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Analyzing the Impact of ICT Investments on Productivity Growth in Developing Countries: Evidence from Cameroon

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Abstract

To what extent investments in Information and Communication Technologies (ICT) have contributed to productivity growth in Cameroon? This paper explores the relationship between productivity and investment in ICT in Cameroon at firms' level in 2004. Using cross-section data and applying a Cobb-Douglas function, the studies reveals that investment in ICT has no impact on productivity, as the estimated coefficient of ICT investment on productivity is not significant. Also, ICT investment has no impact on labor productivity and labor intensity. These findings differ from results obtained by Shymal Chowdhury (2002) according to which ICT investment has negative and significant impact on labor productivity in East Africa. In Cameroon labor remains the key factor of value added growth. This seems to be realistic as the country has an important workforce that tends to slow down salaries. Since labor is the abundant factor, it is profitable for firms to increase their production by recruiting more units of labor. If ICT investment contributes to rapid globalization of economies, it does not contribute to productivity growth in Cameroon.

Keys words: Information and Communication Technologies; Firms' Productivity; Growth; Cameroon.

1. Introduction

Evidence about the contribution of Information and Communication Technologies (ICT) investment to productivity and growth has been very controversial. In developed countries and especially among the G-7 countries, ICT investment has a large impact on productivity growth in the United States while in Japan, the United Kingdom and France for example labor productivity did not increase despite a high level of investment in ICT (IMF 2001). In developing countries, this controversy still persists.

In the context of developed countries, Jorgensen and al. (2002) analyzed the sources of U.S. labor productivity growth in the post-1995 period and presented projections for both output and labor productivity growth for the next decade. They found that ICT played a substantial role in the U.S. economy by reviving productivity. Their projections put the rate of trend productivity growth at 2.1 percent per year over the next decade. Daveri (2002) showed that throughout 1992-2001, even if two thirds of the European Union population reached or came too much closer to the same levels of ICT diffusion as the U.S., ICT have so far delivered limited overall productivity gains in Europe. Hempell (2002) found significant productivity effects of ICT on German service sector. In many other studies, empirical evidence for effects of ICT investment on firms' performance in the context of industrialized countries has reported positive effects in the case of US large enterprises (Brynjolfsson and Hitt 2000 for example). Using the production function approach, Brynjolfon and Hitt (1996) found that the gross marginal product of computer capital ranges from 56% to 68% while the gross marginal product on non-computer capital is between 4.14% and

6.86% in the United States firm-level data. An important number of studies had jointly considered both developed and developing countries.

Concerning studies on both developed and developing countries, Dewan and Kraemer, 2000 (see Pohjola 2001) have estimated a Cobb-Douglas function in a cross-countries analysis using GDP as output and ICT capital, non-ICT capital and labor hours as inputs. Based on data on 22 developed countries and 14 developing countries over the period 1985-1993, results indicate that the returns from ICT capital investments are positive and statistically significant for developed countries but not significant for developing countries. In developed countries, the output elasticities of ICT capital, non-ICT capital and labor are respectively 0.057, 0.160 and 0.823. In developing countries results indicate that ICT investments are not productive as the 0.593 ICT elasticity is statistically equal to zero. As pointed out by Pohjola (up cit.) and contrary to results from developed countries, the authors did not include human capital in the production function. Investment in ICT being strongly correlated with investment in human capital, this seems to explain differences in results in developed and developing countries. In exploring the impact of information technology investment on economic growth in a cross-section of 39 countries in the period 1980-1995, Pohjola (2000) applied the augmented version of the neo-classical growth model. The results indicate that for the full sample, physical capital has been a key factor in the growth of GDP per worker in both developed and developing countries whereas, human capital and information technology were shown to have had no strong impact. However, in the smaller sample of 23 OECD countries, information technology has had a strong impact on growth. An explanation for the poor or non-impact of ICT in developing countries can

be explained by the fact that developing countries have not yet invested enough in ICT. This is not because ICTs is not a priority in developing countries, but because developing countries lag behind developed countries in terms of investment level. The diffusion and introduction gap of ICT between developing and developed countries - the former having experienced ICT many years after the latter - can also explain this conclusion. As ICT is expected to take time before having its full effects on productivity, it might be normal that ICT impact in developed countries is greater than ICT impact in developing countries. Also, the intensity of ICT use may explain the difference. If one can found many studies centered on developed countries, it should be recognized that less has been done as regarding developing countries and especially for sub-Sahara Africa.

In developing countries, some recent studies on small and medium scale enterprises in the manufacturing sector in India have reported a positive link between ICT capital and productivity (Muller-Falke 2001) and between ICT adoptions and export performance (Lal 1996). In Sub-Sahara Africa, very little has been done to capture the impact of ICT investment on productivity. Recently, Chowdhury and Wolf (2002) assessed the uses of information and communication technologies and their impact on the economic performance of small and medium scale enterprises of Kenya, Tanzania and Uganda. Findings suggest that the diffusion of ICT among East African small and medium scale enterprises is both industry and country specific. The model that is based on a Cobb-Douglas specification is modified to take into account ICT impact on labor productivity, ICT impact on return on investment and ICT impact on market expansion. The empirical findings suggest that investment in ICT has a negative impact on labor productivity

and a positive impact on general market expansion. But such investment does not have any significant impact on enterprises' return and neither determines enterprises exporter status. This approach is very interesting in the sense that it underlines the relationship between labor intensity, labor productivity and ICT investments.

The focus in this paper is to contribute to this debate by measuring the effect of ICT investment on Cameroon's enterprises productivity. The analysis that is concentrated on both secondary and tertiary sectors, also distinguishes small size from large size enterprises. The paper is organized as follows. Section two is a brief review of Cameroon's ICT infrastructure that gives a better idea of the ICT environment within which firms operate. Section three presents the analytical framework. Data used in the analysis are presented in section four, followed by empirical results in section five. Section six presents some implications of the results. In section seven, the last section, I discuss important policy recommendations.

2. Brief Profile of Cameroon's ICT Infrastructure

Radios, televisions, fixed phones, mobile phones, personal computers, and the internet are the main ICT devices used to study access to information society. Among these devices, radios are the most widespread in developing countries, followed by televisions. In fact, the availability of radios is relatively high as compared to other ICT devices in developing countries. One main reason is that radios can operate only with batteries and their prices are relatively affordable for low income persons. For the other ICT devices, access to electricity has limited their penetration in developing

countries as the development of new ICT tends to be dependent on the availability of energy. As an example, it is very likely that in a region without electricity, no or very few computers would be found leading to no access to internet.

In Cameroon, access to electricity is a major constraint for economic development in general and for ICT penetration in particular. Rural area that represents about 53 percent of total population and where access to electricity is limited to 23% (compared to 50% for Cote d'Ivoire for example) needs a lot to catch up urban areas where about 88% of population do have access to electricity in 2001 (confer Cameroon Poverty Reduction Strategy Paper).

Table 1: Selected ICT indicators in selected countries, 2003

ICT indicators	Cameroon	Cote D'Ivoire	Senegal	Africa
Total telephone subscribers per 100 inhabitants	5.13	9.13	7.77	8.66
Main telephone lines per 100 inhabitants	0.7	1.43	2.21	3
Cellular mobile subscribers per 100 inhabitants	6.62	7.7	5.56	6.18
Internet users per 10 000 inhabitants	37.9	144.3	217.2	156
Personal computers per 100 inhabitants	0.57	0.93	2.17	1.44

Source: International Telecommunication Union database

Compared to Senegal and Cote d'Ivoire, Cameroon is lagging behind these two countries in terms of access to ICT investment as one can observe in table 1. Total telephone subscribers, main telephone lines, cellular subscribers, internet users and personal computer per 100 inhabitants are not only lower than the African level, but also than these countries with

relatively same level of development. This differential in ICT penetration might be a source of differential in growth potentials.

3. Theoretical Framework

Before presenting empirical results, I believe it is useful to briefly present the structured framework that would help interpret the regressions that would follow. The framework focuses on two main points: the estimation of production elasticity with respect to ICT investment and the measurement of the impact of ICT on labor intensity and labor productivity.

3.1 The Output Elasticity of ICT Investment.

To identify the channel through which ICT affects firm output or productivity, let's consider the production function approach that can be summarized as follows. Suppose the production function:

$$Y_i = F(ICT_i, NICT_i, L_i) \tag{1}$$

where, for firm i the value added Y is produced from inputs consisting of ICT capital (ICT), non-ICT capital (NICT), and labor (L).

Suppose that (1) assumes the simple Cobb-Douglas form and suppose also that the α_i's are constant from one firm to another, one can write:

$$Y_i = A \bullet ICT_i^{\alpha_1} \bullet NICT_i^{\alpha_2} \bullet L_i^{\alpha_3} \tag{2}$$

Taking natural logarithms, one obtains the following:

$$\log Y_i = Log A + \alpha_1 \log ICT_i + \alpha_2 \log NICT_i + \alpha_3 \log L_i \tag{3}$$

Given information about Y, ICT, NICT and L at a given time, one can estimate the parameters A and α_i. Note that A represents the level of technology while the α_i are elasticities of Y with respect to i (i = ICT, NICT, L).

Special attention will focus on α_1 that represents the elasticity of production (value added) with respect to the use of ICT capital. In other words, α_1 is the output elasticity of ICT investment. If $\alpha_1 > 1$, a one-percent increase in ICT investment would lead to more than one-percent increase in output. In such situation, increasing ICT investment in the economy would be very important for boosting overall economic growth. The importance of growth could therefore be explained by the level of ICT investment in sectors accounting for a higher percentage to aggregated output. On the contrary, a one-percent increase in ICT investment would generate less than one-percent increase in output. Comparison of α_1 with α_2 and α_3 would ameliorate the analysis. As an example, if for a country $\alpha_1 > \alpha_i$ (i = 2, 3) it would be more efficient for this country to increase its ICT investment as compared to non-ICT investment and labor in order to accelerate growth. On the contrary, if for example $\alpha_1 < \alpha_i$ (i = 2, 3) more emphasis would be put on non-ICT capital and labor if the country aims at boosting growth. α_1 equal to zero means that ICT investment does not affect productivity growth; consequently, increasing investment on such assets could in a long run be economically costly or non viable.

3.2 The Impact of ICT on Labor Intensity and Labor Productivity

ICT investment can enhance enterprise performance due to some indirect cost saving as labor costs and increased labor productivity. It can also affect direct cost of firms' inputs. An obvious example is when ICT investment reduces information costs. ICT also affects inputs allocation. It can have both substitution and complementary effects. It is possible that ICT investments increase employment at firms' level. On the other hand, it is also possible to imagine that increased ICT investment could lead to job reduction as firms increase ICT intensity (substitution between ICT capital and labor). Both situations affect labor productivity. To assess the impact of ICT investments on labor intensity and labor productivity, let's consider the following production function (Berndt and Morrison 1995).

$$Y_i = F(K_i^*, L_i) \qquad (4)$$

where, for firm i production Y is obtained from inputs consisting of quality-adjusted stock of aggregate capital K^* and labor L.

Suppose that (4) assumes the simple Cobb-Douglas form and suppose also that the α_is are constant from one firm to another. One can write:

$$Y_i = AK_i^{*\alpha} L_i^{\beta} \qquad (5)$$

Taking natural logarithms, one obtains the following:

$$\log Y_i = LogA + \alpha \log K^*{}_i + \beta \log L_i \qquad (6)$$

Suppose K^* is the quality-adjusted stock of aggregate capital and suppose it can be divided into ICT capital (ICT) and non-ICT capital (NICT) as follows.

$$K_i^* = K_i (ICT_i / K_i)^{\delta} (NICT_i / K_i)^{\gamma} \qquad (7)$$

In logarithm form one obtains:

$$\log K_i^* = \log K_i + \delta \log(ICT_i / K_i) + \gamma \log(NICT_i / K_i) \qquad (8)$$

If ICT capital is more productive per monetary unit of services than other capital, one would expect δ to be positive. On the other hand, if ICT capital does not have any differential impact, then $\delta = \gamma = 0$. Combining (6) and (8) one gets:

$$\log Y_i = \log A + \alpha(\log K_i + \delta \log(ICT_i / K_i) + \gamma \log(NICT_i / K_i)) + \beta \log L_i \quad (9)$$

Assuming constant returns to scale ($\alpha+\beta = 1$) and solving for $\log(L_i/Y_i)$, gives

$$\log(L_i / Y_i) = a_1 + a_2 \log(K_i / Y_i) + a_3 \log(ICT_i / K_i) + a_4 \log(NICT_i / K_i) \qquad (10)$$

where $a_1 = -\log A / \beta$; $a_2 = (\beta - 1)/\beta$; $a_3 = -\delta(1-\beta)/\beta$; $a_4 = -\gamma(1-\beta)/\beta$ (11)

Equation (10) gives the basic relationship between labor productivity, labor intensity and ICT-capital intensity. If $a_3 < 0$, ICT-capital has a positive impact on labor productivity as labor intensity decreases. If $a_3 = 0$, the effect of ICT-capital is not different from non-ICT capital.

In fact, provided that $\beta \neq 0$ (as I assumed a Cobb-Douglas form, $0<\beta<1$) testing the null hypothesis that ICT capital is not different in its productivity than non-ICT capital is equivalent to a test of $\delta = 0$. If $\delta = 0$, $a_3 = 0$. If ICT capital is more productive than non-ICT capital, $\delta > 0$ implies that $a_3 < 0$ as $0<\beta<1$. Consequently, if ICT capital is more productive than other capital, it would lead to reduced labor intensity ceteris paribus.

4. Data and Summary Statistics

The main problem encountered here is the measurement of ICT capital. ICT capital is measured by expenses in ICT that include: spending on computer hardware equipment, computer software, computer services, maintenance support services, consulting services, training, telecommunication equipment and services. Each firm was asked to estimate such ICT investment. For firms that failed to indicate their ICT spending, I assumed that in each sector the share of ICT capital in firms' total capital is constant so that the share of ICT capital in total capital was used for these firms even if ICT investment can be intra-industry specific.

The value added represents the firm's output. Non-ICT capital is measured by the value of total capital minus the value of ICT capital. Total capital is estimated by the value of total physical capital plus expenditures in ICT that are not included in the capital stock expenditure. The total labor hours represent the labor variable. In Cameroon and according to the legislation, a working day lasts 8 hours and there are five working days per week. The total labor hours for a given firm is measured by timing the number of employees by per annum working hours. The number obtained is diminished by the equivalent of nine days for public holidays. This brought us to about 2000 working hours per annum.

For further details, results are presented in three main steps. In the first step, I examine the relationship between ICT and production in both industrial and service sector. In the second step, I analyze this relationship using data from the secondary sector and the tertiary sector separately. Lastly, the

analysis distinguishes small-size enterprises from large size enterprises. Small-size enterprises are defined here as firms having less than 50 employees. Data are drawn from a sample of 81 enterprises of which 46 are from the industrial sector and 35 from the service sector. These enterprises are among those contributing most to GDP and for which data where available at this time. The time period is determined by the availability of data. Data are for year 2004 and represent the most recent available data. The second type of data, which are qualitative data help in understanding the behavior of firms in terms of information about ICT, skills upgrading in ICT knowledge and services computerization.

Table 2: summary statistics

	K (in 10^6 CFA francs)	ICT (in 10^6 CFA francs)	NICT (in 10^6 CFA francs)	employees	Ln(K/Y)	Ln(ICT/K)	Ln(NICT/K)
Mean	4503	1024	3479	342	0.398	-2.629	-0.148
Median	3478	21	304	38	0.239	-2.374	-0.097
Maximum	87959	53617	44929	13299	4.662	-0.494	-0.0003
Minimum	8.3	0.090	3.3	2	-3.441	-8.111	-0.941
Std. Dev.	12433	5812	8362	1475	1.666	1.402	0.165

5. Empirical Results

5.1 The Output Elasticity of ICT Investment.

For the overall sample, empirical estimation of equation (3) provides elasticities of value added with respect to ICT capital, non-ICT capital and labor.

$$\log Y = 5.27 + 0.043\log(ICT) + 0.187\log(NICT) + 0.829\log(L)$$

(0.00) (0.61) (0.109) (0.00)

$R^2 = 0.716$ adjusted $R^2 = 0.705$ (*) = probability t statistics; n = 81

The dependent variable is firms' value added. ICT capital, non-ICT capital and labor are independent variables. Both independent and dependent variables are expressed in logarithm form. Value added is most determined by labor. According to the results, an increase of one percent in labor would lead to an increase of 0.829 percent in productivity. This coefficient is significant at 5% as the probability of t statistic is zero (less than 0.05).

The ICT impact on productivity is 0.043, meaning that if one increases ICT capital by 10 percent productivity would increase by 0.43 percent. This coefficient is not only smaller, but also not significant, meaning that in Cameroon, ICT capital does not appear to affect productivity growth. Non-ICT capital has a 0.187 impact on productivity. Again, this coefficient is not significant. These results corroborate the fact that in developing countries, labor, the abundant factor, is the main input used in production and so, constitutes the best channel through which production can be increased. Broadly speaking, capital (ICT and non-ICT capital) is not an important determinant of productivity in Cameroon's enterprises.

One important explanation to this is that firms do not operate at their full capacities. The rate of utilization of production capacities was estimated at about 60 percent in the industrial sector in 2002 according to the Department of Forecast, Ministry of Economy and Finance.

Equation (3) that was also estimated for the industrial sector gave the following.

$$\log Y = 3.94 + 0.23\log(ICT) + 0.106\log(NICT) + 0.763\log(L)$$

$$(0.018) \quad (0.132) \quad (0.607) \quad (0.001)$$

$R^2 = 0.75$ adjusted $R^2 = 0.742$ (*) = probability t statistics; $n = 46$

In the industrial sector, labor still constitutes the main determinant of firms' productivity with a coefficient of 0.76 meaning that in Cameroon's industrial sector if we increase labor by 10%, value added would increase by 7.6%. This coefficient is significantly different from zero at five percent. As it can be observed, the impact of ICT (0.23) is not significant. The same conclusion applies to non-ICT investment which impact on productivity is statistically equal to zero. Because of high unemployment and consequently low salary, labor, the abundant factor, is more utilized for production and remains the most important determinant of output.

In the tertiary sector, estimations gave:

$$\log Y = 4.79 + 0.0309\log(ICT) + 0.23\log(NICT) + 0.85\log(L)$$

$$(0.0048) \quad (0.723) \quad (0.05) \quad (0.000)$$

$R^2 = 0.762$ adjusted $R^2 = 0.738$ (*) = probability t statistics; $n = 35$

The 0.03 impact of ICT investment on productivity is not significant. Labor constitutes the main determinant of productivity growth. In fact, if one increases labor by 10 percent in the service sector, it is expected that productivity would increase by 8.5 percent. This coefficient is significant at five percent. This result indicates that as a developing country, and having an abundant unemployed labor force, Cameroon's tertiary sector would increase its productivity by increasing employment. Non-ICT investments

have a positive impact on productivity. The 0.23 coefficient is significant at 5 percent. To increase productivity, Cameroon's tertiary sector has to increase labor and non-ICT capital. ICT capital would have no effect on productivity growth. This finding is in contradiction with what is really expected. In fact the tertiary sector is the one that is supposed to get important benefits from ICT investment as compared with other sectors. Equation (3) was also estimated for small size and large size enterprises. The following are the main findings.

Estimation of equation (3) for small size enterprises gave the following.

$$\log Y = 1.294 - 0.013\log(ICT) + 0.184\log(NICT) + 1.307\log(L)$$

(0.61) (0.91) (0.23) (0.000)

$R^2 = 0.53$ adjusted $R^2 = 0.49$ (*) = probability t statistics; $n = 45$

In small size enterprises, ICT capital has a non-significant negative impact on production. Labor remains the fundamental factor of output growth. Consequently, any increase in ICT investment would increase firms' total costs without leading to any increase in productivity. Labor, as in other sectors or in other types of enterprises, remains the central determinant of output growth. Non-ICT capital is not a significant factor of output.

In large-scale enterprises, labor is the most important determinant of output while ICT investment does not have a significant impact on productivity. The main trend observed in industrial and tertiary sectors is also valid for small size and large-scale enterprises where estimations gave:

$$\log Y = 7.43 + 0.143\log(ICT) + 0.137\log(NICT) + 0.598\log(L)$$
$$(0.0031) \quad (0.25) \quad (0.43) \quad (0.0041)$$

$R^2 = 0.56$ adjusted $R^2 = 0.52$ (*) = probability t statistics; $n = 36$

To sum up, ICT investment does not affect enterprises' productivity in Cameroon. Any investment of this type would be leading to increase in production costs without affecting total output. Can such investment effects labor intensity and so labor productivity? The following paragraph gives an answer to this question. But one would expect that as ICT investment does not affect total productivity, it does not affect labor productivity even if some compensations in terms of increase and decrease in labor or capital productivity would lead to the same conclusion.

5.2 The Impact of ICT on Labor Intensity and Labor Productivity

In order to recap the impact of ICT investment on labor intensity and labor productivity, Equation (10) was estimated for the 81 selected enterprises of the sample. Empirical results gave the following:

$$\log(L/Y) = -7.419 + 0.302\log(K/Y) + 0.076\log(ICT/K) + 1.37\log(NICT/K)$$
$$(0.00) \quad (0.0001) \quad (0.507) \quad (0.156)$$

$R^2 = 0.20$ adjusted $R^2 = 0.17$ (*) = probability t statistics; $n = 81$

The value of ICT capital as a proportion of total capital has a positive impact on labor intensity. The coefficient is 0.076 meaning that if ICT intensity increases by 10%, labor intensity would increase by 0.76 percent. This implies that the stock of ICT-capital has a negative impact on labor productivity as labor intensity increases. Hence as firms increase the share of

ICT capital stock to total capital stock, labor intensity would increase and labor productivity would decrease. For a given output, increasing labor intensity implies increased labor units and hence low labor productivity.

The coefficient measuring the impact of ICT intensity on labor intensity and labor productivity is not significant; outlining the fact that ICT intensity does not affect labor intensity and labor productivity in Cameroon's economy. The corresponding coefficient for non-ICT capital is 1.37. This coefficient, which is greater than the ICT coefficient, is not significant. The impact of ICT capital is therefore not different from the impact of non-ICT capital. However, results show that firms would benefit more by increasing the capital (total capital) output ratio rather than ICT capital share as percentage of total capital stock.

In the industrial sector, empirical estimation of equation (10) gives:

$$\log(L/Y) = \underset{(0.00)}{-7.483} + \underset{(0.0003)}{0.45}\log(K/Y) + \underset{(0.90)}{0.025}\log(ICT/K) + \underset{(0.20)}{2.48}\log(NICT/K)$$

$R^2 = 0.33$ adjusted $R^2 = 0.29$ (*) = probability t statistics; n = 46

In the industrial sector, ICT intensity has a 0.02 non-significant impact on labor intensity. This seems realistic since in this sector and especially for Cameroon, firms need non-computerized equipments and machines to transform their products. ICT capital is just used to improve the productivity of both labor and non-ICT capital. This is why the impact of capital-output ratio (0.45) is significant. As in the previous case, non-ICT investment does not have a significant impact on labor intensity and labor productivity.

For the tertiary sector, estimation gives:

$$\log(L/Y) = -7.75 + 0.080\log(K/Y) + 0.052\log(ICT/K) + 0.449\log(NICT/K)$$

(0.000) (0.47) (0.71) (0.68)

$R^2 = 0.019$ adjusted $R^2 = -0.07$ (*) = probability t statistics; n = 36

In the service sector, there is no significant impact of ICT intensity, non-ICT intensity nor capital-output ratio on labor intensity and labor productivity as indicated in the above regression because of the insignificance of corresponding estimated coefficients. Hence ICT investment does not have any impact on labor productivity in Cameroon.

As stated in the following regressions, ICT intensity does not significantly affect labor intensity and labor productivity in small-size enterprises. In large-scale enterprises, non-ICT capital intensity is an important and significant determinant of labor intensity and labor productivity. In large-scale enterprises, the impact of non-ICT intensity (2.85) is significant at five percent. Consequently if non-ICT intensity increases, labor intensity would increase and labor productivity would decrease.

In Small size enterprises, the following estimations are obtained:

$$\log(L/Y) = -7.84 + 0.41\log(K/Y) + 0.028\log(ICT/K) - 0.67\log(NICT/K)$$

(0.000) (0.0001) (0.84) (0.61)

$R^2 = 0.33$ adjusted $R^2 = 0.28$ (*) = probability t statistics; n = 45

Large size enterprises

$$\log(L/Y) = -7.22 + 0.18\log(K/Y) + 0.06\log(ICT/K) + 2.85\log(NICT/K)$$

(0.000) (0.11) (0.72) (0.04)

$R^2 = 0.20$ adjusted $R^2 = 0.12$ (*) = probability t statistics; n = 36

6. Some Implications

The results indicate that ICT is not a significant determinant of productivity in Cameroon's enterprises. Consequently, any increase in ICT capital would deteriorate firm's performance, as additional costs would just increase total costs without an increase in total output. Hence, firms' performance would decline with increase in ICT investment. This result contradicts the main findings in developed countries were increasing ICT investment contributes to additional growth of output. The situation might be explained by the fact that ICT is not well allocated among firms' activities. Also, ICT investment, as many other investments, can have drawbacks if it is used in non-efficient way. This is the case for example when people only use internet for sending mails to their friends instead of using it to prospect new markets. This can be the case when users have little knowledge in alternative uses of ICTs. Also, it is important to note that as firms do invest very little in training and skills as well as in development, such result can be predictable. As an example, qualitative data indicate that about all firms (97 percent) visited were using computers in one-way or another. Accounting was the service that used computers the most (about 82 % of firms). Inventory for raw materials and final products occupied the second position with about 38% of firms. These activities however are not producing value added but do indirectly support other activities by reducing time. Production is weakly computerized in Cameroon's economy while this activity is the main channel trough which productivity can be improved. Less than 50% of firms have access to Internet. For those having access to the Internet, about 90% use it for personal e-mail (not in connection with firms activities) instead of contacting new clients or marketing new products, meaning that much

production time is wasted on the internet making the latter to have a negative impact on production. In fact, Internet should be used for gathering of information for new technologies, new products and new markets. Some companies have embarked on training their personnel in computer skills but this training is usually limited to administrative tasks. For these reasons and many others, it is expected to get results that are closer to the main findings of the present analysis.

Another implication of the findings of the study is that, as ICT intensity does not significantly affect labor intensity and labor productivity, more investment in ICT would not lead to nether more recruitment in Cameroon's enterprises, nor more reduction in employment. Consequently, ICT investment has no incidence on the level of employment. Only non-ICT capital has a positive impact on the level of employment in Cameroon's enterprises. The level of employment would increase with the capital-output ratio. This level of employment being the more important determinant of productivity growth, enterprises would benefit from increasing the number of employees if they want to accelerate their output growth.

7. Concluding Remarks

Using data from Cameroon, the analysis shows that investment in ICT has no impact on productivity, as the estimated impact of ICT investment on productivity is not significant. Also, ICT investment has no impact on labor productivity and labor intensity as ICT-capital ratio has no significant impact on labor-output ratio. These findings differ from Shymal Chowdhury (2002) who found that ICT investment has negative and significant impact

on labor productivity in East Africa. For the sample considered, labor remains the key determinant factor of value added growth in Cameroon. This seems to be realistic as labor is abundant in the country, leading to relatively law salaries. Since labor is the abundant factor, it is profitable for firms to increase their production by recruiting more units of labor. If ICT investment contributes to rapid globalization of economies, it does not contribute to productivity growth in Cameroon. It might even lead to poor performance.

To sum up, the study reveals the following: ICT does not affect productivity in Cameroon. Labor is a very significant factor determining output growth for the overall sample. Capital-output ratio is significant for the overall sample while non-ICT capital significantly determines output in the service. Finally, Non-ICT-capital-output ratio significantly determines labor-output ratio in large-scale enterprises.

One of the limits of the above analysis is that the impact of ICT on product-quality improvements is not taken into account. In fact, if ICT can affect productivity and labor intensity, it is important to note that information and communication technologies are important source of product-quality improvements. Another limit is due to the principal limits of the model used and assumption adopted. Also, as the analysis only considers one given year, it is certain that one may get different results while considering different years.

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