

The Impact of Loan Portfolio Diversification on Tunisian Bank's Profitability

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Abstract—

This paper examines the effect of loan portfolio diversification on Tunisian banks profitability over the period 2000-2015. By using panel data method, our finding, show that focusing on few sectors is more profitable than diversifying bank lending operations. In addition, we find that this negative impact is more pronounced in private banks. However, for foreign banks loan portfolio diversification is found to be positively associated with higher bank profitability. Also, we find support to the hypothesis stating that the positive effect of loan portfolio diversification is more pronounced for credit risky banks.

Keywords— Loan portfolio composition, concentration, diversification, bank profitability, Tunisian Banking sector.

I. INTRODUCTION

The question of whether it is preferable for banks to concentrate or diversify their loan portfolio across economic sectors has become of uttermost importance for the study of financial stability (Tabak and al, 2011), and the analysis of default interdependence between borrowers in credit portfolios have become more important than ever in the practices of financial institutions, as was highlighted by the financial crisis and credit concentration (large-lot borrowers and sector concentration)

A large literature in banks finance has addressed the issue of concentration or diversification in sectoral Diversification Strategy which takes place where a company seeks new businesses that have no relationship with their present business or market operations (Rao, (2015). Classical finance theory suggests that diversification should be a way to reduce the risk within a portfolio of assets given asymmetric information in banking markets, theory highlights that concentration increase the cost of financial intermediation (Diamond, 1984) and reduces the incentive to monitor.

In real world, we observe both diversification and concentration strategies. On one hand, several countries possess rules limiting a bank's exposure to a single borrower, encouraging them to « put eggs in more than one basket ». On the other hand, however, some banks decide to involve in sectors which they have expertise and enjoy comparative advantages. Subprime crisis, in the year 2008, which later lead to global financial crisis is partly due to too much exposures to real estate industry which is highly related to macro economy. This crisis, caused by credit portfolio concentration, in return, hit the whole banking industry of US heavily. In the light of financial crisis, diversification versus concentration has become one of the most important issues to be discussed concerning bank's stability.

Should banks diversify their loans or concentrate on those firms whose business they are familiar with? There are some research works on the relationship between diversification and performance of banks, however there is no consensus so far, because findings of different countries vary, with evidences supporting both opinions.

Should bank loan portfolio be focused or diversified? Traditional arguments based on Diamond (1984) suggest that bank should be as diversified as possible. Does the extent of loan portfolio focus or multiple diversification affects default risk in a distressed bank's equity return under capitalization intervention and regulation (often conflicting)?

Recent literature questions the beneficial effects of loan portfolio concentration for banks, no matter which measures of concentration are used. Defining concentration as exposure to economic sector, Raei (2016); Chen and al, (2013), draw a good picture on the role of concentration. Their results give us strong evidence that concentration influences positively bank's return; the reason may be that loan portfolio concentration increases monitoring efficiency, since banks may have expertise in the sectors they lend, as Winton (1999) affirms. Also Tabak and al (2011) tests whether diversification of the credit portfolio at the bank level leads to better performance and lower risk, they find that loan portfolio concentration increases return and also reduces default risk. However, this positive influence of sectoral focus on return decreases with bank's risk, contradicting the U-shaped relationship found by Acharya et al, (2006) between focus and return. High –risk banks may even have their returns decreased due to concentration, but their risk may also reduce due to this strategy, which becomes a clear risk-return trade-off for these banks.

Tunisian banking regulations limit the credit exposure of a bank to a single borrower. The Circular of the Central Bank of Tunisia (CBT) to credit institutions No 91-24 of 17 December 1991 regulating the division, risk coverage and follow-up of the auditors (as amended by circular to banks no. 2001-12 of May 4, 2001, Circular No. 2012-09 of June 29, 2012 and Circular No. 2013-21 of December 30, 2013) limits the risk concentration ratio which is calculated as the ratio of the risks incurred on the same beneficiary in relation to the net capital stock at 25%. This rule

reflects the need for diversification arising from the regulation of the Basel Committee on Banking Supervision. However, Tunisian banking regulation does not limit the bank's exposure to credit risk in terms of the share of the loan granted to companies operating in the same economic sector. Thus, Tunisian banks develop their lending activities in sectors where they have a comparative advantage.

From this point of view, whether the banks' concentration or diversification of their credit portfolio affects their profitability and whether the banking regulator should take it into account in prudential banking standards. The main objective of this chapter is to examine how credit portfolio diversification impacts the profitability of Tunisian banks.

Another interesting research question to be answered in this chapter is to examine how the diversification of credit portfolio impacts the profitability of banks depending on their ownership structure. To do so, we distinguish between state, private and foreign owned banks to see how these features affect the relationship between loan portfolio diversification and bank profitability. According to Hass and al. (2010), bank ownership is one of the important determinants of banks' loan portfolio composition. Specific characteristic and behaviour of Tunisian state-, private- and foreign-owned banks may, therefore, induce them to have different optimal loan portfolio strategies. This allows the follow up of changes in portfolio decisions after the breakthrough of the crisis in September 2008.

The research contributes to the related literature on loan portfolio diversification which is an up-to-date topic being of concern to regulators, researchers and practitioners, through analysing the determinants of the situation of the loan portfolio diversification in the Tunisian banking sector in the aim of insuring its profitability and facing the remaining challenges taking into consideration a series of bank specific factors. We respond to one drawback that has been observed in the previous empirical studies that tried to link credit portfolio diversification and profitability

We structure the remainder of the chapter as follows. In Section 2, we exposes the two mains theories about portfolio strategies as well as we presents a summary of the literature review in developing and developed countries, we describe our methodology, defining the variables of interest and the regression approaches taken in section 4. In Section 5, we present our empirical analysis .Finally, we conclude in Section 6.

II. LITERATURE REVIEW

Tabak et al (2011) suggests that there are two main theories about credit portfolio strategies in the literature

A. *Credit portfolio diversification: insights from the Traditional Banking Theory*

Traditional banking theory (Diamond, 1984) suggests that the diversification of banks' credit portfolio is positively associated with bank profitability. This positive link between credit portfolio diversification and bank performance is due to the fact that as the bank expands its lending activities to new economic industries, the quality of its credit portfolio will increase with the decline in the probability of default. Moreover, more diversified credit institutions would be less vulnerable to economic downturns in many sectors. Classical finance theory suggests that diversification should be a way to reduce the risk within a portfolio of assets Given asymmetric information in banking markets, theory highlights that diversification reduces the cost of financial intermediation (Diamond, 1984) and increases the incentive to monitor

Also, traditional banking theory suggests that banks should diversify their credit portfolio to decrease credit risk, which is also in accordance with portfolio theory, given that through the expansion of their credit lines to new sectors, the bank's probability of default will be reduced (Diamond, 1984). The idea is that due to asymmetric information, diversification reduces financial intermediation costs. Moreover, less diversified banks would be more vulnerable to economic downturns, since they expose themselves to few sectors.

Looking at the effect of diversification on the realized ex-post risk, the classical theory of finance suggests that a higher diversification in a bank's loan portfolio should reduce realized risk, measured by the amount of provisions for bad loans (classical diversification hypothesis). In banking, however, diversification per se is no guarantee for a reduction in the risk of failure or for better performance. One reason for this is the importance of loan monitoring.

If the management lacks the time/expertise to monitor the loan granting process to new customer segments or new industries effectively, more diversification does not necessarily imply less provisioning (lack of expertise hypothesis). A second reason why high diversification does not necessarily lead to a reduced need for provisioning may be due to the quality and composition of the portfolio. If a bank has a less diversified portfolio focused on low risk lending activities (e.g. lending to the public sector), the need for provisioning might still be lower than for a bank with a more diversified portfolio of highly risky assets. Therefore, one has to control for the quality of a bank's portfolio when analysing the impact of diversification on realized risk. We do so by including economic capital to correct for risk-weighted assets.

Looking next at the link between diversification and efficiency, we have to distinguish between cost and profit efficiency, given that the predicted effects can be conflicting. Starting with the link between cost efficiency and diversification, we can assume two alternative hypotheses. The first one, which we call monitoring hypothesis, suggests that diversification may dampen cost efficiency. This hypothesis is motivated by the fact that internal or regulatory guidelines may prescribe some level of monitoring independent of the level of diversification. Having a diversified portfolio with a large number of individual clients in different industries may thus increase monitoring costs and reduce cost efficiency. The monitoring hypothesis could furthermore be supported by the fact that managers may very well be risk averse instead of risk neutral. Therefore, they may be willing to incur additional costs for selecting a high quality loan portfolio and for monitoring its performance in order to reduce risk. This is particularly relevant if, for instance, a proportion of their income is tied to their bank's performance.

On the other side, proponents of focus argue that diversified banks can suffer from diluting the comparative advantage of management by going beyond their existing expertise diversification inducing competition (Winton, 1999), and increased agency costs resulting from value-decreasing activities of the managers who have lowered their personal risk (Berger and al, 2010).

On the other hand, as diversification reduces the idiosyncratic risk, this may enable banks to loosen their monitoring efforts and therefore to lower operating costs, which *ceteris paribus* should lead to higher cost efficiency: idiosyncratic risk hypothesis would suggest that concentration can have a negative effect on cost efficiency (Rossi, 2009).

The ultimate guideline, however, on whether diversification pays off or not in terms of efficiency is to look at the link between diversification and profit efficiency. In line with classical finance theory and thus our classical diversification hypothesis, we would expect the risk-adjusted returns to be higher for a well-diversified portfolio, and we would therefore predict a positive relation between diversification and profit efficiency. Although diversification may be costly to handle as it entails cost inefficiencies (monitoring hypothesis), rational managers should bear these costs only if diversification ultimately yields benefits from the profit efficiency perspective. We would therefore expect that, on the one hand, diversification decreases cost inefficiency and, on the other hand, increases profit efficiency. This hypothesis could also help explain the contradictory results for banks' cost and profit efficiency often documented in empirical literature.

However, loan portfolio concentration could also result in great profit efficiency. If managers are risk averse, it could be rational for them to engage in costly monitoring (monitoring hypothesis) even though they are not able to raise profit efficiency. In order to reduce risk, risk adverse managers may be willing to incur so many additional costs for selecting a high quality loan portfolio and for monitoring its performance that not only cost but also profit efficiency is reduced.

Finally, the effect of diversification on bank capitalizations looked by Rossi, (2009) who examine whether the level of capitalization is sensitive to the degree of diversification. If diversification is seen as a valid and necessary means to reduce risk by managers, regulators, creditors and/or owners, we expect more diversified banks to be able to operate with less capital than more concentrated peers. The amount of economic capital retained to cover unexpected losses should *ceteris paribus* be smaller for diversified banks.

Among other reasons, concentration in bank's loan portfolios have caused many banking crises in the last three decades, which supports the view that risk, is highly associated with this strategy (Basel Committee on Banking Supervision, 1991). Empirical studies in Brazilian banks (Tabak and al 2011), also on the Argentinean financial crisis of 2001 and 2002 (Bebczuk and Galindo, 2008) and by Austrian banks over the years 1997–2003 (Rossi and al, 2009) also are in favour of this view.

B. Credit Portfolio Diversification: insights from the Theory of Corporate Finance

Contrary to traditional banking theory, the theory of corporate finance argues that the diversification of the credit portfolio is negatively associated with the profitability of banks. Jensen, (1986); Denis and al. (1997); Meyer and Yeager, (2001); and Acharya and al (2006) indicate that for firms (including financial firms or banks) to concentrate their activities on a specific economic sector in a small group of sectors in order to capitalize on their expertise in these sectors.

The theory of corporate finance states the idea that firms should concentrate their activities on a specific sector or group of sectors to take benefits of expertise in how business in these sectors in or are familiar with (Jensen, 1986; Denis and al., 1997; Meyer and Yeager, 2001; Acharya and al., 2006). Another argument against portfolio diversification is that it can also result in increasing competition with other banks, making this strategy less attractive. In particular, Winton (1999) defends that diversification only reduces the chances of bank failure in the case of moderated risks of default. When the risks are low, banks may benefit more from specialization than from diversification, since there is a low probability of failure. Conversely, when the probabilities of insolvency are high, diversification may even worsen the situation since the bank will expose itself to many sectors, and the downturn of one may be enough to lead this bank to bankruptcy.

The existing banking literature does not provide consensus as to the question “should banks diversify portfolios and geographic regions, or should they specialize?” Instead, there is evidence supporting both arguments. Traditional arguments suggest that banks should be as diversified as possible, as banks are typically highly levered, and diversification across sectors reduces their chance of costly financial distress/bankruptcy. Several models of intermediation suggest that diversification makes it cheaper for institutions to achieve credibility in their role as screeners or monitors of borrowers (Diamond, 1984; Boyd and Prescott, 1986). On the other hand, some studies (Jensen, 1986; Denis and al., 1997) argue and/or provide evidence that financial institutions should focus on a single line of business so as to take greatest advantage of management's expertise and reduce agency problems, leaving investors to diversify on their own.

Overall conclusion is that the relationship between bank's focus and return is U-shaped in risk. Furthermore, there is also empirical evidence that diversification increases the risk in the Italian banking sector (Acharya and al., 2006) and reduces the performances of the banks in the Chinese banking sector (Chen and al, 2013 ; Berger and al., 2010), in the German banking sector (Hayden and al., 2007), and of small European banks (Mercieca and al., 2007).

Diversification Tends to Increase with Intermediary Size, in fact, delegation to one or a few intermediaries avoids costly duplication of effort, if there are fixed costs to evaluating or monitoring an individual borrower, also, a more intermediary can serve larger borrowers, and so be better diversified, at lower cost. The same applies to diversifying across types of borrowers when there are fixed costs to developing skills to deal with each type of borrower,

and to diversifying across customers in an insurance setting when there are fixed costs to providing insurance to a single customer or type of customer .

Finally, intermediaries can share risks among themselves without excessive agency problems if they can credibly share information with ease, allowing diversification without an increase in scale. A related question is that, to the extent an intermediary has some choice over how and where it expands the degree to which size improves diversification can be partly under the institution’s control and is likely to be partly unobservable.

Table1 Summary of the contributions related to loan portfolio concentration.

| Authors | Country | Period | Empirical funding |
|------------------------|---|--------------------------------|--|
| Acharya and al. (2006) | 105 Italian banks | 1993-1999. | The diversification of banking assets is not guaranteed to produce better performance or greater security for banks. Its results are consistent with a classical finance theory that predicts deterioration in the banking supervision at high levels of risk. |
| Baele and al. (2007) | 17 European banks | 1989-2004 | Diversification has had a positive impact on the long-term performance of banks. In addition, the impact of diversification on the systemic risk of banks has improved. |
| Berger and al. (2010) | Chinese banks | 1996-2006 | The four dimensions of diversification are associated with lower profits and higher costs. They observe that banks with foreign ownership (both majority and minority) and banks with affiliation to a conglomerate are associated with less economies of diversification, suggesting that foreign ownership and affiliation of conglomerates may play an important mitigating role. |
| Chen 2013a | 16 Chinese listed commercial banks | 2007-2011 | Sectoral concentration is associated with higher risk, and her new measurement performs well to capture the change of systematic risk of sectors and exposures to sectors at the same time. Her analysis may provide important implication for regulators and policy makers of the banks in developing markets. |
| Chen 2013b | Chinese banks | 2007-2011 | That sector diversification is associated with reduced returns and risk reduction at the same time, which contradicts existing findings in developed countries such as Italy and Germany, and that in economies emerging countries such as Brazil and Argentina. |
| Hayden and al., (2007) | 983 German banking sector | 1996-2002 | Are no significant performance benefits associated with diversification since each type of loan diversification tends to reduce the performance of banks. Also, they find that the effect of focusing strongly depends on the level of risk. However, it is only for moderate levels of risk and, in the case of industrial diversification, that diversification significantly improves the profitability of banks. |
| Hass 2010 | 220 banks in 20 transition countries. | 2005 | Bank ownership, bank size, and legal creditor protection are important determinants of the composition of banks’ loan portfolios. In particular, they show that foreign banks play an important role in mortgage lending. Furthermore, banks that see guarantee and mortgage laws to be of high quality chosen to concentrate more on mortgage lending. |
| Jahn et al, (2013) | German banks to 23 different industries. | 2003 -2011 | Banks that are specialized in lending to a special industry are faced with less credit risk than the average credit risk of banking system. |
| Kamp and al (2007) | German banks | 1993-2003 | The main benefit of diversifying credit portfolios is the achievement of relative lower levels of risk compared to concentrated portfolios. The returns of concentrated portfolios, however, seem to be higher than those of diversified banks. The authors conclude that the typical risk-return tradeoff appears to be the solution of this analysis, leaving banks to choose their own strategy in order to maximize their performance. |
| Raei and al (2016) | 7 banks listed in Tehran Stock Exchange (TSE) | 2009-2014 | that there is a significant relationship between loan portfolio diversification and risk; also, it is the size that influences return on equity (ROE) and return on asset (ROA) of banks and in fact, there is no statistically significant relationship between use of diversification strategy in banks’ credit portfolio and their ROA and ROE. |
| Tabak and al (2011) | 96 Brazilian commercial banks | January 2003 to February 2009, | Loan portfolio concentration seems to increase the performance of Brazilian banks in both return and risk of default. The reason may be that loan portfolio concentration increases monitoring efficiency, since banks may have expertise in the sectors they lend |

III. METHODOLOGY

We empirically analyze the effects of loan portfolio diversification in a sample of ten Tunisian banks over the period 2000-2015. We start our empirical analysis by describing the data and discussing the evolution of diversification of loan portfolio in the Tunisian banking sector. Afterwards, we explain our choices in terms of variables specification and we present our hypotheses to be tested in this chapter. Later, we show our econometric methodology and the motivations behind it. Finally, we present the empirical results.

Our sample which has been chosen in this study consists of a panel data of the ten largest banks operating in the Tunisian banking sector and holding more than 85% of the total assets of the banking sector in 16 years from 2000 to 2015, totalizing 160 observations. The Central Bank of Tunisia provides the individual bank-level data, as well as the relative exposures to the economic sectors. Even though, the majority of banks in Tunisia are private-owned amongst the largest banks in Tunisian banking system. There are three state-owned (BH; BNA and STB), four private-domestic-owned banks (AMEN BANK; ATB; BIAT; BT) and three foreign owned bank (AT; UIB and UBCI). We use in this study two datasets containing bank-specific factors (Size; Equity ratio; Ownership dummies (State, Private Domestic or Foreign Private and non performing loans) and macroeconomic variables (GDP and inflation). The dataset containing bank-specific factors has been drawn from the Central bank of Tunisia. The macroeconomic variables have been obtained from the National Institute of Statistics.

Table 2: Tunisian Economic Sector

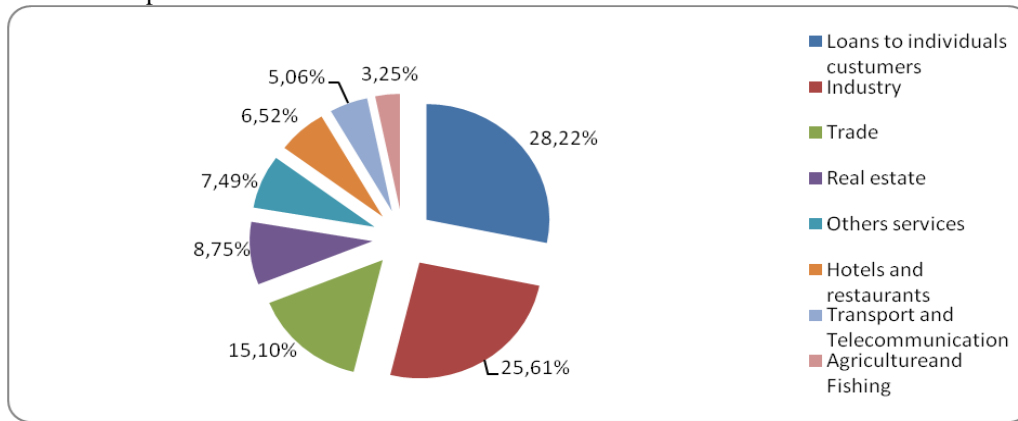
| Distribution of loans | Sector | Activities |
|----------------------------------|-------------------------|---|
| Loans to professionals customers | Agriculture and fishing | - Agriculture -Fishing -Forestry -Livestock -Aquaculture |
| | Industry | -Manufacturing industries ; -Agro food industries; - Building materials, ceramics and glass industries; - Mechanical and electrical, Chemical industries; -Textile and clothing industries; -Other manufacturing industries; -Mining; -Energy :Fuel extracting ; Oil refining , Electricity production and distribution, Water catchment, treatment and supply |
| | Services | Trade automobile repair and household items Transport & communications Hotels and restaurants Real estate, renting & service to businesses Others services: Financial activities Health & social services Education Miscellaneous Administration Collective, Social & personal services |
| Loans to individuals customers | Consumer loans | |
| | Housing loans | |

Source: Annual Report 2015 of central bank of Tunisia

The Tunisian economic sectors to which banks can lend are equal to 8, and Table 2.1 illustrates them. Our data includes the relative exposures of Tunisian banks to all these sectors, which will make the results more accurate in comparison to other studies about this issue.

Loan concentration means high exposure to one or few of these sectors, while diversification means a more equal loan portfolio distribution across them (Tabak and al, 2011). However, according to Raei, (2016) concentration means a high divergence from the economy's mean exposure to these sectors, while diversification stands for being close to this reference

Fig1: Loan Portfolio Composition of Tunisian Banks



Resource: Annual report 2015 of Central Bank of Tunisia

Table: 3: Summary Statistics

| Variable | Mean | Std. Dev. | Min | Max |
|----------|----------|-----------|-----------|----------|
| ROA | 1.153188 | 1.41718 | -9.9 | 4.4 |
| ROE | 5.442544 | 38.7782 | -372.0488 | 99.20692 |
| RAROA | 2.64283 | 2.354931 | -.3.40 | 8.525159 |
| RAROE | 1.934536 | 2.075203 | -3.564044 | 7.820161 |
| HHI | .25754 | .1431123 | .0670992 | .7136617 |
| SIZE | 7.7526 | .5315748 | 6.573122 | 8.661484 |
| EQUITY | 8.825451 | 3.21383 | -3.250904 | 16.62433 |
| NPL | 17.42213 | 9.375986 | 5.08 | 47.9 |
| GDP | 3.357476 | 2.154121 | -2.38 | 6.70962 |
| INF | 3.87125 | 1.09693 | 2.11 | 6.35 |

Table 3 presents the summary statistics of the variables that we use in our specifications. Starting with looking the mean and the standard deviation of the concentration measure (HHI), we find that Tunisian bank's loan portfolios seems to be diversified (0.257). If we compare the Tunisian bank's loan portfolio concentration with the concluding of the literature, we can see that in general it is more diversified than Brazilian banks (HHI=0.316) Tabak and al, (2011). We can conclude that in general it is approximately equal to Italian banks (HHI= 0.237) Acharya and al, (2006), also the Germans banks with an average (HHI=0.291) Hayden and al, (2007). Finally, in percentage the non performing loans are 17.42% meaning the Tunisian banks characterize by a higher probability of default.

a- Variables definition and hypothesis

In this section we define the variables used in this chapter. We show how we specify our dependent variables, explanatory variables as well as the control variables. Also, we present the hypotheses to be tested.

1. Profitability measure

Many variables have been used by the banking literature as proxies for profitability (Raei et al, (2016) ; Chen et al, (2013a) et Tabak et al, (2011) and Acharya et al, (2006). We use in this chapter a set of dependant variables as proxy for bank profitability. We use return on asset (ROA), return on equity (ROE), risk adjusted return on asset (RAROA), risk-adjusted return on equity (RAROE).we use these variables to see how credit portfolios diversification impacts bank profitability. To do so, we regress bank profitability variables on loan portfolio diversification measure.

Where ROA_{it} is the Return on Assets of bank i at year t measured as bank return on total assets; ROE_{it} is the Return on Equity of bank i at year t computed as return over total equity; $RAROA_{it}$ is the risk-adjusted return on assets of bank I at year t computed as ROA divided by its standard deviation and $RAROE_{it}$ is the risk-adjusted return on equity of bank I at year t computed as ROE divided by its standard deviation.

$$ROA = \frac{\text{Net income} / \text{total asset}}{\text{total asset}} ; \text{Acharya et al, (2006); Chen et al, (2013a); Raei et al, (2016) ; and Tabak et al, (2011)} \quad (1)$$

$$ROE = \frac{\text{Net income} / \text{total equity}}{\text{total equity}} ; \text{Acharya et al, (2006); Raei et al, (2016) and Tabak et al, (2011)} \quad (2)$$

$$RAROA = \frac{ROA}{\sigma_{ROA}} \quad \text{Chiorazzo et al. (2008); Meslier, (2014) and Sissy and al (2017).} \quad (3)$$

$$RAROE = \frac{ROE}{\sigma_{ROE}} \quad \text{Meslier et al, (2014) Sissy and al, (2017) and Tan, (2016)} \quad (4)$$

2. Loan portfolio diversification measure

We use in our empirical analysis of the impact of loan portfolio diversification in the context of the Tunisian banking sector. We present the way they are calculated. Also, we show a brief overview of the discussion in the related

empirical literature about the interpretation of these variables. The group of these independent variables contains the following bank-specific factors, namely, Loan portfolio concentration.

As proxy of loan portfolio diversification, we consider in this study, the classical concentration measure: the Hirshmann–Herfindahl Index which is computed as the sum of the square of the share of credit exposure to each economic sector. This diversification measure is based on the assumption of considering an equal exposure to every sector.

It is important to highlight that the goal of our analysis is to examine whether the sectoral composition in the banks ‘loan portfolio affect the banks’ return. Sectoral composition means the bank’s relative exposure to certain sectors

Hirschman–Herfindahl Index (HHI) is usually used as a measure of market concentration. It supposes ideal diversification as equal exposure to every sector.

We define relative exposure of each sector i at time t as its nominal exposure e_{it} divided by the total exposure (e_{kt}), then we calculate the concentration measure, for each bank,

$$\text{relative exposure}_{ik} = \frac{e_{ikt}}{\sum_{k=1}^n e_{ikt}}$$

The HHI is the sum of the squares of the relative exposures which has been one the most used concentration measure in Industrial Organization due to its relatively simplicity (Raei, 2016 ; Chen, 2013). The HHI of bank i at time t is defined as following:

$$\text{HHI}_{it} = \sum_{k=1}^n \left(\frac{e_{ikt}}{\sum_{k=1}^n e_{ikt}} \right)^2$$

Where

HHI_{it}: Credit based Herfindahl index for bank i in years t

Exposure_{ikt}: Credit provided for a special sector k by bank i at year t .

Exposure_{it}: Total credit provided by bank i at year t .

n : Total number of economic sectors to which the banks have provided credits.

The higher HHI value is (1), the less is the diversification of the bank. The inferior limit of the HHI is $\frac{1}{n}$ and represents a perfect diversified portfolio which signifies an equal share of exposure to each economic sector. If the HHI is equal to 1, the bank grants credits to only one economic sector. This means a perfect specialization. The banking crises of the 1980s and 1990s have taught us that banking institutions should not have expose themselves to only few economic sectors. The financial crisis of 2007 of the Subprime was partly caused by the higher exposure of banks to the real estate sector which is correlated with macro economic conditions.

Our empirical analysis is based on theoretical developments that come from different theories. In the first literature related to credit portfolio diversification, Diamond (1984), Winton (1999), Acharya and al, (2006) and Berger et al (2010), ask the question of whether or not a given bank should diversify its loan portfolio. Diamond (1984) argues that a bank may delegate the monitoring activities through the perfect diversification strategy which maximizes its gains by minimizing the monitoring expenses. Winton (1999) for instance shows through modeling the tradeoff between diversification and specialization that the gains that stem from diversification are most dominant.

However, Acharya and al, (2006) provide evidence that the loan portfolio diversification does not guarantee an efficient performance and/or a greater safety for individual banks. In the same line of reasoning, Berger and al, (2010) argue that aggressive diversification strategies of loan portfolios may negatively impact bank performance through an increased risk taking during the recent financial crisis.

Based on the theoretical developments regarding the relationship between loan portfolio diversification and bank profitability, we formulate and test the following hypothesis.

Hypothesis 1: “Loan portfolio diversification positively impacts bank profitability”

Private/ foreign owned bank and HHI interaction

In order to check whether bank ownership structure affects the relationship between loan portfolio diversification and bank profitability, we construct ownership dummies variables. These variables indicate whether a bank is a state bank, private domestic bank or a foreign bank. We interacts these dummy variables with our main explanatory variables which is HHI.

The ownership dummies are measured as follow:

| | |
|------------------|---|
| State | Takes the value 1 if the bank is a state-owned bank. |
| Domestic private | Takes the value 1 if the bank is a domestic private bank and 0 otherwise. |
| Foreign private | Takes the value 1 if the bank is a foreign owned bank. |

We formulate and test the following hypothesis

Hypothesis 2: “The positive effect of loan portfolio diversification on bank profitability is more pronounced in private banks.”

Hypothesis 3: “The positive effect of loan portfolio diversification on bank profitability is more pronounced in foreign banks.”

Thus, we estimate the effect of loan portfolio diversification and profitability from a model that includes interactions of diversification measure with two ownership dummies.

We examine the relationship between loan portfolio diversification and bank profitability as function of bank credit risk. To do so, we use the variable NPL, which is calculated as the ratio of nonperforming loans to total loans.

Hypothesis 4: “the positive effect of loan portfolio diversification on bank profitability is more pronounced for credit risky banks.”

3. The Control variables

We use a set of control variables that represent the effect of bank specific factors as well as macroeconomic conditions. As bank specific factors, we control for bank size, bank equity, bank credit risk proxies using the NPL ratio. We also control for macroeconomic variables using information on economic growth and inflation. To do so, we take into account GDP growth and inflation rate

. Bank size (SIZE) is measured using the logarithm of bank total assets, following Raei and al, (2016); Chen and al., (2013); Tabak and al, (2011) and (Acharya and al, 2006). Authors studies use different measures of bank size. For example, Louzis and al, (2012) and Roman and Sargu, (2015) use the bank 'assets as a percentage of the total assets of the whole banking system as a proxy for bank size.

Thus, the variable SIZE is computed as follows:

$$SIZE = \text{Log}(\text{total assets})$$

Equity ratio (EQUITY) is measured as total equity divided by total assets, reflecting the capital structure of the bank, following Chen and al, (2013), and Tabak and al, (2011).

The variable EQUITY is measured as follow:

$$EQUITY = \frac{EQUITY}{TOTAL\ ASSETS}$$

Ownership dummies, another interest of ours is to test whether ownership control affects the results on the relationship between loan portfolio concentration and returns, as in the following hypothesis

Nonperforming loans ratio is calculated as the ratio of nonperforming loans to total loans following Raei and al, (2016); RAO; (2015); Chen and al, (2013) and Tabak and al, (2011).

$$NPL = \frac{\text{non performing loans}}{\text{total loans}}$$

Many variables have been used in banking literature to proxy for credit risk. One measure of credit risks according to the regulation of Central Bank of Tunisia, banking institutions classify their loans into two sub-groups such as: current assets and classified assets.

Are considered as current assets, the credit for which the total reimbursement seems to be ensured. These credits are provided to firms which are characterized, mainly, by: balanced financial situation, management judged satisfactory, adequate form and volume of credit with regard to the needs of the main activity and the real capacity of repayment of companies. The second group is composed by classified credit. The classification of these loans is made with regard to the severity of the problem loan and therefore the risk of loss for banks.

We use to macroeconomic indicators such as GDP growth and inflation rate.

Economic growth (GDP): is defined as the annual growth of the gross domestic product .Inflation rate (INF): is the annual growth of the Consumer Price Index (CPI). It reflects the changes associated with the cost of living.

B. Panel specification

In this section, we present the models to be tested in order to the influence of loan portfolio diversification on Tunisian banks' profitability. First of all, we estimate the average effect of diversification on returns. Second, we check whether this relationship depends on the type of bank's ownership. Then, we introduce variables of risk (NPLs) in order to see how this relation changes as function of bank's credit risk.

We use in this study a panel dataset on 10 Tunisian banks over 16 years (from 2000 to 2015) for a total 160 observations. We regresses bank profitability on a loan portfolio diversification and we control for a set of bank specific factors including bank's size, equity ratio, and ownership dummies. We control also for macroeconomic condition by taking into account information on economic growth and inflation rate.

The most fundamental question concerning to this subject is if loan portfolio diversification impact in higher return. We can examine with this topic by regressing profitability on a diversification measure, as in the following model:

Model 1:

$$Return_{it} = \alpha + \beta HHI_{it} + \gamma V_{it} + \delta M_t + \varepsilon_{it}; \quad i = 1, \dots, N = 10; \quad t = 1, \dots, T = 16$$

Where,

| | |
|-------------------------------|--|
| profitability | Return on Assets, Return on Equity |
| Risque-adjusted profitability | Risque-adjusted Return on Assets, risque-adjusted return on equity |
| HHI _{it} | Diversification measure |
| V _{it} | Size and Equity of bank |
| M _t | GDP growth and Inflation rate in year t, |
| ε _{it} | Error term |

In addition, another interesting question is to test whether ownership type control affects the relationship between loan portfolio diversification and banks returns. Thus, we estimate equation including interaction of diversification measure with two ownership dummies, as in the following models.

$$Return_{it} = \alpha + \beta_1 HHI_{it} + \beta_2 Private + \beta_3 HHI * private + \gamma V_{it} + \delta M_t + \varepsilon_{it}$$

$$Return_{it} = \alpha + \beta_1 HHI_{it} + \beta_2 foreign + \beta_3 HHI * foreign + \gamma V_{it} + \delta M_t + \varepsilon_{it}$$

We estimate the relationship between loan portfolio diversification and profitability as function of bank risk by another equation. For this purpose, we use the variable NPL_{it} which represents, in this case, the ratio of nonperforming

loans to total loans. We use its interaction with loan portfolio diversification measure to test the effect of bank 'credit risk on the relationship between profitability and loan portfolio diversification. We consider the following model:

$$\text{Return}_{it} = \alpha + \beta_1 \text{HHI}_{it} + \beta_2 \text{NPL}_{it} + \beta_3 \text{HHI} * \text{NPL}_{it} + \beta_4 \text{V}_{it} + \beta_5 \text{M}_{it} + \varepsilon_{it}$$

IV. EMPIRICAL RESULTS

In this section we present our empirical results. Three econometric methods are used is Random effects regression.

. The random effects model is used when there is no correlation between the unobserved individual and time specific effects and the regresses taken into account in the equation to be tested.

Table 4 displays the results of the relationship between bank loan portfolio diversification and bank profitability while controlling by other bank specific and macroeconomic indicators. Bank profitability is measured using return on assets (ROA) and return on equity (ROE) as well as by risk-based performance through risk-adjusted return on assets (RAROA) and risk-adjusted return on equity (RAROE). (RAROA) and (RAROE) are calculated as ROA and ROE divided by the standard deviation of ROA and ROE, respectively.

The result displays in table 4 show that the loan portfolio diversification negatively impacts bank profitability. All coefficients of HHI are positive in table 4 except for model 7. This negative association between loan portfolio diversification and bank profitability indicates that focusing credit loan portfolios to few economic sectors is more profitable for Tunisian banks that diversifying. This result can be explained by the fact that when banks diversify their loan portfolios for many economic sectors, this well lead to an increase in monitoring costs which may negatively affect banks return (Acharya and al, 2006). In fact, when bank loan portfolios are diversified, bank are exposed to the economic conditions variations of many sectors, and taking into consideration that a bank many not important cost of monitoring compared to a situation where a bank is lending to only few economic sectors which are well known by the bank and for which the monitoring cost is not important.

It has been shown in the previous empirical studies that the lack of loan portfolio diversification is highly associated with poor banking performance and greater risk. Many authors argue that credit portfolio concentration was the main cause of banking crises over the last 25 years (Tabak and al, 2011; Bebczuk and Galindo, 2008; Rossi and al, 2009).

Acharya and al, (2006) find empirical evidence that credit portfolio diversification worsens the profitability of Italian banks ans increase banking risks. In addition, Norden and Szerencses, (2005) and Hayden and al, (2007); find that bank's performance in Germany is negatively impacted by loan portfolio diversification. Mercieca abd al, (2007); find similar results for small European banks.

In the German context, Kamp and al, (2007) suggest neither the traditional banking theory nor the theory of corporate finance are completely right all German banks within the period 1993-2003.

V. CONCLUSION

The main aim for this chapter is to test whether it is better for banks to concentrate or diversify loan portfolio across industry. However, the literature dealing with the relationship between loan portfolio composition and bank return is scare for emerging market. In this chapter, we contribute to evaluate in which way the diversification of the loan portfolio impacts the profitability of 10 Tunisian bank using periods from 2000 to 2015. We estimate several regressions using statically specification random effect of panel data models and employing traditional concentration measures HHI as proxy for loan portfolio diversification.

We find that Tunisian banks' loan portfolio are, on average diversified. We can see that the average of HHI it is equal to developed markets (Italian in which average is 0.237 (Acharya and al, 2006), German market (with an average HHI equals to 0.291, Hyden and al 2007). The loan portfolios of Tunisian banks are more diversified than Argentina (0.55) (Bebczuk and Galindo, 2008) than Brazilian banks (0.342) Tabak and al, (2011).

Many studies have empirically examined the relationship between credit portfolio diversification and bank profitability. For instance, Berger and al, (2010); find that in the Chinese banking sector, loan portfolio diversification worsens the profitability of banks. In addition, the theoretical developments that stem from the theory of corporate finance argue that when banks increase their loan portfolio toward many economic sectors, this banking strategy will result in an increasing competition with other banks which leads to lower banking profitability (Tabak and al, 2011). Winton (1999) argue that the relationship between credit portfolio diversification and bank profitability depends on the level of bank's risk of default. From this perspective, the author suggests that loan portfolio diversification only reduces the likelihood of bank failure in presence of moderated risks of default. In presence of low risks of failure, banks many benefits more from specialization than from diversification. This is because banks face a low likelihood of failure. However, in presence of high chances of default, credit portfolio diversification many even worsen bank overall performance. This is because when banks are exposed to many economic sectors, the downturn of one sector many be enough to lead to a significant deterioration in bank profitability and in some cases to bank failure (Tabak and al; 2011).

Our general conclusion is that the concentration of the loan portfolio seems to improve the profitability of Tunisian banks. The reason may be that the concentration of the loan portfolio increases the effectiveness of supervision, as banks can have expertise in the sectors they lend, as Winton (1999) argues. When we consider the different types of banking properties, we find that for private banks, the higher the specialization of the credit portfolio, the higher the returns. In other words, the profitability of these banks seems, on average, to be less affected by the concentration of loans.

Table 4: Finding for Random effects regression

| method | Model (1) | Model (2) | Model (3) | Model (4) | Model (5) | Model (6) | Model (7) | Model (8) | Model (9) | Model (10) | Model (11) | Model (12) |
|--------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|
| Dependent variable | ROA | RAROA | ROE | RAROE | ROA | RAROA | ROE | RAROE | ROA | RAROA | ROE | RAROE |
| HHI | 2.15* | 1.50* | 5.81 | 1.94** | 2.13* | 1.45 | -19.11 | 1.89* | 1.21 | 0.83 | 32.82 | 2.17 |
| | (1.10) | (0.88) | (32.76) | (0.96) | (1.23) | (1.02) | (38.44) | (1.13) | (1.74) | (1.44) | (54.51) | (1.58) |
| Size | 0.54 | 0.66 | 10.68 | 0.70 | -0.31 | 0.07 | -3.29 | 0.29 | -0.23 | 0.10 | -2.99 | 0.46 |
| | (0.81) | (0.65) | (24.05) | (0.70) | (0.78) | (0.65) | (24.57) | (0.72) | (0.81) | (0.67) | (25.38) | (0.74) |
| Equity | 0.25*** | 0.15*** | 9.77*** | 0.10** | 0.30*** | 0.14*** | 10.61*** | 0.11** | 0.25*** | 0.15*** | 9.44*** | 0.11*** |
| | (0.05) | (0.04) | (1.61) | (0.04) | (0.05) | (0.04) | (1.71) | (0.05) | (0.05) | (0.04) | (1.61) | (0.04) |
| Private | | | | | -2.56** | 4.71*** | -50.83 | 2.63** | | | | |
| | | | | | (1.07) | (0.89) | (38.44) | (0.99) | | | | |
| HHI*priv | | | | | 0.16 | 2.11 | 75.94 | 1.55 | | | | |
| | | | | | (2.27) | (1.88) | (71.17) | (2.10) | | | | |
| foreign | | | | | 1.09 | -4.31 | 17.19 | -2.81 | | | | |
| | | | | | (1.06) | (0.88) | (33.40) | (0.98) | | | | |
| HHI*foreign | | | | | 0.95 | -5.73** | 2.15 | -3.25 | | | | |
| | | | | | (3.22) | (2.67) | (100.78) | (2.98) | | | | |
| npls | | | | | -0.09*** | -0.06*** | -1.82 | -0.04** | -0.06 | -0.67 | 10.29 | -0.68 |
| | | | | | (0.03) | (0.01) | (3.13) | (0.02) | (0.26) | (0.40) | (15.39) | (0.44) |
| Npls*hhi | | | | | | | | | 1.76 | 1.14 | -36.75 | 0.22 |
| | | | | | | | | | (1.71) | (1.41) | (53.57) | (1.56) |
| GDP | 0.10 | 0.21*** | 0.62 | 0.19** | -0.01 | 0.12 | -1.82 | 0.13 | -0.08 | 0.08 | -2.21 | 0.09 |
| | (0.09) | (0.07) | (2.86) | (0.08) | (0.10) | (0.08) | (3.13) | (0.09) | (0.10) | (0.08) | (3.16) | (0.09) |
| INF | -0.05 | -1.38 | 4.57 | -0.08 | 0.41 | 0.20 | 12.72 | 0.16 | 0.38 | 0.16 | 11.88 | 0.09 |
| | (0.25) | (0.20) | (7.52) | (0.22) | (0.26) | (0.21) | (8.15) | (0.24) | (0.26) | (0.21) | (8.29) | (0.24) |
| Constant | -5.28 | 1.12 | -173.08 | -2.42 | 2.75 | -0.11 | -41.97 | -2.84 | 0.319 | 5.19 | -75.78 | -0.84 |
| R-square | 0.3751 | 0.8792 | 0.3950 | 0.8182 | 0.5691 | 0.8927 | 0.4380 | 0.8278 | 0.5572 | 0.8910 | 0.4260 | 0.8295 |

Note: * p < 0.10, ** p < 0.05, *** p < 0.01. T-statistics are between parentheses. The dependent variables are ROA, ROE, RAROA and RAROE and the measure of loan portfolio diversification HHI defined as the sum of the squares of the relative exposures. NPL is nonperforming loans ratio and calculated as nonperforming loans divided by total gross loans. GDP is the gross domestic product annual growth. INFL is the annual inflation rate.

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