Indian Journal of Applied Economics and Business
Vol. 2, No. 2, 2020, pp. 187-212

ARF INDIA
Academic Open Access Publishing
www.arfjournals.com

The Digital Divide at the Firm Level in Cameroon*

Ariel Herbert FAMBEU

Laboratoire d'Economie Théorique et Appliquée (LETA),
BP : 4032 FSEGA, University of Douala (Cameroon)
E-mail : afambeu@yahoo.fr

Received: 28 April 2020; Revised: 4 May 2020;
Accepted: 29 May 2020; Publication: 15 July 2020

Abstract*: The ICT revolution is already a reality for firms in advanced countries and many emerging countries, especially since there is now strong evidence on improving productivity and growth. However, the ICT penetration rate remains low in African firms. Using data on industrial firms in Cameroon, this study identifies the factors responsible for ICT adoption. The results from OLS and Heckman models show that the size, the human capital of employees, the proportion of staff who know how to use ICT, the organizational practices, the regional effect and the characteristics of the leader determine the level of ICT adoption in firms. However, the discriminatory effect of these factors narrows over time. These results make it possible to draw some lessons for the development of a policy of ICT diffusion not only in the Cameroonian firms, but also in other similar African countries that have a weak process of ICT diffusion.*

Keywords*: ICT adoption, firms, Cameroon*

JEL Classification*: L6, L7, O33*

1. INTRODUCTION

Information and Communication Technologies (ICT) are at the heart of the "new" economy based on knowledge. There are proves suggesting that ICTs, innovation and technological changes are important determinants of productivity, growth as well as the capacity of countries to benefit from globalisation (Jorgenson and Stiroh, 2000; Oliner and Sichel, 2000; OCDE, 2004; Timmer and Van Ark, 2005; Holt and Jamison, 2009; Kretschmer, 2012; Biagi, 2013).

The impact of investment in ICTs on productivity and growth is more important to firms than industries and countries (Brynjolfsson and Hitt, 2000, 2003; Lehr and Lichtenberg, 1999; Matteucci *et al*, 2005). At the level of firms the use of ICTs leads to an improvement in the conception of products, marketing, production, financing and the organization of the firm (Hollenstein, 2004; Bloom *et al.* 2012), but equally to the development of the export market (Machikita *et al.* 2010). Moreover, ICT are engines of

innovation which facilitate the creation of new products and services (Becchetti *et al.* 2003; Carlsson, 2004; Hollenstein, 2004).

Nowadays, it is clear that technological change is an important engine of productivity and the performance of firms in developed countries as well as in developing countries. However, despite the important role of ICT in the firm, the economy and the society, the adoption of ICT continues to be significantly different across firms. Also, even though the relationship ICT- productivity is quite certain, some firms especially SME are reluctant to adopt a certain number of ICTs despite the fact that technology is becoming more and more accessible (Giunta and Trivieri, 2007).

Despite the strong progression of ICT in the world especially mobile services and the internet, the penetration rate remains low in developing countries and especially in Africa. In fact if the penetration rate of internet is 87% in developed countries, it is 40% in developing countries and 25% in Africa (ITU, 2016). In Africa, telecommunications costs have fallen sharply in recent years, but remain higher than in other developing regions. For example, Africa's mobile and Internet charges are about four times higher than those in South Asia, and international call prices are more than twice as high. African countries connectivity to international broadband networks is nearing completion, but cost is a key factor influencing adoption. In Africa, the cost of 1 GB of data in 2016 represented nearly 18% of the income of an average citizen, against only 3% in Asia (A4AI, 2017). Non-competitive pricing policies of mobile operators, such as increased call pricing to competing networks, also make ICT relatively expensive. As the fastest growing mobile phone market in the world, Africa's economic growth is positively influenced by mobile telephony. Currently, the majority of mobile phones used are multi-purpose phones. However, smartphones are also entering the market, as evidenced by the increasing percentages of mobile users with these devices in several countries, such as: Nigeria (25%), Egypt (22%), Ghana (18%), Cameroon (17%), Kenya (13%) and Senegal (11%) (Nyirenda-Jere and Biru, 2015). The sector is expected to grow, with smartphones becoming more affordable for consumers.

Analysis of ICT Development Index (IDI)[1] values by level of development reveals important disparities between developed and developing countries. The first indicate an average IDI value of 7.20, whereas it is only 3.84 for the second that is almost half (UIT, 2014). The regional IDI index for Africa is much lower with only two countries, Mauritius (5.22) and the Seychelles (4.97) which are more than the world average of 4.77. Three quarter (29 on 38) of African countries are considered to be among the less connected countries. The last ten countries in the IDI classification

of 2013 are all African countries including The Central African Republic being the only country with an IDI value less than one. Cameroon ranks 18th out of 38 African countries, just behind Angola and ahead of Mali. Moreover, in terms of digital affordability, Cameroon is in penultimate place with an index of 25.6, just ahead of Ethiopia with a score of 13.4 (A4AI, 2014).

The challenge of policymakers is to identify the combination of policies that will enable their economies to maximize the benefits of an increasingly digital global economy and respond appropriately to the resulting challenges. In other to do this it is important to ensure access to the digital economy by all. Thus, in order to increase the propagation of ICT in Africa, it is interesting to study the factors which hinder (or favour) their adoption. This study attempts to determine these factors at the level of firms of a Sub-Saharan African country such as Cameroon. Cameroon is connected to the internet since April 1997. But, the rate of penetration of ICT in firms remains low and is less than 50% (INS 2009). In fact, if 78% of firms have at least a computer, hardly one firm out of two is connected to the internet and a lower proportion (23%) have an intranet network and use internet for business operations. This penetration rate of ICT has progressed sharply since 2006 where 7% of the firms were equipped with a computer (ANTIC, 2007). The objective of this paper is to identify the factors that hinder the adoption of ICT at the level of Cameroonian firms. This microeconomic study complements the existing work on the digital divide in Cameroon (Fambeu and Bakehe, 2015, Bakehe, Fambeu and Tamokwe, 2016, Fambeu 2017, etc.). In addition, it could serve as a support for an ICT development policy not only in Cameroon, but also in countries with the same level of development and a low ICT penetration rate.

The rest of the paper is organised as follows. Section 2 presents the review of literature on the determinants of ICTs in firms. The methodology is presented in section 3 and the results are discussed in section 4. Finally, we conclude in section 5 and give recommendations for public policy.

2. LITERATURE REVIEW

Two main approaches are generally used in economic literature to explain the adoption (or not) of ICTs in firms. The first is made up of factors which directly affect the costs and benefits of the adoption of new technology. In this approach, four effects are usually identified: the rank effects, the stock effect, the order effects and the epidemic effects (Karshenas and Stoneman, 1993; Geroski, 2000). The second approach is based on the complementarity between ICTs and some organizational practices and the associated gains

of efficiency (Milgrom and Roberts, 1990, 1995). In this study we equally highlight the profile of the manager of the firm as a determinant of ICT investment. The later plays an important role in African Countries characterized by the predominance of very small firms, small firms and family SME whose managers are often the founders.

Literature on the ICT adoption has documented empirical proves of several factors that are inherent in the adoption of ICT in an firm in developed countries[2] as well as in developing countries[3]. Lal (2007), in a study in Nigeria, proved that the absorption capacity of employees (number of technical employees) played an important role in the adoption of ICT. The multi varied approach used by the author equally enables him to notice that SME adopt ICT to obtain appropriate and precise commercial information on market tendencies in terms of the specifications of the product, information on the technology of new productions and the exchange of commercial information. This absorption capacity of employees (human capital) is equally found in the studies in Uganda (Ssewanyana and Busler, 2007) and in Tunisia (Ben Youssef *et al.*, 2015 and Kossaï *et al.* 2019). On the contrary, Nkouka (2014) show that the level of education of the employees has no effect on the adoption of ICT in Congolese SME, but it is the presence of white collar workers that plays an important role. The studies of Appiah *et al.* (2016) and Thuo *et al.* (2017) confirm the role of human capital of the manager mainly for the adoption of e-commerce respectively in Ghanaian and Kenyan SME. Moreover, whereas some studies (Gnansounou, 2010; Ochola, 2015) show that age of the manager has no effect on the adoption of ICT in a firm, Adebimpe (2014) shows a positive relation between age and the use of ICT. Their use is due to the experience and better exposure because of their education (Adebimpe, 2014).

In a study carried out in Benin, Gnansounou (2010) shows that in addition to the characteristics of the manager, age, size and export capacity of the firm are positively related to the adoption of ICT. Large firms are considered to be more susceptible of adopting ICT since they have more resources and knowledge to invest in new technologies. However, Olise *et al.* (2014) conclude in Nigerian SME that there is no link between size and the use of internet. Moreover with the same methodology (simple probit), Benabderrahmen *et al.* (2016) show that the impact of size depends on the technology used. In fact, the study realized on textile firms in Tunisia confirms that the size of the firm has no impact on the use of internet, but instead on the adoption of softwares (Computerised system of data exchange and a management software). Studies highlighting organizational practices are very rare. Nevertheless, Ben Youssef *et al.* (2014) showed using a data of Tunisian firms influenced by new organizational practices

positively on the adoption or the use of ICT. This result is confirmed by Ben Khalifa (2014). These are firms which have the highest innovative organizational practices which have the highest probability of intensifying their use of internet. In addition, the author shows that the sectorial and regional effects are significant on the intensity of internet usage. The positive effects of the environment were equally found in other studies (Ochola, 2015; Agyire-Tettey, 2015; Cirera *et al.*, 2016).

Cirera *et al.* (2016), in a study on firms of six Sub-Saharan African countries[4] show imports, the participation of foreigners in the capital, organizational practices and competition positively affect the adoption of ICT and particularly the e-commerce. This study also shows that Kenya has a very high rate of ICT penetration whereas countries such as Democratic Republic of Congo and Tanzania have the lowest rates which are related to the income per head. However, the study of Agyire-Tettey (2015) shows that the impact of factor is different from country to country. His study is based on twelve (12) sub Saharan African countries[5] with 3996 SME. The bivaried probit model and particularly the meta-analysis enable to identify the sectorial effects and the perception of competition as the common factors to all the countries of the adoption of computers and internet. Moreover, Agyire-Tettey (2015) find for example that the effect of size of the firm is positive on the adoption of computers and null on the adoption of internet in Bostwana, in Ghana and in Kenya, whereas this effect is null for computers and negative for internet for Cameroon. Another result of this study shows that human capital of the employees positively impacts on the adoption of computers and internet in Cameroon, in Ethiopia, in Mozambique and Rwanda whereas there is no effect on the adoption of ICT in Ghana, in Kenya and in Nigeria.

At the end of this literature it is noticed that studies integrating the role of organizational practices (mentioned in the supermodularity theory of Milgrom and Robert (1990, 1995)) and the proximity effects (regional and sectorial) are very scarce. Thus, this study attempts to complete existing studies by integrating the variables mentioned above on the data of industrial firms in Cameroon.

3. METHODOLOGY

3.1. Data

In this study we use two data bases, one of 2009 and the other of 2012 from the National Institute of Statistics of Cameroon. These surveys were based on samples of 1008 and 183 firms of the industrial sector. All the firms of

this sample are from the National directory of firms put in place with the help of the general census of firms realized in 2009 (RGE 2009). According to the nomenclature of activities in Cameroon (NACAM), each sample was made by dividing the industrial sector into 5 sub sectors: extraction (made up of two branches), the food industries (7 branches), the other manufacturing les industries (14 branches), electricity water and gas (1 branch) and construction (1 branch). This nomenclature of Cameroon is an adaptation of the activities of AFRISTAT member states (NAEMA) inspired from the international classification by firm of all the branches of economic activity (CITI rév. 3.1).

However, since some sub-sectors are very poorly represented in these samples, we remove them and finally retain only three (food industries, other manufacturing industries and construction). In addition, while the 2009 sample was conducted across the entire national territory, the 2012 sample was only conducted in the two major cities of the country and in the west region (these three regions of the country hold more than 85% of firms). Thus, for analysis purposes, we also delete the other regions of the 2009 database to retain only the three regions that are also in the 2012 database. Finally, the two samples used are the data from three regions and three sectors of activity, some of which are presented in Table 1.

Table 1
Repartition of firms by size, sub sector and region

	2009		*2012*	
	N	*%*	*N*	*%*
Size of Firm				
VSE	401	51.74	95	53.37
SE	156	20.13	36	20.22
ME	147	18.97	29	16.29
LE	71	9.16	18	10.11
Sub-secteur of activity				
food industries	154	19.87	35	19.66
other manufacturingindustries	375	48.39	112	62.92
Construction	246	31.74	31	17.42
Region				
Douala	500	64.52	103	57.87
Yaoundé	223	28.77	50	28.09
West	52	6.71	25	14.04
Total	**775**	**100**	**178**	**100**

Source: Author, from surveys 2009 and 2012, NIS

These representative samples of the industrial sector have almost the same proportions of firms in terms of size, sub sector and region. The results from these samples can therefore enable us to give public policy recommendations on all the industrial firms in Cameroon.

3.2. Measurement of variables

In this work, we analyze the determinants of ICT adoption in firms. Our data make it possible to distinguish three types of ICT: the number of functional computers (COMPUTER), the internet connection (INTERNET) and the practice of the business operations online (E_ BUSINESS).

The table of descriptive statistics (Table A1 in appendix) highlights the existence of a digital divide within industrial firms in Cameroon. Moreover, we note that this fracture would increase with time. Indeed, 53% of firms have at least one functional computer in 2009 against 45% in 2012. However, 41% have an internet connection in 2009 against 39% in 2012. As for business transactions via the Internet, only 31% and 30% of firms do so in 2009 and 2012 respectively. The most widespread technology is the mobile phone, with a penetration rate of 81% in 2012. This strong democratization of the mobile can be explained in particular by the dramatic fall in the price of this technology in developing countries in recent years. In addition, over 81% of leaders adopt this technology because it would have a positive impact on their firm.

For the explanatory variables, we distinguish five types (they are defined and coded in detail in Table A2 in the appendix): *The rank effects* that contains age, size, human capital of the employees, research and development, the ownership of capital, belonging to a group, legal status, degree of competition (Herfindahl index) and commercial exposure (exports) ; *The stock-order effect* and *the epidemic effect* will be captured through "dummy" variables representing respectively the sector of activity and the region of location of the firm. *The effect of organizational practices* is measured by some organizational dispositions relative to the new flexible production system put in place by the firm. Our data enabled us to describe three adopted organizational dispositions: the training of personnel related to technology, the ISO certification, social benefits order than transport and housing indemnities and social insurance contributions with the aim of motivating workers. *The characteristics of the manager* are measured by gender, age, level of education and the perceived effect of ICT.

3.3. Strategy for the estimation of empirical model

Based on the theoretical and empirical literature developed above, the empirical model of ICT adoption can be formulated as follows:

$$ICT_{ijr} = \alpha + \beta_R X_i^R + \beta_{SO} X_j^{SO} + \beta_E X_r^E + \beta_{PO} X_i^{OP} + \beta_D X_i^M + \varepsilon_{ijr}$$

Where *i*, *j* and *r* are the indices of the firm, of the sector of activity and location region respectively. As mentioned above, the ICT variable can be the number of functional computers (COMPUTER), the internet connection (INTERNET) and the practice of business operations online (E_ BUSINESS). β is the vector of the parameters to be estimated; X^R defines the rank effects; X^{SO} represents the stock-order effect; X^E represents the epidermic effect; X^{OP} represents the effect of organizational practices; X^M represents the effects of the individual characteristics of the manager; ε is the error term considered as normally distributed.

Two econometric techniques are used to estimate the factors of ICT adoption by Cameroonian industrial firms. First, the ordinary least squares (OLS) method is used to estimate the model with the number of computers (quantitative variable) as the explained variable. Secondly, for the qualitative explained variables (internet connection and business online), the approach chosen is the probit model with correction of the selection bias. Indeed, on the one hand, the internet connection is conditional on the presence of a computer, and the practice of online operation is conditional on the internet connection. To correct this bias, we use Heckman's (1979) two-step estimation procedure, which was refined by Van De Ven and Van Praag (1981). This method consists in first estimating a Probit model on the choice of an Internet connection, and then calculating for each of the firms the inverse of the Mill's ratio which corresponds to the normal density function divided by the normal distribution function. The latter is then introduced into the probit online business transaction model as an explanatory variable. The estimated coefficient ρ, associated with the inverse of Mill's ratio, then measures the correlation of errors between the adoption model of the Internet and the online business transaction model. When this coefficient is significantly different from zero, we can conclude that there is a selection[6] bias. This method thus makes it possible to obtain consistent and asymptotically efficient estimators with respect to simple probit.

4. RESULTS

We can say that multi-collinearity between variables is not a problem in this research. Indeed, as shown in Table A3 (in the appendix), the values of the variance inflation factor (VIF) of all the independent variables are less

than 10. Thus, the estimated models do not suffer from the problem of multi-collinearity for values of VIF <10 (Marquardt, 1970, Theil, 1971, Mason *et al.*, 1989). The results (Table 2 and 3) show that the coefficient associated with the inverse of the Mill ratio is negative and significant over the two periods, confirming the existence of a selection bias. The negative sign can be interpreted as follows: the unobserved characteristics that positively influence the probability of having at least one computer, play negatively on the probability of having an internet connection. Similarly, unobserved characteristics that positively influence the probability of having an Internet connection negatively affect the likelihood of doing online transactions.

However, the coefficients obtained from the probit model must be interpreted with care. The absolute value taken by the estimated coefficients cannot be directly interpreted in terms of partial derivatives, or elasticities, of the explained variable with respect to the explanatory variables (Greene and Hensher 2010). What is important in these results is not so much the absolute value of the coefficients as the sign and the degree of significance of these. The marginal effects (Table A4 in the appendix) make it possible to estimate the extent (or gaps) of the digital divide in industrial firms in Cameroon.

As concerns the *rank effects*, the size of firms and the presence of foreign capital significantly influence the adoption of ICT, mainly the computer. Despite lower costs for hardware and computer components, as well as information and communications processing in recent years, ICT adoption is still low in small firms with lower financial capacity. The financial factor would therefore still be responsible for the adoption of ICT in firms in Cameroon. Moreover, according to Mansfield (1961), SME managers tend to be risk averse. But investing in new technologies necessarily entails a risk. This confirms the positive link between the size of the firm and the adoption of ICT. Another explanation would come from the fact that small and very small firms have not initiated strategies and organizational practices to adopt new technologies. This influence of the size of the firm was found, especially in the work of Machikita *et al.* (2010), Agyire-Tettey (2015) and Benabderrahmen *et al.* (2016). In contrast, Kontolaimou and Skintzi (2018) found a negative relationship between size and adoption of e-commerce. A possible explanation could be provided on the basis of the greater flexibility of small firms (compared to larger ones) and the need to gain a competitive advantage over large firms in order to survive. This negative relationship was also found by Bayo-Moriones and Lera-López (2007). The influence of human capital of employees (SAL) is positive and significant on the adoption of the computer and the internet. A workforce with high levels of human capital is often needed to facilitate the adoption

Table 2
Estimation of the adoption of ICT (year 2009)

Variables	*COMPUTER*		*INTERNET*		*E_ BUSINESS*	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*
TXUCOMP	0.074	(0.855)	0.834***	(0.2547)	0.759***	(0.233)
AGE1	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
AGE2	0.112	(0.588)	-0.0026	(0.141)	0.0468	(0.139)
AGE3	0.359	(0.574)	0.217*	(0.129)	0.186	(0.124)
SIZE	0.835***	(0.442)	0.552***	(0.126)	0.359***	(0.121)
SAL	1.603***	(0.417)	0.043	(0.062)	-0.00025	(0.049)
WCE	-0.0151	(0.023)	0.012	(0.013)	0.0175	(0.011)
FDI	3.039**	1(0.214)	0.292	(0.337)	-0.195	(0.262)
EXPORT	-0.262	(0.915)	0.308	(0.264)	0.044	(0.240)
ISO	-0.251	(0.510)	0.0010	(0.157)	0.1675	(0.150)
MOTIVATION	-0.651	(0.499)	0.3814***	(0.139)	0.314**	(0.131)
ICTTRAINING	-0.512	(0.876)	0.778**	(0.321)	0.448**	(0.247)
MAN	0.224	(0.589)	0.592***	(0.163)	0.614***	(0.167)
AGEMANAGER1	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
AGEMANAGER2	0.922	(0.698)	0.780***	(0.194)	0.416***	(0.195)
AGEMANAGER3	0.666	(0.714)	0.973***	(0.191)	0.622***	(0.189)
AGEMANAGER4	0.404	(0.672)	1.109***	(0.165)	0.681***	(0.165)
PRIMARY	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
SECONDARY	-0.990	(0.708)	0.124	(0.1820)	0.1614	(0.185)
GCEA	-0.940	(0.673)	0.454**	(0.193)	0.468**	(0.193)
GCEA+	-0.852	(0.587)	0.745***	(0.140)	0.674***	(0.138)
WEST	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
DOUALA	-0.328	(0.486)	0.591***	(0.141)	0.432***	(0.141)
YAOUNDE	-0.283	(0.634)	0.279*	(0.159)	0.167	(0.162)
CONSTRUCTION	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
FOOD	-0.0320	(0.534)	-0.611**	(0.154)	-0.431***	(0.153)
MANUFACTURES	0.1963	(0.454)	-0.131	(0.121)	-0.088	(0.116)
Mill's ratio		-0.228*	(0.125)	-0.183*	(0.094)	
cons	-9.889***	(3.138)	-3.019***	(0.487)	-2.529***	(0.455)
Obs.	775		775		340	

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Ref.: Reference variable

Table 3
Estimation of the adoption of ICT (year 2012)

Variables	*COMPUTER*		*INTERNET*		*E_ BUSINESS*	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*
TXUCOMP	-0.334	(5.5139)	2.215**	(0.899)	0.951	(0.734)
PERCEIVEDEFFECT	1.907	(4.157)	2.763***	(0.890)	1.869*	(1.049)
AGE1	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
AGE2	-0.087	(3.775)	0.684	(0.598)	-0.533	(0.5007)
AGE3	4.627	(3.475)	-0.232	(0.491)	0.033	(0.432)
SIZE	8.605**	(3.787)	1.411**	(0.577)	0.654	(0.476)
SAL	0.854**	(0.497)	0.216**	(0.105)	0.043	(0.0767)
WCE	-0.00717	(0.1004)	-0.0172	0.0141)	-0.0099	(0.026)
FDI	7.907*	(4.459)	0.386	(0.723)	-0.014	(0.461)
EXPORT	0.544	(3.288)	-0.0412	(0.456)	-0.326	(0.378)
ISO	-4.583	(6.509)		0.985	(0.661)	
MOTIVATION	-0.524	(3.644)	0.771*	(0.605)	0.032*	(0.434)
ICTTRAINING	-5.0901	(5.204)	1.0178*	(1.243)	1.199*	(1.151)
ORGINNOV	1.824	(3.175)	0.323	(0.529)	0.106	(0.411)
FORMAL	1.791	(5.563)	-0.157	(0.966)	0.3670	(0.605)
MAN	0.165	(0.421)	0.318**	(0.149)	0.472*	(0.118)
AGEMANAGER1	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
AGEMANAGER2	-0.538	(3.385)	-0.227	(0.596)	0.202	(0.506)
AGEMANAGER3	0.215	(3.932)	0.101	(0.596)	0.635	(0.508)
AGEMANAGER4	8.818**	(3.698)	-0.0190	(0.568)	1.260***	(0.482)
PRIMARY	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
SECONDARY	0.591	(4.216)	-0.6305	(0.7102)	1.028	(0.646)
GCEA	0.992	(4.756)	1.351**	(0.684)	0.331	(0.682)
GCEA+	1.864	(3.643)	0.329	(0.5103)	1.140**	(0.462)
WEST	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
DOUALA	5.793	(4.288)	1.371**	(0.669)	1.059*	(0.551)
YAOUNDE	1.439	(4.512)	0.9202	(0.588)	-0.423	(0.523)
CONSTRUCTION	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
FOOD	0.8005	(4.483)	-0.242	(0.629)	0.086	(0.571)
MANUFACTURES	0.701	(3.974)	0.874	(0.604)	0.256	(0.472)
Mill's ratio		-0.859***	(0.316)	-0.431**	(0.186)	
cons	-6.993	(7.265)	-6.697***	(2.107)	-3.141**	(1.562)
Obs.	178		178		70	

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Ref.: Reference variable

of new technologies. Kossai *et al.* (2010) showed that the human capital of employees is the most significant explanatory variable of ICT adoption in Tunisia. Our results confirm that the percentage of staff who know how to use a computer is an ICT absorption variable in firms. Ssewanyana and Busler (2007) suggest that there is a need to expand ICT training for employees, including computers and internet services.

Like the human capital of employees, that of the leader is also positively and significantly related to the adoption of the internet and online business operations. Since investment in ICT is a source of productivity gains, the deployment and use of these digital tools requires skilled leaders, that is, those with higher levels of human capital. However, given the uncertainty associated with the introduction of new products and processes, it is the managers with the highest human capital - the best-informed and skilled leaders - who can cope with it and thus ensure the best possible results introduction and adoption of new technologies. Also, the positive perception that leaders have of the internet on their business positively impacts the adoption of ICT. Knowing that in Cameroon more than 90% of firms are SMEs and very small firms, the human capital of the manager is fundamental. VSEs and SMEs are mainly simple, highly centralized structures with a business owner where, in most cases, the owner and manager are one and the same person. The results also show that the leader's gender and age influence the adoption of ICTs for men and the elderly. A number of studies in Africa have revealed the importance of education (Kossai et al, 2010; Appiah *et al.*, 2016; Thuo *et al.*, 2017; Ben Youssef *et al.*, 2015), perception and sex (Ochola, 2015, Adebimpe, 2014) of the leader on ICT adoption in firm.

The stock-order effect and *the epidemic effect* show that the probabilities of adopting the internet and doing business online are higher for firms operating in the construction industry and in the city of Douala. Thus our results show that a firm tends to adopt ICT when it belongs to a sector of activity where the level of utilization of ICT is high. Here, we obtain the same results as Karshenas and Stoneman (1993) and Bocquet and Brossard (2008) who did not obtain the expected effect (negative sign). This positive effect of the stock-order effect equally found in the study of Ben Khalifa (2014) can come from a social conformism behavior of the market that incites the non-adopters to become adopters so as to remain competitive. There is therefore a greater intra sectorial homogeneity of adoption behaviors than between different sectors. In some sectors of activity several firms adopt ICT and encourage the others to adopt whereas in other sectors most of the firms do not adopt and incite others to do the same. This type of adoption behavior is equally found in firm in the same geographical area (*epidemic*

effect). It is therefore observed that in terms of ICT adoption firms behave in a similar manner to their peers irrespective of the type of proximity (sectorial or geographical). Moreover, the sectorial effect disappears with time since it is no longer significant in 2012. In other to be competitive, firms would adopt similar technologies as their competitors in the same sector. These technologies could also enable them to construct or main barriers to entry (Robertson and Gatignon, 1986). Thus, the proximity effects show that nowadays the adoption of ICT in Cameroonian firms would be the consequence of a geographical (or spatial) effect, which could be an infrastructural problem.

As for the impact of *organizational practices*, we notice that the training of the employees and organizational innovations are responsible for the adoption of ICT in firms. This positive effect corresponds to the results of several studies which show that the adoption of ICT is preceded by organizational changes in the firms so as to benefit much from this technology (in terms of productivity and growth) (Ben Youssef *et al.*, 2014 ; World Bank, 2016, Cirera *et al.*, 2016 ; Benabderrahmen *et al.*, 2016).

Table A4 of marginal effects shows that ICT adoption gaps have decreased over time. Several factors responsible for adoption gaps in 2009 are no longer in 2012 (size, age, location, etc.). In addition, we find that the motivation of employees increases the probability of firm to connect to the internet and to make online transactions of 10 points in 2009, against only 1 point in 2012. Similarly, be a manager with a level of university education increases the probability of connecting to the internet and making online transactions of 26 points against less than 10 points in 2012. These results show that over time these factors are less and less discriminating from the adoption of ICT in Cameroonian firms. However, the results show that the perception of the manager is the most important factor in the explanation of the digital divide in 2012. Indeed, a manager who has a positive perception of the use of the Internet has a probability of adopting internet and make online transactions of 34% and 41% respectively in 2009 and 2012.

5. CONCLUSION

In this paper, we have studied the determinants of the digital divide in Cameroonian industrial firms. The mobilization of OLS and probit with correction of selection bias gives us some results highlighting the important role of size, absorptive capacity (proportion of staff who know how to use ICT), organizational practices, the regional and managerial effect on the adoption of ICTs. However, the discriminatory effect of these factors narrows over time.

At the end of this study we can draw some lessons for the elaboration of a policy of diffusion of ICT. Thus, in terms of industrial policy, in other to extend the diffusion of ICT in the economic tissue of Cameroon and gain in competitiveness, it is essential to promote organizational changes in firms. It should also be apprehended that it is the quality of competence and the capacity of utilization of ICT and not the presence of employees with certificates (or white collar employees) that determines the level of adoption of these technologies in Cameroonian firms. It is therefore important to reconsider the education and training systems so as to improve the quality of certificates and workers in general. But most especially promote the specific trainings for promoters or managers with low levels of instruction. This involves the opening of windows on the possibilities offered by ICT so as to make them perceive the importance of these technologies in the firm. Public authorities have to equally give advantages of tax exemptions on computer material such that the adoption of these technologies extends to other firms, notably small firms which have limited financial capacity.

NOTES

* I wish to express my deep appreciation to African Economic Research Consortium (AERC) for the financial support to carry out this research. I am also grateful to the resource persons and members of AERC's thematic group D for various comments and suggestions that helped the evolution of this study from its inception to completion. I am indebted to the anonymous referees who reviewed the paper and provided comments and suggestions that helped in shaping and improving the overall quality of the paper. The findings made and opinions expressed in this paper are exclusively those of the author. The author is also solely responsible for content and any errors.

1. The ICT Development Index (IDI), which has been published annually since 2009, is a composite index that combines 11 indicators into one benchmark measure. It is used to monitor and compare developments in information and communication technology (ICT) between countries and over time.
2. Fabiani *et al.* (2005); Hollenstein and Woerter (2008); Bocquet and Brossard (2008); Haller and Siedschlag (2011).
3. Lal (1999); Indjikian and Siegel (2005); Nour (2011); Mughal and Diawara (2011); Gallego *et al.* (2015).
4. Democratic Republic of Congo, Ghana, Kenya, Tanzania, Uganda and Zambia.
5. Botswana Cameroon, Ethiopia Ghana Kenya Mozambique, Namibia Nigeria Rwanda South Africa, Tanzania Uganda Zambia Zimbabwe.
6. The correction of selection bias can, however, lead to heteroskedasticity problems. To correct this problem, the STATA software uses the Huber / White procedure.

REFERENCES

Adebimpe, L.A (2014). "The Determinant of use and impact Assessment of ICT as an Enhancing Tool in Small and Medium Scale Enterprises (SMEs) in Nigeria", *International Journal of Advanced Research in Computer Science*, 5 (8), 45-48.

Agence Nationale des Technologies de L'information et de la Communication (ANTIC), (2007). Données statistiques au Cameroun de la téléphonie fixe, mobile et de l'internet de 1999 à 2006. Available at: *http://www.antic.cm/images/stories/data/donneesTICCameroun.pdf.*

Agyire-Tettey, F. (2015). Adoption, returns and variation of information and communication technology in Sub-Sahara Africa, PhD thesis, University of Nottingham. *http://eprints.nottingham.ac.uk/29013/1/FAT_Thesis-%20Final.pdf.*

Alliance for Affordable Internet (A4AI) (2017). Affordability Report 2017, Washington DC, USA.

Alliance for affordable Internet (A4AI) (2014). Affordability Report 2014, Washington DC, USA.

Appiah K. M., Anin-Agyei J. and Manu E. P. (2016). "Electronic Commerce Adoption among SMEs in Ghana: Manifestation from Wa-Municipality", *The International Journal Of Business & Management Vol 4 Issue 4* (ISSN 2321–8916).

Bakehe, N. P., Fambeu A. H. and Tamokwé Piaptié G. B. (2016). "Adoption and usage of internet in Cameroon: an analysis of the stability of determinants", Final Report, AERC, 336.

Bayo-Moriones, A. and Lera-López, F. (2007). "A firm-level analysis of determinants of ICT adoption in Spain", *Technovation*, 27(6-7), 352-366.

Beccheti, L., Londono Bedoya, D.A. and Paganetto, L. (2003). "ICT Investment, Productivity and Efficiency: Evidence at Firm Level using a Stochastic Frontier Approach", *Journal of Productivity Analysis,* 20(2), 143-167.

Benabderrahmen, I., Bensalem Brahmi, M. and Hmida, M. (2016). "Explanatory Factors Determining of ICT Adoption Level in Tunisian Textile Companies", *Journal of Behavioural Economics, Finance, Entrepreneurship, Accounting and Transport*, Vol. 4, No. 1, 1-7.

Ben Khalifa, A. (2014). "Déterminants de la diffusion des TIC dans les pays Sud-Méditerranéens : Cas de la Tunisie", International Conference on Business, Economics, Marketing & Management Research (BEMM'13)Volume Book: Economics & Strategic Management of Business Process (ESMB) Copyright – IPCO Vol.2, 185-190.

Ben Youssef, A., Hadhri, W. and M'Henni, H. (2014). "Adoption of Information and Communication Technologies and New Organizational Practices in the Tunisian Manufacturing Sector", *Economics Bulletin*, Vol 34 (4), pp. 2237-2252.

Ben Youssef, A., Hadhri, W. and Meharzi, T. (2015). "Adoption of Cloud Computing in Emerging Countries: The Role of the Absorptive Capacity", *Systèmes d'Information et Management*, Eska, 20 (4).

Biagi, F. (2013). "ICT and productivity: A review of a literature", *Working Paper*, Institute for Prospective Technological Studies Digital Economy.

Bloom, N. Sadun, R. and Van Reenen, J. (2012). "Americans Do IT Better: US Multinationals and the Productivity Miracle", *American Economic Review*, 102(1), 167-201.

Bocquet, R. and Brossard, O. (2008). « Adoption des TIC, proximité et diffusion localisée des connaissances », *Revue d'économie régionale et urbaine*, n°3.

Brynjolfsson, E. and Hitt, L. (2000). "Beyond Computation: Information technology, Organizational Transformation and Business Performance", *Journal of Economic Perspectives*, 14, 23-48.

Brynjolfsson, E. and Hitt, L. (2003). "Computing Productivity: Firm Level Evidence", *The Review of Economics and Statistics*, 85(4), 793-808.

Carlsson, B. (2004). "The Digital Economy: What is New and What is Not?", *Structural Change and Economic Dynamics*, 15(3), 245-264.

CIPESA, (2017). A Framework for Calculating the Economic Impact of Internet Disruptions in Sub-Saharan Africa. www.cipesa.org.

Cirera, X., F. Lage , and Sabetti, L. (2016). "ICT Use, Innovation, and Productivity Evidence from Sub-Saharan Africa", *Policy Research Working Paper* 7868, *world Bank Group*, Trade and Competitiveness Global Practice Group.

Cohen, J. and Cohen, P. (1983). Applied Multiple Regression and Correlation Analysis for the Behavioral Sciences (2nd Edn.). Mahwah, NJ: Lawrence Erlbaum Associates.

Fabiani, S. Schivardi, F. and Trento, S. (2005). "ICT adoption in Italian manufacturing: firm-level evidence", *Industrial and Corporate Change*, 1-25.

Fambeu A.H. (2017). « L'Adoption des TIC dans un pays en développement », *Revue d'Economie Industrielle*, N ° 157, 61-101.

Fambeu, A. H. and Bakehe, N. P. (2015). "Interaction sociale et Usages de l'internet au Cameroun", *l'Actualité Economique/Revue d'Analyse Economique*, 91(4), pp. 421-460.

Gallego, J. M., Gutiérrez, L. H. and Lee, S. H., (2015). "A firm-level analysis of ICT adoption in an emerging economy: Evidence from the Colombian manufacturing industries", *Industrial and Corporate Change*, 24(1).

Geroski, P. A., (2000). "Models of Technology Diffusion", *Research Policy*, vol. 29, pp. 603-626.

Giunta, A. and Trivieri, F. (2007). "Understanding the determinants of information technology adoption: evidence from Italian manufacturing firms", *Applied Economics*, 39, 1325–34.

Gnansounou, S.U. (2010). « Utilisation des Technologies de l'Information et de la Communication dans les Entreprises Béninoises : Niveau d'Adoption et Effets sur la Performance », Projet de Renforcement des Capacités en Conception et Analyse des Politiques de Développement, Document de Travail n°005/2010.

Greene, W.H. and Hensher, D.A (2008). *Modeling Ordered Choices: A primer and recent developments*, Cambridge: Cambridge University Press.

Haller, S.A. and Siedschlag, J. (2011). "Determinants of ICT adoption: evidence from firm- level data», *Applied Economics*, 43(26).

Hollenstein, H. (2004). "Determinants of the Adoption of Information and Communication Technologies: an Empirical Analysis Based on Firm-Level Data

for the Swiss Business Sector", *Structural Change and Economic Dynamics*, 15(3), 315-342.

Hollenstein, H. and Woerter, M. (2008). "Inter- and intra-firm diffusion of technology: The example of E-commerce. An analysis based on Swiss firm-level data", *Research Policy*, 37, 545-564.

Holt, L. and Jamison, M. (2009). "Broadband and Contributions to Economic Growth: Lessons from the US Experience", *Telecommunications Policy*, 33, 575-581.

Institut National de la Statistique (2009). « Recensement Général des Entreprises (RGE) : document de Nomenclatures », INS Cameroun.

Indjikian, R. and D. Siegel, S. (2005). "The Impact of Investment in IT on Economic Performance: Implication for Developing Countries", *World Development* Vol. 33, No. 5, pp. 694-698.

International Telecommunication Union (2016). ICT Facts and Figures 2016, Geneva, Switzerland.

Karshenas, M. and Stoneman, P. (1993). "Rank, Stock, Order and Epidemic Effects in the Diffusion of New Process Technology", *Rand Journal of Economics*, 24 (4): 503-527.

Kontolaimou, A. et Skintzi, G. (2018). « E-commerce and Information and Communication Technologies in Greek firms », *ÊÅPÅ, Greek Economic Outlook*, issue 36, pp. 83-90.

Kossaï, M., Lapa de Souza, M. L., Ben Zaied, Y. and Nguyen, P. (2019). "Determinants of the Adoption of Information and Communication Technologies (ICTs): the Case of Tunisian Electrical and Electronics Sector", *Journal of the Knowledge Economy*, pp 1–20. https://doi.org/10.1007/s13132-018-0573-6.

Kossai, M., Lapa de Souza, M.L. and Roussel, J. (2010). « Adoption des technologies de l'information et capital humain : le cas des PME tunisiennes », *Management et Avenir*, 31, 131-159.

Kretschmer, T. (2012). "Information and Communication Technologies and Productivity Growth: A Survey of the Literature", *OECD Digital Economy Papers*, 195.

Lal, K. (2007). "Globalization and Adoption of ICTsin Nigerian SMEs", *Science, Technology Society*, 12(2), 217-244.

Lehr, B. and Lichtenberg, F. (1999). "Information Technology and its Impact on Productivity: Firm Level Evidence from Government and Private Data Sources, 1977- 1993", *Canadian Journal of Economics*, 32, 335-362.

Machikita, T., Tsuji, M. and Ueki, Y. (2010). "How ICTs Raise Manufacturing Performance: Firm-level Evidence in Southeast Asia", Papers DP-2010-07, Economic Research Institute for ASEAN and East Asia.

Mansfield, E. (1961). "Technical Change and the Rate of Imitation", *Econometrica* 29, 741-766.

Marquardt, D. W. (1970). "Generalized Inverses, Ridge Regression, Biased Linear Estimation and Nonlinear Estimation", *Technometrics*. 12(3), pp. 591–612.

Mason, R. L., Gunst, R. F. and Hess, J. L. (1989). Statistical Design and Analysis of Experiments: Applications to Engineering and Science. New York: John Wiley and Sons, Inc.

Matteucci, N., O'Mahony, M., Robinson, C. and Zwick, T. (2005). "Productivity, Workplace Performance and ICT: Industry and Firm-Level Evidence for Europe and the US", *Scottish Journal of Political Economy*, 52(3), 359-386.

Milgrom, P. and Roberts, J. (1995). « Complementarities and fit strategy, structure and organizational change in manufacturing », *Journal of Accounting and Economics*, 19, 179-208.

Milgrom, P. and Roberts, J. (1990). « The Economics of Modern Manufacturing: Technology Strategy and Organization », *The American Economic Review*, 80(3), 511-528.

Mughal, M. and Diawara, B. (2011). "Human Capital and the Adoption of Information and Communications Technologies: Evidence from Investment Climate Survey of Pakistan", Economics Discussion Papers, No 2011-21, Kiel Institute for the World Economy.

Nkouka, S. L. (2014). "Déterminants de l'adoption des technologies de l'information et de la communication (TIC) : Cas des petites et moyennes entreprises (PME) au Congo." *Revue internationale P.M.E.,* 272 : 115–133.

Nour, S. (2011). "The Use and Economic Impacts of ICT at the Macro-Micro levels in the Arab Gulf Countries", Maastricht Economic and social Research Institute on Innovation and Technology, UNU-MERIT Working Papers, 059.

Nyirenda-Jere, T. and Biru, T. (2015). "Internet development and Internet governance in Africa", *Internet Society*.

Ochola, P. (2015). "An empirical study of determinants of e-commerce adoption amongst micro, small and medium enterprises (msmes) in Kenya », *International Journal of Economics, Commerce and Management* United Kingdom Vol. III, Issue 12, ISSN 2348 0386

OECD, (2004). *The Economic Impact of ICT, Measurement, Evidence and Implications*, OECD, Paris.

Oliner, S.D., Sichel, D.E. (2000). "The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?", *Journal of Economic Perspectives*, 14, 3-12.

Olise Moses C., Anigbogu, T. U. Edoko, T. D. and Okoli, M. I. (2014). "Determinants of ICT Adoption for Improved SME's Performance in Anambra State, Nigeria", *American International Journal of Contemporary Research* Vol. 4, No. 7; 163-176.

Ssewanyana, J. and Busler, M. (2007). "Adoption and Usage of ICT in developing Countries: Case of Ugandan Firms", *International Journal of Education and Development using ICT*, Vol. 3, No. 3.

Tamokwe Piaptie, G. B. (2013). « Les déterminants de l'accès et des usages d'internet en Afrique Subsaharienne Analyse des données camerounaises et implications pour une politique de développement des TIC », *Réseaux*, 180(4), 95-121.

Theil, H. (1971). Principles of Econometrics. New York : John Wiley & Sons, Inc.

Thuo, S. N., Kenyatta, U. and Namusonge, M. (2017). "Determinants of Adoption and Usage of ICT by Small and Medium Enterprises in Kenya: The Case of Kikuyu Sub-County in Kiambu County", *European Journal of Business and Strategic Management* ISSN 2518-265X (Online) Vol.2, Issue 1 No.2, pp 15–28.

Timmer, M. and Van Ark, B. (2005), "Does Information and Communication Technology Drive EU-US Productivity Growth Differentials?", *Oxford Economic Papers*, 57, 693-716.

Union Internationale des Télécommunications (UIT) (2014), Rapport: Mesurer la société de l'information 2014 : Résumé analytique, CH-1211 Genève Suisse.

Van De Ven, W. and Van Praag, B. (1981), "The demand for deductibles in private health insurance: a Probit model with sample selection", *Journal of Econometrics*, vol. 17, pp. 229-252.

World Bank, (2016), *World Development Report 2016: Digital Dividends*, World Bank, Washington DC.

APPENDIX

Table A1: Descriptive statistics

	2009					2012				
Variables	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
COMPUTER	448	0.8203321	5.814077	0	120	141	7.453901	17.53709	0	150
COMPUTER1	775	0.5380645	0.4988709	0	1	178	0.4494382	0.4988401	0	1
INTERNET	775	0.4387097	0.4965497	0	1	178	0.3876404	0.4885862	0	1
E_ BUSINESS	775	0.3341935	0.4720124	0	1	178	0.3033708	0.4610108	0	1
MOBILE						178	0.7977528	0.4028087	0	1
TXUCOMP	775	0.4541622	0.229132	0	1	178	0.5213067	0.3510656	0	1
PERCEIVEDEFFECT						178	0.4382022	0.497566	0	1
AGE1	775	0.2696774	0.4440788	0	1	178	0.3202247	0.4678789	0	1
AGE2	775	0.2735484	0.4460677	0	1	178	0.2191011	0.4148041	0	1
AGE3	775	0.396129	0.4894077	0	1	178	0.3707865	0.4843779	0	1
SIZE	775	0.4749082	0.5258548	0	1.386	178	0.4593615	0.5279217	0	1.386
WCE	775	1.753658	5.607137	0	119	178	4.089888	19.36923	0	253
SAL	331	7.052832	1.047874	3.113	11.988	178	8.396741	3.496723	0	16.585
RD	775	0.08	0.2714684	0	1	178	0.0786517	0.2699537	0	1
FDI	775	0.0374194	0.1899097	0	1	178	0.1235955	0.3300479	0	1
EXPORT	775	0.0425806	0.2020401	0	1	178	0.4775281	0.5009038	0	1
ISO	775	0.1187097	0.3236555	0	1	178	0.0561798	0.2309181	0	1
MOTIVATION	775	0.1909677	0.3933175	0	1	178	0.6516854	0.4777803	0	1
ICTTRAINING	775	0.04	0.1960857	0	1	178	0.8764045	0.3300479	0	1
INNOVORG						178	0.5617978	0.497566	0	1
FORMAL						178	0.3932584	0.4898513	0	1

Contd. table A1

Variables	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
MAN	775	0.7367742	0.4406683	0	1	178	0.6739587	0.4406	0	
AGEMANAGER1	775	0.0258065	0.1586599	0	1	178	0.3314607	0.4720661	0	1
AGEMANAGER2	775	0.1535484	0.3607481	0	1	178	0.2303371	0.4222363	0	1
AGEMANAGER3	775	0.163871	0.3703975	0	1	178	0.1629213	0.3703356	0	1
AGEMANAGER4	775	0.3509677	0.4775811	0	1	178	0.241573	0.4292442	0	1
PRIMARY	775	0.0348387	0.1834896	0	1	178	0.2134831	0.4109218	0	1
SECONDARY	775	0.116129	0.3205865	0	1	178	0.247191	0.4325956	0	1
GCEA	775	0.0941935	0.2922864	0	1	178	0.0955056	0.2947411	0	1
GCEA+	775	0.3819355	0.4861746	0	1	178	0.3707865	0.4843779	0	1
DOUALA	775	0.6451613	0.4787734	0	1	178	0.5786517	0.495168	0	1
YAOUNDE	775	0.2877419	0.4530025	0	1	178	0.2808989	0.450706	0	1
WEST	775	0.670968	0.2503511	0	1	178	0.1404494	0.3484328	0	1
FOOD	775	0.1987097	0.3992867	0	1	178	0.1966292	0.3985707	0	1
MANUFACTURES	775	0.483871	0.5000625	0	1	178	0.6292135	0.4843779	0	1
CONSTRUCTION	775	0.3174194	0.4657727	0	1	178	0.1741573	0.3803145	0	1

Table A2
Description of variables

Variables	*Definition*
Dependent variables	
COMPUTER	Number of functional computers
COMPUTER1	= 1 if the firm has at least one working computer and 0 otherwise
INTERNET	= 1 if the firm has an internet connection and 0 otherwise
E_ BUSINESS	= 1 if the firm does business operations online and 0 otherwise
Rank variables	
TXUCOMP	Part des employés permanents sachant utiliser un ordinateur
AGE	AGE1 = 1 if Age of firm <5 years and 0 otherwise (ref. Group); AGE2 = 1 if 5-9and 0 otherwise; AGE3 = 1 if 10 and more and 0 otherwise
SIZE	Log of the number of permanent employees
SAL	Log of average salary of permanent employees
WCE	=1 if there is at least one white collar employee in the firm and 0 otherwise
RD	= 1 if the firm has invested in R&D or has made experimnetal R&D in thefirm and 0 if not
FDI	= 1 if the firm is a foreign affiliate ; 0 if not
EXPORT	=1 if the firm produces mainly for exports ; 0 if not
FORMEL	= 1 if the firm has a taxpayer number and 0 otherwise
Stock-order variable	
Sector	FOOD = 1 if the firm is in the food industry and 0 otherwise; MANUFACTURES =1 if the firm is in other manufacturing industries and 0 otherwise; CONSTRUCTION = 1 if the firm is in the construction industry and 0 otherwise
Epidemic variable	
Region	DOUALA = 1 if the firm is located in Douala; YAOUNDE = 1 if the firm is locatedin Yaoundé; WEST = 1 if the firm is located in the west region
Variables organisation nelles	
MOTIVATION	= 1 if the firm pays social benefits other than transport and housingallowances and CNPS contributions in order to motivate employees and 0 otherwise
ICTTRAINING	= 1 if the firm has provided training to employees related to new technologiesand 0 otherwise
ORGINNOV	=1 if the firm has made organisational innovations and 0 otherwise

contd. table A2

Variables	*Definition*
ISO	= 1 if the firm has an ISO certification and 0 otherwise
Characteristics of the manager	
MAN	= 1 if the manager is a man and 0 if not
AGEMANAGER	AGEMANAGER1 = 1 if 21-31 years and 0 otherwise (ref. Group);AGEMANAGER2 = 1 if 32-42 and 0 otherwise; AGEMANAGER3 = 1 if 43-53and0 otherwise; AGEMANAGER4 = 1 if 54 and over and 0 otherwise
EDUCATION	PRIMARY = 1 if the manager has at most the primary level and 0 otherwise (ref.Group); SECONDARY = 1 if the highest academic level of the manager is secondary and 0 otherwise; GCEA = 1 if the highest academic level of the manager is GCE A and 0 otherwise; GCEA+= 1 if the highest academic level of the manageris at least GCE A+2 and 0 otherwise;
PERCEIVEDEFFECT	= 1 if the manager thinks the internet has a positive effect on his firm and 0 otherwise

Table A3
Values of the variance inflation factor (VIF)

2009			*2012*		
Variable	*VIF*	*1/VIF*	*Variable*	*VIF*	*1/VIF*
AGEMANAGER4	4.14	0.241419	FORMAL	4.54	0.220272
AGEMANAGER3	3.43	0.291880	DOUALA	3.17	0.315341
AGEMANAGER2	3.24	0.308709	YAOUNDE	3.13	0.319973
GCEA+	2.16	0.462135	SIZE	2.90	0.344296
DOUALA	1.84	0.542009	PERCEIVEDEFFECT	2.54	0.393630
SECONDARY	1.82	0.550528	GCEA+	2.28	0.437732
GCEA	1.74	0.574296	MANUFACTURES	2.27	0.441065
YAOUNDE	1.73	0.578073	FOOD	2.13	0.468746
FOOD	1.69	0.590433	AGE3	2.06	0.486252
AGE3	1.67	0.598809	AGEMANAGER4	1.98	0.505789
AGE2	1.60	0.624448	TXUCOMP	1.79	0.557313
SIZE	1.53	0.651599	SECONDARY	1.63	0.611955
MANUFACTURES	1.49	0.671256	AGEMANAGER3	1.59	0.628791
TXUCOMP	1.39	0.720030	MOTIVATION	1.54	0.648288
WCE	1.27	0.786373	AGEMANAGER2	1.52	0.658739
MOTIVATION	1.19	0.839145	FDI	1.49	0.671623
FDI	1.19	0.840716	GCEA	1.46	0.685122
ICTTRAINING	1.16	0.859792	AGE2	1.44	0.693880
ISO	1.11	0.896891	EXPORT	1.43	0.698440
EXPORT	1.05	0.948495	WCE	1.43	0.701661
		ICTTRAINING	1.22	0.817324	
		ISO	1.19	0.837634	
Mean VIF	1.82		Mean VIF	2.03	

Table A4
Marginal effects

	2009		*2012*	
VARIABLES	*INTERNET*	*E_ BUSINESS*	*INTERNET*	*E_ BUSINESS*
TXUCOMP	0.317***	0.246***	0.295	0.137
	(0.0948)	(0.0750)	(0.232)	(0.0958)
PERCEIVEDEFFECT			0.628***	0.411***
			(0.210)	(0.116)
AGE1	Ref.	Ref.	Ref.	Ref.
AGE2	-0.0142	0.00455	0.236	-0.0130
	(0.0519)	(0.0442)	(0.225)	(0.0621)
AGE3	0.0785*	0.0624	0.00284	0.0332
	(0.0476)	(0.0400)	(0.0961)	(0.0725)
SIZE	0.218***	0.136***	0.0439	0.00360
	(0.0465)	(0.0382)	(0.119)	(0.0711)
SAL			0.0296	0.0109
			(0.0265)	(0.0108)
WCE	0.00440	0.00526	-0.00135	-0.000443
	(0.00473)	(0.00346)	(0.00220)	(0.00219)
FDI	0.121	-0.0565		
	(0.129)	(0.0731)		
EXPORT	0.120	0.0174	0.0848	-0.0261
	(0.100)	(0.0778)	(0.124)	(0.0490)
ISO	0.0188	0.0672		
	(0.0592)	(0.0518)		
MOTIVATION	0.140***	0.106**	0.0816	0.0138*
	(0.0531)	(0.0456)	(0.104)	(0.0559)
ICTTRAINING	0.279**	0.131		
	(0.119)	(0.0917)		
ORGINNOV			0.0488	0.0309
			(0.0854)	(0.0511)
FORMAL			0.0782	0.0207
			(0.164)	(0.0709)
MAN	0.0154	(0.088)	(0.0114)	(0.1004)
	(0.0887)	(0.088)	(0.088)	(0.0777)
AGEMANAGER1	Ref.	Ref.	Ref.	Ref.
AGEMANAGER2	0.381***	0.233***	-0.0722	0.00869
	(0.0648)	(0.0700)	(0.0867)	(0.0674)
AGEMANAGER3	0.453***	0.316***	0.0756	0.128
	(0.0594)	(0.0672)	(0.166)	(0.126)

contd. table A4

VARIABLES	*INTERNET*	*E_ BUSINESS*	*INTERNET*	*E_ BUSINESS*
AGEMANAGER4	0.503***	0.325***	-0.0164	0.236
	(0.0497)	(0.0535)	(0.0965)	(0.146)
PRIMARY	Ref.	Ref.	Ref.	Ref.
SECONDARY	0.0840	0.0907	-0.0845	0.0648
	(0.0697)	(0.0654)	(0.111)	(0.119)
GCEA	0.219***	0.209***	0.455	0.0606
	(0.0744)	(0.0734)	(0.326)	(0.140)
GCEA+	0.322***	0.260***	0.0514	0.110*
	(0.0500)	(0.0466)	(0.121)	(0.0991)
WEST	Ref.	Ref.	Ref.	Ref.
DOUALA	0.216***	0.143***	0.226	-0.111
	(0.0490)	(0.0432)	(0.187)	(0.0987)
YAOUNDE	0.109*	0.0626	0.200	-0.0375
	(0.0612)	(0.0546)	(0.215)	(0.0604)
CONSTRUCTION	Ref.	Ref.	Ref.	Ref.
FOOD	-0.220***	-0.134***	-0.102	0.140
	(0.0467)	(0.0402)	(0.211)	(0.144)
MANUFACTURES	-0.0576	-0.0352	0.0335	0.0307
	(0.0442)	(0.0368)	(0.103)	(0.0599)
Mill's ratio	-0.0517	-0.0507	-0.126	0.0570*
	(0.120)	(0.0724)	(0.445)	(0.0313)
Obs.	946	340	178	70

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Ref.: Reference variable