International Research Journal of Applied Finance ISSN 2229 – 6891
Vol. VII Issue – 6 June, 2016 www.irjaf.com
DOI: 10.0706/article-2

The Impact of Financial Innovation on Interest Rate Spread in the Tunisian Banking Industry

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Abstract

This study aims at determining the effects of financial innovation on bank performance[1]. Specifically, we examine the effects of financial innovation on interest rate spread in the Tunisian banking industry over the 1987-2010 period. The results indicate that, contrary to our expectations, in Tunisia, the financial innovation process significantly affects spread pricing policy. We found that adoption of unconventional products, source of commissions, allows banks to offer lower spread rates, while the first mover's initiatives in process innovation increase spread rates. On the other hand, banks practicing lower spread rates are encouraged to be the first adopters of banking services and to first develop their own risk assessment system to cover their credit risk by building up provisions. Moreover, high spread rates do not encourage the bank to be the first mover in banking services but rather to imitate their adoption. High spread practice makes banks more willing to install a retailing apparatus and automated teller machines.

Key words: product innovation, process innovation, Performance, income, interest rate spread, first mover, imitation.
JEL codes: G21, , G28, O31, C33, C36, E43

I. Introduction

The banking sector is witnessing change, where the technological revolution, the emergence of new markets and the complexity of financial instruments are combined to push banks to deploy unprecedented efforts. This implies that it became imperative for all banks to introduce NICT in their distribution channels and increase their product offerings to stay ahead of competition. Thus, adoption of financial innovation became rather mandatory than optional. Hylton and Guangling (2016) found a significant decrease in the impact of technology and monetary policy shocks over three recession periods. Although financial innovation is accused of causing international crises (Betz, 2016), it continues to prevail. Indeed, it is still the way for banks to improve their performance (Dan Awrey, 2013; Frame and White, 2009; Batiz-Lazo and Woldesenbet, 2006). We focus on the first mover advantage because the bank-customer relationship is important (Berger and Dick, 2006).

Net interest income is fundamental to the bank. Indeed, banks collect deposits in exchange of paying a higher interest rate. Spread is the net interest margin between debts rate (especially for deposits) and assets rate (especially for loans). Following the Basel rules, banking spread rates have been considered as performance indicators of the banking system (A.Ghasemi and M.Rostami, 2016).

We note[2] that, except for the year 1999, deposits growth was less than that of credits before the volume of the latter reaches that of 2005 and then it increases again. This latter trend is probably explained by the increase in spread[3] observed from 2005, which discouraged

[1] And vice versa
[2] According to data of the Central Bank of Tunisia
[3] A high *spread* rate results in discouraging credits in favor of and vice versa. For instance, in 2005 an increase in the spread rate led to widening the gap between deposits and credits volume. In other words, an increase in spread rates is reflected in more collection of deposits than in granting credits.

DOI: 10.0706/article-2

granting credits in favor of collecting deposits. We note that in general the intermediation margin, currently practiced, is above the calculated spread. In addition, the noticed slowdown in granting credits can be also explained by the still high volume of bad debts. Moreover, in this regard Mabrouk and Mamoghli (2010) found that high levels of bad loans in the Tunisian banking sector discourage the introduction of traditional intermediation-based product innovations[4]. This last finding is supported by conducting regressions testing the reciprocal impact between financial innovation adoption and credit quality.

Income of Tunisian banks is limited to collecting interest income (mainly interest on loans) and non-interest income (fees and income on securities portfolio). Although the share resulting from granting credits has decreased, interest income is still the predominant share[5]. Change in income structure of Tunisian banks over time reflected their growing focus on non-traditional activities in order to face increasing competition.

These findings raised our interest in study the relationship between financial innovation and first bank earnings (interest income, non-interest income) and second interest rate spread charged by banks.

In this study, our aim is to examine the relationship between the adoption of financial innovation and bank performance in terms of income and interest rate spread, and before 2011. To this end, we use simultaneous equation modeling to control for any reverse causality bias. We believe that using the Control Function Approach would allow us to solve financial innovation and bank performance endogeneity problem (Mabrouk and Mamoghli, 2010). The aim is to avoid the negative impacts on the financial strength of the Tunisian banking system, resulting from the revolution and the country's political instability. This is to ensure a certain reliability of results and analysis. This study is structured as follows: after a brief introduction, section II presents the literature review. Section III describes the sample and data, while Section IV discusses the modeling procedure. Section V presents the analysis and interprets the results. Section VI summarizes the findings. Finally, Section VII suggests future research.

II. The Previous literature

II.1. Financial Innovation Theory

Tufano (2003) defines financial innovation as the act of creating and then popularizing new financial instruments, as well as new technologies, institutions and markets. Several authors like Dan Awrey (2013), Frame and White (2009) and Batiz-Lazo and Woldesenbent (2006) distinguish between product and process innovation. They add that this distinction is important in so far as the adoption of each type of innovation requires different organizational skills. Indeed, first, product innovation[6] requires banks to assimilate customer needs and their change in behavior and to create new ways to access banking markets. Moreover, process innovation[7] requires banks to apply new technologies affecting the production or the retailing modes of financial institutions, to improve their internal operations.

[4]This negative impact is significant at the 10% and the 1% levels respectively on the first mover's initiatives and on imitation. Product innovation adoption as traditional intermediation activities led to an increase in Non Performing Loans.
[5]Against the share coming from commissions and income of the securities portfolio which continues to increase
[6] They have a *market focus* and are essentially *customer driven*, otherwise.
[7] They have an *internal focus* and are essentially *efficiency driven*.

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II.2. The Innovation-Income Relationship

Research found that high levels of innovation are associated with high levels of performance. Generally, two main opinions are presented. The first mainly reports to profit. Indeed, new products generate profits and a larger market share. The firm will benefit from new trends, which will be eroded once other companies start to imitate. The second opinion points to the importance of process innovation where efficiency improvements can be achieved.

In this study, we will focus on the first mover advantage theory. This advantage may be more likely in the banking industry than in other industries because of the importance of the customer-bank relationship (Berger and Dick, 2006). The "first mover" advantage theories[8] typically develop the Schumpeterian perspective claiming that a successful innovation delivers a competitive advantage and a superior performance of the bank. Then, these temporary monopoly incomes are eroded once competition starts to imitate.

Young et al (2007) studied the impact of Internet Banking on the credit performance of 424 US commercial banks and compared their financial performance with other 5175 US banks that have not adopted Internet banking between 1999 and 2001. They found that Internet banking adoption improved bank profitability, mainly because of an increase in non-interest income. Young et al (2007) suggest that the introduction of Internet as a new distribution channel encourages bank customers to request and therefore to pay other banking services via the net.

To assess the impact of internet banking on credit performance of a sample of US banks, Sullivan (2000) compares performance of banks that have adopted Internet with banks that have not done in the Tenth Federal Reserve District. Banking performance includes measures of profitability, costs and risk. They found that unlike non-internet banks: i) Internet banks have an average efficiency ratio (non-interest expenses / net operating income) higher and more "other non-interest expenses". These latter include several costs associated with the development of banking sites. They argue that when banks are early adopters, it is not surprising to see their costs rise, given that much of these costs are spent on the development of websites at the early stages of introducing internet baking. They add that these costs are expected to decrease progressively as banks gain more experience with internet banking. ii) Internet banks achieve more incomes from non-interest income, allowing them to cover the additional costs of developing their banking branches. This implies that an increase in costs does not necessarily lead to lower profits.

Interest rates represent the interest currently paid (remuneration of deposits collected) and currently received (income received on loans granted) by banks. We found that lending rates are above the money market rate. Indeed, the central bank continues to manage it in order to allow banks to benefit from high credits returns in order to provide enough provisions to cover their credit risk. Furthermore, we found that the spread rate is not significantly different than that currently taken by banks.

III.3. The innovation - interest rate spread relationship

According to Hanson and de Rezende Rocha (1986), some factors play an important role in defining interest rate spread, including direct taxes, required provisions, as well as transaction costs and the imposed environmental conditions.

[8]Lucio Fuentelsaz et al. (2012),Herrera and Schroth (2011), Goddard et al. (2007).

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According to A. Ghasemi and Mr. Rostami (2016), the effect of the rules and principles 6 to 15 of the Basel Accord on banking system performance was the focus of some authors. They, thus, concluded that the bank's spread rates can be considered as banking performance indicators. The results indicate that the use of the Basel regulations will be likely to result in improved banking spread rates as an indicator of banking system performance. In fact, building up provisions following the Basel prevention of bankruptcy principle can improve banking system performance (Atabaki, 2006).

In fact, banks collect deposits from their customers while paying in part a certain interest rate. They use these deposits to make loans at a higher rate. The difference between these two rates, which we call "intermediation margin" fluctuate for a number of reasons, most of which are beyond the control of the bank[9]. Obidike. Paul. C et al. (2015) suggest that a high interest rates spread discourages borrowing. Were and Wambua (2013) found that low interest rates encourage borrowing and if the spread remains the same banks will benefit from an increased interest earning.

Moreover, Abir and Mamoghli (2010) found that: 1. banks charging high spread rates are significantly likely to adopt electronic banking services on the one hand, to monitor the program installed by the Tunisian monetary agency and on the other hand, to increase their income and to preserve their market share. They add that they are more willing to do so because of high spread rates, allowing them to deal with the high cost associated with the implementation of automatic cash dispensers and teller machines. 2. Interest rate spread has a positive impact on adopting a risk assessment system (significantly at the 5% level). Indeed, aware of borrowers' high opportunism and to cover credit risk, the bank is encouraged to develop its own risk assessment system. 3. Practicing a high spread rate significantly seems to encourage the bank to set up and fund an electronic recovery system.

Chand (2002) identifies several factors behind high interest rates margins. These are lack of adequate competition, diseconomies of scale because of the market's small size, presence of regulatory controls and perceived market risk. According to Dow (2007), the spread could relate to the decision to adopt in several ways. Indeed, on the one hand, banks supporting a low cost may offer a low interest rate spread and may therefore be more likely to develop a website. On the other hand, credit unions developing websites may end up with higher costs, forcing them to raise their interest rate spread. Subsequently, the banks adopting technology to reduce costs may be able to offer a lower spread rate. According to Dow (2007), the decision to adopt technologies and spread rate is a joint decision[10]. The author proposes to consider this joint decision through the effect of non-interest income and expenses. Alternatively, banks using technologies to reduce costs are able to offer a lower spread rate. For Tunisian banks, they continue to charge high lending rates to cover their credit risk. Our interest is among others and in particular the relationship between financial process innovation and spread pricing policy by Tunisian banks. Dow (2007) found that a high volume of bad debts and a low level of non-interest expenses do not encourage credit unions to develop websites.

III.4. The First Mover Advantage Theory

We focus on the first mover advantage theory because this advantage may be more likely in the banking industry than in other industries because of the importance of the customer-bank

[9]Among others, for example, the fact that the receipts for deposits are not always synchronized with those of loans, the bank incurs certain costs.
[10] A credit union has to decide what mix of better interest rates and better services it wants to offer.

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relationship (Berger and Dick, 2006). "First mover" advantage theories[11] typically develop the Schumpeterian perspective, claiming that a successful innovation delivers a competitive advantage and a superior performance of the bank. Then, these temporary monopoly returns are eroded once competition starts to imitate.

III. Sample and data

Sample

The banks in our sample are those who provided the information required throughout the study period. These banks are 10 formerly listed deposit banks. The choice of commercial banks is explained by their significant innovative behavior. These banks assume multiple roles at once: deposit gathering, credit allocation, foreign exchange transactions and securities transactions. Thus, our choice is limited to deposit banks to avoid difficulties arising from lack of homogeneity and insure data and analysis coherence.

The study period

In this study, we examine income and spread rate of formerly deposit banks in Tunisia over the period 1985 to 2010. This period was considered appropriate because it was the period when the interest rate was gradually liberalized in Tunisia[12], locating therefore the effect of income[13] and spread on financial process innovation and vice versa. Data, organized in panel, totals 260 observations (converted into 200 observations).

List of financial innovations

Two successive surveys were conducted, the first one with banking experts and the other with Tunisian banks of the sample. We selected a sample of homogeneous innovations referring to two important and selective criteria for analysis coherence purposes, allowing us to measure the differences in the impact, resulting from differences in innovations category (product, process). The targeted innovations include 17 classic and unconventional intermediation product innovations, and 8 process innovations.

Table 1 List of product and process innovations

Product Innovations	Process Innovations
Loans • Lease credit • Express credit • Auto loan • Flexible interest rate mortgage • Line of credit (up to 3 times the sum in savings) • Child savings plan loan Investments • Certificates of deposit[1] • Foreign currency deposits • Investment account • bond open-ended investment company Currency exchange • Transfer of funds • Forward cover	Electronic payment services • Magnetic strip card (debit) • Magnetic strip card (debit and ATM card) • Magnetic strip card (ATM and credit card) • Automatic cash dispenser • Automatic teller machine • Electronic payment terminal Risk assessment system

[11] Lucio Fuentelsaz et al. (2012), Herrera and Schroth (2011), Goddard et al (2007).
[12] Exactly starting from 1987.
[13] Interest income and non-interest income.

Telematic products • Telephone banking (voice server) • Fax banking • SMS banking • Net banking (account access and consultation of operations on the account)	
Magnetic strip card (business card with special privileges)	

Note
[1] This is a short or long-term negotiable security issued by the bank for a specific term. The subscriber may re-sell the bond at any time on the secondary market.

IV. Empirical Modeling

We used a panel technique to model our data. Our empirical study focuses on the first mover and imitator behavior towards financial innovation. We propose to examine the relationships under study through a simultaneous equation modeling, because we believe that a causal reverse event can be captured by this type of modeling. This will also allow us to consider the control variables of financial process innovation, those related to income and those related to spread.

IV.1. Model specification

The models below are applied first to financial innovation (product and process) and bank performance (revenue, spread). Consider, as well, the following systems with two simultaneous equations:

$$\text{System[I]} \quad \begin{cases} IVF_{i,t} = \alpha_{i1} \,.\, PRF_{i,t} + \beta'_{i1} \,.Z_{i,t1} + \lambda_1 .Y_{t1} + a_{i1} + \mu_{i,t1} & (1.1) \\ PRF_{i,t} = \alpha_{i2} \,.\, IVF_{i,t} + \beta'_{i2} \,.Z_{i,t2} + \lambda_2 .Y_{t2} + a_{i2} + \mu_{i,t2} & (1.2) \end{cases}$$

In the first equation of system[I], we regress financial innovation on performance and variables representing the environmental and organizational context of banks. In the second equation, we regress bank performance on financial innovation and a set of control variables including variables representing banks characteristics, the banking sector and the macro-economic conditions.

With

$IVF_{i,t} = (IVPD_{i,t1}\,,\, IVPC_{i,t1})$

$IVPD_{i,t} = (FIRST_{i,t},\, IMIT_{i,t})$

$IVPC_{i,t} = (FIRST_{i,t},\, IMIT_{i,t})$

$Z_{i,t1} = (DIV_{i,t},\, PUB_{i,t},\, ETR_{i,t}\,,T_{i,t},\, RF_{i,t})_{(1,5)}$

$\beta_{i1} = (\beta_{1,i1},\, \beta_{2,i1},\, \beta_{3,i1},\, \beta_{4,i1},\, \beta_{5,i1})_{(1,\,5)}$

$\beta_{i3} = (\beta_{1,i3},\, \beta_{2,i3},\, \beta_{3,i3},\, \beta_{4,i3},\, \beta_{5,i3})_{(1,\,5)}$

$Y_{t1} = (IHHD_t)_{\,(1,1)}$

$PRF_{i,t} = (TI_{i,t},\, NIINCOME_{i,t},\, SPR_{i,t},\, MI_{i,})_{(1,5)}$

$\beta_{i2} = (\beta_{1,i2},\, \beta_{2,i2})_{\,(1,\,2)}$

$Y_{t2} = (IHHA_t,\, TFL_t,\, SBC_t)_{\,(1,\,3)}$

$\lambda_2 = (\lambda_{1,2},\, \lambda_{2,2}\,,\, \lambda_{3,2})_{\,(1,\,3)}$

$\mu_{i,t1}$, $\mu_{i,t2}$ are error terms. a_{i1}, a_{i2} are unobservable effects.

IV.2. Measurement of the endogenous variables

The endogenous variables are financial innovation and bank performance.

DOI: 10.0706/article-2

IV.2.1 Financial innovation indicators

The first measure (FIRST) represents the willingness of a bank to be the "first mover". It is measured by the number of innovations introduced over the last five years and for which the bank was the first mover.

The second measure IMIT reflects the imitating behavior of banking innovations. It represents the number of innovations imitated by the bank over the past five years. It reflects the imitator bank's adoption of innovations, after introduced by the first movers.

We are interested in these measures because they are complementary and that each of them represents a separate aspect of innovation[14].

IV.2.2 Performance Indicators

"Income"

The non-interest income ratio reflects which proportion of bank incomes are derived from commissions. We believe that banks anxious to consolidate their non-traditional income are more likely to adopt process innovations (Furst et al, 2002) and commissions-generating products. By analogy, the banks that depend most on traditional incomes are the most supposed to innovate in credit, source of interest.

• Δ**TI**: variance in traditional income = Δ (aggregated interest and income / GDP).
• Δ**NIINCOME**: variance in non-interest income = Δ [(operating income –aggregated interest and income) / GDP].

"Interest Rate Spread"

Tunisian banks continue to charge high lending rates to cover their credit risk. A. Ghasemi and M. Rostami (2016) and A. Mabrouk and C. Mamoghli (2010) use a weighted average method. The interest rate spread will be calculated by using the definition of interest rate of loans and deposits[15] :

• Δ**SPR**: variance spread = Δ [(interest received / credits) - (interest payments / deposits)].

The intermediation margin, as defined below, represents the spread practiced by Tunisian banks. For this measure, we used data from 1998 and 2008.

• Δ**IM**: variance in interest margin = Δ [credits income – deposits cost].

with:

Credits income = income received on granted loans (in terms of interest) / Average outstanding loans

Deposits cost =expenses paid on deposits / average outstanding deposits

IV.3. Measurement of the control variables

The control variables are divided in to two groups, namely those explaining: 1. financial innovation 2. bank performance

[14]Moreover, the two measures move in the same direction, differently put the two measures are higher for the most innovative banks and vice versa.

[15] However, according to Mazroii Rad and Salehi et al. (2013) this method is not enough reliable because it estimates expectations of earnings and payment of cost of financing abstractly.

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IV.3.1 Control variables explaining financial innovation

We take the average values of the independent variables[16] between years (t-5) and (t-1). In this study, choosing the measures of the independent variables is not straight forward because adoption of financial innovation is a cumulative process that takes five years: [t-4 ; t], which might create a simultaneity problem. Among these variables, we mention: competition[17], represented by the Hirschman-Herfindahl average bank deposits concentration index. In addition, the selected variables representing organizational capacity are: diversification, ownership structure, size and financial resources. Boot and Thakor (1997) suggest that the fact that credit is more profitable than issuing shares[18], it encourages an international bank to opt for the first activity rather than for the second. The D measure takes into account income diversity[19] and was used to study banking industry by several authors (Baele et al, 2007; Leaven and Levine, 2007; Stiroh, 2006). In addition, Mohieldin and Nasr (2007) found that, unlike public banks, private banks invest more in innovation and in introducing new financial instruments in order to be more competitive. As for size, it is used by all studies on innovation adoption in the banking sector (Dow, 2007; De Young et al, 2007; Milnes.A, 2006; Furst et al, 2002; ...). Especially, the interest placed on financial resources comes from the fact that they reflect the bank's ability to finance these investments and take risks (Fuentelsaz et al, 2003), while providing banks with the necessary funds to adopt financial innovation (Furst et al, 2002).

IV.3.2 Control variables explaining bank performance

The independent variables are measured in terms of change between (T-6) and (t-1). This change was lagged by a year compared to performance variation in order to avoid to the maximum any simultaneity. These variables represent: 1) characteristics of each bank. They represent structure effect, thus making it possible to take in to account deformation in balance sheets via respectively deposits weight in the liabilities and credits weight in the assets[20]. We believe they have a good explanatory power in so far as Tunisian banks operate mainly in the traditional business of collecting deposits and granting loans. 2) the characteristics of the banking sector, through Hirschman-Herfindahl bank assets concentration index and 3) inflation rate and balance of trade balance represent macro-economic conditions. Hernández-Murillo.R et al. (2010) found substantial evidence showing that adoption depends on markets' characteristics and that although the bank's specific characteristics are important determinants of adoption decisions, competition also plays a leading role. Similarly, Afanasieff et al (2002) concluded that macro-economic variables are the most relevant to explain banking performance in emerging countries.

[16]Like Herrera and Minetti (2007), who examined the average over a 9-year period, values of instruments explaining firms' credits to their banks. Indeed, using questionnaires, they foundthat this relationship lasts at least 9 years. This endogenous variable explains product and process innovation adoption for Italian manufacturing firms.

[17]Several authors examined the effect of competition on innovation like De Young et al (2007) and Herrera and Minetti (2007)...

[18]Where the universal bank has no advantage against a specialized bank.

[19]It takes the values between 0 and 1 and it increases when the bank's diversification degree increases.

[20]These two ratios are adjusted to interbank operations because they bias the results.

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Table 2 Summary of the variables

Variable	Definition
Financial Innovation (total count of innovative acts during the previous five years)	
FIRST (product)	The number of innovations adopted during the previous five years for which the bank was the first mover in product innovation.
FIRST (process)	The number of innovations adopted during the previous five years for which the bank was the first mover in process innovation.
IMIT (product)	The number of innovations adopted during the previous five years for which the bank was the imitator in product innovation.
IMIT (process)	The number of innovations adopted during the previous five years for which the bank was the imitator in process innovation.
Performance "income" (Δ between t and (t-5))	
Δ TI	Δ (net profit /total bank assets).
Δ NIINCOME	Δ (overhead costs / net operating income).
performance "Interest Rate Spread" (Δ between t and (t-5))	
Δ SPR	Δ [(interest paid by borrowers / loans) - (interest paid to depositors / deposits)].
Δ IM	Δ (credit sreturns –deposits cost)
Control variables explaining financial innovation (Average between (t-5) and (t-1))	
IHHD	The average of Hirshman-Herfindhal index of concentration of bank deposits.
DIV	The average of D = (1-|2x-1|) where x = non-interest income / net operating income.
PUB	The average percentage of public share ownership.
FRG	The average percentage of foreign share ownership.
SIZE	The logarithm for the average of the total assets of the bank.
FR	The average of net profit.
Control variables explaining bank performance (Average between (t-6) et (t-1)).	
DEP	Ratio variance (Deposits / Total assets)
CRD	Ratio variance (Credits / Total assets).
IHHA	The average of Hirshman-Herfindhalbank assetsconcentration index.
TFL	The average of inflation rate = the average retail price variance.
SBC	Variance in trade balance.

IV.4. Estimation procedure

Financial innovation measures proposed in this study are counting measures. We suspect, therefore, the presence of some bias once the procedure is poorly adapted to data generating processes. After a series of tests meant to choose the most appropriate estimation procedure, we found that using the Poisson law is better. Moreover, given the excessive number of zeros in the First measure[21], we use the *zero inflated* Poisson regression, where competition is the *inflate* variable explaining the counting measure, causing the excessive number of zeros. We believe that unlike the classic Schumpeterian argument, a more concentrated market discourages firms to innovate, as their market position is already secure[22].

IV.5. Choice of instruments

In the Control Function Approach, estimators are obtained in two steps. Consider for example, equation (1.1) of the [I] system. The first instrumental step consists in regressing the endogenous variables $IVF_{i,t}$ on the exogenous variables in equation (1.2) and instruments present in equation (1.1) , then extract the fitted value of error terms. In the second step, we regress $IVF_{i,t}$ on the exogenous variables of equation (1.1), $PRF_{i,t}$ and fitted value of error

[21]Lack of initiatives by the *first mover* in a bank was observed by Roberts and Amit (2003).
[22]Moreover, the results corroborate this economic intuition and indicate that a highly concentrated market, in other words, less competitive, is the variable causing the excessive numbers of zeros, significant at the 1% level.

DOI: 10.0706/article-2

term. This will control the endogeneity of the endogenous variables $IVF_{i,t}$. We do the same steps for $PRF_{i,t}$.

V. The Results

V.1. Banking income

In Tables 3 and 4, we see that product innovation adoption (First) led to a significant decrease in conventional interest income reaching 5% in favor of a significant increase of 5% for non-interest income. This may be explained by adopting innovations centered around non-classical intermediation activities. Moreover, imitating product innovations in traditional activities led to an increase of 1% in conventional income at the expense of non-interest income (at 1%). Meanwhile, high interest income (1%) and low non-interest income (1%) encourage banks to imitate products in their traditional activity. However, the first mover's initiatives are not influenced by the two types of bank incomes. Thus, banking income does seem to influence imitators' behavior towards product innovation centered on the traditional business of banks. Moreover, we found that high non-interest income as well as low interest income correlate positively and significantly (at 5% and 5% respectively) with the first mover's initiatives in process innovation. The regressions taking in to account the different types of process innovations, has shown that this result is valid when adopting electronic payment services. The banks that are most interested in expanding their income from non-interest income are encouraged to develop their electronic banking services. We found evidence significant at the 10% level indicating that non-interest income increases with the adoption of electronic payment services. Indeed, despite the modernization of electronic payment networks and the significant increase in the number of bank cards, their use for domestic payment is minimal compared to other means, where card holders account for only 9.40% of the banked population in 2005. In addition, increase in net interest income (1%) and lower fees (1%) lead Tunisian banks to imitate in terms of process innovation, probably in an effort to diversify their income sources. Imitation is valid for both electronic payment services and the risk assessment system[23].

V.2 Interest rate spread

Table 5 reports the results of the regressions for reverse causality between financial innovation adoption and the spread charged by banks. The spread has a positive impact on adopting new products in the traditional intermediation activity. This impact is significant on imitation behavior (1%). Moreover, the adoption in First of products in unconventional activity led to an increase in commissions, which will allow banks to offer their customers a spread rate significantly lower than 5%. Abir and Mamoghli (2010) found that banks practicing high spread are encouraged to adopt other innovations under their main activity, since this is likely to increase their intermediation margin, while it significantly undermines the adoption of new products under unconventional banking.

Furthermore, for financial process innovation, we found that:
1. Banks practicing low spread rates are encouraged to be the first adopter of electronic payment services (1%) in order to increase their commissions and ultimately their income.

2. Banks charging high spread rates have no incentive to first adopt electronic payment services to increase incomes but to imitate adoption (1%) not to lose market share and to comply with the program of the Tunisian Electronic Monetary Agency. They are more

[23]Increase in interest income represents in parallel for banks an increase in the probability of credit risk, which requires setting up a borrower assessment system.

DOI: 10.0706/article-2

willing to do so thanks to high spread rates, which enables them to meet the high costs associated with installing distribution networks[24] and ATMs.

3. The spread negatively affects the first mover setting up a risk assessment system (5%). Indeed, practicing lower spread does not allow the bank to hedge its credit risk by setting allowances for bad accounts, increasing its incentive to develop the first its own risk assessment system. However, practicing high spread, the bank manages to cover its credit risk, and become among later adopters and rather imitators (5%).

In addition, we found that the first mover's initiatives in process innovation increase the spread rate. Indeed, banks developing the first process innovations incur higher installation costs at the initial phase than subsequent adopters and can end up with higher costs forcing them to increase their spread rates. On the other hand, imitation of new processes, likely to result in lower costs than those of the first movers under a stowaway principle, can decrease spread rates because banks using technology to reduce costs may then be willing to offer lower spread rates (without being significant).

Measuring intermediation margin calculated by the central bank, we found the same impact of financial process innovation, but with higher significance (1%). We conclude that financial process innovation in Tunisia affects, contrary to our expectations, notably the spread pricing policy (actually cashed in margin). Thus, apart from the fact that banks still charge high lending rates, because the central bank still administers the average money market (intermediation margin)[25], it turns out that Tunisian bank's adoption of financial innovations affects to a large extent the practiced spread rate. Furthermore, the effect of intermediation margin on financial innovation adoption is significant at the 1% level. Thus, this result leads us to conclude that financial process innovation is significantly affected by spread pricing policy in Tunisia[26].

VI. Conclusion

In summary, we found that most banks interested in expanding their non-interest income are encouraged to develop their electronic banking services (or only at 10% significance). Indeed, despite the modernization of electronic payment networks, using bank cards for domestic payment is still minimal compared to other means. In addition, adopting first unconventional products, source of commissions, allows banks to offer customers a low spread rate.

Moreover, we found that the first mover's initiatives in process innovation increase the spread rate. Indeed, banks developing the first process innovations incur higher installation costs at the initial stage than subsequent adopters and can end up with high costs forcing them to increase their spread. This leads us to conclude that financial process innovation in Tunisia affects, contrary to our expectations, notably spread pricing policy. This is amply confirmed by measuring the intermediation margin calculated by the central bank.

[24]We believe also that the interbank agreement in 2001, aiming at modernizing electronic banking, explains this effect observed in electronic banking-based innovation adoption.
[25]The aim was that banks continue practicing higher lending rates in order to build up risk provisions and amounts to cover their credit risk.
[26]Nevertheless, low degrees of freedom leave us doubtful about the results obtained on this performance indicator.

International Research Journal of Applied Finance ISSN 2229 – 6891
Vol. VII Issue – 6 June, 2016 www.irjaf.com
DOI: 10.0706/article-2

Table 3: Estimation by the *control function approach* of the effect of financial innovation on the *traditional income* ratio (Entire sample)

	Product innovation model		Process innovation model	
	First mover (FIRST)	Imitation (IMIT)	First mover (FIRST)	Imitation (IMIT)
Constante	-38.1179*** (-2.90)	49.5312*** (2.97)	9.5946 (1.39)	-20.9865 (-1.14)
IHHD	-0.0151*** (-3.91)	-0.0288*** (-5.26)	-0.0015*** (2.81)	-0.0029*** (-5.28)
DIV	-2.2454** (-2.03)	-5.1613** (-2.15)	2.15201** (1.98)	-6.5228* (-1.75)
PUB	-1.7032*** (-2.88)	0.3264 (0.39)	-0.5539* (-1.93)	0.4033** (1.99)
ETR	2.2352*** (3.29)	-1.3238** (-2.19)	-2.33103*** (-3.58)	5.4713*** (5.10)
T	0.9857** (2.18)	-0.3334** (-2.07)	-0.7159** (-2.37)	1.4615* (1.81)
RF	0.0813* (1.91)	0.0948 (0.58)	0.2179*** (3.08)	-0.4961*** (-3.56)
TI	5.9919 (1.08)	4.1907*** (4.03)	-5.9678** (-2.48)	4.8019*** (5.08)
	TI	TI	TI	TI
Constant	-0.0409*** (-5.05)	-0.0762** (-5.59)	-0.05132** (-5.41)	-0.0472*** (-4.56)
IHHA	-0.0009*** (-4.53)	-0.0004** (-3.82)	-0.0007** (-4.23)	-0.0005** (-3.02)
DEP	-0.03047** (-2.03)	-0.0565 (-0.93)	0.06731 (1.28)	-0.04202 (0.82)
CRD	0.00429 (0.08)	-0.0507 (-0.98)	-0.0364 (-0.68)	-0.0276 (-0.51)
TFL	-0.1963 (-0.42)	-0.489** (-2.25)	0.1453 (0.31)	-0.0507** (-2.07)
SBC	-0.0005** (-2.04)	-0.0031 (-1.43)	-0.0001** (-2.19)	-0.0012** (-2.13)
FIRST (Inv. produit)	-0.01563** (-2.19)			
IMIT (Inv.		0.0101*		

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produit)								
					(2.83)			
FIRST (Inv. processus)						-0.0138 (-1.33)		
IMIT (Inv. processus)								-0.0075 (-0.14)
R^2 ajusté / Pseudo R^2		0.1406		0.1535	0.1139		0.1271	0.1170
Log pseudolikelihood	-129.4351		-326.8707			-121.0153	-322.5784	

Table 4: Estimation by the control function approach of the effect financial innovation on the *non interest income ratio* (Entire sample)

	Product innovation model		Modèle relatif à l'innovation de processus	
	First mover (FIRST)	Imitation (IMIT)	First mover (FIRST)	Imitation (IMIT)
Constante	-27.1132*** (-2.97)	31.0017*** (3.05)	7.9753 (1.19)	-17.2336 (-1.03)
IHHD	-0.0132*** (-3.03)	-0.0309*** (-4.28)	-0.02143*** (-3.50)	-0.21591*** (-2.75)
DIV	-3.0233** (-2.08)	-5.26851* (-2.45)	4.00541** (2.05)	-5.78832* (-1.58)
PUB	-1.5132*** (-2.92)	0.82353 (0.97)	-0.7548* (-1.92)	0.8112** (2.11)
ETR	3.4351*** (3.01)	-1.89345** (-2.17)	-3.4201*** (-3.27)	7.5389*** (3.77)
T	1.04535** (2.34)	-0.45577* (-1.94)	-0.5357** (-2.54)	3.7654** (2.53)
RF	0.0711* (2.25)	0.0845 (0.75)	0.5239*** (3.44)	-0.5023*** (-4.21)
NIINCOME	-7.8715 (-0.95)	-3.5725*** (-3.17)	8.11525** (2.18)	-32.50972*** (-3.52)
	NIINCOME	NIINCOME	NIINCOME	NIINCOME
Constant	0.0334*** (3.01)	0.0543*** (3.09)	0.0575*** (3.37)	-0.0504*** (2.89)
IHHA	0.0001 (1.23)	0.0001 (0.79)	-0.0001** (-2.55)	0.0005 (0.79)
DEP	-0.0416** (-2.51)	0.0476 (1.13)	0.1543 (-1.07)	-0.0738** (-2.19)
CRD	-0.0228 (-0.75)	0.0615 (1.25)	-0.0257* (-1.89)	-0.0405* (-1.79)
TFL	0.1963 (0.87)	0.3161 (0.57)	-0.1997 (-0.98)	-0.1545 (-0.37)
SBC	0.0525**	0.0328**	0.0203**	0.0428**

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		(2.22)		(2.55)		(2.54)		(2.51)
FIRST (Inv. produit)		0.0175 **						
		(2.37)						
IMIT (Inv. produit)				-0.0121***				
				(-2.97)				
FIRST (Inv. processus)						0.0158*		
						(1.82)		
IMIT (Inv. processus)								0.0011
								(1.03)
R^2 ajusté / Pseudo R^2		0.1143	0.1854	0.1002		0.1101	0.1714	0.1019
Log pseudolikelihood	-119.0914		-305.1252		-111.3107		-314.5152	

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Table 5: Estimation by the *control function approach* of the effect of financial innovation on spread (Entire sample)

	Product innovation model		Modèle relatif à l'innovation de processus	
	First mover (FIRST)	Imitation (IMIT)	First mover (FIRST)	Imitation (IMIT)
Constant	-13.2028*	23.36196***	9.98896	-10.3286
	(-1.88)	(3.31)	(1.52)	(-1.02)
IHHD	-0.09802***	-0.0136***	-0.0079***	-0.0011***
	(-3.12)	(-6.21)	(-3.33)	(-3.24)
DIV	-2.10402*	-0.9514*	0.5196**	-2.2434**
	(-1.93)	(-1.84)	(2.02)	(-2.40)
PUB	-2.1378***	0.1267**	-0.6243*	0.712**
	(-3.26)	(2.17)	(-1.88)	(2.11)
ETR	1.3005***	-0.2927*	-6.4879***	1.6127***
	(3.05)	(-1.83)	(-7.67)	(3.32)
T	0.6043**	-0.3439*	-3.232***	0.6479*
	(2.24)	(-1.74)	(-5.74)	(1.91)
RF	0.1073*	0.0433	1.9478***	-0.1588*
	(1.85)	(0.90)	(4.54)	(-1.69)
SPR	2.3049	10.4086***	-14.1458***	22.4726***
	(0.47)	(3.86)	(-2.71)	(5.14)
	SPR	SPR	SPR	SPR
Constante	-0.0041	-0.0114	-0.0142***	-0.0042
	(-0.63)	(-1.17)	(-2.60)	(-0.54)
IHHA	-0.0002**	-0.0001**	-0.0002*	-0.0002*
	(-2.00)	(-2.03)	(-1.88)	(-1.78)
DEP	-0.0439	0.0302	0.0257	0.041*
	(-0.56)	(0.97)	(0.57)	(1.11)
CRD	0.0947	0.0398	0.0441	0.0482
	(1.12)	(0.55)	(0.70)	(0.72)
TFL	-0.7346	-0.4333	-0.3817	-0.67771*
	(-1.47)	(-0.69)	(-0.58)	(-1.65)
SBC	0.0001**	0.0001*	0.0001*	0.0001
	(2.06)	(1.79)	(1.80)	(1.15)
FIRST (Inv. produit)	-0.0379**			
	(-2.00)			
IMIT (Inv. produit)		-0.0008		
		(-0.18)		
FIRST (Inv. processus)			0.0101**	
			(2.50)	
IMIT (Inv. processus)				-0.01001
				(-1.42)
R^2 ajusté / Pseudo R^2	0.1206	0.2038	0.1109	0.0971 0.0970

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Log pseudolikelihood	-119.9319	-326.8707	-115.0127	-322.5784

DOI: 10.0706/article-2

VII. Suggestions for Further Research

Like Dow (2007), we consider the decision to adopt financial process innovation and interest rate spread to be a joint decision. Therefore, Tunisian banks have to decide on what interest rates and services mix they want to offer. To our view, only time can judge financial innovation because it is found to determine interest rate spread. As this study considered only two interest rate spread variables, we propose to enrich this research by using pre-performance and post-performance method, and identify which of them is the most adequate to Tunisian banks. Moreover, further study will seek to examine the factors that affect banks' decisions to offer financial innovation. In particular, we will look for more possible influences like: the effect of non performing loans, whether it matters and how the decision to adopt financial innovations relates to interest rate spread.

References

Afanasieff.T, Lhacer.P and Nakane.M [2002], "The determinants of bank interest spreads in Brazil", Banco Central di Brazil, Working Papers.

A.Ghasemi and M.Rostami [2016], "Determinants of interest rate spread in banking industry", ECOFORUM, Volume 5, Issue 1 (8).

Baele.L, De Jonghe.O and Vennet.R.V [2007], "Does the stock market value bank diversification? ", Journal of Banking and Finance, vol. 31, issue 7, pp. 1999-2023.

Batiz-lazo.B and Woldesenbet.K [2006], "The dynamics of product and process innovation in UK banking", International Journal of Financial Services Management, vol 1, n° 4, p400-421.

Berger.A.N and Dick.A.A [2006], "Entry in to banking markets and the early-mover advantage", The Journal of Money, Credit and Banking, vol 39, issue 4, p 775-807.

Betz.F [2016], " International Grid of Capital Flows: Innovation, Crisis, and Off-shore Banking", Stability in International Finance, Part of the series Springer Briefs in Economics, pp. 19-49.

Boot.A.W.A and Thakor.A.V [1997], " Banking Scope and Financial Innovation ", The Review of Financial Studies, Vol. 10, n°4, printemps, pp. 1099–1131.

Dan Awrey [2013], "Toward a Supply-Side Theory of Financial Innovation", Journal of Comparative Economics, Vol. 41, No. 2.

De Young.R, Lang.W.W and Nolle.D.L [2007], "How the internet affects output and performance at community banks", Journal of Banking and Finance, Vol. 31, Issue 4, pp. 1033-1060.

Fuentelsaz.L, Gomez.J and Polo.y [2003], "Intrafirm diffusion of new technologies: an emprirical application", Research Policy, Vol. 32, Issue 4, Avril, pp. 533-551.

Furst.K, Lang.W.W and Nolle.D.E [2002], " Internet banking ", Journal of Financial Services Research, Août-Octobre, Vol. 23, n° 3, pp. 95-123.

Goddard.J, Molyneux.P, Wilson.J.O.S and Tavakoli.Manouche [2007], "European banking: an overview", Journal of Banking and Finance, Vol. 31, Issue 7, pp. 1911-1935.

Hernández-Murillo.R, Llobet.G and Fuentes.R [2010], "Strategic online banking adoption", Journal of Banking & Finance, Vol. 34, Issue 7, July, Pages 1650-1663.

Herrera and Schroth.E [2011], " Advantageous innovation and imitation in the underwriting market for corporate securities", Journal of Banking & Finance, Vol. 35, Issue 5, May, pp.1097-1113.

Herrera.A.M and Minetti.R [2007], "Informed finance and technological change: evidence from credit relationships", Journal of Financial Economics, Vol. 83, Issue 1, Janvier, pp.223-269.

Hylton.H and Guangling.L [2016], "Credit spread variability in the U.S. business cycle: The Great Moderation versus the Great Recession", Journal of Banking and Finance, Volume 67, June 2016, pp. 37–52.

DOI: 10.0706/article-2
Leaven.L and Levine.R [2007], "Is there a diversification discount in financial conglomerates? ", Journal of Financial Economics, Vol. 85, Issue 2, Août, pp. 331-337.
Lucio Fuentelsaz and al. [2012], " Production technologies and financial performance: The effect of uneven diffusion among competitors", Research Policy, 2012, 41, (2), pp.401-413.
Mabrouk, A. and Mamoghli. C [2010], "Is Financial Innovation Influenced by Financial Liberalization in the banking industries of emerging markets?: Evidence from the Tunisian Banking Industry, Banks and Bank Systems", Vol. 5, Issue 3, pp. 97-111.
Mabrouk. A and Mamoghli. C [2010], "Dynamic of Financial Innovation and Performance of Banking Firms: Context of an Emerging Banking Industry", International Research Journal of Finance and Economics, Issue 51, Octobre, pp.17-37.
Mazroii Rad, A., Salehi, H. and Shorvarzi, M. (2013). The impact of electronic banking services the bank's profit margin growth. Journal of Accounting Research, vol. 4.
Milnes.A [2006], "What is in it for us? Network effects and bank payment innovation", Journal of Banking and Finance, Vol. 30, Issue 6, Juin, pp. 1613-1630.
Mohieldin.M and Nasr.S [2007], "On bank privatization: the case of Egypt", The Quarterly Review of Economics and Finance, Vol. 46, Issue 5, février, pp. 707-725.
Roberts.P.W and Amit. R [2003], "The dynamics of innovative activity and competitive advantage: the case of Australian retail banking, 1981 to 1995", Organization Science, Mars /Avril, Vol 14, no 2, pp. 107-122.
Stiroh.K.J [2006], "A portfolio view of banking with interest and non interest activities", Journal of Money, Credit and Banking, Vol. 38, n° 5, pp. 1351-1361.
Sullivan.R.J [2000], "How has the adoption of internet banking affected performance and risk in banks", Financial Industry Perspectives, Federal Reserve Bank of Kansas City, December, pp.1-16.
Tufano.P. [2003], "Financial Innovation", Handbook of the Economics of Finance, ed. George Constantinides, Milton Harris and Rene Stulz.

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