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Information Technology And Banking Productivityy: The Tunisian Case

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ABSTRACT*: The development of technology in all economic sectors has led Tunisian banks gradually invest in new technologies of information and communication (NTIC). The purpose in what follows is how the performance of the banking sector, mainly banks deposit is affected by the new banking. Indeed, this technology currently represents one of the most important concerns of the bank and that is why we try to measure the impact. This paper aims to measure the performance of the Tunisian bank after following a program of innovation using primarily an econometric model that allows us to measure the impact of the introduction of new information technologies in the Tunisian banking system, the level of its production and respond to the problem, which seeks to show that innovations and changes experienced by the banking system have allowed the bank to regain its position as a financial intermediary.*

KEYWORDS: *Investment in Information technology (IT), financial innovation, Banking productivity.*

I. INTRODUCTION

Should we wish to quote one particular phenomenon which marked the transition from the twentieth to the twenty-first century, it is undoubtedly the emergence of information and communication technologies, which rapidly took over all aspects of economic and social life.Thus the development of technology in all economic sectors led Tunisian banks to gradually invest in new information and communication technologies (NICT). These have become essential for the development of banking. They are liable to influence the operating mode of Tunisian banks and their restructuring.With the dematerialisation of money, information technology has become a production tool (Rowe (1994)), giving it a privileged position in the process of banking production and raising on-going issues as to the pertinence of its reinforcement and how to optimise it. "Information technology management is an essential key to performance in banking" (Guillouzo and Thenet (2002)).Most studies of performance - information technology relations have been made in developed countries, essentially the USA, where the impact of information technology on growth is the most visible and above all where statistics are available.

This effect of information technology on the level of productivity and of banking profitability was barely studied outside developed countries until the very beginning of the twenty-first century. Only two empirical studies existed, one by Calderon and al. (2001) on Korean banks and the second by Eze (2001), until Chowdhury's work (2003) on the emerging markets. Although adopting new technologies is synonymous with extending the field of action of banks, the main reason has proved to be the desire to improve productivity. Cooke (1997) found a positive effect of information technology on efficiency and minimising risk, even if it is incapable of supplying new products. Productivity gains can furthermore be greater if the number of data processing tool failures is reduced.Improving productivity has long been a major strategic stake for banks and remains so. Our main objective is to measure the impact of information technology, as an innovation, on banking productivity. However, indicators of the impact of this technology on productivityare not available. Marrakchi (2000) emphasizes that "we have no detailed figures in terms of percentage of the effect of technology on productivity. For my part, I have seen no figures."If we use the particular form of production function adopted by Chowdhury (2003) and 'applied to only one year (1999), although he took several developed countries as a sample, we can econometrically estimate the contribution of investments in information technology to the level of marginal productivity.

Thanks to the findings of one survey (Ben Romdhane and Rajhi (2003)), it is interesting to note that the thirteen retail banks surveyed all use the new modes of distribution, made up of bankcards, automatic cash points, payment terminals, SWIFT, Internet and "home banking" networks, as well as financial information networks which have been introduced recently. As part of the national strategy of modernisation of methods of payment, these banks are also connected to the electronic compensation system for which they have set up a distance compensation service. According to the findings of the survey, the average number of network processing units

(microcomputer, printer, scanner etc.) is quite high and the fruit of enormous investments in technology.
For our reasoning, we would have liked to apply this model to a maximum number of Tunisian deposit banks but access to the statistics we need is almost impossible. The data we have was given to us by the BIAT (Tunisian International Arab Bank) and will be used as a sample for our model. We can consider these figures to be sufficient for the needs of our analysis which is based on a deductive and non comparative approach, particularly as there is a similitude in the relevant technologies of the deposit banks. These figures date from the year in which the investments in information technology equipment were made.
The paper is organised as follows. Section 2 reviews Productivity-based analysis. Section 3 presents and discusses the results of estimations ; while the paper ends with concluding remarks in Section 4.

II. AN EMPIRICAL APPLICATION: INFORMATION TECHNOLOGY - PRODUCTIVITY RELATION

The production function : If we use the analysis made by Chowdhury (2003) for a certain number of developed countries, it is possible to estimate the impact of investments in information technology by adopting a production estimation function. As the cost-profit analysis of the investment in information technology is difficult to undertake because of the absence of measurement of income from the investment in technology, the production function linking the investment in information technology with production or with the measurement of output is considered as the best alternative (Parsons (1993)).
If we proceed with this operation, the banking company is modelled by a multifactor production function:
y_t= P(x_t(t),...x_k(t)) where x_t(t)...k(t) are the k inputs used to, produce the added value of the production of the firm at time t.
The production function is a Cobb-Douglas function which is written as follows:

$$Y = e^{a0}\, c^{a1} k^{a2} s^{a3} 1^{a4}$$

where:
Y: output of the firm;
C: capital invested in information technology;
K: capital input not invested in information technology; S: information technology labour input;
L: non information technology labour input;
a_1, a_2, a_3, a_4: associated output elasticity.

Using the following linear logarithmic equation, we can make an estimation:
Log (y_t) = a_0 + a_1 log (C_t) + a_2 1og (K_t) + a_3 log (S_t) + a_4 log(L_t) + μ_t ;where $\mu_t$is the error term.
Two testable hypotheses Hl and H2 derive from it:
H_1: $a_1 > 0$; $a_3 > 0$.

H_2:a_1 (output/capital in information technology) > 1;
a_3 (output/labour in information technology) > 1.
Hypothesis H_1tests whether there is a positive effect associated with information technology, whilst H_2tests whether the level of income procured by the investment in information technology is higher than its cost.

Data and sample : For our study we need five variables: an independent variable Y (output) measured by the net banking product (NBP) and four independent variables (inputs): C, K, S and L.
It should be noted that the total labour has been considered as a physical capital which is divided into information technology labour (S) and non information technology labour (L); the capital has been divided in the same way into (C) and (K).
This data was given to us, as already mentioned, by the BIAT over a period of time from 1987, when there was a real investment in information technology capital, until 2003.

The estimation function is written as :

$$\text{Log NPB} : B_1 \text{Log C} + B_2 \log k + B_3 \log S + B_4 \log L + \varepsilon D94 + \mu t$$

where:
Y: output of the firm;
C: capital invested in information technology;
K: capital input not invested in information technology; S: information technology labour input;
L: non information technology labour input;
μ_t: error term;

III. RESULTS AND INTRPRETATIONS

Our estimates are listed in Table1. As the model is specified in a logarithm, each is interpreted as an elasticity. For example, measures the elasticity of the net banking product in relation to the capital invested in information technology and the D94 variable is an indicator with a value of 1 from the year 1994 and 0 otherwise. It has been inserted in order to take into account the radical change observed in labour and also in the quality of the data processing capital.

Table 1 : Banking productivity : the incidence of information technology

	$\widehat{B_1}$	$\widehat{B_2}$	$\widehat{B_3}$	$\widehat{B_4}$	$\hat{\varepsilon}$	R^2	D-W	AIC	SC
Coefficient	0.040036 (0.498099) [0.6274]	0.113395 (1.924461) [0.0783]	0.185973 (3.754527) [0.0027]	0.878397 (20.8379) [0.0000]	-0.51211 (-11.162) [0.0000]	0.993868	1.97205	-2.7118	-2.4667

Note: The values in parenthesis represent the t-Student statistics.
The values in brackets are the probabilities to them respectively.

All the signs are plausible (they are positive) and the t of Student indicates that the K variable is not significant at the conventional threshold of 5 %, which is an unexpected result. However, this can be explained by the fact that our study focuses on capital invested in information technology and also by the fact that our model did not focus on several explanatory factors such as the structure of the capital and the bank's operation. The error terms are not correlated as the covariance is different from 0.
A durbin-watson test exhibit positive autocorrelation (DW: 1.97) very significant, nearly 2; and fisher's test confirmed this significance.

FISCHER = $(T - K - 1) / K) (R / 1 - R^2)$
= (17 - 6) / 5) (0.994 / (1– 0988)
= 364 > F α (5,11).
Hypothesis 1 which tests whether the investments in information technology have a positive effect on production is confirmed, as the coefficients of C (0.11) and S (0.18) are positive and statistically significant.
The coefficient of L is also positive and statistically significant. And the marginal production of S is the highest ($a_3\left(\overline{Y} / \overline{S}\right)$ = 0.18 (83626.53/1283.58) and equal to 11.727, followed by that of L ($a_4\left(\overline{Y} / \overline{C}\right)$= 0.87 (83626.53/27354.53) at 2.65 and that ofC ($a_1\left(\overline{Y} / \overline{C}\right)$ = 0. 11 (83626.53/592412) equal to 1.601. This indicates that each of these three variables is associated with the progression of the bank's production (this result is close to Chowdhury's in the case of certain developed countries). For example, each dinar invested in information technology costs one dinar, so the income obtained from labour in information technology 3(S) stands at: $\Delta y_t / \Delta s_t = a_3$ (Y/ L) -1 = 10.727 > 0
and $\Delta y_t / \Delta c_t = a_1\left(\overline{Y} / \overline{C}\ Y / C\right)$- 1= 0.601 > 0.
Thus hypothesis 2 is confirmed and we can therefore conclude that capital investments in information technology have a positive impact on banking productivity. The variation of one unit of S produces 10.727 units of Y. Information technology is thus capable of improving productivity in the bank which we used as our sample. As we have already emphasized the similarities in the acquisition of new information technology by all the Tunisian deposit banks, this result can be taken into consideration for all these banks.

IV. CONCLUSION

This paper aims to study the relationship between information technology and banking productivity. With the introductionof bankinginnovationsandespecially newinformation technologies, theTunisian bankno longer contenttoits traditional roleof lender andborrowermoney, hisbusiness ismore, achieve financial engineeringoperations,isgiving it abetter productivityas we haveseenin the model.Using a cobb-douglass function over the period 1987-2003, our fundings show that information technology has a positive and significant impact on banking productivity.This result holds that Information technology is able to improve productivity within the bank that has served us as a sample and having previously reported similarity in the

acquisition of new information by all Tunisian banks deposits technologies this can be taken into account by all the banks.

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