda. The data used in this study was obtained from survey data that was collected from an interview during 2002-2003, by World Bank as a part of the Investment Climate Survey, in collaboration with local organizations in East Africa. The collaborating institutions for the design and enumeration of the East African surveys were the Kenya Institute for Public Policy Research (KIPPRA), the Economic and Social Research Foundation-Tanzania (ESRF) and the Uganda Manufacturers' Association Consulting Services (UMACIS).

The sampling strategy was standardized across the East African surveys. The firms were randomly selected from a sampling frame constructed from different official sources and stratified by size, location and industry. Investment climate surveys were completed in the three East African countries almost at the same time. The relevant sample included 403 manufacturing firms that had complete data on all variables of our interest. Although the data are not strictly comparable to surveys in other countries, useful comparisons were made between the results obtained from the survey data and those obtained in other African countries.

RESULTS AND DISCUSSION

There are two main estimation techniques used in the panel data analysis; Random Effect and Fixed Effect. It is crucial in a panel framework to decide which of the two estimators, Fixed Effect Models (FEM) or Random Effect Model (REM) one uses. The Random Effects Model is an appropriate specification if we are drawing N individuals from a large population (Baltagi, 2005). This is usually the case of firm panel studies. Care is taken in the design of the panel to make it "representative" of the population. In this case, N is usually large and a fixed

effect model would lead to enormous loss of degrees of freedom. The individual effect is characterized as random and the inference pertains to the population from which this sample was randomly drawn. On the other hand, the fixed effect model is an appropriate specification if we are focusing on specific set of firms. Inferences in this case are conditional on the particular N firms that are observed. The Hausman specification test proposed by Hausman (1978) which is based on the difference between the fixed and random effects estimators is usually used in order to decide whether to use FEM or REM. A rejection of the null hypothesis leads to the adoption of the fixed effects model and non-rejection leads to the adoption of the random effects model (Baltagi, 2005). This study used both the fixed and random effect techniques to estimate the modified human capital equation. The regression results of log linear model (6) are reported in Table 2. A Hausman test in all the estimations led to non-rejection of the null hypothesis, which showed a P-value greater than 10 percent, implying that there was insufficient evidence to reject the null hypothesis.

Explanatory variables were tested for partial correlation and variables that were significantly correlated with other explanatory variables were not considered independent. If we found any two variables to be correlated, one of them had to be excluded, retaining the variable that was the best determinant of labor productivity. In Tanzania, average education was significantly partially correlated with the education of the top manager and training. We therefore dropped average education from the labor productivity equation for Tanzanian manufacturing firms. All the models in the empirical chapters were estimated using STATA version 9.

In Kenya, results in Table 2 showed the positive determinants of labor productivity as capital-labor ratio, average education, and training. The proportion of skilled workers, average age of workers and education of the top manager, ought to affect labor productivity in a positive way, but this does not happen in the model. In Uganda results showed that capital-labor ratio, foreign ownership, size, proportion of skilled workers, and average education were the only positive determinants of labor productivity. The other variables that ought to positively influence labor productivity in a positive way such as average workers age, training, education of the manger were shown to be insignificant.

In Tanzania, results showed that it was proportion of skilled workers, and education of the manager that were positively associated with labor productivity. Firm size was shown to be negatively associated with labor productivity a finding that was consistent with estimates by Goedhuys (2006) in a study on manufacturing firms in Tanzania.

Table 2: Determinants of Labor Productivity: GLS Random Effects Estimates
Dependent variable: Ln(Value Added Labor Ratio)

Parameters	Kenya Coefficient	Tanzania Coefficient	Uganda Coefficient
Constant	2.314(.47)	9.322(1.78)*	9.0785(5.76)***
Ln(capital/labor ratio) _{t-1}	0.329(4.98)	- 0.306(-.94)	0.139(3.15)***
Ln(size) _{t-1}	- 0.171(-1.76)*	- 0.724(-3.65)***	0.138(1.84)*
Ln(average education) _{t-1}	2.208(2.16)**		1.367(2.67)***
Ln(education manager) _{t-1}	- 0.281(-.48)	1.716(1.99)**	- 0.266(-.58)
Skilled proportion _{t-1}	0.000902(.22)	0.0227(2.23)**	0.0130(4.12)***
Training dummy _{t-1}	0.429(1.82)*	0.292(.55)	- 0.0501(-.21)
Ln(workers age) _{t-1}	0.749(.78)	1.0297(.83)	0.233(.54)
Unionized	0.00278(.93)	- 0.00233(-.41)	- 0.00045(-.08)
Foreign ownership	0.000537(.11)	- 0.00244(-.28)	0.00803(2.69)***
Textiles dummy	- 0.602(-1.91)*	0.383(.42)	- 0.948(-2.01)**
Chemicals dummy	0.178(.36)	0.959(1.27)	0.148(.35)
Metals dummy	- 0.510(-1.53)	- 1.143(-1.24)	- 0.385(-.95)
Furniture dummy	- 0.794(-1.79)*	- 0.357(-.54)	- 0.934(-3.23)***
Other sectors	- 0.532(-1.16)	- 0.334(-.36)	- 0.152(-.61)
R ² : Within	0.15	0.0005	0.003
R ² : Between	0.33	0.30	0.39
R ² : Overall	0.29	0.25	0.38
Number of observations	207	189	410
Hausman test			
Chi ²	0.02	3.0	0.03
Prob>Chi2	1.00	0.999	1.00

***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Values in brackets are robust Z-statistics

In Kenyan manufacturing firms, firms that undertake training were shown to exhibit significant higher levels of labor productivity than firms that do not train their workers. This is consistent with the argument that training enhances diffusion of new technology, since the purpose of training often is to get employees acquainted with new techniques of production, new machines, new kinds of raw materials, and all other new features in the production process. A national policy in Kenya concerning training should serve an increase in participation in on-the job training, by initiating an apprenticeship system.

In Uganda and Tanzania, manufacturing firms that carry out training was not significantly different from firms that do not train in terms of labor productivity. This finding is consistent with the conclusion of Goedhuys *et al.* (2006) who demonstrate, on a sample of Tanzanian firms, an insignificant relationship between training and labor productivity. If training of labor, improves 'allocative effect' and 'workers effect', we should expect a positive effect of training on labor productivity. A number of reasons may explain lack of training effect on labor productivity in Ugandan manufacturing firms. First, although training improves labor productivity, it may reduce the amount of labor being involved in the production. Second, training may also be serving objectives other than labor productivity, for example, career prospects. Third, the impact of training on labor productivity may have lag time longer than allowed in our analysis. Lastly, the use of simple dummy variables for training may not control for quality.

High proportion of skilled workers was shown to be positively related to labor productivity in a sample of Ugandan and Tanzanian manufacturing firms. This is consistent with Jones (2001) argument that countries with

highly skilled work forces are more productive than those with less skilled workers. Bartel and Lichtenberg (1987) show that firms with new capital stock have a higher demand for educated workers relative to uneducated workers because skilled workers are able to implement innovations more quickly and thereby reduce a firm's costs of adjustment. The lack of association between skill proportion and labor productivity in Kenyan manufacturing firms was comparable to estimates by Lundvall and Battesse (2000) using Kenyan manufacturing data.

In Tanzania manufacturing firms, the education of the manager was shown to be positively associated with labor productivity confirming earlier findings by Goedhuys *et al.* (2006) in the same country. This result is as expected because better educated managers are able to supervise workers and reduce shirking. This raises effectiveness of labor. This finding is also consistent with Fafchamps *et al.* (2001) argument that capacity to handle formal organization of production on a larger scale, are in short supply in African small firms. The ability of a firm to make use of external technologies may also depend on the absorptive capacity of the top manager. In Ugandan and Kenyan manufacturing firms, the education of the manager was not significantly associated with labor productivity.

The average education variable was shown to be positively associated with labor productivity in a sample of Kenyan and Ugandan manufacturing firms. This result is consistent with the fundamental assumption of human capital theory that education raises productivity. Moreover, numerous studies have revealed a significant relationship between the accumulation of human capital and per capita growth rates, particularly in developing countries (World Bank, 1993; Jorgenson *et al.*, 1987). Welch (1970) argues that education can improve a firm's technical efficiency since more educated workers are presumed to have an advantage over less educated workers in gaining information on how to choose the correct mix of outputs and inputs for achieving productive efficiency. This evidence of the importance of average education supports efforts to provide incentives to increasing investments in human capital in general in Kenya and Uganda.

The workers age variable that was used as a proxy for workers experience was not significantly associated with labor productivity in all the regressions, implying that the static effects were not significant for this human capital variable. This result is inconsistent with the notion of learning-by-doing and the idea that workers become more productive as they learn both firm specific and industry specific skills. The assumption that experience raises productivity is the rationale behind including experience in the specification of earnings functions. However, the coefficient on age doesn't need to be positive, because

there may be an optimal age.

Foreign ownership was shown not to be associated with labor productivity in Kenya and Tanzania. Lundvall (1999) also found no support for the argument that foreign ownership has an influence on labor productivity in Kenya. Goedhuys *et al.* (2006) also find no support for the argument that foreign ownership has no influence on labor productivity in Tanzania and argues that firms can make use of external technology through licensing from international firms. In Ugandan manufacturing firms, foreign ownership was found to be positively associated with labor productivity. This result was consistent with the long held view that foreign ownership is believed to be a vehicle for the international transfer of management skills that cannot be licensed out or transferred to clients via technical assistance arrangements (Teece, 1997).

The estimated coefficient of the firm size proxied by the total number of workers was negative in Tanzanian and Kenyan manufacturing firms. This evidence may indicate diseconomies of scale, implying that an increase in firm size results in the decrease in labor productivity.

As expected, manufacturing firms with high capital labor ratio revealed high values of value added per worker except in Tanzanian manufacturing firms. Workers participation in a trade union was shown not to be significantly associated with labor productivity in all the regressions. The sector effects on labor productivity in Tanzania manufacturing firms were not significantly different from that of agro based manufacturing firms compared to Ugandan and Kenyan manufacturing firms where both textile and furniture sector firms had significantly lower labor productivity compared to agro based manufacturing firms.

CONCLUSION

This paper analyzes the contribution of human capital to labor productivity in East African manufacturing firms. Since labor productivity can be regarded as an indicator of competitiveness, the study used a modified human capital model to analyze the importance of investments in different indicators of human capital for increasing the international competitiveness of East African manufacturing firms. In Kenyan manufacturing firms, firms that undertake training were shown to exhibit significant higher levels of labor productivity than firms that do not train their workers. This is consistent with the argument that training enhances diffusion of new technology, since the purpose of training often is to get employees acquainted with new techniques of production, new machines, new kinds of raw materials, and all other new features in the production process. A national policy in Kenya concerning training should serve an increase in participation in on-the job training, by initiating an apprenticeship system.

High proportion of skilled workers was shown to be positively associated with labor productivity in Ugandan and Tanzanian manufacturing firms. In Tanzania manufacturing firms, the education of the manager was shown to be positively associated with labor productivity. Consistent with the human capital theory, average education variable was shown to be positively associated with labor productivity in Kenyan and Ugandan manufacturing firms. The most important policy recommendation to emerge from this paper is that a well-balanced allocation of investment sources over different components of human capital is important in order to provide workers with the skills needed to make them productive. Since labor productivity is regarded as an indicator of competitiveness, the importance of investing in human capital in increasing competitiveness of manufacturing firms in East Africa cannot be understated.

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