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Topic :

Has income diversification proved its worth as a vehicle in driving Tunisian banks' financial performance and stability?

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Abstract

Our thesis sheds light on the diversification strategy and examines its impact on the banking sector's performance and financial stability. Using a sample of 11 Tunisian commercial banks over the period of 2005 to 2019, our study provides two major results. First, non-interest income as well as its components foster banks' performance and boost their financial stability. Therefore, shifting toward non-traditional activities as well as operating in new businesses seems to be a rewarding path for Tunisian banks' in terms of performance and stability. Second, private ownership does not moderate the diversification influence on performance and stability. Nevertheless, the long-term trading impact on stability is amplified by private ownership. We find that privatization has a significant positive effect in reinforcing the long term trading-stability relationship.

Key words: diversification; non-interest income; bank' performance; bank' stability; privatization.

JEL Classification: G11, G21, G32, G29.

Résumé

Notre étude met l'accent sur la stratégie de diversification et ses effets sur la performance et stabilité financière du secteur bancaire. Nous avons utilisé un échantillon de 11 banques tunisiennes couvrant la période de 2005 jusqu'à 2019. Notre recherche nous a permis d'aboutir à deux principaux résultats. Premièrement, les revenus hors intérêts ainsi que leurs composantes influencent positivement la performance et la stabilité des banques tunisiennes. De ce fait, ces dernières ont intérêt à opérer dans des nouvelles activités non-traditionnelles et commercialiser de nouveaux produits et services afin d'améliorer leur profitabilité et leur stabilité financière. Deuxièment, la propriété privée des banques n'a aucune influence sur les liens entre la diversification et la performance ainsi qu'entre la diversification et la stabilité financière. Toutefois, l'effet des gains de portefeuille d'investissement sur la stabilité des banques tunisiennes est amplifié par la privatisation.

Les mots clés : la diversification, revenu hors intérêt, la stabilité bancaire, la performance bancaire, la privatisation.

Classification JEL: **G11, G21, G32, G29.**

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Dedication

I dedicate this thesis to my parents Abdelwaheb and Naima for their love, to my best friend Bassem for his unconditional support, and to my friends' Rim, Sahar, Zaineb, and Khouloud for their bits of advice and encouragement.

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INTRODUCTION

The banking sector is the backbone of all economic and financial systems all over the world, especially in the less developed countries such as Tunisia. The presence of some issues that might harm the banking industry will affect the whole system which could lead in the worst cases to the country going bankrupt. It is important to stress that the main purpose of international and national banks' guidelines is to improve stability and boost performance. Financial stability and efficiency are the main issues for regulators and policymakers who seek to identify all the determinants which drive banks' stability and performance to implement the appropriate standards that aid economic growth. Since the 1990s', diversification has been highlighted as a key factor essentially due to financial liberalization, intense competition (opening the market to non-bank rivals), and technological innovation which led banks to shift away from traditional intermediation business and move toward non-interest income such as commissions, fees, and trading securities. In order to maintain future returns and to compete with their rivals, banks choose to diversify their business and operate in new fields: brokerage, insurance, trading, derivatives, and many other financial services.

Non-traditional income has become an important source for banks' financial performance. Innovation and technological development have increased banks' framework complexity. Nevertheless, they have aimed to provide new methods to facilitate banks' business and solve bank-client distance issues. Furthermore, these emerging methods presented a crucial tool for banks to differentiate themselves from other competitors and improve their performance under environmental constraints. We believe that banks have to integrate new technologies and diversify their activity to satisfy new clients' needs which are becoming increasingly demanding and vigilant. Given that diversification is adopted by banks to attract new clients, make their current clients loyal, compete with their rivals, improve their profitability and reduce their risk-taking, we can hint to the idea that diversification can be considered as a determinant of banks' performance and stability (Chiorazzo et al. 2008**;** Edirisuriya et al. 2015; Nisar et al. 2018).

During the last decade, the Tunisian government pushed banks to shift toward non-traditional income through several reforms such as the enacted law of 2001 in which the concept of the "universal" bank was first introduced which reduced banks' specialization (development,

Investment, and deposit banks). Moreover, we can cite the 2016s' reform that formalized Islamic transactions within the Tunisian banks.

The Sub-prime crisis reshaped the financial environment and led international supervisors to implement new and enhanced reforms (Basel III)[1] in which they have recommended holding a higher capital rate[2]. Tunisian banks' regulation requires banks to hold at least 7% tier 1 ratio and 10% solvency ratio[3]. Banks can't exceed a maximum of 120% for the loan to deposit ratio (LTD henceforth) and a minimum of 0.3% for the total bank's deposits as a guarantee in order to protect depositors[4]. The three aforementioned reasons (capital requirement, LTD ratio, and bank deposit guarantee fund) limit lending activity sources. Hence, we can picture how such stringent regulations can lower performance which can lead to changes in the income structure. At this point, a question sparks the practitioners' attention which is: ***is diversification within Tunisian banks still a voluntary move?***

In this context, the main existing studies focus is on how diversification affects banks' risk and profitability. They provide mixed results. On one hand, it can be beneficial through exploiting managerial skills, economies of scopes, and cross-selling opportunities *(*Hahm, 2008; Mostk, 2017). On the other hand, agency costs, asymmetry information, growing organizational complexity and the loss of focus (DeYoung and Roland, 2001; Stiroh and Rumble, 2006; Abedifar et al. 2018) could offset diversification benefits. Thus, it is uncertain whether revenue diversification can lead to more stable and profitable banks. Given the inconsistency of the previous studies, we conclude that the diversification effects exist yet its direction still ambiguous.

This leads us to investigate ***how income diversification can affect banks' stability and profitability in the Tunisian context?***

To reach our aim and give an appropriate answer to our research question. We will start by understanding the theoretical background followed by an empirical investigation based on the Tunisian market context.

[1] Basel III is a norm created in 2010 by the Basel Committee on Banking Supervision to enhance global financial
[2] A minimum capital adequacy ratio (Tier 1 and Tier 2 to risk-weighted assets) of 8%; a minimum Tier 1 capital ratio of 6% and a minimum core tier 1 ratio of 4.5%.
[3] Bank circular 2018-06.
[4] Bank law 2016-48.

CHAPTER 1: THEORETICAL PART

Traditionally, banks have built their profitability through their intermediation activity (deposit-taking and lending). For the last decade, the banking market's environment has become more complex due to financial liberalization, deregulation, competition, innovation, and new customers' behavior. Furthermore, the intermediation activity faces some expansion limitations due to heavy competition. This has led banks to pay more attention to non-traditional activities to reap benefits from income diversification, to secure future cash-flow, and be more competitive. Nevertheless, previous studies failed to provide a consensus about the diversification effects**.** This has led a large body of research to investigate and cut doubt on the real effect of diversification. Is diversification beneficial or not? Should financial institutions diversify their activities or specialize?

Previous literature provides mixed results on the impact of diversification and non-traditional income on performance and stability. Meslier et al. (2014); Nguyen et al. (2015); Sissy et al. (2017); Mostak, (2017); Nguyen, (2017); Hamdi et al. (2017); Jouida, (2018); Brahmana et al. (2018); found a positive relationship, while DeYoung and Roland, (2001); Acharya et al. (2002); Stiroh, (2004b); Stiroh and Rumble, (2006); Mercieca et al. (2007); Ayedi and Ellouze, (2015); Williams, (2016); Maudos, (2017) revealed contrast findings of the above. This suggests that the impact of diversification depends on the country's environment, regulation, and customer culture.

Hence, the aim of this work is to test this strategy in the Tunisian context to provide policymakers with empirical evidence on the basis of the relationship and help them decide whether Tunisian banks should opt for diversification or specialization.

This chapter includes 6 sections. In **section 1**, we will define the concept of diversification, its' benefits, and its' drawbacks. In **section 2**, we will present the determinants of bank diversification. **Section 3** presents the related theories that carry about diversification. In **section 4** we will set some empirical studies on the association between diversification-profitability and diversification-risk. **Section 5** includes our hypothesis. In **section 6**, we will pay close attention to the Tunisian context. Finally, we conclude to move to the second part.

SECTION 1: The concept of bank diversification

The concept of diversification has been presented in several fields of research (finance, marketing, and risk-management). In this section, we will focus on diversification in the banking area.

1.1. Diversification concept definition

Diversification strategies in the banking sector were adopted since a couple of decades ago through brokerage subsidiaries in order to deal with all services that can attract potential clients. Benefitting from strong client relations and a stable clientele base, banks didn't find it very hard to sell other services to their customers such as insurance policies. This has given them a competitive edge compared to other financial institutions. Furthermore, when a bank provides its clients with a wide range of products and services they are more likely to stay loyal to their bank which in turn would minimize the chances of leaving for another bank.

There are four types of diversification;

- ***Horizontal diversification,*** which refers to an extension of production in the same sector that the company operates in. Companies adopt this type of diversification by adding new products and services to the exciting product range.
- ***Vertical diversification,*** also known as the integration strategy (forward or backward integration). It suggests that firms, in addition to their main activity, operate in the previous or in the next step of their main production process.
- ***Concentric diversification*** refers to the development of new complementary products or services in order to fully exploit production capacity, technologies and distribution channels.
- ***Conglomerate diversification*** refers to operating in a new business that has minimal correlation with the current activity. That is when companies launch new products and services to attract new customers.

In the previous literature, and according to Mercieca et al. (2007), there are three types of diversification; first, activity diversification when banks operate in several businesses. Second, geographic diversification if banks expand their market locations. Third, it is a combination between both activity and geographic diversification. In our research we will

focus on the first type “activity diversification” that generates multiple sources of income; net interest income from the lending activity and non interest income such as commission, fees, net trading income and others.

1.2. Diversification benefits

By adopting a diversification strategy, banks aim to boost their growth rate which in turn would boost their market value. Diversification allows firms to adjust to environmental change and technological innovation, attract new customers and enhance customers’ loyalty. In addition, it helps in maximizing the use of their potential resources and reduces risks by moving away from activities that are in decline.

Add to that, the banks choose to diversify for five reasons (Elyasiani and Wang, 2012; Sun et al. 2017).

1- Operating in non-traditional business lines intensifies competition within financial institutions (banks, insurances) which in turn has led them to be more efficient, competitive and profitable due to innovative techniques.
2- Operating in non-traditional activities allows banks to gain from economies of scope. Fee-based activities do not require fixed assets or regulatory capital. Further, banks can exploit fully the skills of their labor. The fixed costs will be divided into multiple product lines which increase the margin profit and allow banks to be more competitive.
3- Operating in non-traditional activities allows banks to collect more information on their customers. This may enhance banks’ profitability.
4- Operating in non-traditional activities satisfies new customers’ needs for financial services and products. This generates more fees and commissions, enhances market competitiveness, and maintains a stable client-bank relationship.
5- Operating in non-traditional activities boosts banks’ income. Investing in financial markets generates more gains from trading (bonds and stocks). Furthermore, exchange activity and other businesses can also increase banks’ revenue.

1.3. Drawbacks

Diversification has also entailed several new added costs such as the increase of expenses due to entering new markets or developing new products, which requires more resources and learning new skills. Some activities such as investing in the stock market require specific skills. However, not all banks have the possibility to invest. As a result, investing in the stock market can lead to lower income due to investment losses. Moreover, an over-diversified activity can limit the growth of the core activity and the potential opportunities for the bank. Diversification also requires good management in order to deal with several segments and products without loss of focus.

A large stream of academic research assumes that non-interest income is more volatile than traditional income. The diversification effect has been highlighted by portfolio theory which opines that the higher the reliance on non-interest income, the higher the volatility of returns (DeYong and Roland, 2001; Stiroh, 2004; Stiroh and Rumble, 2006). According to DeYoung and Roland, (2001), this could be explained by three reasons. First, the relationship between a bank and its clients is stable because changing banks is costly for both. However, fee-based activities are not correlated which make lower switching and information costs, hence bank-client relationship is not stable and the client can change its bank easily with low costs. Second, operating in non-traditional activities requires greater operating leverage because fee-based activities need to invest more in technology and labor. Third, banks' regulation does not require banks to hold high capital in order to operate in non-interest income activities, which leads to banks employing higher financial leverage to invest more in non-traditional activities, and in turn this would lead to higher volatility.

SECTION 2: Determinants of bank diversification

The mixed results provided by the earlier studies on the diversification effects can be explained by the presence of key factors which can change from one country to another or it can also vary between banks. This may affect the impact of diversification strategy on both profitability and stability. The determinants of bank diversification can be divided into two categories. On one hand, bank-specific factors such as bank size, ownership structure, capital, profitability, asset quality, management skills, and innovation. On the other hand,

macroeconomic determinants like market structure, regulation, idiosyncratic events (crisis), and economic situation in terms of inflation and gross development product.

In the following, we will focus on the most investigated factors in previous literature: capital, size, ownership structure, competition, and financial crisis.

2.1. Determinants of bank diversification

Bank Capital

There are two controversial points of view regarding bank capital. On one hand, banks with low capital need to expand their business into non-lending activity which does not require banks to hold regulatory capital. Hence, they can invest more in fee-based activities due to high financial leverage. Meng et al. (2017) supposed that less-capitalized banks are more likely to shift toward product lines which require less capital. Meslier et al. (2014) also support this point of view and assume that lower equity push banks to operate in more risky business. On the other hand, high capital provides banks the financial resources and the needed buffer to operate in other business lines (Nguyen et al. 2012; Pennathur et al. 2012; Hahm, 2008). Nguyen et al. (2012) found that banks with high capitalization (equity/total asset) and credit risk (Non-performing loans) tend to shift towards income source diversification. Hamdi et al. (2017) deem that high solvability through higher capital ratio might lead banks to enter new businesses. Jouida, (2018) built a dynamic relationship model between diversification, performance, and capital structure to catch the bidirectional causality between the variables using a panel vector autoregression model "PVAR" on 412 French financial institutions from 2002 to 2012. The main findings indicate that diversification, capital structure, and profitability are related but their relationship is not stable, it changes over time. Moreover, leverage increases diversification while the inverse is not significant.

Bank size

Bank size plays a crucial role in this issue. Large banks are generally more apt than smaller sized banks to expand their activities, innovate, manage risks and benefit from economies of scale (DeYong et al. 2004; Meslier et al. 2014; Nguyen, 2017). According to Abedifar et al. (2018) smaller banks should not engage in non-interest activities due to their size constrain. Nguyen, (2017) shows that income diversification within large scale banks affects deeply operational efficiency. However, another point of view suggests that large banks should focus

on their traditional business line because the larger the bank is, the higher asymmetry of information and agency costs are (Hamdi et al. 2017).

Ownership structure

A large body of studies focuses on ownership structure effects. The main conclusions indicate that foreign banks strive to compete with domestic banks in non-interest income because the latter has more information on clients' quality and country. Hence, the high asymmetry of information has led foreign banks to rely on non-traditional activities and minimize lending due to lack of information (Nguyen et al. 2012). Meslier et al. (2014) opine that foreign banks benefit more from diversification than domestic banks. Considering the banks' ownership structure, Mostak's, (2017) findings indicate that neither public banks nor private domestic banks benefit from a higher focus on income diversification. However, the diversification strategy increases the risk-adjusted profits of foreign banks. Another point of view assumes that private banks are more able to reap benefits from income diversification than public ones since they have the required management skills to deal with multiple lines of products and services (Saghi-Zedek, 2016). Saghi-Zedek, (2016) analyzed 710 banks from 17 European countries from 2002 to 2010, to catch how banks' ownership structure can impact the link between diversification and bank's risk-return. He found that diversification effects depend on shareholders category. When banks are controlled by families and state shareholders, diversification would increase earnings volatility and default risk. This is explained by the idea that states and families do not have large experience compared to banks, institutional investors, or companies' shareholders to manage several activities and provide the necessary skills. However, non-state-owned banks could easily reap benefits from diversification through risk reduction and increased profitability. In addition, he finds that the presence of these shareholders in the control chain is beneficial for both large and small banks. However, benefits from diversification are more pronounced in small banks. Public banks are usually required to focus on lending in order to provide financial stimulus to certain industries. Nonetheless, state-owned banks are usually large-scale banks with a greater scope which provides a perfect environment to diversify. Pennathur et al. (2012) revealed that fee-based income helps public banks to reduce their risk while it increases the risk of both private domestic and foreign banks.

Competition

The competitive environment had forced banks to compete and attract potential clients with well-diversified services and products. Amidu and Wolf, (2013) assume that in emerging countries, revenue diversification is the tool through which market competition affects positively bank stability. However, in developed regions such as Europe, Maudos, (2017) shows that market power enhances banks' stability. Nevertheless, it does not influence the risk of banks with a well-diversified income structure. We assume that competition is positively correlated to income diversification.

Idiosyncratic events

The financial crisis has been the main reason for reshaping bank income structure. It has pushed banks, through regulatory changes, to increase their capital ratios in order to maintain stability. Hence, banks' attention has been directed to the non-traditional activities that do not require a regulatory capital. Brighi and Venturelli's, (2016) findings indicate that in the post-crisis period, risk-adjusted profits were less penalized within well geographically diversified banks, and non-interest income was strictly associated with bank performance. Kim et al. (2020) pointed out that under crisis, diversification may raise the probability of financial system collapse. However, the crisis had badly affected the financial market activities. As noted by Maudos, (2017) the income structure had become very important during the crisis because only banks that are specialized in intermediation were able to maintain their solvency level and avoid the negative impact of the crisis on their performance. In addition, diversified banks are riskier and less profitable during the crisis.

2.2. Results of some empirical studies on the determinants of income diversification

Hahm, (2008) examined the determinants of non-interest income taking into account bank-specific factors and macroeconomic factors. He used a database of 662 commercial banks from 29 OECD countries over the period from 1992 to 2006 and found that bank size, profitability, and bank capitalization affect positively non-interest income. In addition, low net interest margins, high cost-to-income ratio, and impaired loan ratio are also associated with a higher share of non-interest income. For macroeconomic factors, high non-interest income share is related to slow economic growth, stable inflation, and well-developed stock

market. In Ghana, Damankah et al. (2014) revealed that interest income, liquidity, and exposure to risk are key factors that drive engagement in non-traditional activities. In addition, it seems that smaller banks, with high liquidity, low level of deposits, and higher anticipation of loan losses, engage more in non-interest activities. In China, Meng et al. (2017) analyzed 88 domestic banks over the period 2003-2010. They reveal two conclusions. First, while there are positive relationships between non-interest income and cost of production (operating expense to total assets), insolvency risk through Z-score, asset scale and capital position (book value equity to total assets), there is a negative relationship with interest spread and volatility. Second, resisting shocks and supplementing liquidity shortage from intermediation drives large banks to shift toward non-traditional activities. In Tunisia, Hamdi et al. (2017) found that performance through relative return on assets (RROA) and relative return on equity (RROE), size, loan specialization, credit cards, new e-payment channels, and automatic teller machine (ATM) are the specific key factors of non-interest income. This is consistent with Hakimi et al. (2012) results which revealed the importance of bank-specific factors (size, efficiency, strategy), and the information / telecommunication technologies such as cards and ATM's in driving non-interest income.

SECTION 3: Related theories

Diversification is a well-known strategy by institutional and private investors alike. Traditional and modern theories provide conflicting predictions regarding diversification impact whatever on the risk or the profitability. Traditional theories predict that diversification reduces risks by eliminating the specific or idiosyncratic risk of each activity and leaving only the systematic risk that cannot be avoided. When companies launch new products and services, open new locations, or have other business partners, they do so to reduce risks and increase long-term profits. In this research, we will rely on the portfolio theory. Traditional portfolio theory (Markowitz, 1952) deems that for the same expected return, a diversified portfolio is less risky than undiversified ones because diversification strategy eliminates the specific risk of each security. Furthermore, the diversification decision is beneficial only if income sources are imperfectly correlated. In the banking context, it is the income that should come from different activities in order to reduce the total risk (Klein and Saidenberg, 1998; Sawada, 2013; Belguith and Bellouma, 2017).

For more explanation, we will consider the E-V rule. As Markowitz defines, the E is the expected yield while the V is the portfolio variance. According to Markowitz, (1952), diversification minimizes portfolio risk. To be more specific, we have to take into consideration the two key factors that drive assets' performance: the expected return (yield) and the risk. The expected return is what investors predict to reap by investing in such security. While the risk is a measure of uncertainty that investors support in order to deal with such security. In practice, investors pay a lot of attention to the Risk-Return tradeoff; a high return implies high risk. In fact, if an investor wants to reach more benefits, he will support a higher risk. These two concepts are strongly correlated. Hence, as portfolio theory opines, diversification is needed to minimize the total risk by eliminating the idiosyncratic one. Investors can expand their ambitions and choose a portfolio with a high expected return and deal with risk by adopting a diversification strategy. However, there is a specific threshold of the beneficial diversification effect, exciding it will provide opposite results. Consequently, investors seek to optimize the risk-return couple to reap more gains with less risk. Markowitz explains the crucial role of diversification in portfolio management in this way: The return of n securities is determined by the weighted average of expected returns of each security. While risk is not simple as that, it is measured by the variance of the entire portfolio which gives us lower risk. Furthermore, the E-V rule implies the superiority of diversification, except of some particular cases where an undiversified portfolio can be the optimal choice. If a security has higher returns and lower risk level compared to the other securities, then an undiversified portfolio grants the maximum returns with the minimum variance.

In sum, the E-V rule implies the superiority of diversification. "… For a large presumably representative range of u_i, σ_i, (with u_i refers to the expected returns while σ_i presents the variance) the E-V rule leads to efficient portfolios almost all of which are diversified" (Markowitz; 1952, page 89). The higher is the number of assets in the same portfolio; the lower is the risk until it reaches the optimal level. This could be correct if securities are imperfectly correlated. We have to mention also that diversification cannot eliminate the total risk. For each security, there are two kinds of risk: systematic risk (related to market evolution) and specific risk (linked to specific factors). The diversification strategy can only affect the specific risk.

According to Stiroh, (2012), idiosyncratic and systematic risks both entail costs for the firm and if adopting a diversification strategy is able to reduce the idiosyncratic risk, then it is desirable. Furthermore, he suggests that if the banking sector is well diversified

geographically, this would improve the financial stability of the sector as a whole. Various other studies have also shed light on the diversification-risk link. Sharpe, (1964) postulates that investors should not be concerned with their portfolio idiosyncratic risk if they hold a well-diversified portfolio. Traditional intermediation theories (Diamond, 1984) also predict that banks can benefit from diversification choice by reducing their risk and improving their profitability. Diamond, (1984) and Niinimäki, (2001) argue that diversification may solve the problem between lenders (depositors) and banks since returns are independent and identically distributed. It could also minimize the risk through a well-diversified loan portfolio.

Another stream of research supports the negative effects of diversification. Diversification sorts out many problems such as the increase of the asymmetry information, the cost of management, and the appearance of conflicts of interest. The agency theory (Jensen and Meckling, 1976) assumes that managers can widen the range of activities to extract private benefits. Agency costs weaken the profitability of diversified banks or financial conglomerates. In this line, Laeven and Levine, (2007) found that engaging in multiple activities destroys financial conglomerates value due to increased agency costs and that economies of scope are not large enough to compensate for diversification losses which leads to a diversification discount instead of a diversification premium.

Moreover, several studies shed light on the asymmetry information problem. Stigler, (1961); Akerlof, (1970), and Spence, (1973) developed the Asymmetric information theory. When banks expand their activities their organizational structure becomes more complex. This leads to asymmetric information between managers and shareholders which generates more costs that reduce profitability (Harris et al. 1982; DeYoung and Roland, 2001; Stiroh, 2004, Elyasiani and Wang, 2012). In addition, shifting toward non-interest income increases management costs. DeYoung and Roland, (2001) mention that non-interest income raises fixed costs due to new inputs' costs in technology and human resources.

However, Klein and Saidenberg, (1998) suggested that through several sources of income, banks can increase their efficiency and profitability because they can use the existing information database obtained during loan processing which facilitates non-traditional activities (Diamond, 1991; Saunders and Walter, 1994). On the other side, underwriting securities, insurance, brokerage, and other business also produce information that enhances the lending activity, and risk detecting (Laeven and Levine, 2007). In addition, Saunders and Walter, (1994) confirm that non-intermediation activities are beneficial by saving information

costs since clients' data is shared with subsidiaries without any additional cost. Furthermore, Agency theory assumes that separating between managers and shareholders implies conflicts of interest which increase costs. Hence, according to the signaling theory (Ross, 1979), opening up to the financial market is the tool to send signals to the stakeholders since it implies greater transparency and continuous communication of the managers' decision consequences. This decreases the possibility of opportunistic behavior and enhances governance quality (Saunders, 1994).

SECTION 4: Results of some empirical studies

Academic research on the diversification impact is inconclusive. We can distinguish between three schools. The first school opines that focusing on traditional activity reduces risk and in turn reduces the likelihood of failure. The second school suggests that non-traditional activities are more likely to enhance bank return and reinforce bank stability through risk reduction. Finally, the third school finds that the impact of revenue diversification is inconclusive (Sun et al. 2017).

4.1. Diversification - Performance nexus

Earlier studies on diversification effects provide conflicting results. This conflict is more pronounced between developed and emerging countries due to the difference in context and regulations. Hence, the impact of diversification varies from one country to another.

Starting with the USA, Elyasiani and Wang, (2012) support the findings of a diversification discount by using a database of only large banks over the period 1997-2007. They measured income diversification through the HHI index and non-interest income share and applied data envelopment analysis approach to measure technical efficiency. They found that bank holding companies cannot reap benefits from diversification and it negatively affects technical efficiency. However, a recent study by Saunders et al. (2014) shows, by examining a large database of 10341 banks dating from 2002-2013, that a high level of non-interest income is associated with higher profitability.

In Europe, Mercieca et al. (2007) examined 755 small European banks over the period 1997-2003. They found that diversification has no direct benefit across business lines, while, there

is an inverse relationship between non-interest income and profitability. More recently, Maudos, (2017) has found that income structure has a negative effect on profitability, while more diversified banks are less profitable during crises. In France, Jouida, (2018) used a panel vector autoregression model "PVAR" on 412 French financial institutions from 2002 to 2012, to show the bidirectional causality between diversification, profitability, and capital structure. He found an inverse bidirectional link between profitability and diversification. Diversification strategy leads to enhanced profitability but profitability does not lead to diversification. Further, a shock of both geographic and income diversification leads to an increase in profitability but this effect only lasts for three years. In Italy, however, some studies were able to catch a positive relationship. Chiorazzo et al. (2008) showed the positive association between diversification and Italian banks' profitability and found that revenue diversification improves risk-adjusted returns. Brighi and Venturelli, (2016) revealed the positive link between geographic/income diversification and banks' performance in 491 Italian banks from 2006 to 2012. For income diversification, an increase in commissions and fees income enhances risk-adjusted profitability and reduces risk. For geographical diversification, it affects only risk-adjusted profitability.

In Australia, Edirisuriya et al. (2015) studied Australian banks from 2000 to 2012, using two measures of profitability (return on average assets and return on average equity) and two measures of banks' stability (Z-score and a normalized standard deviation of accounting five-year profit before tax). They catch a positive effect of income diversification and through dividing the non-interest income into three categories; securities trading, fees and commissions, and others, they found that securities trading and insurance are beneficial, they enhance the bank's performance, while fees and commissions are not. Despite the fact that commissions and fees dominate the income structure.

Moving to emergent markets, Sissy et al. (2017) studied 320 banks in 29 African countries to test the impact of diversification and cross border banking impact on risk and return. They found that when banks engage in cross border banking, they diversify their activity in order to be more profitable. In addition, revenue diversification and cross border banking improve both banks' performance and stability. In India, Mostak, (2017) examined Indian commercial banks over the period 1998-2014. He supports the idea that increasing the share of non-interest income improves banks' profitability and increases risk-adjusted profits. In China, Sun et al. (2017) examined 16 listed banks from 2007 to 2013 to investigate the link between banks' profitability and diversification strategy. Thus, they revealed a nonlinear association.

Moreover, non-interest income may negatively affect Chinese banks' profitability. However, a high share of non-interest income positively affects banks' profitability. In this research, Sun et al. (2017) tried to find the optimal level of non-interest income in which banks could reap benefits from revenue diversification. They found that when the share of non-interest income is less than 9% the negative effect is very important (-1.8) while when the share is between 9% and 16%, the negative effect will be almost 0.8. But if the share is more than 16%, the negative effect will be reduced to reach 0.5. In sum, the non-interest income effect can be positive if its share is important. In Nigeria, Adedeji and Adedeji, (2018) put into use data of deposit banks over the period 2006-2015. They used profit before tax as a profitability clue and non-interest income share as diversification index. They found that the higher the non-interest income share is, the more profitable Nigerian banks are. In Sri Lanka, Ekanayake and Wanamalie, (2017) analyzed 11 banks from 2002 to 2015 and used the Sharpe ratio as a measure of shareholders' risk-return trade-off. They found a positive association between non-interest income and shareholders' risk-return trade-off. In Philippine, Meslier et al. (2014) examined 39 banks from 1999 to 2005. They revealed that shifting away from traditional activities positively affects banks' profitability and risk-adjusted return. This result is more pronounced when banks are more involved in trading and less exposed to SMEs. In Vietnam, Nguyen, (2017) proved that operational efficiency goes hand in hand with income diversification. To do so, he put into use a database of 34 commercial banks over the period 2007-2015. He used the DEA (data envelopment analysis) approach to measure technical efficiency as a dependent variable, and the Herfindahl-Hirschman index (HHI) as an independent variable to measure the degree of diversification. In Malaysia, Brahmana et al. (2018) looked into the diversification-performance relationship using a database of 15 Malaysian banks from 2005, the year that Malaysian banks started diversifying their activity, to 2015. They found that non-interest income increases risk-adjusted profitability. In Tunisia, Hakimi et al. (2012); Hamdi et al. (2017), and Belguith and Bellouma, (2017) support the positive relationship. Hamdi et al. (2017) investigated the non-interest income effects on performance and risk-taking of 20 Tunisian banks over the period of 2005-2012. They found a positive relationship between non-interest income and profitability, measured by ROA and ROE. For risk, they found a negative association. In contrast, Mnasri and Abaoub, (2010) found that the shift into non-interest activities is not beneficial and reduces Tunisian banks' performance. However, Ayedi and Ellouze, (2015) focused on the determinants of 19 Tunisian banks' performance from 2003-2012. They found that non-traditional activities have no effect on performance.

4.2. Diversification – stability nexus

Focusing on the USA banking sector DeYoung and Roland, (2001) examined 472 commercial banks from 1988- 1995. They found that the trend toward fee-based activities implies higher revenue volatility and a higher degree of total leverage, hence higher earnings volatility. In the same line, Stiroh, (2004b) revealed that banks with a high level of non-interest income are riskier because non-traditional income, more precisely, trading income is highly correlated with income volatility. As Stiroh and Rumble, (2006) said; "…they may have gotten the diversification idea wrong." They shed light on the dark side of diversification and found a negative association between income diversification and risk-adjusted performance (RAROA / RAROE) for a sample of 1800 financial holding companies (FHC's) in the USA from 1997 to 2002. The paper found that diversification benefits exist but they are offset by the costs of exposure to non-traditional activities which are more volatile and less profitable than traditional ones. Despite the fact that the marginal increase in non-interest income is positively correlated with declines in risk-adjusted return, the FHC's moved into non-traditional business. These findings supported the study of stiroh, (2004a) on community banks in the USA. Abedifar et al. (2018) tested how non-interest income could affect lending quality and banks' interest spread, using a quarterly database of 6921 banks in the USA during 2007-2016. They divided it into three sub-samples (small, medium, and large banks) to consider the size effect on the aforementioned relationship. Results indicate that non-traditional income increases banks' risk. Hence there is a negative effect on lending quality through credit risk and interest spread. The fixed effects regression shows that only the income from the fiduciary activity of medium banks has a negative impact on credit risk and no significant result for the other sub-samples. In addition, smaller banks should not engage in non-interest activities due to their size constrain. In Italy, Acharya et al. (2002) studied the focus and diversification strategies impact on banks' return and risk using 105 Italian banks during 1993-99. Their main findings suggested that if banks have a high level of risk, sectoral loan diversification would imply inefficient risk–return trade-off. Hence, banks have to specialize in their loan activity in particular sectors to better control and monitor risks. However, Williams, (2016) found that a loan's growth increases risk if banks' have a concentrated revenue portfolio. In Australia, Williams, (2016) used quarterly data from 2002 to 2014 and found a positive link between banks' risk and income diversification. To reach their goal, he applied two methods, Generalised Method of Moments "GMM" and Feasible

Generalised Least Squares "FGLS". Banks' risk was measured by two market-based estimates, marginal expected shortfall "MES" and historical value at risk "VAR" while non-interest income to total revenue and Herfindahl-Hirschman index "HHI" as diversification measures. He found that non-interest income does not garner any diversification benefits and is associated with high systemic risk. However, diversification through non-interest income complicates banks' activity which suggests an increase in agency costs and information asymmetry, which negatively affects the risk level.

Moving to emerging markets, Amidu and Wolf, (2013) examined 55 emerging countries using 978 banks from 2000 to 2007 and found that competition and income diversification positively affect bank stability. Furthermore, well-diversified activities are associated with less risky loan portfolios. In Vietnam, Nguyen et al. (2015) put into use 32 Vietnamese banks during 2005-2012. They measured diversification income by the HHI index and bankruptcy risk by the adjusted Z-score and found that if banks operate more in non-traditional activities, they will be more stable by reducing bankruptcy risk. In India, Pennathur et al. (2012) studied the impact of ownership structure on non-interest income and risk using a database of mixed banks (public banks, private domestic and foreign banks) during 2001-2009 and revealed that fee-based income helps public-sector banks to reduce their risk. However, it increases the risk of both private domestic and foreign banks. In south Asia, Nguyen et al. (2012), using a database of 151 commercial banks from four countries; India, Pakistan, Sri Lanka, and Bangladesh during 19998-2008 showed that diversifying into non-traditional activities increases banks' stability. In Nepal, Nepali, (2018) used a database of 20 commercial banks over the period 2009-2015 to show the positive relationship between non-interest income and risk-adjusted-performance (return on assets and return on equity). He found that diversification (non-interest income), capitalization (equity to total assets), ownership structure (foreign ownership) are the key factors that drive the risk-return trade-off of the Nepalese banking market. In Tunisia, Belguith and Bellouma, (2017); Hamdi et al. (2017); Hakimi et al. (2012) studies also support the positive effect of diversification on Tunisian banks' stability. Belguith and Bellouma, (2017) analyzed 11 Tunisian banks from 2001 to 2014 and found that the non-interest income effect depends on its correlation with interest income while the positive effect is highly pronounced if non-interest income and net interest income are imperfectly correlated.

SECTION 5: Hypothesis development

Despite the fact that previous literature is inconclusive on the direction of the association between diversification-profitability, we will assume that diversification affects positively Tunisian banks' profitability for three reasons. First, major studies on emerging economies revealed the positive association between diversification policy, and banks' profitability (Hamdi et al. 2017; Mostak, 2017; Sissy et al. 2017). Second, the majority of Tunisian banks are considered as small and medium banks[5] comparing to other countries. According to Abedifar et al. (2018), small banks can benefit from diversification activity to improve their lending activity, hence, their profitability in three ways:

- Diversification allows bankers to collect more information on their client's quality and attract potential borrowers.

- Activity diversification enhances banks' value through increasing customer relationships, information and reputation which could increase costs of potential financial distress, thereby, lead banks to be prudent in granting loans.

- Well diversified income could lead banks to lower their interest margins which in fact, improve lending.

Third, in the last decades, the Tunisian banking market has been more competitive. Considering technologies development and environment constraints such as customers' behavior, Tunisian banks have to shift toward non-interest income in order to maintain their profitability and minimize their risk under an unstable context. Thus our first hypothesis is formulated as follows:

H1: *Opting for income diversification is the solution for Tunisian banks to enhance their performance.*

Our second issue is how can diversification affect the financial stability. Following portfolio theory (Markowitz 1952), diversifying activity is the way to reduce total risk by eliminitating the idiosyncratic one. Hence, diversification reduces risk and in return enhance the financial stability. Furthermore, academic research on emerging market support the positive link between the financial stability and the diversification strategy (Amidu and Wolf, 2013; Sissy

[5] According to an article cited by Amine Ben Gamra in the Kapitalist site (October 2019), the Tunisian banking system is dominated by small banks.

et al. 2017; Hamdi et al. 2017). As Sissy et al. (2017) note "…there is evidence that diversification benefits exist for banks in Africa…" Thus, our second hypothesis will be introduced as follows:

H2*: Income diversification is the way to improve Tunisian financial stability.*

Earlier research has shown that private banks are more profitable and efficient than public ones (Boycko et al. 1996; Altunbas et al. 2001; Beck et al. 2004; Andrianova, 2012; Iannotta et al. 2013; Ayadi and Ellouze, 2015) because privatized institutions have a greater ability to optimize their costs. Boycko et al. (1996) reveal that privatization pushes banks to focus on financial objectives and decreases their contribution to social and political activities. Moreover, public banks are riskier than private counterparts. According to Demirgüç-Kunt and Detragiache, (2002) public banks take more risk because they rely on government protection so that it bears their excessive costs and their potential losses. In addition, public banks grant loans to finance high risky and less profitable investments in favor of social purposes as jobs creation (Dong et al. 2014). Furthermore, the lack of efficient monitoring in public banks allows managers to trail their interests and do not make any effort to enhance banks' efficiency. Saghi-Zedek, (2016) assumes that private banks are more able to reap benefits from income diversification than public ones since they have the required management skills to deal with multiple lines of products and services. Pennathur et al. (2012) revealed that fee-based income helps public banks to reduce their risk while it increases the risk of both private domestic and foreign banks. However, the study of Mostak, (2017) indicates that neither public banks nor private domestic banks benefit from a higher focus on income diversification. Thus, we will introduce the following assumption:

H3*: Bank' privatization affects positively the diversification-performance and the diversification-stability links.*

SECTION 6: An overview of the Tunisian context

The banking sector forms the main bedrock of the Tunisian economy. Hence, ensuring the banking market stability and improving its performance should be out of question. Tunisian regulators have enacted several laws to reach their aim which is stability and growth.

6.1. Tunisian banking market overview

Since obtaining its independence in 1956 Tunisia tried to fix and adjust the economic situation and build a stable financial system through two development policies. First, it started by setting up the pillars for a sound banking system by creating the Central Bank of Tunisia (CBT, henceforth) and issuing the Tunisian Dinar as the local currency in 1958. Then, a list of changes was undertaken to ensure the development of the Tunisian banking sector. The Tunisian government began with the 'Tunisification' of banks like the CFAT[6]. Then it opened doors for international investors by the launch of foreign branches such as UBCI in 1961 as well as UIB in 1963.

In order to run an efficient banking system, market authorities imposed the separation between deposit banks and investment banks and reinforced supervision. Up until 1985, it pushed local industries to create import-substituting products to limit trade deficit and satisfy the needs of the local consumers. Unfortunately, this policy backfired and increased the budget deficit because Tunisian companies were not competitive and did not benefit from economies of scale. As a response to the problem, policymakers opted for external debt. Debt represented up to 60% of the gross domestic product (GDP) in 1986. As a result, the International Monetary Fund (IMF) imposed the quick implementation of the structural adjustment program (SAP). The SAP has changed the Tunisian economy system with its several reforms such as lifting protective barriers. It had also pushed banks to grant more loans to households in order to improve their purchasing power. This has led the economy to be based mainly on indebtedness. Hence, the crucial role of the banking system appeared in 1987 and, since, forced the system to undergo major restructuring to increase banks' competition, mobilize savings, and to allow for a more efficient allocation of resources. The reforms had five main axes: interest rate liberalization and credit allocation, the introduction of a new indirect monetary policy, strengthening of prudential regulation through the introduction of prudential ratios inspired by the Basel prudential measures, the opening of the market to foreign financial institutions, and promoting the stock market. These financial liberalization measures were intended to limit banks' concentration and reduce the inefficiencies of over-indebtedness. In 2001, a new concept was introduced to the Tunisian financial market. Universal banks came to put an end to specialization. Since the reform, banks were allowed to exercise new areas of activities beyond the scope of their traditional

[6] Crédit Foncier d'Algérie et de Tunisie

activity such as trading, currency exchange, payments' tools (checkbooks, credit cards...) among others. 2005 was marked by three events: (1) the creation of "Banks of Financing of Small and medium-sized firms", (2) the setting up of "Attijari Bank" through the privatization of "Banque de Sud", and (3) the acquiring of BTK, TQB, BTL and STUSID the quality of a universal bank.

The Arab spring in 2011 had a deep impact on the banking system in terms of liquidity and stability which prompted the CBT to adjust its monetary policy and implement new reforms.

In 2016, a new banking law was implemented. The act n° 2016-48[7] relating to banks and financial institutions, in which and within chapter 1 (art 4) it listed the scope and the framework of Tunisian and foreign banks domiciled in Tunisia and formalized Islamic transactions. The activities that were permitted for banks were: the deposit collection, lending, leasing, factoring, payment tools management, trading, currencies exchange, financial engineering, and Islamic transactions.

The law also included the liberalization of some activities that were previously only allowed to be practiced by banks such as the management of payment tools and currency exchange which now can be practiced by specialists other than banks.

These aforementioned reforms lead us to come up with two conclusions. On one hand, the CBT attempted to reinforce market competition by opening barriers to new entry while, on the other hand it has opened the doors for banks to diversify their assets.

6.2. Current context

The growth rate of GDP in Tunisia reached 2.5% in 2018 against 1.9% in 2017 and 1% in 2016. This is mainly due to improvements seen in the agriculture and the tourism sectors. In addition, the budget deficit has also improved to reach 4.8% against 6.1% during the period between 2017 and 2018. Tunisian economy still suffers, however, from several issues such as high inflation (7.3% against 5.3% between 2017 and 2018), domestic currency deterioration (in average, the Dinar deport against the euro reach 12.9% and 8.6% to dollar), and high unemployment rate which sits at 15.5%.

[7] https://www.bct.gov.tn/bct/siteprod/documents/Loi_2016_48_fr.pdf

To control for inflation and stabilize prices, the CBT uses its tools to adjust the monetary policy and mainly through the interest rate channel. To do so, it increased the monetary market rate twice in March and June 2018 by 75 and 100 points to reach 6.75%. Then, following the consistent upward trend of inflation, the CBT revealed it again by 1% to reach 7.75% in February 2019. The banking sector also suffers from illiquidity which prompted the CBT to impose new liquidity standards. Banks are now required to hold an LTD ratio less than 120%[8]. This way the CBT has rationalized loan making through deposit requirements in order to solve the illiquidity issue.

Tunisia is a developing country in which the economy is financed mainly by the banking sector which is the backbone of the Tunisian financial system. In 2018, the banking sector provided 84743 MD as loans to the Tunisian economy. Moreover, the capitalization of the listed banks (only 12 banks) represents 40% of total market capitalization. This could highlight the crucial role of banks in the Tunisian economy and their direct effects on financial stability.

The Tunisian banking system is controlled by the CBT and encompasses 25 banks in which only 12 banks are listed on the stock market. Several financial advisors believe that the number of Tunisian banks is too large considering the country's size and financial transactions. However, this has not slowed down the new stream of competitors from appearing such as Fintechs, and Tunisian post (Tunisian post is planning to start lending activity). According to the CBT, competition should enhance banks efficiency. Sghaier and Ben ali, (2012) found the positive association between Tunisian banks' efficiency and market competition using data from 1990 to 2009.

According to the Professional Association of Tunisian Banks statistics, the total net income of universal banks has increased on average by 20 % during the period 2016-2018 (**fig 1**). This mainly is due to the increase of earnings from interest income, commissions, and trading.

[8] Bank circular n° 2018-10 (1/11/2018)

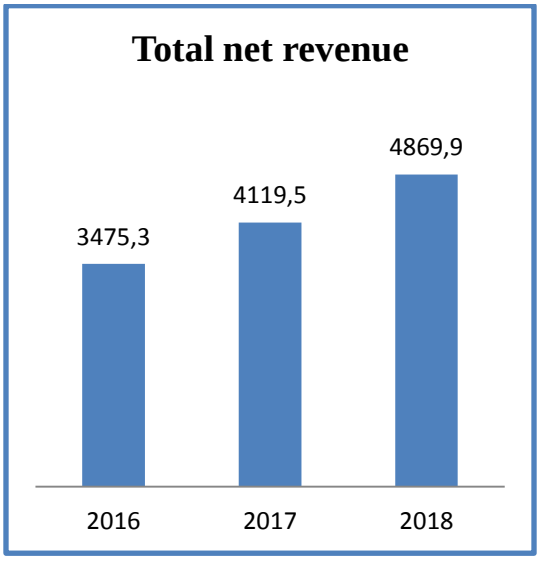


Figure 1: Total net revenue during 2016/2018

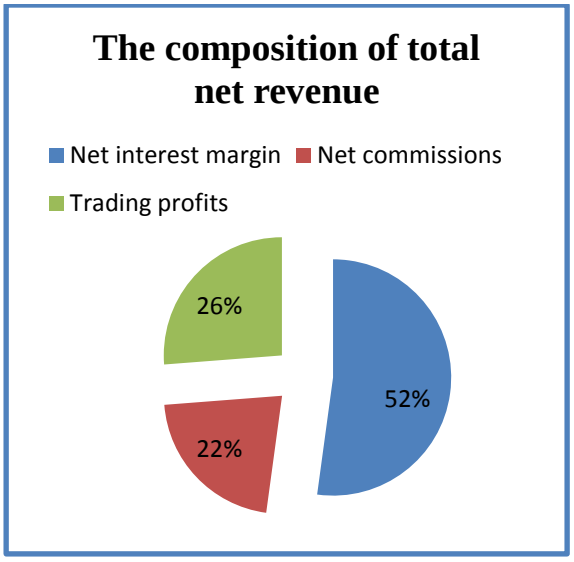


Figure 2: The composition of net revenue

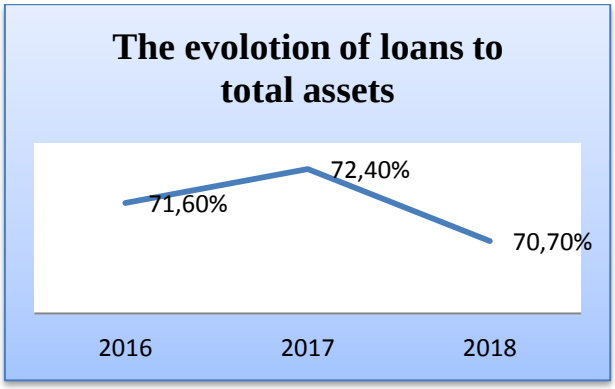


Figure 3: Lending activity to total assets from 2016 to 2018.

Data source: The annual report of Professional Association of Tunisian Banks (2018)[9]

In 2018, the net interest margin increased by 23.5%, due to the increase in the monetary market rate. In addition, their contribution to banks' net income has also increased by 2.2% to reach 52.1% **(fig 2)** against 49.9% in 2017. However, banks' lending activity has decreased by 1.7%. Thus, despite having a positive evolution during 2016-2018, their part in total assets has decreased **(fig 3).**

Furthermore, the net commissions and trading profits have increased by 11.9% and 13.9% respectively in 2018. The growth in commissions could be explained by several factors such as bank telecompensation activities (bank transfer, check, bill of exchange, and bank direct debits), With an increase of 15.9% of its amount while the number of its transactions has risen

[9] https://www.apbt.org.tn/wp-content/uploads/2020/01/rapport-annuel-2018.pdf

by 6.9%. In addition, the number of domestic credit cards holders increased by 27% from 3.6 million to 4.46 million in 2018. Moreover, the number of ATMs and electronic payment terminal has also increased by 4% and 14% respectively in 2018. This provides incentives for decashing. A strategy for Tunisian banks for the last couple of years was to try to cover more than 60% of their operational costs and mainly payroll through commissions. This strategy seems to be successful as they achieved their goal in 2016 with unbroken improvement to reach 66.4% **(fig 4)** in 2018. For the listed banks, this ratio counts 70.8% in 2018 against 68.2% in 2017.

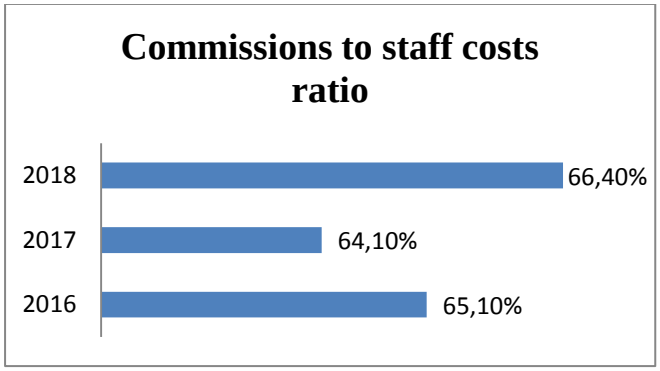


Figure 4: Commissions to staff costs ratio from 2016 to 2018.

Data source: The annual report of Professional Association of Tunisian Banks (2018)

This suggests that banks are very intrigued by non-traditional activities that generate commissions. Tunisian banks' profitability reached an increase of net income by 9.2%. The ROA stabilized in 1.1% and the ROE decreased by 0.2% from 13% in 2017 to 12.8% in 2018. During the last decade, policymakers and regulators attempted to reorganize the banking sector through liberalization and intensifying competition. This has led banks to diversify their business and move toward non-traditional activities. They opt for geographical diversification and for operating in new markets. The number of branches increases by 31 in 2018 to reach 1935 branches against 1904 in 2017. They also opt for product and service diversification through "bancassurance". In May 2018, the Professional Association of Tunisian Banks and the Tunisian Federation of Insurance Companies signed a convention to reinforce and organize the relationship between banks and insurance companies in terms of insurance life products which is one of the necessary conditions in the credit process. In this topic, Peng et al. (2017) revealed the effect of bancassurance on Taiwan's economy throughout 2004-2012 period. They tested the impact of bancassurance on banks'

performance and concluded that engaging in said activity can enhance banks' efficiency and profitability. Furthermore, they suggest that the concentration strategy in bancassurance cannot provide the same benefits as diversification for the banking industry.

The aforementioned statistics and the CBT reforms led us to have a closer look at the non-intermediation income effects. The following figures summarize the evolution of both net-interest margin and non-interest income to net operating income ratios (**fig 5**), and banks' profitability evolution through ROA indicator (**fig 6**) from 2012 to 2018. **Figure (5)** shows that since 2012, the share of net-interest margin declined in favor of non-interest income till they stabilized between 2016 and 2017. During 2017, non-interest income and net-interest margin shares are almost equal, while **figure (6)** shows that from 2012 to 2018, the ROA reach its high level in 2017. However, in 2018 the trend of both incomes has been inversed. The non-interest income decreases, while, the net-interest income increases. As a result, the ROA declined in 2018, which led us to conclude that non-interest income is positively associated with Tunisian banks' profitability and investigate more in this issue considering also banks' stability.

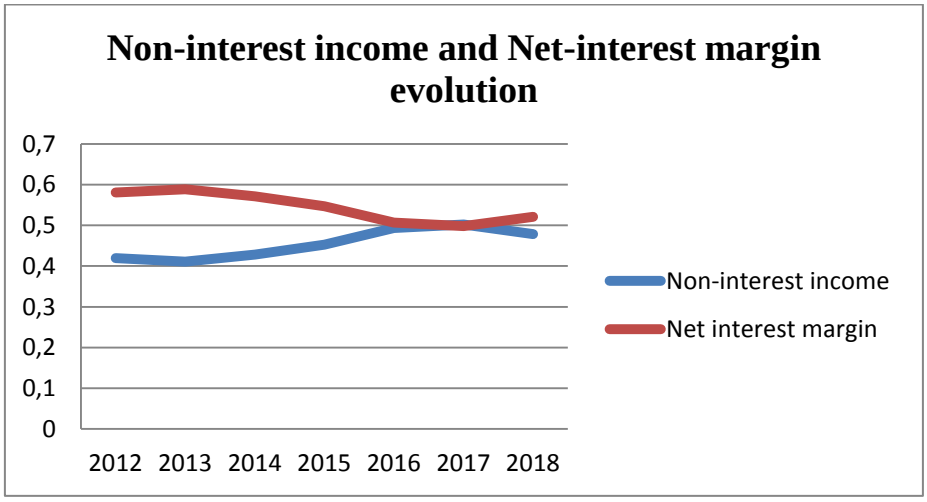


Figure 5: Non-interest income and Net-interest margin evolution from 2012 to 2018.

Data source: The annual report of Professional Association of Tunisian Banks (2018

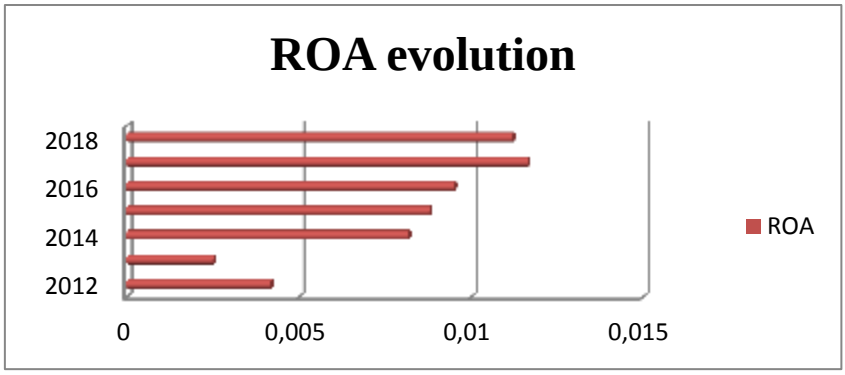


Figure 6: Return on assets evolution from 2012 to 2018.

Data source: The annual report of Professional Association of Tunisian Banks (2018)

In overall, According to Moody's most recent ratings, the perspectives for the Tunisian economy were under revision[10] with the possibility of downgrading. The Tunisian economy suffers from a high rate of indebtedness, unemployment and, inflation. The recession and the political instability might imply that the state will not be able to support or bail out banks in the case of a crisis or a financial slump. The Tunisian market is heavily bank-based and banks constitute an important engine to the economy. A large number of Tunisian banks are characterized by a low ability to absorb losses due to a low level of capitalization and debt coverage. In response, the CBT attempted to limit bank reliance on their refinancing with a maximum LTD ratio of 120%. The downward trend and the reduction in available liquidity for banks to borrow, we expect the lending activity to decrease for two reasons: First, banks have to abide by the CBT regulations. Second, they have to raise their capitalization in order to ensure their stability. The question is how can Tunisian banks improve their financial performance without undermining their stability? A trend for Tunisian banks in the last couple of years was to shift to non-interest-based banking activities. We think that the decision to diversify was not a voluntary move but more of a necessary shift in order to remain profitable amidst competition and to maximize their profitability while reducing their risks through diversification.

In this chapter we presented the theoretical background and we tried to explain diversification strategies to better understand banks' decisions. As we mentioned, prior investigations are inconclusive and do not provide a clear result on the impact of diversification on profitability and financial stability. In the next chapter we will provide empirical evidence in order to catch how revenue diversification can affect the Tunisian banking system in terms of profitability and risk.

[10] https://fr.tradingeconomics.com/tunisia/rating

CHAPTER II: DATA, METHODOLOGY AND EMPIRICAL RESULTS

The previous chapter presented the theoretical background on diversification strategy and its effects on both banks' performance and financial stability. It also provided an overview on the Tunisian context, which pushed us to pay a closer look and assess the impact of income diversification on the Tunisian banks' performance and stability, as the background of academic research in the field is very limited.

To reach our aim, the following sections will provide empirical evidence that investigates how can revenue diversification affect the Tunisian banking market performance and stability? Therefore, we will run a panel data of 11 commercial banks dating from 2005 to 2019.

SECTION 1: The research design

The first section will present the sample of our study, the used variables and the model specification. Then, it will provide the specification tests (multicollinearity test, stationarity test, homoscedasticity test, heterogeneity test, autocorrelation test and Hausman test).

1.1. Sample

Our data includes 11 conventional banks. We picked only listed banks for information accessibility. Our data is hand-collected from the Professional Association of Tunisian Banks, the World Bank for the macroeconomic clues, and the individual financial statements. We will assess the impact of diversification on Tunisian banks from 2005, in which all the necessary variables are accessible, to 2019. The following table lists our sample of banks

Table 1: The banks' sample

	Acronym	Bank	Ownership
1	AM	Amen Bank	Private
2	ATB	Arab Tunisian Bank	Private
3	ATTIJARI	Attijari Bank	Private
4	BH	BH Bank	Public
5	BIAT	Banque Internationale Arabe de Tunisie	Private
6	BNA	Banque Nationale Agricole	Public
7	BT	Banque de Tunisie	Private
8	BTE	Bank of Tunisia and Emirates	Private
9	STB	Société Tunisienne de Banque	Public
10	UBCI	Union Bancaire pour le Commerce et l'Industrie	Private
11	UIB	Union internationale des Banques	Private

1.2. Variables description

1.2.1. Dependent variables

Our purpose is to claim the impact of diversification on Tunisian banks' performance and stability. To measure banks' performance we will use the return on assets ratio "ROA" since it is the most used measure of banks' profitability. It takes into consideration the ability of managers to generate profits by using only available resources (Chiorazzo et al. 2008; Meslier et al. 2014; Chunhachinda, 2014; Edirisuriya et al. 2015; Mostak, 2017; Nisar et al. 2018). The ROA uses two variables, net income, and total assets. It is calculated as follows:

$$\text{ROA} = \frac{\text{Net income}}{\text{Total assets}}$$

Banks' stability will be measured by Z-score. This indicator is largely used (Stiroh, 2004; Mercieca et al. 2007; Sanya and wolf, 2011; Nguyen et al. 2012; Chunhachinda, 2014; Edirisuriya et al. 2015; Nguyen et al. 2015; Belguith and Bellouma, 2017; Lassoued and Sassi, 2017; Nisar et al. 2018) as a risk proxy. It is a clue of the distance to insolvency because it indicates the standard deviation that the ROA has to fall and as a result, the bank becomes insolvent.

It is calculated through dividing the sum of the return on assets and the capital ratio by the standard deviation of ROA. A high level of Z-score indicator denotes a low level of risk, and in turn high stability.

$$Z - score = \frac{\text{ROA} + \text{Capital}}{Standard\ deviation\ ROA}$$

Where:

$$Capital = \frac{\text{Total equity}}{Total\ assets}$$

1.2.2. Independent variables

Income diversification can be measured through two methodologies. On one hand, the Herfindahl-Hirschman Index (HHI) has been used widely by empirical studies (Elyasiani and Wang, 2012; Nguyen et al. 2015; Williams, 2016; Nguyen, 2017; Nepali, 2018) to account for diversification level. It measures the level of income diversity in net operating income. On the other hand, the second methodology uses directly the non-interest income ratio as an indicator for income diversification (DeYong and rice, 2004; Nguyen et al. 2012; Meslier et al. 2014; Ayedi and Ellouze, 2015; Sun et al. 2017; Hamdi et al. 2017; Nisar et al. 2018). In our analysis, we will rely on the second methodology and introduce the non-interest income to total assets ratio to count for diversification effects. Our choice is explained by the fact that the non-interest income ratio best meets our aim since it helps us to catch the direct effect of diversification, while the HHI measures the level of diversification and take into consideration the two incomes (the net-interest income and the non-interest income).

The non-interest income ratio (NON)

The non-interest income ratio is calculated as follows:

$$\text{NON} = \frac{\text{Non} - \text{interest income}}{\text{total assets}}$$

According to several studies such as Edirisuriya et al. (2015), and Meslier et al. (2014), the non-interest income ratio affects positively banks' performance. Additionally, Nisar et al. (2018) studied the banking sector of South Asian countries and find out that the non-interest income ratio has a positive impact on both banks' profitability (ROA) and stability (Z-score).

Furthermore, since several studies revealed different impact across non-interest income components (Meslier et al. 2014 ; Chunhachinda, 2014; Edirisuriya et al. 2015; Mostak, 2017; Belguith and Bellouma, 2017; Nisar et al. 2018), we will look deeper and split the non-interest income into three components following the Tunisian accountant classification: commission, short trading income (commercial portfolio) and long trading income (investment portfolio).

The commissions (COM)

The first and the main component of non-interest income is the commissions.

$$COM = \frac{\text{Total commissions}}{\text{Total assets}}$$

Edirisuriya et al. (2015); Mostak, (2017) and Nisar et al. (2018) found that fees and commissions income affect negatively banks' profitability and stability. Most commissions and fee incomes come from traditional activities such as lending, payment, and deposit account services. As DeYoung and Rice, (2004) revealed that non-interest income stemming from traditional activities like lending is highly and positively correlated to the intermediation activity. Hence, non-interest income generating through traditional business might imply a diversification discount (Markowitz, 1952; DeYoung and Rice, 2004; Meslier et al. 2014) and increases income volatility. This is also supported by Stiroh, (2006) for the USA banking sector which explained the correlation of the fees and commissions income with the net-interest income by the cross-selling of several products to the same sample of customers. In the same vein, DeYoung and Roland, (2001) suggest that fee-based activities absorb high costs, thus they imply higher earnings volatility. However, Meslier et al. (2014) found that fees and commissions incomes are positively associated with banks' profitability. In addition, Pennathur et al. (2012) proved that public-Indian banks have to shift toward fee-based activity

to reduce their risk' level. Since the commissions' share dominates the net-operating income of all the Tunisian banks we expect a positive correlation with both performance and stability.

Trading income (SHORT and LONG)

The second and the third components are stemming from trading activity. To account for trading income, we will introduce two ratios: the short term trading to total assets ratio (SHORT) for income stemming from the commercial portfolio. While the long term trading to total assets ratio accounts for the investment portfolio. They are calculated as follows:

$$SHORT = \frac{\text{commercial portfolio}'\text{profits}}{\text{Total assets}}$$

$$LONG = \frac{\text{Investement portfolio}'\text{ profits}}{\text{Total assets}}$$

Trading can affect positively banks' performance (Lepetit et al. 2008; Meslier et al. 2014; Edirisuriya et al. 2015; Mostak, 2017). According to Meslier et al. (2014) and DeYoung and Rice, (2004) non-traditional activities' income such as trading business increases banks' profitability. Hence its growth is weakly or negatively correlated with intermediation-activity. Furthermore, Lepetit et al. (2008) found that trading-income decreases small European banks' risk and enhances their profitability. Additionally, Nisar et al. (2018) proved that trading return is positively related to banks' stability and performance in South Asian countries. While, Stiroh, (2004b) reported that relying on trading activities increases banks' risk. All the previous research proved in different contexts that the trading income has an effect on the bank's performance, and stability.

1.2.3. Control variables

Banks' specific and macroeconomic factors play a crucial role in explaining profitability and stability levels. In our study we will control for: the intermediation activity, the capitalization, the operating costs, the credit risk, the economic growth, and the inflation.

The net-interest income (NET)

We introduced the net interest income to total assets ratio to account for intermediation-activity which is the banks' core activity. A higher level of the ratio indicates that banks are focusing on the lending-deposit activity. Its measure is:

$$NET = \frac{\text{Net} - \text{interest income}}{\text{Total assets}}$$

Following Maudos and Guevara, (2004) and Demirguc-Kunt and Huizinga, (1999) works, a higher value of net-interest income ratio implies that the bank is able to make its intermediation activity beneficial. However, Ayadi and Ellouze, (2015) have proved the insignificant effect of the net-interest margin in improving Tunisian banks' performance. As the core activity of Tunisian banks is the deposit-lending business we expect that this ratio contributes to banks' performance. Moreover, banks must be able to reap significant benefits stemming from interest-generating activity to cover all sorts of costs and risks related to intermediation activity. As Angbazo, (1997) said: "*Adequate net interest margin should generate sufficient income to increase the capital base as risk exposure increases*". Indeed, we can assume that a higher net-interest income help banks cover their risk and in return be more stable.

The capital ratio (CAP)

The capital ratio is measured by the equity to total assets ratio. A large body of literature proved the crucial role of banks' capitalization in both performance and stability. It is calculated as follows:

$$CAP = \frac{\text{Total equity}}{\text{Total assets}}$$

According to Berger, (1995); Nguyen et al. (2015); and Nepali, (2018) banks with high capitalization are more likely to be stable than less-capitalized ones. Berger, (1995) revealed that less risky banks, due to their high capitalization, can access the financial resources on better terms, which affect positively the bank's profitability. In addition, several studies such

as Karakaya and Er, (2013); Demirgüç-Kunt et al. (2013); Anginer and Demirgüç-Kunt, (2014); Edirisuriya et al. (2015); Tan, (2016); Bitar et al, (2018), revealed the positive effect of capitalization on banks' profitability. Anginer and Demirgüç-Kunt, (2014) deem that well-capitalized banks are more likely to resist potential shocks and deal with their engagement. In addition, Tan, (2016) found that reinforcing banks' capitalization leads to well-efficient banks, reduces their costs and increases their profitability due to higher creditworthiness, to more engagement in prudent lending, and less borrowing. Furthermore, Dhouibi, (2015) found that for Tunisian banks, the capital structure has a positive relationship with banks' ROA.

The loan loss provision (LLP)

The loan loss provision to total assets ratio is used as a proxy of credit risk or asset quality. A higher ratio denotes a bad quality of loan portfolio and clients, a high risk-taking, and poor risk management. It is measured as follows:

$$LLP = \frac{\text{Loan Loss Provision}}{\text{Total assets}}$$

Williams, (2016) revealed that when banks are looking for risk, they hold a loan portfolio with low quality and in return, a high level of non-performing loans. Indeed, this requires a high level of loan loss provision. Furthermore, as showing in Edirisuriya et al. (2015) work, the LLP ratio is negatively associated with banks' performance. Overly conservative banks are more likely to be less profitable. Additionally, Hsieh et al. (2013) suggested that "…*the coefficient of loan loss provisions to total assets should be positive as more provisions can provide a bigger buffer for expected loan losses".* Thus, a higher level of loan loss provisions helps banks to minimize their credit risk.

The Expenses (EXP)

Expenses are a measure of operating costs. It could be also a measure of bank efficiency (Elsas et al. 2010). A lower ratio of operating income to total assets denotes a high efficiency, and that banks know how to deal and optimize their costs. The expenses ratio is calculated as follows:

$$EXP = \frac{\text{Operating costs}}{Total\ assets}$$

Sun et al. (2017) revealed that a lower level of costs reflects the banks' resources sufficiency to provide the need for non-interest income products. According to Nguyen et al. (2015), operating in new business lines increases banks' costs such as wages and marketing costs. While an increase in expenses could influence banks' risk. As for performance, Karakaya and Er, (2013) opine that managing operating costs is the best way for banks to be more efficient and profitable.

The Gross Domestic Product (GDP)

Economic growth affects all the economic agents in general and banks in specific as the bedrock of the economic system. The Gross Domestic Product is a proxy of economic growth. When the economy is doing well, banks have more opportunities for expansion, being more profitable (Meslier et al. 2014; Belghuith and Bellouma, 2017; Nguyen et al. 2018) and more stable (Nguyen et al. 2012). Thus, the economic growth affects positively banks' profitability and stability. Further, Hakimi et al. (2012) show that non-traditional activities are positively related to high economic growth.

The inflation rate (INF)

The inflation rate is represents a proxy of macroeconomic conditions. It is more likely to decrease banks' profitability and stability (Dhouibi, 2015; Nisar et al. 2018), and it is negative effect is deeper when it is not anticipated. A high non anticipated inflation could lead to a mismatch between banks' liabilities and assets which is an inappropriate situation for banks. Tan and Floros, (2012) studied the effect of inflation on the performance of Chinese commercial banks. They revealed that the lower the inflation rate is, the higher the performance is.

The following **table (2)** summarizes all the used variables, and displays its expected effect on both performance and financial stability.

Table 2: Dependent and independent variables description and references

	Measured by	References	Ex-S.P	Ex-S.S*
ROA	Return on assets (net income to total assets)	Meslier et al. (2014); Edirisuriya et al. (2015); Nisar et al. (2018); Chiorazzo et al. (2008)	NA	NA
Z-score	The sum of ROA and capital ratio to the standard deviation of ROA	Edirisuriya et al. (2015) ; Nguyen et al. (2015) ; Nguyen et al. (2012) ; Nisar et al. (2018) ; Belguith and Bellouma, (2017)	NA	NA
NON	Non-interest income to total assets	Nisar et al. (2018) ; Nguyen et al. (2012)	+	+
COM	Commissions to total assets	Nisar et al. (2018) ; Edirisuriya et al. (2015) ; Meslier et al. (2014)	+	+
SHORT	Profits from commercial portfolio to total assets	Nisar et al. (2018) ; Edirisuriya et al. (2015) ; Meslier et al. (2014)	+	+
LONG	Profits from investment portfolio to total assets	Nisar et al. (2018) ; Edirisuriya et al. (2015) ; Meslier et al. (2014)	+	+
NET	Net-interest income to total assets	Ayadi and Ellouze, (2015)	+	+
CAP	Equity to total assets	Dhouibi,(2015); Nguyen et al. (2015); and Nepali, (2018)	+	+
EXP	Operating costs to total assets	Nguyen et al. (2015), Karakaya and Er, (2013)	-	-
LLP	Loan loss provision to total assets	Edirisuriya et al. (2015); Hsieh et al. (2013)	-	+
GDP	Gross Domestic Product	Nguyen et al. (2018); Belghuith and Bellouma, (2017) ; Meslier et al.(2014)	+	+
INF	Inflation rate	Nisar et al. (2018); Dhouibi, (2015)	-	-

(*) Ex-S.P: expected sign on performance and expected sign on stability for Ex-S.S.

Source: own construction

1.3. Model

To catch the effect of the income diversification on bank's performance and risk we will apply the following model:

$$\mathbf{Y_{it} = \alpha + \beta\, DIV_{it} + \Sigma\, \delta\, X_{it} + a_i + u_{it}} \qquad \mathbf{(1)}$$

Where **table (3)** describes our model components:

Table 3: Model' specification

$\mathbf{Y_{it}}$	The dependent variables of bank' performance (ROA) or bank' stability (Z-score) for the bank "i", for the year "t".
$\boldsymbol{\alpha}$; $\boldsymbol{\beta}$; $\boldsymbol{\delta}$	Model' parameters (constant and coefficient).
DIV	The diversification which is accounted in two ways: • The non-interest income ratio. • The non-interest income' components ratios: the commission ratio, the short-term trading profits ratio and the long-term trading profits ratio
$\mathbf{X_{it}}$	A vector of bank specific variables including traditional-income (NET), bank' capitalization (CAP), operating costs (EXP), asset quality (LLP), and macroeconomic factors like the economic growth (GDP) and inflation rate (INF).
$\mathbf{a_i}$	The fixed effect of bank i.
$\mathbf{u_{it}}$	The idiosyncratic error term.

Our methodology is based on two steps. First we will test the effect of income diversification in general. Second, we will test the effect of each component (short-long term trading, and commissions) on both stability and performance. In order to reach our purposes, we will run four models, two for each step:

Step 1: The non-interest income' effect on banks' performance and stability

$$ROA_{it} = \alpha + \boldsymbol{\beta}\, NON_{it} + \boldsymbol{\delta}_1\, NET_{it} + \boldsymbol{\delta}_2\, CAP_{it} + \boldsymbol{\delta}_3\, EXP_{it} + \boldsymbol{\delta}_4\, LLP_{it} + \boldsymbol{\delta}_5\, GDP_t +$$

$$\boldsymbol{\delta}_6\, INF_t + a_i + u_{it} \qquad (2)$$

$$Z\text{-}score_{it} = \alpha + \boldsymbol{\beta} NON_{it} + \boldsymbol{\delta}_1 NET_{it} + \boldsymbol{\delta}_2 CAP_{it} + \boldsymbol{\delta}_3 EXP_{it} + \boldsymbol{\delta}_4 LLP_{it} + \boldsymbol{\delta}_5 GDP_t + \boldsymbol{\delta}_6 INF_t + a_i + u_{it} \quad (3)$$

Table (4) displays the previous model variables:

Table 4: Variables' specification

Acronym	Variables
ROA	The Return on assets.
Z-score	The stability ratio.
NON	The non-interest income to total assets ratio.
NET	The net-interest income to total assets ratio.
CAP	The equity to total assets ratio.
EXP	The operating costs to total assets ratio (banks' expenses)
LLP	The loan loss provision to total assets ratio.
GDP	The Gross Domestic Product ratio.
INF	The inflation rate

Step 2: The non-interest income components' effect on banks' performance and stability.

$$ROA_{it} = \alpha + \boldsymbol{\beta_1} COM_{it} + \boldsymbol{\beta_2} SHORT_{it} + \boldsymbol{\beta_3} LONG_{it} + \boldsymbol{\delta}_1 NET_{it} + \boldsymbol{\delta}_2 CAP_{it} + \boldsymbol{\delta}_3 EXP_{it} + \boldsymbol{\delta}_4 LLP_{it} + \boldsymbol{\delta}_5 GDP_t + \boldsymbol{\delta}_6 INF_t + a_i + u_{it} \quad (4)$$

$$Z\text{-}score_{it} = \alpha + \boldsymbol{\beta_1} COM_{it} + \boldsymbol{\beta_2} SHORT_{it} + \boldsymbol{\beta_3} LONG_{it} + \boldsymbol{\delta}_1 NET_{it} + \boldsymbol{\delta}_2 CAP_{it} + \boldsymbol{\delta}_3 EXP_{it} + \boldsymbol{\delta}_4 LLP_{it} + \boldsymbol{\delta}_5 GDP_t + \boldsymbol{\delta}_6 INF_t + a_i + u_{it} \quad (5)$$

Where COM, SHORT and Long are defined in the **table (5)** below:

Table 5: The non-interest income components

Acronym	Variables
COM	The total commissions to total assets ratio.
SHORT	The gains from commercial portfolio to total assets ratio.
LONG	The gains from investment portfolio to total assets ratio.

The following part will provide specification tests: multicollinearity test, stationarity test, homoscedasticity test, heterogeneity test, autocorrelation test and Hausman test.

1.4. Specification tests

1.4.1. Testing for multicolinearity issue

The multicollinearity is an econometric issue that can cause the estimation biases. Hence, to test it we will apply the variance inflation factor. Following James et al. (2013) book "…*a VIF value that exceeds 5 or 10 indicates a problematic amount of collinearity"*. According to **tables (6)** and **(7)**, our independent variables for both steps of regressions reported a mean value of 1.374 and 1.663. Hence, there is no multicollinearity issue and our variables are accepted.

Table 6: The variance inflation factor of step 1 regressions

	VIF	1/VIF
NON	1.662	.602
EXP	1.581	.632
NET	1.469	.681
CAP	1.386	.722
LLP	1.279	.782
INF	1.189	.841
GDP	1.056	.947
Mean VIF	1.374	.

Table 7: The Variance inflation factor of step 2 regressions

	VIF	1/VIF
COM	2.454	.407
EXP	1.988	.503
CAP	1.919	.521
NET	1.868	.535
SHORT	1.533	.653
LONG	1.498	.667
LLP	1.315	.76
INF	1.31	.763
GDP	1.085	.921
Mean VIF	1.663	.

1.4.2. Testing for stationarity

After testing multicollinearity issue, we will make sure that they do not contain unit roots and our distribution will be stable over time. To do so, we will apply two tests, Augmented Dickey-Fuller, and Levin-Lin-Chu, in which the first hypothesis suggest the presence of unit roots.

H0: There are unit roots

H1: variables are stationary

Table 8: The results of Augmented Dickey-Fuller and Levin-Lin-Chu tests

	ADF test				Levin-Lin-Chu test			
	Without Trend		With Trend		Without trend		With trend	
	Value	P-value	Value	P-value	Value	P-value	Value	P-value
ROA	32.281	0.0727	36.401	0.027	-2.634	0.0042	-4.4577	0.000
Z-score	38.0965	0.017	17.5074	0.7348	-4.245	0.000	-0.9241	0.177
NON	10.228	0.984	11.538	0.966	1.9822	0.9763	-1.4475	0.0739
COM	30.984	0.096	35.851	0.031	0.2473	0.5977	-2.0719	0.0191
SHORT	17.443	0.738	35.4129	0.0351	- 0.565	0.285	-3.5512	0.0002
LONG	14.742	0.873	9.02	0.993	1.9621	0.975	-1.7071	0.0439
NET	14.917	0.865	14.379	0.887	-2.739	0.0031	-3.9803	0.000
CAP	38.725	0.015	8.541	0.995	-4.299	0.000	-0.2113	0.4163
EXP	24.2655	0.333	15.8219	0.824	0.3643	0.6422	-1.9791	0.0239
LLP	68.3675	0.000	79.1698	0.000	-0.499	0.000	-6.0399	0.000
GDP	53.1052	0.0002	86.7565	0.000	-6.816	0.000	-9.0863	0.000
INF	60.0102	0.000	104.2071	0.000	-7.066	0.000	-9.3029	0.000

Table (8) reports that all our variables are stationary since there is at least one test that shows a p-value under 5% except for the NON. The Levin-Lin-Chu test displays a p-value of 0.07 for the NON variable so we can assume that it is stationary with trend at 10% level of significance.

1.4.3. Testing for homoscedasticity (Breusch-Pagan test)

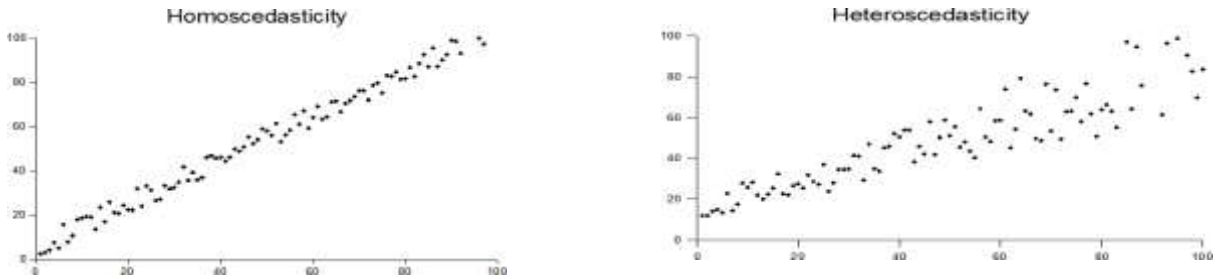
The Breusch-Pagan test in statistics is a Chi-squared test of heteroscedasticity for linear regressions. Breusch and Pagan; (1979) introduced this test while Cook and Weisberg ; (1983) had independently developed it to present the (Cook–Weisberg test). Indeed, to apply the ordinary least squares (OLS) regression the assumption of homoscedasticity should be verified. In other words, the variance of the error term has to be constant. Otherwise the OLS estimation is biased and cannot provide reliable predictions. To test the econometric assumption of homoscedasticity we apply the Breusch-Pagan test, where the null hypothesis is homoscedasticity. This hypothesis is rejected if the P-value of the test is less than an appropriate threshold (Generally 5%).

Based on the Lagrange multiplier test, the Breush-Pagan tests verify whether the variance of the error term is constant or it depends on the independent variables. Given the assumption of the non-dependency between the independent variables and the variance of the error term (unobserved), we can estimate the error term's variance through the average of the squared residuals (observed). Hence, the homoscedasticity assumption is applied and the variance is constant. However, if the independency hypothesis is not held to be true, the variance of the error term is a linear function of the independent variables. Therefore, we examine it by regressing the squared residuals on the independent variables.

H0: The variance of the Error term is constant

H1: The variances of the Error term are not equal

The following figure illustrates the heteroscedasticity issue and how it can bias estimation and future predictions through the increasing gaps between the observed and the predicted values.



Breush-Pagan P-Value is greater than 5% Breush-Pagan P-Value is less than 5%

Figure 7: Homoscedasticity Vs Heteroscedasticity

Our test for the four regressions shows the following results:

Table 9: The results of Breush-Pagan test.

Model	Breush-Pagan chi2-Value	P-Value
1	345.37	0.000
2	2.66	0.1027
3	370.92	0.000
4	3.53	0.0603

Model 1, 3 reported a Breush-pagan p-value of less than 5%. Thus there is a heteroscedasticity issue, and the GLS is the appropriate estimation to resolve the said problem. As for models 2 and 4, no issue is reported.

1.4.4. Testing for heterogeneity (the F-test)

For the panel data, testing the individual and temporal effects should be out of the question. Indeed, the error term of our model is divided into an idiosyncratic error term ($U_{i,t}$) and an individual effect (a_i). This individual effect reflects a time or bank unobserved heterogeneity. The F-test is a test that verifies the existence of fixed effects under the assumption of the independently identically distributed (iid) errors. It assumes that all the a_i are equal to zero. Hence, there is no unobserved heterogeneity.

H0: There is no individual effects ($a_i = 0$)

H1: The error term includes individual or temporal effects ($a_i \neq 0$)

If the P-value of the F-test is under 5% we reject the null hypothesis and the GLS is better than the OLS regression. Our test for the four regressions shows the following results:

Table 10: The results of F test.

Model	F-test value	P-Value
1	2.43	0.0106
2	596.43	0.000
3	2.19	0.0214
4	455.52	0.000

Our four regressions reported a P-value of less than 5%. Hence we can assume that the error term includes individual or temporal effects and the GLS is the appropriate regression to deal with the heterogeneity issue.

1.4.5. Testing for autocorrelation

To test the assumption of no autocorrelation, we will use the Wooldridge test. When serial correlation is not detected and solved it would produce inefficient estimates. The null hypothesis for the test is that there are "no first order autocorrelation".

Our test for the four regressions shows the following results:

Table 11: The results of Wooldridge test

Model	Wooldridge test	P-Value
1	4.055	0.0717
2	72.801	0.000
3	3.707	0.0831
4	72.936	0.000

Our results show that models 2 and 4 suffer from first order autocorrelation and the GLS must be applied to deal with the problem.

1.4.6. Hausman test

If the previous test revealed the existence of individual effects, we have to specify whether these effects are fixed or random. Hence, a test for the model specification is required. The Hausman test (Hausman; 1978) is a test based on the comparison of two estimators in which one proposed estimator of a parameters is simultaneously consistent and efficient under the null hypothesis and inconsistent under the alternative one. In our study, we use this test to select the adequate estimation among the fixed and the random effects regressions. If the Hausman test has a P-value greater than 5% then our null hypothesis is accepted. Thus, the

random effect is greater than the fixed effect estimation and vice-versa. The Hausman test seeks whether there is a correlation between the errors and the regressors. Hence, the null hypothesis is the non-correlation between them.

H0: The random effect is better than the fixed effect estimation.

H1: The fixed effect is more appropriate than the random effect estimation.

Our test for the four regressions shows the following results.

Table 12: The results of Hausman test.

Model	Chi-square test value	P-Value
1	32.128	0.000
2	-.055	1
3	26.34	0.002
4	-2.647	1

Model 1 and 3 reported a p-value of less than 5%. Hence we reject the null hypothesis and we apply the fixed effect regression. As for the models 2 and 4, findings support the Random effect regression.

To reach our purposes, the Generalized Least Squares (GLS) seems to be the best estimation.

SECTION 2: Findings and discussions

In the following section, we will discuss our results and investigate the income diversification effects on both performance and stability of Tunisian listed banks. Then, we will test if the ownership structure has an impact on the aforementioned nexuses by adding an interaction term that accounts for privatization.

2.1. Descriptive statistics

The descriptive statistics will follow two steps. First, we will present the summary statistics. Second, we will display the correlation matrix that shows the possible correlations between our exogenous and endogenous variables.

2.1.1 Summary statistics

The following **table (13)** describes our variables for the 11 Tunisian banks over the study period.

Table 13: Summary statistics

	Mean	St.Dev	Min	Max	Skewness	Kurtosis
ROA	.009	.014	-.104	.029	-5.428	38.975
Z-score	22.154	16.232	-4.996	55.823	0.377	-1.029
NON	.019	.005	.007	.031	-0.117	-0.732
COM	.01	.003	.001	.02	0.054	-0.021
SHORT	.006	.004	0	.021	1.321	1.657
LONG	.003	.003	0	.012	1.018	0.658
NET	.024	.007	.008	.041	-0.353	-0.253
CAP	.101	.063	-.016	.489	3.242	14.71
LLP	.059	.03	.01	.182	2.104	5.109
EXP	.021	.006	.011	.042	0.608	-0.212
GDP	2.792	1.967	-1.917	6.71	-0.507	0.897
INF	4.733	1.341	2.1	7.3	0.121	-0.075

- The ROA averaged at 0.9% with an important standard deviation of 1.4%. This is due to a large difference between the minimum (-10.4%), and the maximum (2.9%). Thus, our sample includes both performant and non-performant banks.

- Regarding the Z-score, the Tunisian banking system suffers from instability with a high level of standard deviation (16.232). This could be explained by a range from -4.996 to 55.823. The Z-score presents on average 22.154. Hence, the Tunisian banking market encompasses both stable and risky banks.

- The income structure of Tunisian banks (the net-interest and the non-interest incomes) is changing. On one hand, the non-interest-income to total assets ratio (NON) reported an average of 1.9% with a range from 0.7% to 3.1% and a standard deviation of 0.005. On the other hand, the net interest income to total assets (NET) averaged at 2.4% with a range from 0.8% to 4.1%, and a standard deviation of 0.007. The average rate of the

NON (1.9%) and the NET (2.4%) are very close. These statistics provide clear evidence that Tunisian banks diversify their income and focus less on lending activity.

- The commissions to total assets ratio has a mean value of 1% with a range from 0.1% to 2%. These statistics prove that the income structure is more related to bank services and fee-based activities. Hence banks are shifting toward non-traditional businesses.

- The SHORT ratio reported an average of 0.6% with a standard deviation of 0.004. This means that short-term trading (commercial portfolio) presents 0.6% of total assets. Consequently, Tunisian banks are focusing more on the commercial portfolio than the investment one. This ratio reaches a minimum of zero (banks did not trade) and a maximum of 2.1% (banks are focusing on trading book operations).

- The LONG ratio statistics show that the gains from the investment portfolio to total assets has a mean value of 0.3% with a range from zero to 1.2%, and a standard deviation of 0.003. These low statistics prove that Tunisian banks are not motivated to invest in long-term stocks in the financial market. This could be explained by the deterioration of the Tunisian economic context, which led banks to prefer short-term trading as it is less risky than long-term trading.

- On average, the capital ratio presents 10.1%. According to the Tunisian banking circular of 2018, Tunisian banks have to hold at least a capital ratio of 10%. Consequently, Tunisian banks comply with Tunisian standards. While this ratio reaches a minimum of -1.6 and a maximum of 48.9% with a standard deviation of 0.63. The negative value is due to the negative amount of total equity for some banks as UIB in 2007 and STB in 2013-2014.

- Regarding the LLP ratio, the loan loss provisions reported an average of 5.9% with a range from 1% to 18.2% and a standard deviation of 3%. The average rate reaches almost 6%. This implies that Tunisian banks suffer from the low quality of their clients. Thus, Tunisian banks have to focus on their credit policy.

- As for the banks' expenses, the operating costs averaged at 2.1%, with a low standard deviation of 0.006 and a range from 1.1% to 4.2%.

- The GDP rate reported a mean value of 2.792 with a range from -1.917 to, 6.71. These statistics are related to the Tunisian economic context which has been in deterioration since the revolution. Hence, this could explain the high standard deviation of 1.967.

- The inflation rate averaged at 4.733 with a range from 2.1 to 7.3 and a standard deviation of 1.341. This large difference between the min and the max could be explained by the upward trend of inflation these last years.

2.1.2. Correlation Matrix

Table (14) presents the correlation matrix that provides us information about the bivariate correlation between our dependent and independent variables. Based on the correlation matrix (**Table 14**) we can assume that the more the bank is stable, the more it is profitable since the correlation coefficient between the ROA and the Z-score is equal to 0.389. The non-interest income (NON) is positively correlated with ROA, hence we can conclude that revenue diversification affects positively banks' performance. As for non-interest income' components, commissions (COM) are negatively correlated to banks' stability and have no significant impact on Tunisian banks' performance. This could be explained by the fact that the majority of commissions are related to traditional activities. The short-trading income does affect neither the performance, nor the stability, while the long-trading income is beneficial for both of them. Further, the intermediation activity (NET) and bank-capitalization are positively correlated to Tunisian banks' performance, whereas the loan loss provision ratio (LLP), the operating costs (EXP) and the GDP are negatively associated with it. Regarding financial stability, only the capitalization has a positive effect while the LLP and the operating costs report a negative and significant impact.

Table 14: The correlation matrix of Pearson.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) ROA	1.000											
(2) Z-score	0.398***	1.000										
(3) NON	0.188**	0.127	1.000									
(4) NET	0.240***	0.108	-0.172**	1.000								
(5) COM	-0.036	-0.206***	0.562***	0.320***	1.000							
(6) SHORT	0.121	-0.019	0.649***	-0.489***	-0.050	1.000						
(7) LONG	0.237***	0.548***	0.323**	0.036***	0.000	-0.208***	1.000					
(8) CAP	0.314***	0.559***	-0.247***	0.271***	-0.340***	-0.245***	0.306***	1.000				
(9) LLP	-0.309***	-0.246***	-0.173*	-0.056	-0.083	-0.128	-0.048	-0.315***	1.000			
(10) EXP	-0.231***	-0.260***	0.386***	0.328***	0.685***	-0.025	-0.012	-0.209***	-0.009	1.000		
(11) GDP	-0.167**	0.047	-0.160**	0.096	-0.085	-0.025	-0.184**	0.077	-0.108	-0.008	1.000	
(12) INF	0.103	-0.060	0.293**	0.053	0.168**	0.024	0.358***	-0.119	0.155**	0.087	-0.120	1.000

2.1. Main results and discussions

The following part will present and interpret our regressions' results for diversification-performance nexus, diversification-stability nexus, and the privatization' effect.

2.1.1. Diversification- Performance nexus

We will start by investigating the diversification-performance link following the two steps. The first column (equation 2) provides the step one' regression results, while column two (equation 4) displays the second step' regression.

Table 15: The fixed-effect regressions results (model 2 and 4).

ROA	**Model 2**	**Model 4**
NON	1.836*** (0 .290)	-
COM	-	1.605** (0.617)
SHORT	-	2.007*** (0.381)
LONG	-	1.552*** (0.541)
NET	1.013*** (0.261)	1.045*** (0.270)
CAP	0.014 (0.030)	0.016 (0.036)
EXP	-2.256*** (0.402)	-2.115*** (0.430)
LLP	-0.119*** (0.034)	-0.124*** (0.036)
GDP	-0.001** (0.000)	-0.001** (0.00)
INF	0.00 (0.001)	0.000 (0.001)
Constant	0.004 (0.009)	0.002 (0.01)
Obs.	165	165

(*) represent statistical significance at 1%.

(**) represent statistical significance at 5%.

(***) represent statistical significance at 10%.

Table (15) column 1 displays the results of our first regression that try to catch the impact of diversification strategy on Tunisian banks' performance. The following equation shows the second model' results:

$$ROA_{it} = 0.004 + 1.836\ NON + 1.013\ NET + 0.014\ CAP - 2.256\ EXP - 0.119\ LLP - 0.001\ GDP + a_i + u_{it}$$

- As we expected, the non-interest income (NON) shows a positive and highly significant effect on Tunisian banks' performance (ROA). Enhancing the non-traditional income by 1% implies an improvement of the return on assets by 1.836% at 1% significance level. Our findings are consistent with Meslier et al. (2014); Mostak, (2017); and Nisar et al. (2018) who support the positive relationship between the non-interest income and bank profitability. In contrast, as showing by Stiroh and Rumble, (2006), and Mercieca et al. (2007), the potential gains of diversification strategy are insufficient to cover their potential diseconomies. The diversification strategy in Tunisian banks is beneficial since the non-interest income is a component of the operating income. In addition, they can fully exploit the skills of their labor. Thus the fixed costs will be divided into multiple product lines which increase the margin profit and allow banks to be more profitable.
- The net-interest income (NET) has also a positive effect on performance. This was expected since intermediation-activity is the core business of Tunisian banks. Enhancing the net-interest margin by 1% implies an improvement of the return on assets by 1.013% at 1% significance level. This suggests that Tunisian banks' performance is still dependant on intermediation activity. In the same line, Ayadi and Ellouze, (2015) found that Tunisian banks' performance is positively affected by the net-interest income ratio. In contrast, Ekanayake and Wanamalie, (2017) revealed that the net-interest income has a negative and significant link with bank profitability.
- The capital ratio (CAP) shows a positive sign, but it is not significant. While some studies such as Mercieca et al. (2007); Nguyen et al. (2012); Ayadi and Ellouze, (2015); Edirisuriya et al. (2015); Hamdi et al. (2017); Nisar et al. (2018) have proved the positive and significant relationship between capitalization and banks' performance. Our results suggest that Tunisian banks' performance is not affected by the capital level.
- The operating costs (EXP) display a negative and significant impact on the Tunisian banks' performance at 1% level of significance. Our result is in line with Nisar et al. (2018) and Zhang and Daly, (2013) findings which proved that banks have to reduce their overheads in order to enhance their performance. We can assume that Tunisian banks'

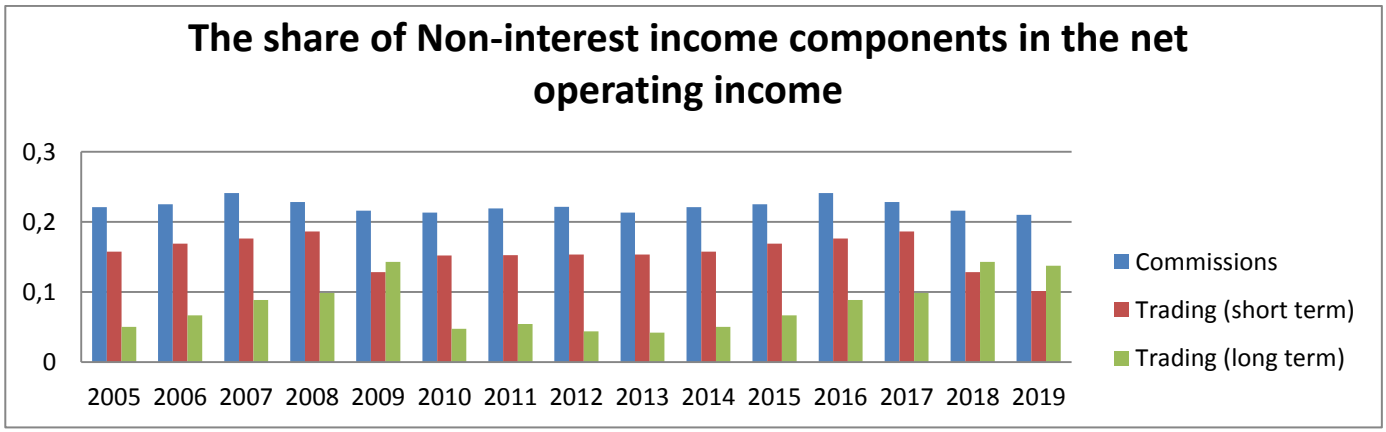
income is highly and negatively correlated with operating costs. Hence, they should run efficiently their expenses to be more profitable.

- The loan loss provisions ratio (LLP) as a credit risk proxy shows a negative and significant coefficient at 1% significance level. As shown in several studies such as Nisar et al. (2018); Ekanayake and Wanamalie, (2017), credit risk is negatively related to banks' performance. Nguyen et al. (2012) opines that banks with high credit risk should shift toward non-traditional lines of business if they look for more benefits. A higher value of loan loss provision means a low asset quality and as a result low profitability. Further, it detects the ability of managers to identify the safe and less risky investment (Chiorazzo, 2008; Nguyen, 2017). Hence, based on our result, Tunisian banks' performance is negatively affected by credit risk which confirms our prediction.
- As for macroeconomic factors, the GDP rate displays a negative and significant impact on Tunisian banks' performance at 5% level of significance. This is inconsistent with Meslier et al. (2014); Belghuith and Bellouma, (2017) and Nguyen et al. (2018); who suggest that when the economy is doing well, banks have more expansion opportunities, and can be more profitable. Our results support the negative correlation between Tunisian banks' performance and economic growth. There are two explanations for our findings. First, in the case of economic crunch, the financial policy-makers emit treasury bonds with high-interest rates. Second, the difficult economic situation increases the demand for credit which boosts the lending activity, and in return the operating income. Our results support the study of Hamdi et al. (2017) who assume that the Tunisian economic instability could explain the negative correlation of the GDP and the banking market performance.
- Our findings also show that inflation (INF) does not affect Tunisian banks' performance. However, Ayadi and Ellouze, (2015) support the work of Demirguc-Kunt and Huizinga, (1999) and found for 19 Tunisian banks from 2003 to 2012 that the inflation affected positively the banking system. This was due to interest rate adjustment following the inflation' anticipation. In contrast, Dhouibi, (2015) claimed a negative association for a sample of 10 Tunisian banks over the period 2005-2014. Based on our result, there is no effect of inflation on the performance of the Tunisian banking market.

Column 2 in **table (15)** presents our fourth equation that focus on the three components of the non-interest income and how they can affect Tunisian banks' income. The following equation displays the fourth model' results:

$$ROA_{it} = 0.002 + 1.605\ COM + 2.007\ SHORT + 1.552\ LONG + 1.045\ NET +$$
$$0.016\ CAP - 2.115\ EXP - 0.124\ LLP - 0.001\ GDP + a_i + u_{it}$$

- First, the commission share (COM) shows a positive and significant sign at 5% level of significance. The commissions play a crucial role in enhancing Tunisian banks' performance. Our findings invalidate the studies of Nisar et al. (2018); Edirisuriya et al. (2015); and Mostak, (2017) who revealed that income stemming from fees and commissions are negatively correlated with banks' profitability. Our results do not come as a surprise since commissions dominate the non-interest income**. Figure 8** presents the share of non-interest components in the net operating income during the study period. We can observe clearly that commission is still the major source of non-interest income.



Source: Financial statements

Figure 8: The share of non-interest income components in the net operating income for the listed Tunisian banks from 2005 to 2019.

- Regarding the trading income, both short and long trading incomes (SHORT-LONG) display positive and significant signs at 1% level of significance. Thus trading income as expected, contributes in enhancing Tunisian banks' performance. Our findings corroborate with the studies of Lepetit et al. (2008); Meslier et al. (2014) ; Edirisuriya et al. (2015); Mostak, (2017); and, Nisar et al. (2018). Even though that the Tunisian financial market is not well-developed, it seems beneficial for banks' performance. There are two possible explanations for our results. On one hand, since the revolution, Tunisian banks earn profits from trading treasury bonds with a high-interest rate. On the other hand, Tunisian banks are the monopole in exchanging currencies.

- As for control variables, they display almost the same coefficient with the same level of significance as model 2. Hence, we can conclude that the intermediation activity contributes in Tunisian banks' performance, while the costs, the LLP, and the GDP are negatively correlated to the ROA. Whereas bank capitalization and inflation are still insignificant.

To summarize, Tunisian banks' performance is highly correlated with income diversification. Hence we can confirm our first hypothesis.

2.1.2. Diversification-Stability nexus

After investigating the diversification-performance nexus, **Table (16)** pointed out the diversification – stability nexus. **Column 1** provides evidence on the sign of diversification effect in general. While **column 2** displays the regression results of the non-interest income components' effects.

Table 16: The random effect regressions results (model 3 and 5).

Z-score	Model 3	Model 5
NON	2.398*** (0.563)	-
COM	-	2.740** (1.331)
SHORT	-	2.257*** (0.819)
LONG	-	3.887*** (1.165)
NET	1.316*** (0.506)	1.281** (0.58)
CAP	1.222*** (0.057)	1.190*** (0.077)
EXP	0.001 (0.001)	0.000 (0.001)
LLP	0.010 (0.067)	0.013 (0.78)
GDP	0.119 (0.080)	0.158* (0.092)
INF	-0.349*** (0.131)	-0.444*** (0.158)
Constant	2.25 (4.423)	3.698 (3.008)
Obs.	165	165

The following equation displays the third model' results:

$$Z\text{-}score_{it} = 2.25 + 2.398\,NON + 1.316\,NET + 1.222\,CAP + 0.001\,EXP$$

$$+0.01LLP + 0.119\,GDP - 0.349\,INF + a_i + u_{it}$$

- The non-interest income (NON) has a positive impact on stability. The more the bank' income is coming from non-interest income, the more it is stable. At 1% level of significance, Tunisian banks' stability will grow up by 2.398% if they increase their non-interest income by 1%. These results confirm our prediction and corroborate with the studies of Nisar et al. (2018). Additionally, Hamdi et al. (2017) and Nguyen et al. (2015) revealed that banks with a higher share of non-interest income are more likely to be less risky banks. The positive sign could be interpreted by the fact that the non-interest income is more certain (like fees from ATM's and bancassurance), and does not correlate with interest fluctuation as interest-income generating activities.
- The net interest income (NET) is positively correlated to Tunisian banks' stability at 1% level of significance. Tunisian banks' activity still relies heavily on intermediation activity. Thus, as the net-interest income is higher, the bank is more able to cover its risk (Angbazo, 1997). In light of our findings, we can assume that a higher net-interest income contributes to enhance Tunisian banks' stability.
- Bank capitalization (CAP) displays also a significant positive sign at 1% level of significance. Well-capitalized banks are more likely to absorb any potential shocks (Anginer and Demirgüç-Kunt, 2014). Hence, a high level of capitalization helps banks to be more stable. Our results corroborate with several studies such as Nisar et al. (2018); Berger, (1995); Nguyen et al. (2015); and Nepali, (2018). In light of our results, holding a high level of capital contributes to Tunisian banks' stability since the capital requirement is one of the most important prudential standards in the Tunisian banking regulation. Thus, we can confirm that well-capitalized Tunisian banks are more likely to be stable.
- Controversy to what we expected operating costs show a positive sign. But it is not significant. Our result is in contrast with Nguyen et al. (2015) and Nisar et al. (2018) who argue that a high level of expenses increases banks' risk and subsequently hits its stability. Consistent with Nguyen et al. (2012), our finding show that Tunisian banks' stability is not affected by the operating costs.
- Credit risk is one of the most key factors that can hit badly banks' stability. The better the bank manage it, the greater its solvency gets. Hence, if banks are cautious and deduct the adequate provisions, they will be able to be more stable. Inconsistent with Nisar et al.

(2018) who reveal that credit risk threatens the long-term stability, therefore South Asian banks should enhance their loan portfolio' quality. As Hsieh et al. (2013) study our findings report an insignificant coefficient of loan loss provision on the Z-score. Given that the provisions are a sensitive issue for banks' managers that must be a key factor in driving banks' stability, we investigated deeper to explain the insignificance of the LLP ratio. We suggested that the problem comes from the public banks which may dispose of some particular advantages. To cut doubt, we picked only the private banks. As we predicted the LLP ratio affects the Tunisian private banks' stability. **Annex (6)** displays the results regressions for private banks. It shows that the higher the level of provisions is, the higher the stability is.

- Regarding the macroeconomic variables, the GDP displays a positive sign. But statistically, it is not significant. Thus, the Tunisian economic growth has no effect on banks' stability. Our results are inconsistent with Hamdi el al. (2017) and consistent with Nisar et al. (2018) in terms of insignificance. As for the inflation rate, it reports a negative impact at 1% level of significance. Hence, a higher level of inflation affects negatively Tunisian banks' stability. We could explain our results by the fact that an increase of inflation rate has a direct and positive impact on the monetary market rate, and subsequently, a decrease in the purchasing power, and an increase in the probability of default by borrowers. Our results support the work of Nisar et al. (2018).

Column 2 in **table (16)** shows the results concerning how can diversification strategy affects Tunisian banks' stability through using the non-interest income components. The following equation shows the fifth model' results:

$$Z\text{-}score_{it} = 3.698 + 2.74\ COM + 2.257\ SHORT + 3.887\ LONG + 1.281\ NET$$
$$+1.19\ CAP + 0.013\ LLP + 0.158\ GDP - 0.444\ INF + a_i + u_{it}$$

The three components of non-interest income display a positive and significant impact on the Z-score. This means that diversification strategy through shifting into non-generating interest business aids Tunisian banks to reduce their risk and enhance their stability. Our results support the studies of Lepetit et al. (2008) and Nisar et al. 2018 for the relationship between trading income and banks' stability. Kohler, (2018) suggests that "*Bank stability is correlated positively with the share of securities business income, possibly because it*

responds to different shocks than net interest income and, therefore, offers the largest diversification potential." As for commission income, our results are inconsistent with Edirisuriya et al. (2015); Mostak, (2017) and Nisar et al. (2018). However, they are in the same line as Kohler, (2018) findings and Pennathur et al. (2012) for public banks. This is may be explained by the fact that commissions contribute to Tunisian banks' performance and that the more the bank is profitable, the more it is stable (Lassoued and Sassi, 2017). For the trading income, Tunisian financial market is neither developed nor volatile. Hence, the Tunisian banks' volatility could be anticipated. Furthermore, trading income is not correlated to interest-income so diversification through securities could decrease risk and subsequently enhance banks' stability.

As for controls, the GDP became significant. As we expected, when an economy is doing well, Tunisian banks will be more stable.

Based on our results, we can confirm our second assumption, which suggests that Tunisian banks' stability is positively correlated with income diversification strategy.

2.1.3. The effect of bank' privatization

Most of the extent research has shown that private banks are more efficient and less risky than public banks (Altunbas et al. 2001; Beck et al. 2004; Andrianova, 2012, Iannotta et al. 2013) since they have the capacity to reduce their costs and the necessary skills to run their risks (Ayadi and Ellouze, 2015). Boycko et al. (1996) reveal that privatization pushes banks to focus on financial objectives and decreases their contribution to social and political activities. In a similar vein, Iannotta et al. (2013) opine that public banks are controlled by bureaucrats with political and social backgrounds, which might drift the bank's efficiency and profitability goals. Brown and Dinç, (2011) find that public banks are less likely to default than private counterparts. Hence, state ownership is positively correlated with risk-taking. Another stream of research focused on the effect of privatization on the bank' risk level.

Mohsni and Otchere, (2014) find that privatized banks are less risky and more prudent after privatization, "… *prior to being privatized, the state-owned banks exhibited higher risk (as measured by the z-score) than rival banks*". More recently, Boubakri et al. (2020) studied the risk-taking behavior of privatized banks from 45 countries in the post-privatization period,

and conclude that state ownership is associated with higher risk and lower performance. "*Our results suggest that financial system stability is inversely related to state ownership of banks, reinforcing the case for full privatization and the complete disengagement of governments from banks*". Regarding the diversification issue, Lassoued and Sassi, (2017) show that public banks' managers do not make any efforts to enhance the bank's performance through diversification because it needs specific skills. Further, Andrianova, (2012) underlined that private banks behave opportunistically, due to the failures in corporate governance and regulation, aiming to reap more benefits from short term trading income. In addition, Saghi-Zedek, (2016) assumes that private banks are more able to reap benefits from income diversification than public ones since they have the required management skills to deal with multiple lines of products and services.

Hence we will test whether the privatization affects the diversification-performance link and diversification-stability link. To do so we will apply the following model:

$$Y_{it} = \alpha + \beta_1 (DIV^* D)_{it} + \beta_2 DIV_{it} + \beta_3 D_{it} + \Sigma \boldsymbol{\delta} X_{it} + a_i + u_{it} \qquad (6)$$

Where the D refers to the dummy variable, which takes 1 for private banks and zero otherwise. The DIV^*D_{it} is an interaction term between the diversification measures and the dummy variable to test if the association between diversification-performance and diversification-stability differs from private to public banks and to test whether privatization moderates the diversification effect on bank's stability and performance.

Table (17) displays the four regressions results following the new model.

Table 17: The privatization effects

	ROA	ROA	Z-score	Z-score
NON	1.812***	-	0.350***	-
NET	0.877***	0.903 ***	0.141***	0.659***
COM	-	0.579	-	1.373
SHORT	-	2.079***	-	-0.259
LONG	-	2.040**	-	1.761**
CAP	0.043**	0.043**	0.120***	0.059***
LLP	-0.125***	-0.127***	-0.002	0.062*
EXP	-1.133***	-1.079***	0.066	-0.719***
GDP	-0.115***	-0.113**	0.000	0.000
INF	0.000	0.008	0.000***	-0.002***
DUMMY	-0.001	-0.007	0.010	0.013
NON-D	-0.398	-	-0.147	-
COM-D	-	0.693	-	-1.863
SHORT-D	-	-0.605	-	1.324
LONG-D	-	-0.799	-	2.051**
Constant	-0.011	-0.005	-0.005	-0.03
Obs.	165	165	165	165

Based on our findings (**Table 17**) the dummy variable has no significant effect on the ROA and the Z-score. Hence, the private ownership does not affect the Tunisian banking system's performance and stability. In addition, the interaction term between the diversification and the dummy variable also has no significant effect on both performance and stability. We conclude that private ownership does not moderate the diversification-performance and the diversification-stability links. However, it seems that privatization matters only for long-term securities. The interaction term between long-term trading income and dummy variable shows a positive and a highly coefficient at 5% level of significance. This means that private banks could benefit more, from long-term trading, in terms of stability than public counterparts. Private ownership amplifies the positive effect of the long trading on the banks' stability by 2.051. In other words, long term trading is more beneficial for private banks. We could explain our results by the fact that private banks have the skills to manage specific and

complicated activities such as trading. The positive moderating effect of the private ownership on the Long-term trading-stability link could be justified by the enhanced control applied by private owners on the banks' managers. Indeed, managers will focus on short-term benefits to show their performance and improve their reputation during their tenure. Thus, they might neglect long-term investments. Nevertheless, due to the intensified supervision of private banks' stockholders monitoring efficiency should be enhanced and long-term trading gains greater attention. In addition, private banks' managers have more freedom in decision-making and the choice of the investment portfolio in terms of risk-return. While public banks' managers are mostly oriented by the state which in the majority of cases invest in political and social projects with high risk and low profitability.

In overall, our findings suggest that income diversification is positively correlated to banks' performance and stability which is in the same vein as Nisar et al. (2018) and Nguyen et al. (2012) for the South Asian banks, Hamdi et al. (2017) for the Tunisian banks, Meslier et al. (2014) for banks in the Philippines, Mostak, (2017) for Indian banks and Sissy et al. (2017) for 29 African countries. Hence, under a competitive and unstable context with a large wave of innovation, income diversification seems to be the way for Tunisian banks to compete and survive. Furthermore, we think that Tunisian banks should shift toward non-traditional activities such as trading, insurance, financial services and foreign exchange in order to enhance their performance and their stability. In light of our results, the non-interest income, the net-interest income, the operating costs, the loan-loss provision, and the GDP are the key factors that drive Tunisian banks' performance. As for stability, the non/net interest incomes, bank-capitalization, and inflation are the most important determinants.

Regarding banks' ownership, private or public, it has no significant effect on both performance and stability. Yet, through investigating the diversification components, findings shows that privatization has a positive moderating effect on banks' stability and long-term trading link. Private ownership can amplify the positive influence of investment portfolios due to the enhanced control that improves managers monitoring.

CONCLUSION

Our thesis highlights the diversification issue in the Tunisian banking market and aims to investigate the revenue diversification' effects on both performance and financial stability since the ultimate goal of the CBT is to maintain the banking market stable.

The first chapter provides a theoretical background. The earlier and academic research on these matters provided mixed results so stemming benefits from non-traditional activities could be an opportunity as well as a threat. Hence, diversification drawbacks may outweigh its benefits in terms of risk. A closer look at the previous studies revealed that the inconclusive results are very clear between developing and developed countries. As shown by DeYoung and Roland, (2001); stiroh, (2004a); Stiroh and Rumble, (2006); Mercieca et al. (2007); Elyasiani and Wang, (2012); Maudos, (2017) studies for developed economies, income diversification decreases profitability and increases risk. Whereas, another stream of research on the emerging countries has proved the opposite conclusion (Nguyen et al. 2012; Meslier et al. 2014; Nguyen et al. 2015; Sissy et al. 2017; Mostak, 2017; Hamdi et al. 2017; Belguith and Bellouma, 2017). This pushed us to pay a closer look to the Tunisian banking system. For the last decade, Tunisian banks have been offering a broader array of financial products and services (trading, bancassurance, foreign exchange, consulting). The CBT has set up several reforms that intensify competition, and pushed banks to diversify their income structure. Additionally, it has restricted their lending activity. Due to the financial liberalization, the technology wave, the cutthroat competition, the lending activity restriction, and the economic context' instability, opting for diversification strategy is not a voluntary move for Tunisian banks.

To reach our goal, the second chapter provides empirical evidence that used a sample of 11 listed commercial banks over the period 2005-2019. Results provided a clearer proof that shifting toward non-interest income is a way for Tunisian banks to enhance their profitability (ROA) and stability (Z-score). To cut doubt and provide more specific evidence, we split up the non-interest income into three components (commissions, short-term trading, and long-term trading). The findings provided the same relationship for the three components. Hence, Tunisian banks could reap benefits from revenue diversification in terms of profitability and risk reduction. This could be also interpreted as the Tunisian banks are able to deal with different activities. Regarding the determinants of banks' performance, the intermediation-

activity, the operating costs, the loan loss provisions and the GDP are the key factors. While the financial stability, it is driven by the bank' capitalization, the intermediation activity, and the inflation rate.

Furthermore, since public and private banks has neither the same characteristics nor the same levels of profitability and risk, we tested whether income diversity has the same effect whatever the bank' ownership. Our results highlight a non-significant effect of privatization on diversification-stability and diversification-performance associations. Yet, positive moderating effect of private ownership on long-term trading-stability was reported.

Our research provides valuable insights for Tunisian banks, regulators and policy-makers:

- First, it points out that income diversification policy is beneficial for both performance and stability. Thus, Tunisian banks should pay greater attention to non-traditional income and start seeking for the adequate staff in terms of skills. Further, the CBT must take these results into consideration and implement the appropriate reforms such as the missing decrees that regulate the Islamic activities for conventional banks.
- Second, Tunisian banks have to invest more in technologies and human resources as main tools for diversification and competition. They can also collaborate with the fintech to guarantee their sustainability.
- Third, the loan-loss provisions and the operating costs decrease banks' profitability therefore Tunisian banks have to optimize their expenses by automated transactions, digitalization, and opening staff-free self-service points. Moreover, they should enhance loan portfolio's quality improving their project selection methodology.
- Last, focusing on non-traditional activities does not mean reducing the intermediation business. In contrast, lending and deposit activities remain the core businesses of Tunisian banks and contribute a lot to banks' performance and stability.

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APPENDICES

Annex 1: Stationarity tests (Fisher and Levin-Lin-Chu)

ROA

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 32.2808
Prob > chi2 = 0.0727

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 36.4069
Prob > chi2 = 0.0275

Levin-Lin-Chu unit-root test for ROA

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -5.7572
Adjusted t* -2.6349
Statistic p-value 0.0042

Levin-Lin-Chu unit-root test for ROA

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -9.3154
Adjusted t* -4.4577
Statistic p-value 0.0000

Z-score

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 38.0965
Prob > chi2 = 0.0179

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 17.5074
Prob > chi2 = 0.7348

Levin-Lin-Chu unit-root test for Zscore

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t	-6.2703
Adjusted t*	-4.2451
Statistic p-value	0.0000

Levin-Lin-Chu unit-root test for Zscore

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t	-4.5218
Adjusted t*	-0.9241
Statistic p-value	0.1777

NON

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 10.2288
Prob > chi2 = 0.9841

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 11.5389
Prob > chi2 = 0.9662

Levin-Lin-Chu unit-root test for NON

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -1.4489
Adjusted t* 1.9822
Statistic p-value 0.9763

Levin-Lin-Chu unit-root test for NON

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -4.9474
Adjusted t* -1.4475
Statistic p-value 0.0739

COM

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 30.9847
Prob > chi2 = 0.0964

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 35.8515
Prob > chi2 = 0.0315

Levin-Lin-Chu unit-root test for COM

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -2.7911
Adjusted t* 0.2473
Statistic p-value 0.5977

Levin-Lin-Chu unit-root test for COM

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -6.2951
Adjusted t* -2.0719
Statistic p-value 0.0191

SHORT

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 17.4428
Prob > chi2 = 0.7385
Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 35.4129
Prob > chi2 = 0.0351

Levin-Lin-Chu unit-root test for SHORT

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t	-3.9841
Adjusted t*	-0.5659
Statistic p-value	0.2857

Levin-Lin-Chu unit-root test for SHORT

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t	-8.3964
Adjusted t*	-3.5512
Statistic p-value	0.0002

LONG

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 14.7423
Prob > chi2 = 0.8731
Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 9.0204
Prob > chi2 = 0.9932

Levin-Lin-Chu unit-root test for LONG

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t	-1.7967
Adjusted t*	1.9621
Statistic p-value	0.9751

Levin-Lin-Chu unit-root test for LONG

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t	-5.0431
Adjusted t*	-1.7071
Statistic p-value	0.0439

NET

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 14.9178
Prob > chi2 = 0.8657

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 14.3793
Prob > chi2 = 0.8875

Levin-Lin-Chu unit-root test for NET

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -5.2132
Adjusted t* -2.7390
Statistic p-value 0.0031

Levin-Lin-Chu unit-root test for NET

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -8.5778
Adjusted t* -3.9803
Statistic p-value 0.0000

CAP

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 38.7257
Prob > chi2 = 0.0152

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 8.5417
Prob > chi2 = 0.9954

Levin-Lin-Chu unit-root test for CAP

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -6.4621
Adjusted t* -4.2991
Statistic p-value 0.0000

Levin-Lin-Chu unit-root test for CAP

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -3.8317
Adjusted t* -0.2113
Statistic p-value 0.4163

EXP

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 24.2655
Prob > chi2 = 0.3335

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 15.8219
Prob > chi2 = 0.8246

Levin-Lin-Chu unit-root test for EXP

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -3.6973
Adjusted t* 0.3643
Statistic p-value 0.6422

Levin-Lin-Chu unit-root test for EXP

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -5.6978
Adjusted t* -1.9791
Statistic p-value 0.0239

LLP

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 68.3675
Prob > chi2 = 0.0000

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 79.1698
Prob > chi2 = 0.0000
Levin-Lin-Chu unit-root test for LLP

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -7.8895
Adjusted t* -4.9930
Statistic p-value 0.0000

Levin-Lin-Chu unit-root test for LLP

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -10.1108
Adjusted t* -6.0399
Statistic p-value 0.0000

GDP

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 53.1052
Prob > chi2 = 0.0002

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 86.7565
Prob > chi2 = 0.0000

Levin-Lin-Chu unit-root test for GDP

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -9.3762
Adjusted t* -6.8167
Statistic p-value 0.0000

Levin-Lin-Chu unit-root test for GDP

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -14.0240
Adjusted t* -9.0863
Statistic p-value 0.0000

INF

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 60.0102
Prob > chi2 = 0.0000

Fisher Test for panel unit root using an augmented Dickey-Fuller test (0 lags)
Ho: unit root
chi2(22) = 104.2071
Prob > chi2 = 0.0000
Levin-Lin-Chu unit-root test for INF

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -9.8609
Adjusted t* -7.0667
Statistic p-value 0.0000

Levin-Lin-Chu unit-root test for INF

Ho: Panels contain unit roots
Number of panels = 11
Ha: Panels are stationary
Number of periods = 15

AR parameter: Common
Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included

ADF regressions: 0 lags
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)

Unadjusted t -14.9700
Adjusted t* -9.3029
Statistic p-value 0.0000

Annex 2: Equation 2 (tests and regression results)

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of ROA
chi2(1) = 345.37
Prob > chi2 = 0.0000

F test that all u_i=0: F(10, 147) = 2.43 **Prob > F = 0.0106**

Hausman (1978) specification test

	Coef.
Chi-square test value	32.128
P-value	0

Fixed-effect regression results

ROA	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NON	1.836	0.290	6.33	0.000	1.262	2.409	***
NET	1.013	0.261	3.88	0.000	0.497	1.529	***
CAP	0.014	0.030	0.47	0.640	-0.044	0.072	
LLP	-0.119	0.034	-3.46	0.001	-0.187	-0.051	***
EXP	-2.256	0.402	-5.61	0.000	-3.051	-1.462	***
GDP	-0.001	0.000	-2.48	0.014	-0.002	0.000	**
INF	0.000	0.001	-0.16	0.873	-0.001	0.001	
Constant	0.004	0.009	0.48	0.630	-0.014	0.023	

Mean dependent var	0.009	SD dependent var	0.014
R-squared	0.452	Number of obs	165.000
F-test	17.314	Prob > F	0.000
Akaike crit. (AIC)	-1059.876	Bayesian crit. (BIC)	-1035.029

*** *p<0.01, ** p<0.05, * p<0.1*

Annex 3: Equation 3 (tests and regression results)

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of Zscore
chi2(1) = 2.66
Prob > chi2 = 0.1027

F test that all u_i=0: F(10, 147) = 596.43 **Prob > F = 0.0000**

Hausman (1978) specification test

	Coef.
Chi-square test value	-.055
P-value	1

Random effect regression results

Zscore	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NON	2.398	0.563	4.26	0.000	1.294	3.502	***
NET	1.316	0.506	2.60	0.009	0.325	2.308	***
CAP	1.222	0.057	21.36	0.000	1.110	1.334	***
LLP	0.010	0.067	0.14	0.886	-0.121	0.140	
EXP	0.001	0.001	0.65	0.513	-0.001	0.002	
INF	-0.349	0.131	-2.66	0.008	-0.606	-0.092	***
GDP	0.119	0.080	1.49	0.135	-0.037	0.275	
Constant	2.251	4.423	0.51	0.611	-6.419	10.920	

Mean dependent var	22.154	SD dependent var	16.232
Overall r-squared	0.336	Number of obs	165.000
Chi-square	1089.137	Prob > chi2	0.000
R-squared within	0.881	R-squared between	0.280

**** p<0.01, ** p<0.05, * p<0.1*

Annex 4: Equation 4 (tests and regression results)

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of ROA
chi2(1) = 370.92
Prob > chi2 = 0.0000

F test that all u_i=0: F(10, 145) = 2.19 **Prob > F = 0.0214**

Hausman (1978) specification test

	Coef.
Chi-square test value	26.343
P-value	.002

Fixed-effect regression results

ROA	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
COM	1.605	0.617	2.60	0.010	0.385	2.825	**
SHORT	2.007	0.381	5.27	0.000	1.255	2.760	***
LONG	1.552	0.541	2.87	0.005	0.482	2.622	***
NET	1.045	0.270	3.87	0.000	0.511	1.578	***
CAP	0.016	0.036	0.43	0.665	-0.055	0.086	
LLP	-0.124	0.036	-3.43	0.001	-0.196	-0.052	***
EXP	-2.115	0.430	-4.92	0.000	-2.965	-1.265	***
GDP	-0.001	0.000	-2.62	0.010	-0.002	0.000	**
INF	0.000	0.001	0.15	0.883	-0.001	0.002	
Constant	0.002	0.010	0.22	0.827	-0.018	0.023	

Mean dependent var	0.009	SD dependent var	0.014
R-squared	0.455	Number of obs	165.000
F-test	13.471	Prob > F	0.000
Akaike crit. (AIC)	-1056.929	Bayesian crit. (BIC)	-1025.869

**** p<0.01, ** p<0.05, * p<0.1*

Annex 5: Equation 5 (tests and regression results)

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of Zscore
chi2(1) = 3.53
Prob > chi2 = 0.0603

F test that all u_i=0: F(10, 145) = 455.53 **Prob > F = 0.0000**

Hausman (1978) specification test

	Coef.
Chi-square test value	-2.647
P-value	1

Random effect regression results

Zscore	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
COM	2.740	1.331	2.06	0.040	0.130	5.349	**
SHORT	2.257	0.819	2.76	0.006	0.652	3.863	***
LONG	3.887	1.165	3.34	0.001	1.605	6.170	***
NET	1.281	0.580	2.21	0.027	0.145	2.418	**
CAP	1.190	0.077	15.53	0.000	1.040	1.341	***
LLP	0.013	0.078	0.17	0.867	-0.140	0.167	
EXP	0.000	0.001	-0.21	0.832	-0.002	0.002	
INF	-0.444	0.158	-2.81	0.005	-0.754	-0.134	***
GDP	0.158	0.092	1.72	0.086	-0.022	0.338	*
Constant	3.698	3.008	1.23	0.219	-2.198	9.593	

Mean dependent var	22.154	SD dependent var	16.232
Overall r-squared	0.367	Number of obs	165.000
Chi-square	879.502	Prob > chi2	0.000
R-squared within	0.882	R-squared between	0.320

**** p<0.01, ** p<0.05, * p<0.1*

Annex 6: Regression results on the sample of private banks

	Equation 3	Equation 5
NON	2.230*** (0.678)	-
COM	-	-8.230 (6.246)
SHORT	-	12.444*** (3.214)
LONG	-	37.506*** (4.992)
NET	2.190*** (0.646)	8.022*** (1.965)
CAP	1.120*** (0.071)	0.555** (0.240)
EXP	-0.001 (0.001)	-0.008*** (0.002)
LLP	0.363** (0.183)	2.109*** (0.754)
GDP	0.143 (0.102)	0.255 (0.562)
INF	-0.374** (0.16)	-2.062** (0.863)
Constant	4.563 (6.232)	2.408 (9.610)
Obs.	120	120

Annex 7: Equation 3 for private banks (tests and regression results)

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of Zscore
chi2(1) = 4.19
Prob > chi2 = 0.0407

F test that all u_i=0: F(7, 105) = 649.84 **Prob > F = 0.0000**

Hausman (1978) specification test

	Coef.
Chi-square test value	.795
P-value	.997

Random effect regression results

Zscore	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NONTA	2.230	0.678	3.29	0.001	0.900	3.560	***
NETTA	2.190	0.646	3.39	0.001	0.924	3.455	***
CAPITAL	1.120	0.071	15.69	0.000	0.980	1.260	***
COST	-0.001	0.001	-0.71	0.478	-0.003	0.001	
LLPTA	0.363	0.183	1.99	0.047	0.005	0.722	**
GDP	0.143	0.102	1.40	0.160	-0.057	0.342	
INF	-0.374	0.160	-2.34	0.019	-0.687	-0.061	**
Constant	4.563	6.232	0.73	0.464	-7.653	16.778	

Mean dependent var	25.830	SD dependent var	17.307
Overall r-squared	0.282	Number of obs	120.000
Chi-square	814.607	Prob > chi2	0.000
R-squared within	0.885	R-squared between	0.215

**** p<0.01, ** p<0.05, * p<0.1*

Annex 8: Equation 5 (tests and regression results)

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of Zscore
chi2(1) = 1.02
Prob > chi2 = 0.3127

F test that all u_i=0: F(7, 103) = 461.05 **Prob > F = 0.0000**

Hausman (1978) specification test

	Coef.
Chi-square test value	-123.898
P-value	1

Random effect regression results

Zscore	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
COMTA	-8.230	6.246	-1.32	0.188	-20.472	4.011	
SHTA	12.444	3.214	3.87	0.000	6.144	18.743	***
LGTA	37.506	4.992	7.51	0.000	27.723	47.289	***
NETTA	8.022	1.965	4.08	0.000	4.170	11.873	***
CAPITAL	0.555	0.240	2.31	0.021	0.085	1.025	**
COST	-0.008	0.002	-3.68	0.000	-0.012	-0.004	***
LLPTA	2.109	0.754	2.80	0.005	0.631	3.587	***
GDP	0.255	0.562	0.45	0.650	-0.847	1.357	
INF	-2.062	0.863	-2.39	0.017	-3.753	-0.370	**
Constant	2.408	9.610	0.25	0.802	-16.427	21.243	

Mean dependent var	25.830	SD dependent var	17.307
Overall r-squared	0.611	Number of obs	120.000
Chi-square	172.687	Prob > chi2	0.000
R-squared within	0.592	R-squared between	0.798

**** p<0.01, ** p<0.05, * p<0.1*

Annex 9: Equation 6 (VIF' test and regressions)

Variance inflation factor

	VIF	1/VIF
NON	2.326	.43
dummy	2.159	.463
EXP	1.603	.624
CAP	1.598	.626
NET	1.473	.679
LLP	1.447	.691
INF	1.205	.83
GDP	1.058	.945
Mean VIF	1.609	.

Variance inflation factor

	VIF	1/VIF
COM	3.886	.257
dummy	2.677	.374
CAP	2.457	.407
NET	2.017	.496
EXP	2.008	.498
SHORT	1.702	.587
LONG	1.604	.624
LLP	1.469	.681
INF	1.328	.753
GDP	1.094	.914
Mean VIF	2.024	.

Regression results

ROA	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NON.Dummy	-0.398	0.579	-0.69	0.492	-1.532	0.736	
NON	1.812	0.521	3.47	0.001	0.790	2.834	***
NET	0.877	0.145	6.04	0.000	0.593	1.162	***
CAP	0.043	0.017	2.47	0.014	0.009	0.077	**
LLP	-0.125	0.034	-3.67	0.000	-0.191	-0.058	***
EXP	-1.133	0.174	-6.51	0.000	-1.474	-0.792	***
GDP	-0.115	0.041	-2.80	0.005	-0.196	-0.035	***
INF	0.000	0.064	0.01	0.994	-0.126	0.127	
dummy	-0.001	0.009	-0.11	0.909	-0.019	0.017	
Constant	-0.011	0.008	-1.33	0.183	-0.027	0.005	

Mean dependent var	0.009	SD dependent var	0.014
Overall r-squared	0.475	Number of obs	165.000
Chi-square	136.900	Prob > chi2	0.000
R-squared within	0.427	R-squared between	0.851

**** p<0.01, ** p<0.05, * p<0.1*

Regression results

ROA	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
COM-Dummy	0.693	1.964	0.35	0.724	-3.157	4.543	
SHORT-Dummy	-0.605	0.838	-0.72	0.470	-2.249	1.038	
LONG-Dummy	-0.799	0.921	-0.87	0.386	-2.604	1.007	
COM	0.579	1.882	0.31	0.758	-3.109	4.267	
SHORT	2.079	0.780	2.67	0.008	0.551	3.607	***
LONG	2.040	0.874	2.33	0.020	0.326	3.753	**
NET	0.903	0.166	5.44	0.000	0.578	1.229	***
CAP	0.043	0.021	2.05	0.040	0.002	0.084	**
LLP	-0.127	0.036	-3.54	0.000	-0.198	-0.057	***
EXP	-1.079	0.189	-5.71	0.000	-1.450	-0.709	***
GDP	-0.113	0.044	-2.59	0.010	-0.199	-0.028	**
INF	0.008	0.069	0.12	0.903	-0.126	0.143	
dummy	-0.007	0.016	-0.46	0.643	-0.038	0.023	
Constant	-0.005	0.015	-0.35	0.729	-0.034	0.024	

Mean dependent var	0.009	SD dependent var	0.014
Overall r-squared	0.478	Number of obs	165.000
Chi-square	138.212	Prob > chi2	0.000
R-squared within	0.436	R-squared between	0.832

**** p<0.01, ** p<0.05, * p<0.1*

Regression results

Zscore	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NON*Dummy	-0.147	0.114	-1.28	0.199	-0.371	0.077	
NON	0.350	0.104	3.37	0.001	0.146	0.553	***
NET	0.141	0.050	2.80	0.005	0.042	0.240	***
CAP	0.120	0.006	20.25	0.000	0.108	0.131	***
LLP	-0.002	0.007	-0.32	0.747	-0.016	0.012	
EXP	0.066	0.078	0.85	0.395	-0.086	0.218	
GDP	0.000	0.000	1.47	0.142	0.000	0.000	
INF	0.000	0.000	-2.78	0.005	-0.001	0.000	***
Dummy	0.010	0.012	0.87	0.387	-0.013	0.033	
Constant	-0.005	0.010	-0.50	0.618	-0.024	0.015	

Mean dependent var	0.022	SD dependent var	0.016
Overall r-squared	0.365	Number of obs	165.000
Chi-square	1119.154	Prob > chi2	0.000
R-squared within	0.882	R-squared between	0.305

**** p<0.01, ** p<0.05, * p<0.1*

Regression results

Zscore	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
COM*Dummy	-1.863	1.945	-0.96	0.338	-5.676	1.950	
SHOR*TDummy	1.324	0.830	1.59	0.111	-0.304	2.951	
LONG*Dummy	2.051	0.912	2.25	0.025	0.263	3.840	**
COM	1.373	1.864	0.74	0.461	-2.280	5.025	
SHORT	-0.259	0.772	-0.34	0.737	-1.772	1.255	
LONG	1.761	0.866	2.03	0.042	0.063	3.458	**
NET	0.659	0.164	4.01	0.000	0.337	0.982	***
CAP	0.059	0.021	2.83	0.005	0.018	0.099	***
LLP	0.062	0.036	1.74	0.082	-0.008	0.132	*
EXP	-0.719	0.187	-3.84	0.000	-1.086	-0.352	***
GDP	0.000	0.000	1.14	0.256	0.000	0.001	
INF	-0.002	0.001	-3.50	0.000	-0.004	-0.001	***
Dummy	0.013	0.015	0.86	0.388	-0.017	0.044	
Constant	-0.003	0.015	-0.23	0.816	-0.032	0.025	

Mean dependent var	0.022	SD dependent var	0.016
Overall r-squared	0.645	Number of obs	165.000
Chi-square	274.348	Prob > chi2	0.000
R-squared within	0.568	R-squared between	0.791

**** p<0.01, ** p<0.05, * p<0.1*