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A General Model of Technology Diffusion and Productivity Growth: The Importance of Wireless Mobile Phone Technology in the Sectors of Nigeria's Economy

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This current study examines the effect of wireless telecom technology on productivity of various industry sectors of the economy in Nigeria. A model of technology diffusion studied by Acemoglu (2009) was used to explain differences in productivity and technology adaption across industries. Results found in the literature uphold the view that diffusion of technologies often lead to productivity gains. The primary goal of this study is to develop a general model of how the availability of Wireless Mobile Phone Technology aided the diffusion of technologies and enhance productivity growth rate in the sectors of Nigeria's economy. In addition, the study attempts to establish the the importance of Wireless Mobile Phone Technology in the sectors of Nigeria's economy and provide a theoretical and predictive model. The major findings are that the diffusion of this new mobile phone technology enhances labor productivity growth rate in various industrial sectors. This significant trend is outstanding in industries that are less dependent on telecoms technology and Wireless phone technology, therefore, helps to remove the inequality in the distribution of innovative benefits among industries.

Key Words: Wireless mobile phone technologies, production technology, capital accumulation, technology transfer, technology diffusion, Productivity

Introduction

Technology is strategic to the economic advancement of most developed countries of the World; countries such as USA, Britain, China, Japan, Germany and others. Clearly, telecom technologies play a great role in all the technical accomplishments of these aforementioned economies and technological super powers. The availability of wireless mobile phone technology and education decreases the cost of technology transfer from world frontiers of technology to the less technologically advanced countries (macro-level impact) (Nelson and Phelps, 1996). It is, then, logical to verify the extent of diffusion of these technologies to various sectors (industries) and their impact on productivity of these sectors (micro-level impact).

The implementation of the deregulation policy in Nigeria's telecom industry in 1999 leads to an intensive and extensive adoption of wireless mobile phone technologies in virtually all sectors of the economy. The nternet is a component part of mobile phone technologies. This is generally believed to break barriers of entry to any industrial sector (The Economist, September 2000). It also enriches entrepreneurs and employees with new knowledge that leads to innovation and an increase in productivity.

Freund and Weinhold (2004) argue that it is cheaper to start a business venture online than to establish conventional stores or offices. In contrast, this study is investigating how the diffusion of mobile phone technologies in various industries has led to an increase in labor productivity in these industries. Hence, the primary objective of this research is to examine whether the telecom technologies diffusion has the capacity of increasing productivity in the recipient industries. Furthermore, whether it also has the ability to reduce cost and improve internal industry innovation (Tehranian, 1997). Bearing all these considerations in mind, this current research would attempt to develop a theoretical model for mobile phone technology diffusion on productivity and verify how telecom technology diffusion has influenced productivity of various sectors of Nigeria's economy. Hence, the primary objective of this study is to develop

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a general model of how the availability of Wireless Mobile Phone Technology aided the diffusion of technologies and enhance productivity in the Sectors of Nigeria's Economy.

Literature Review

Evidence-based analyses found in a great deal of the literature uphold the view that diffusion of telecommunication technologies lead to productivity gains. For example, the works of Disney, Haskel and Heden (2003) confirm this assertion. In another development, Bloom, Blundell, Griffith, and Howitt (2005) conclude in their study that diffusion of telecommunication technologies may create higher innovative activity and, hence increase productivity. This is the main finding the research strives to substantiate in this further investigation. On the impact of telecommunications technologies on the overall performance of an economy, Jerbashian and Kochanova (2013) discuss that diffusion of telecommunications technologies intensifies competition. This, in turn, leads to increased productivity. Their empirical findings show a mechanism on how the use of a particular type of information and computer technology can contribute to economic performance. This argument agrees with the productivity improvement mechanism that has been cited above and in other literatures.

There are very recent literatures on the effects of mobile phones technology on agricultural development in particular. It has been shown that cell phones allow farmers to know the weather or input and output prices at the nearest market. Then, farmers can better predict when to plant the seeds, harvest the crops, and sell the crops. This reduces price dispersion and enhances productivity (Jensen, 2007 and Aker, 2010). There is also a literature on the effects of cell phones on mobile money, saving rates, and investment rates. Tavneet Suri, 2011 and David Weil Brown observe that mobile phone technology increases productivity in the financial sector. It is also further observed that mobile phones help in reminding HIV patients on timely intake of their retroviral drugs. These sectors before the advent of mobile phone technology were less dependent on phone services.

Czernich *et al.* (2011) found through empirically tested study that the diffusion of telecommunication technologies might lead to a positive impact on the level of productivity in individual economic sectors that transform to overall economic development and growth. These findings are also in conformity with the results obtained by Roller and Waver Mann (2001). Of course, the theoretical model of this study argues along this same line. In addition, it contributes that the diffusion of mobile phone technologies in various sectors of Nigeria's economy increases their labor productivities.

In addition, the study conducted by Jensen (2007) and Lee (1998) supports this research's claim as stated above. My study opines that there is a labor productivity improvement emanating from the application of mobile phone technology. For instance, there is a change from physical mail to email that has reduced cost. Arrow (1969) as cited by Teece (1977) that the cost of communication or information transfer is a fundamental factor influencing the worldwide diffusion of technology further confirms this claim. Tresse (2008) supports also the view of complementarities of Information and Computer Technology in the technology diffusion process that is also embedded in mobile phone technologies.

In the International Monetary Fund working paper (Thierry Tressel, 2008) that studied the productivity performance of Australian economy, it was broadly found that among the Organization for Economic Co-operation and Development (OECD) countries, reforms of the product market significantly affected Marginal Factor Productivity growth in industries that use ICT intensively. The reason could be that it is a relatively cheap method of communication and information gathering. In the same way, the study further confirms the significance of research and development (R&D) for the speed of technological diffusion. Though the study confirmed evidence of human capital externalities at the industry level, it does not necessarily indicate that more R&D) would always lead to higher productivity. This study also confirms the observation made above on R&D. It does not necessarily lead to greater productivity but the more the industries depend on mobile phone technologies the less the marginal rate of technology diffusion impact.

Nelson and Phelps (1966) agreed that industries that have high human capital (more educated labors) could facilitate the adoption of new technology. Freund and Weinhold (2002 &2004) found that access to the internet increases trade in goods that is consistent with a model where there are market-specific fixed information. In this case, search costs w reduced and more trade brings in more technology and its adoption. Arrow (1969) finds that the cost of communication or information transfer is a fundamental factor influencing the worldwide diffusion of technology which availability of mobile phone technology has reduced in Nigeria.

Blundell, Griffith and Van Reenen (1999) proved that diffusion of technologies also creates higher innovative activity. Etro (2009) stated that there exists a theoretical view that diffusion of telecoms technologies reduces the original investment costs in the computer hardware and software because it supports cloud computing. In summary, this study contributes to the literature that diffusion of mobile phone technology in industries leads to an increase in labor productivity of those industries.

A Model of Technology Diffusion

This model, based on Acemoglu (2009), studies how the economy's latest technology diffuses to different industries and how it influences their productivities. The model's results help to explain productivity differences across industries.

Production Technology

Suppose an economy consists of I industries (i = 1, 2… I) where each industry produces a unique final product with the following production technology: $Y_{it} = F(K_{it}, A_{it}L_{it})$ (1.1)
where Y_{it} is the output of the final good i at time t, K_{it} and L_{it} are the capital and the labor employed for production in industry i at time t respectively, and A_{it} is the level of technology available in industry i at time t. Time is continuous. Technology is labor-augmenting. The production function $F: R_+^3 \to R_+$ is twice differentiable in K and L and satisfies $F_K \equiv \frac{\partial F}{\partial K} > 0$, $F_L \equiv \frac{\partial F}{\partial L} > 0$, $F_{KK} \equiv \frac{\partial^2 F}{\partial K^2} < 0$, and $F_{LL} \equiv \frac{\partial^2 F}{\partial L^2} < 0$. F exhibits constant returns to scale in its two arguments and also satisfies the *Inada* conditions: $lim_{K\to 0}F_K = \infty$ and $lim_{K\to\infty}F_K = 0$ for all $AL > 0$, $lim_{L\to 0}F_L = \infty$ and $lim_{L\to\infty}F_L = 0$ for all $K, A > 0$.

Labor productivity in industry i at t is

$$y_{it} \equiv \frac{Y_{it}}{L_{it}} = A_{it}F\left(\frac{K_{it}}{A_{it}L_{it}}, 1\right) = A_{it}F(k_{it}, 1), \tag{1.2}$$

where k_{it} is the effective capital-labor ratio in industry i at t,

$$k_{it} \equiv \frac{K_{it}}{A_{it}L_{it}}. \tag{1.3}$$

Suppose that labor in industry i grows at a constant rate $n_i \geq 0$, i.e.,

$$n_i \equiv \frac{\dot{L}_{it}}{L_{it}}, \tag{1.4}$$

and that capital depreciates at a common rate δ ≥ 0 for all industries.

Capital Accumulation

The capital accumulation in industry i at t is described as

$$\dot{K}_{it} = x_i Y_{it} - \delta K_{it}, \tag{1.5}$$

where $x_i \in (0,1)$ is the rate of investment in capital in industry i which is assumed to be constant for all t. Then from eqs. (1.2), (1.3), and (1.4), we may rewrite eq. (1.5) as

$$\dot{k}_{it} = x_i \frac{Y_{it}}{A_{it}L_{it}} - \left(\frac{\dot{A}_{it}}{A_{it}} + n_i + \delta\right)k_{it} = x_i f(k_{it}) - (g_{it} + n_i + \delta)k_{it}, \tag{1.6}$$

where g_{it} is the growth rate of technology in industry i at time t, i.e.,

$$g_{it} \equiv \frac{\dot{A}_{it}}{A_{it}}. \tag{1.7}$$

The initial values of k_{it} and A_{it} are given for each industry i = 1, 2,…, I.

Process of technology diffusion

We define the level of the economy's latest technology level at t by X_t. Let us assume that X_t grows at a constant rate,

$$g \equiv \frac{\dot{X}_t}{X_t} > 0 \tag{1.8}$$

where the initial value of X_t is given at $X_0 > 0$. As X_t can be interpreted as the maximum possible technology that can be adopted in any industry i at t in the economy,

$$A_{it} \leq X_t, \tag{1.9}$$

for all i and t.

The diffusion of the economy's latest technology to each industry is modeled as a gradual process:

$$\dot{A}_{it} = \sigma_i(X_t - A_{it}) + \lambda_i A_{it} \tag{1.10}$$

where σ_i is the rate at which industry i absorbs the economy's latest technology and λ_i is the rate of internal innovation which can occur based on the available technology, A_{it} in industry i at time t. We also assume $\lambda_i < g$ for all i = 1, 2…I, that is the internal technological progress rate never exceeds the growth rate of the economy's latest technology. The parameters σ_i and λ_i are industry specific and vary across industries. The smaller σ_i and λ_i indicate that the industry adopts the economy's latest technology only slowly. Eq. (1.10) also implies that A_{it} grows faster in industries that have currently low A_{it} compared to the economy's latest technology, X_t, because they have more technology to absorb.

On the other hand, A_{it} grows only slowly in industries that have already high A_{it} because there is not much difference, $X_t - A_{it}$, that remains to be absorbed for them. Let us define the industry i's state of the technology adoption as

$$a_{it} \equiv \frac{A_{it}}{X_t} \tag{1.11}$$

From eqs. (1.8) and (1.10), we may rewrite eq. (1.11) as

$$\dot{a}_{it} = \sigma_i - (\sigma_i - \lambda_i + g)a_{it}, \tag{1.12}$$

where the initial value of a_{it} is given as $A_{i0}/X_0 > 0$.

Equilibrium Analysis

The equilibrium of the economy is defined as the path of (k_{it}, a_{it}) that satisfies the differential equations (1.6) and (1.12) for all *i* and *t*. As there are I industries in the economy, there are 2I differential equations.

First, we analyze the steady- state of the economy. At a steady state, $\dot{k}_t = \dot{a}_t = 0$ for each *i* = 1, 2,…, I.

Proposition 1. *The steady state-level of effective capital-labor ratio, k_i^*, in industry i is increasing in x_i and decreasing in n_i and δ.*

Proof of Proposition 1:

From eqs. (1.7), (1.8), and (1.11), we get

$$\frac{\dot{a}_{it}}{a_{it}} = g_i - g \tag{1.13}$$

Since $\dot{k}_t = \dot{a}_t = 0$ holds in a steady state,

$$g_i = g, \tag{1.14}$$

for all *i* = 1,2,…, I.

Then from eqs. (1.6) and (1.14), the steady-state, k_i^*, must satisfy

$$x_i f(k_i^*) - (g + n_i + \delta)k_i^* = 0. \tag{1.15}$$

By using the implicit function theorem, we find that

$$\frac{\partial k_i^*}{\partial x_i} = \frac{-f(k_i^*)}{x_i f'(k_i^*) - (g + n_i + \delta)} > 0 \tag{1.16}$$

$$\frac{\partial k_i^*}{\partial n_i} = \frac{k_i^*}{x_i f'(k_i^*) - (g + n_i + \delta)} < 0 \tag{1.17}$$

$$\frac{\partial k_i^*}{\partial \delta} = \frac{k_i^*}{x_i f'(k_i^*) - (g + n_i + \delta)} < 0. \tag{1.18}$$

Note that the denominators of eqs. (1.16), (1.17), and (1.18) are negative because in a steady state, $f'(k_i^*) < f(k_i^*)/k_i^*$.

Proposition 2. *The steady-state level of technology adoption, a_i^* in industry i is increasing in σ_i* and λ_i.

Proof of Proposition 2:

From the steady-state condition $\dot{a}_t = 0$ and eq. (1.12), we obtain

$$a_i^* = \frac{\sigma_i}{\sigma_i - \lambda_i + g} \tag{1.19}$$

By taking derivatives of equation (1.19) with respect to σ_i and λ_i, we find that

$$\frac{\partial a_i^*}{\partial \sigma_i} = \frac{-\lambda_i + g}{(\sigma_i - \lambda_i + g)^2} > 0, \tag{1.20}$$

and

$$\frac{\partial a_i^*}{\partial \lambda_i} = \frac{\sigma_i}{(\sigma_i - \lambda_i + g)^2} > 0, \tag{1.21}$$

respectively. Note that by assumption, $\lambda_i < g$ for all *i* = 1, 2,…, I.

Proposition 3. *There exists a unique steady-state equilibrium of the economy at which the labor productivity in all industries grows at the same rate $g > 0$.*

Proof of Proposition 3:

From eq. (2), the labor productivity in industry i grows at

$$\frac{\dot{y}_{it}}{y_{it}} = \frac{\dot{A}_{it}}{A_{it}} + f'(k_{it})\frac{\dot{k}_{it}}{k_{it}} = g_i + f'(k_{it})\frac{\dot{k}_{it}}{k_{it}} \tag{1.22}$$

From the steady-state condition $\dot{k}_t = 0$ and eq. (1.14), the steady-state labor productivity grows at $\dot{y}_{it}/y_{it} = g$ for all *i* = 1, 2,…I.

Proposition 4. *The steady-state equilibrium of the economy is globally stable.*

Proof of Proposition 4:

Eq. (1.12) is a first-order differential equation that depends on a_{it} only. Thus, we can solve this differential equation explicitly. First, we arrange eq. (1.12) as

$$\int_0^t \{\dot{a}_{i\tau} + (\sigma_i - \lambda_i + g)a_{i\tau}\} e^{(\sigma_i - \lambda_i + g)\tau}\, d\tau = \sigma_i \int_0^t e^{(\sigma_i - \lambda_i + g)\tau}\, d\tau, \tag{1.22}$$

where τ is a time subscript. Then we can rewrite eq. (22) as

$$\int_0^t \frac{\partial}{\partial \tau}\left(a_{i\tau} e^{(\sigma_i-\lambda_i+g)\tau} + c_0\right) d\tau = \frac{\sigma_i}{\sigma_i-\lambda_i+g} \int_0^t \frac{\partial}{\partial \tau}\left(e^{(\sigma_i-\lambda_i+g)\tau} + c_1\right) d\tau,$$

$$\left[a_{i\tau} e^{(\sigma_i-\lambda_i+g)\tau} + c_0\right]_0^t = \frac{\sigma_i}{\sigma_i-\lambda_i+g}\left[e^{(\sigma_i-\lambda_i+g)\tau} + c_1\right]_0^t,$$

$$a_{it} e^{(\sigma_i-\lambda_i+g)\tau} - a_{i0} = \frac{\sigma_i}{\sigma_i-\lambda_i+g}\left(e^{(\sigma_i-\lambda_i+g)t} - 1\right). \quad (1.23)$$

Solving eq. (1.23) for $a_{it,}$ we get

$$a_{it} = a_{i0} e^{-(\sigma_i-\lambda_i+g)t} + \frac{\sigma_i}{\sigma_i-\lambda_i+g}\left(1 - e^{-(\sigma_i-\lambda_i+g)t}\right). \quad (1.24)$$

From eq. (1.19), the coefficient in the second term is the steady-state a_i^*. Thus eq. (1.24) can be expressed as

$$a_{it} = a_{i0} e^{-(\sigma_i-\lambda_i+g)t} + a_i^*\left(1 - e^{-(\sigma_i-\lambda_i+g)t}\right). \quad (1.25)$$

By taking a limit of eq. (1.25), we find that

$$\lim_{t \to \infty} a_{it} = a_i^* \quad (1.26)$$

This means that regardless of the initial valuea_{i0}, a_{it} asymptotically approaches its steady-state value. Thus the path of a_{it} is globally stable. Given the fact that a_{it} is globally stable, we find that k_{it} is also globally stable.

Proposition 5. *The steady-state level of labor productivity, y_i^*, in industry i is increasing in σ_i, λ_i, and x_i, and decreasing in n_i and δ.*

Proof of Proposition 5:

From eq. 1.2, steady-state y_i^*, is

$$y_i^* = A_{it}^* f\left(k_i^*(x_i, n_i, \delta)\right). \quad (1.27)$$

From eqs. (1.8), (1.11) and (1.19),

$$A_{it}^* = a_i^* X_t = a_i^* X_0 e^{gt}. \quad (1.28)$$

Plugging eq. (1.28) in eq. (1.27), we obtain

$$y_i^* = a_i^* X_0 e^{gt} f\left(k_i^*(x_i, n_i, \delta)\right). \quad (1.29)$$

By taking derivatives of eq. (1.29) with respect to σ_i, λ_i, x_i, n_i *and* δ, and using the results from Propositions 1 and 2, we find

$$\frac{\partial y_i^*}{\partial x_i} = a_i^* X_0 e^{gt} f'(k_i^*) \frac{\partial k_i^*}{\partial x_i} > 0, \quad (1.30)$$

$$\frac{\partial y_i^*}{\partial n_i} = a_i^* X_0 e^{gt} f'(k_i^*) \frac{\partial k_i^*}{\partial n_i} < 0, \quad (1.31)$$

$$\frac{\partial y_i^*}{\partial \delta} = a_i^* X_0 e^{gt} f'(k_i^*) \frac{\partial k_i^*}{\partial \delta} < 0, \quad (1.32)$$

$$\frac{\partial y_i^*}{\partial \sigma_i} = X_0 e^{gt} f(k_i^*) \frac{\partial a_i^*}{\partial \sigma_i} > 0, \quad (1.33)$$

$$\frac{\partial y_i^*}{\partial \lambda_i} = X_0 e^{gt} f(k_i^*) \frac{\partial a_i^*}{\partial \lambda_i} > 0. \quad (1.34)$$

Results and Implications

There are four important implications from the model. First, **i**ndustries that absorb the economy's latest technology faster (largerσ_i), innovate internally more (largerλ_i), and invest in capital at higher rates (largerx_i) tend to realize higher levels of technology adoption a_i^* and higher levels of labor productivity y_i^* in the steady state. Second, industries that have slower technology absorption rate (smallerσ_i) grow less than industries that have faster absorption rate (largerσ_i). Third, industry that have currently low technology level compared to the economy's latest technology level grow faster than those who have already high technology level because they have more technology to absorb. And fourth, despite the differences in industry-specific parameters (σ_i, λ_i, x_i, n_i), the growth rate (not the level) of labor productivity will eventually converge to the growth rate, g, of the economy's technology level. This implies that, in the long run, growth of industries depends only on the progress of the country's technology level.

The main results from the baseline specifications are presented in Table 1. For the estimation, least squares method was used. The dependent variable in the labor productivity growth rate, is taken as a naïve (natural) measure of productivity. The ordinary least squares regression is conducted. It is tested by dropping the variable R&D in regression. The estimates of the coefficients of dependence on mobile phone technology and mobile phone subscription rate are positive [2.794(5.254) and 0.083(2.623) respectively].

Table 1. Estimation Result of Technology Diffusion for high-R&D-intensive industries, low-R&D-intensive industries and all industries

	High R&D	P > | t |	Low R&D	P > | t |	All industries	P >|t|
Variables						
Mobile Subscription. Rate$_t$	0.044*	0.832	0.142*	0.198	0.083*	0.235
	(0.065)		(0.109)		(2.623)	
Dependence on Mobile Tech$_{it}$	0.729*	0.853	3.283*	0.594	2.794*	0.595
	(3.933)		(6.149)		(5.254)	
Mobile Subscript*Dependence$_{it}$	-1.78e-06*	0.504	- 0 .451*	0.221	-0.083*	0.656
	(0.0)		(0.366)		(0.187)	
Capital Labor Ratio$_{it}$	0.249	0.832	0.517*	0.397	2.121*	0.419
	(1.176)		(1.948)		(2.622)	
-Cons	1.174	0.80	-0.719	0.739	-0.547	0.806
	(1.174)		(2.152)		(2.219)	
Capital intensity	3.94e-06*	0.479	5.82e-07	739	5.96e-09	0.355
	(5.55e-06)		(3.49e-06)		(6.43e-09)	
Expenditure on R&D	-		-		-	
Number of Industries	8	8	9	9	17	17
Number of Observations	120	120	134	134	255	255
	R-Squared: 0.0099		R-Squared: 0.0424		R-Squared: 0.0349	

Dependent variable: Labor productivity growth rate and the levels of significance are 1%, 5% and 10%. The standard errors are robust and reported in parenthesis. The sample period is 1999-2016 (17 years).

The coefficients of the mobile phone subscription rate and dependence rate are significant at 10% level. The coefficient of the capital per labor ratio is also positive [2.121 (2.622)] implying that a rise in it leads to an increase in productivity. It is significant at 10% level. The interaction coefficient of mobile phone subscription rate and telecom technology dependence rate is negative [-0.083(0.187)]. This negative sign does not connote negative relationship between labor productivity and interaction of these two important variables rather it depends on how large the value of industry dependence rate on the mobile phone technology is to offset the impact of the negative sign when added to the coefficient of the mobile phone subscription rate. This point can be mathematically expressed by taking the first derivative of labor productivity growth rate with respect to mobile phone subscription rate. $\frac{\partial y_{it}^*}{\partial mph_t} = \beta_2 + \beta_4 dpn_{it} \gtreqless 0$ (1.35)

Table 2 shows the results of technology diffusion industry fixed effects for high-R&D- intensive industries, low- R&D-intensive industries and all industries. In order to confirm the authenticity of these results, some specification checks (fixed effects) tests are conducted and this study found that the values do not change.

Table 2. Results of Technology Diffusion industry fixed effects for high-R&D-intensive industries, low- R&D-intensive industries and all industries

	High R&D	P > | t |	Low R&D	P > | t |	All industries	P >|t|
Variables						
Mobile Subscription. Rate$_t$	0.048	273	0.147	0.033	0.088*	0.041
	(0.043)		(0.687)		(0.043)	
Dependence on Mobile Tech$_{it}$	32.256	0.494	20 210	0.893	38.333*	0.454
	(46.986)		(150.616)		(5254)	
Mobile Subscript*Dependence$_{it}$	-1.22e-06	0.504	- 0 .404	0.457	-0.072	0.724
	(0.0)		(0.542)		(0.206)	
Capital Labor Ratio$_{it}$	-4.534	0.126	-9.969	0.397	1.356	0.795
	(2.943)		(17.192)		(5.206)	
-Cons	-1.403	0.821	3.995	0.773	-3.566	0.498
	(1.174)		(13.826)		(5.251)	
Capital intensity	7.47e-06	0.479	-6.50e-06	235	9.26e-09	0.620
	(0.000)		(5.45e-06)		(1.86e-08)	
Expenditure on R&D	-		-		-	
Number of Industries	8	8	9	9	17	17
Number of Observations	120	120	134	134	255	255
R-Square:	0.0377, 0.0147,0.0013;		R-Square: 0.0558, 0.1170, 0.0015;		R-Square 0.0267,0.0028, 0.0023	
Hausman Test:	Chi2 (2) =3.14		Chi2 (2)=2.15		Chi2(2)=3.10	
	prob>chi2=(0.2082);		Prob>chi2= (0.5421)		Prob> 2 = (0.2122)	

Dependent variable: Labor productivity growth rate and the levels of significance are 1% , 5% and 10%. The standard errors are robust and reported in parenthesis. The sample period is 1999-2016 (17 years).

Conclusions

In this research, industry data are used to show the impact of diffused telecom technology on seventeen sectors labor productivity in Nigeria from 1999 to 2016. It is found that the diffusion of this new mobile phone technology enhances labor productivity growth rate in various industrial sectors. This significant trend is outstanding in industries that are less dependent on telecoms technology. This outcome confirms the claim of the model that industries that are hitherto not exposed to a new technology tend to gain more from its introduction. The diffusion effects are more pronounced in low-R&D-intensive industries than high-R&D-intensive industries. Therefore, it is the view of this current research that mobile phone technology bridges the gap created by less investment in research by low-R&D-intensive industries even though it is a little bit at variance with what the model says on innovation. In another development, the mobile phone technology diffusion impact in high-capital-intensive industries is higher than the impact in low-capital-intensive industries. The labor productivity gains that are widespread in the economy are affected by capital intensity.

Finally, it is right to believe that the claims and propositions of the model hold, and one can assert that marginal gains of mobile phone technology industry diffusion is higher in industries that are less dependent on it than those that are more dependent. Wireless phone technology, therefore, helps to remove the inequality in the distribution of innovative benefits among industries.

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