The Tunisian Banks Performance

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Abstract: This paper explores the different factors that lie behind the performance of the Tunisian banks. In fact, this research covers a sample of ten Tunisian banks over the period that ranges from the year 2006 to 2015. The profitability of these banks is measured by conducting an analysis of panel data using two different but complementary indicators, namely Return on Assets (ROA) and Net Interest Margins (NIM). They include both organizational and macroeconomic variables as well macro-financial ones. Results indicate that the bank operating expenses have a positive and significant impact on the interest margins but negatively affect the ROA in our sample. Equity, as a second organizational variable, has a positive effect on both NIM and ROA. The concentration movement, as a macro-financial variable, supports the ROA (profitability) but degrades the NIM. The inflation rate is positively and significantly affected by the net interest margin.

Keywords: Panel Data, Return on Assets, Net Interest Margin, Profitability, Tunisian Banks.

1. Introduction

It goes without saying that the banking sector is the most important pillar of any country's financial system. Banks play a fundamental role in financing the economy by attracting savings and granting credit, they are accounted for as the oil for the wheels that keep the economy turning. Ongore and Kusa G (2013) confirmed that "the commercial banks play an essential role in allocating economic resources to countries".

A well-developed banking sector plays a key role in the economic growth, which justifies the growing attention paid to this sector performance in the recent years. As a matter of fact, several researches about banking performance have been conducted on US commercial banks and less intensively on financial institutions in Europe and in the major emerging markets.

Locally speaking, however, research on the Tunisian banks performance is scarce. Thus, the objective of the present paper is to decipher the determinants of the profitability of a sample of ten Tunisian banks over the period from 2006 to 2015 by conducting an analysis of panel data. The profitability of banks is measured, here, by using two different but complementary indicators, namely Return on Assets (ROA) and Net Interest margins (NIM). They include both organizational factors and macroeconomic variables (exogenous) having a macro-financial nature.

This paper has as objective to answer the following question: What are the internal and external factors that explain the performance of the Tunisian banks?

2. Literature Review

Several studies have attempted to explain the contribution of a variety of variables to the profitability of banks. It should be noted that very often many authors have come to different or even contradictory results. This has been explained, in particular, by the diversity of data used in different periods and territories.

There is a wealth of literature on the factors that influence the profitability of banks. There are some initial surveys of bank profitability (Short, 1979), (Bourke, 1989). Some empirical studies of bank profitability are country-specific, while others focus on a panel of countries. Examples of country studies...
are those of United States (Berger, 1995); (Neeley and Wheelock, 1997), (Angbazo, 1997), (Dimitris et al., 2015), Colombia (Barajas et al., 1999), Brazil (Afanasiiff et al., 2002), Croatia (Kundid et al., 2011). (Mamatzakis and Remoudos, 2003), (Kosmidou, 2008), (Alexiou and Sofoklis, 2009), Tunisia, (Naeur, 2003), Naoual, (Makram et al., 2015), India (Badola and Verma, 2006), China (Heffernan and Fu, 2010), Taiwan (Ramlall, 2009), (Chen and Yeh, 1998), Philippines (Sufian and Chong, 2008), Malaysia (Guru B. K. et al., 1999), Pakistan (Burki and Niazi, 2006); (Javaid et al., 2011), Japan (Lui and Wilson, 2010), Korea (Sufian, 2011), (Jeong and Doyeon, 2013), Turkey (Kaya, 2002), (Tunay and Silpar, 2006), (Alper and Anbar, 2011), Czech republic (Horvath, 2009), Romania (Andrieub and Cocris, 2010), Swiss (Dietrich and Wansenried, 2009), Spain (Vivas, 1997), Ethiopia (Gemechu, 2016), Italy (Paola and Valeria, 2015).


There is a wealth of literature on the factors that influence the profitability of banks. There are some initial surveys of bank profitability (Short, 1979), (Bourke, 1989). Some empirical studies of bank profitability are country-specific, while others focus on a panel of countries.

The economic theory and the various existing empirical studies often diverge at the level of the impact of some organizational factors on the return on assets (ROA). Indeed, the economic theory emphasizes the negative effect of the bank operating costs and return on assets while other empirical studies rather argue that the impact may be positive to the extent that the operating costs contribute to the increase in the productivity of banks and consequently their profitability.

According to Ben (2003) and Bashir (2000), banks tend to earn additional operating costs for the purpose of raising profit by justifying the parallel variation between the general banking costs and the return on assets. Other authors, such as Angbazo (1997) and Guru B. et al. (2002) argued that profits cannot only be realized by incurring expenditure, but also by eliminating the idle expenditure commitments to credit institutions. These discrepancies between the theoretical constructions and the empirical investigations are noted in terms of the impact of equity on the banks asset profitability.

The majority of the empirical researches carried out by Ben (2003) and Bashir (2000) revealed that equity has a stimulating effect on the profitability of firms, but in the case of the excess of the capital ratio, equity is considered detrimental to asset profitability since banks tend to achieve a minimal production of available capital.

On the other hand, there is a near unanimity from the part of economists on the positive impact of bank loans and the size of the bank on the profitability that would corroborate the predictions of the economic theory. As a matter of fact, Ben (2003) and Bashir (2000) reported that strengthening the credit policy of the bank raises its profits. This entails that the more credits the banks provide, the higher the income they receive and therefore the higher the profits they realize. However and according to Bashir (2000), a credit policy can sometimes shake the bank profitability, particularly when an expansionary credit policy is incompatible with the strategy pursued in the search for financial resources. Thus, this reinforcement of the credit policy should be accompanied by an efficient allocation strategy for additional resources. Subsequently, the control of the deposit policy can help the banking firms increase their profitability.

In another vein, Bourke (1989), Ben (2003) and Abreu and Mendes (2002), proved that profitability and the ratio of jobs measured by the credit/deposit ratio lead to a positive relationship. This can be explained by the complementarily between credits and bank deposits. As for the size of the bank, many regressions on panel data were made by expressing profitability according to a set of internal and external factors. Some researchers as Bourke (1989) and Molynieux and Thornton (1992) found out a positive and statistically indicative relationship between the size of the bank and its profitability. Rouabah (2006), by contrast, argued that size is not a source of cost saving given that large banks are subject to inefficiency of scale.

According to Short (1979), Bourke (1989), Molynieux and Thornton (1992), Demirguc and Huizinga (2001), the introduction of this variable has empirically shown a positive relationship with asset returns.

The impact of such macroeconomic variables as economic growth and inflation has been found common among many researchers. Indeed, several authors agreed on the existence of a positive relationship between economic growth and bank profit growth (Bashir, 2000), (Rouabah, 2006), Beckmann (2007). These researchers contended that the national wealth benefits from any economic activity the country undertakes and strengthens the banking sector by encouraging the banks to innovate.
and renew their management techniques and technologies.

As for the impact of the variation in the general level of prices, Moyluneux and Thornton (1992), (B. et al., 2002), Abreu and Mendes (2002) reported the existence of a link between return on assets and inflation. They found out a positive relationship that assumes that the rising inflation will be favorable to the evolution of bank profits.

Generally speaking, the existing empirical research assumes that the studied impact of the organizational variables on the profitability of banks measured by the interest margin is consistent with the predictions of the economic theory.

Such variables as the bank operating costs, the loans granted, the amount of capital and the size of the bank have positive effects on the interest margin. According to Anghbazo (1997), Bashir (2000) and Ben (2003), the massive charges held by the credit institutions are respected by customers. This may, in turn, have a positive effect on interest margins, while the operating expenses will no longer be in favor of maximizing interest margins unless banks maintain an optimal and tolerable level of expenditure to eliminate the waste of available financial resources. A well-managed credit policy ensures the increase in interest margins.

In another vein, the study of the credit policy requires the upholding of a balance between the collection of deposits and the allocation of credits. The role of equity in raising the interest margins has been researched by Anghbazo (1997) and Ben (2003). According to Bashir (2000), a capitalization policy allows the bank to maintain guaranteed funds in order to impose credits in the case of unforeseen crises, which, in turn, encourages external indebtedness and stimulates profitability.

In the same respect, Bashir (2000), Demerguç and Huizinga (2001), claimed that the foreign lending institutions perform better than any of their local counterparts, assuming that the former are larger than the latter. Among the organizational or managerial variables, Ben (2003) assumed that concentration is associated with low deposit rates and high credit rates, which limits the improvement in bank interest margins. This shows that competition allows the bank to have more customers and consequently more interest income. According to Demerguç and Huizinga (2001), competition reflects, in a way, the size of the banking sector and leads to the search for efficiency levels, which also limits the increase in interest margins.

Some authors, such as Barajas et al. (1999), Bashir (2000), Demerguç and Huizinga (2001) and Rouabah (2006), reported a positive impact of financial liberalization on the increase of the interest margins that is conditioned by the strong rejection of both the increased risks (Anghbazo, 1997) and the diversification of the economic activity (Saunders and Ho, 1981).

The improvement in the capital markets can later promote the banking activity through information symmetry. When this market develops, the interest margins may decline. Saunders and Ho (1981) Affirmed that the exogenous variables affect positively and more significantly the interest margins compared to the managerial determinants. This is not the case for other economists like Guru et al (2002) and Ben (2003), who insisted on the major positive effect of the organizational and managerial variables.

3. Research Methodology

Tunisia has experienced the most radical change in its financial system in the last decade having as objective to occupy a determined position among the emerging countries.

In this section, we present the empirical results on the determinants of bank profitability as measured by two indicators, namely the return on assets (ROA) and the net interest margins (NIM). The interpretations of the results obtained will allow us to explain the importance of the estimated relations.

3.1. The Sample

The data used for the empirical analysis are extracted from the financial statements of the ten banks listed on the Tunis Stock Exchange during the period from 2006 to 2015. Particular attention was paid to the temporal continuity of the data by the bank. Information is collected from banks’ balance sheets and financial statements. They are excerpted from the Professional Association of the Banks of Tunis (PABT). We also used the aggregated data of the statistics of the National Institute of Statistics (NIS).

These data, which are external to the banking system, mainly concern gross domestic product and information on the consumer price index. Our database is composed of variables whose choice has been guided by recent studies on the profitability of banks.
Bank profitability is measured in two ways, either as a return on assets or as a net interest margin. The explanatory variables are split into three subsets:

- Managerial or organizational variables;
- Exogenous macro-economic variables;
- Variables that reflect the macro-financial structure.

### 3.2. The Variables

#### 3.2.1. The Dependent Variables

The two dependent variables that are used to explain the profitability of Tunisian banks are the net interest margin (NIM) and the return on asset (ROA).

\[ \text{NIM} = \frac{\text{Net interest income}}{\text{Total assets}} \] (2.1)

The net interest margin (NIM): is a measure of the difference between the interest income generated by banks or other financial institutions and the amount of interest paid out to their lenders (for example, deposits), relative to the amount of their (interest-earning) assets. It is usually expressed as a percentage of what the financial institution earns on loans in a time period and other assets minus the interest paid on borrowed funds divided by the average amount of the assets on which it earned income in that time period (the average earning assets). In a way, the NIM determines the profitability of bank loans. This profitability indicator is often used to compare firms operating within the same industry.

### Table 2. The Bank Calculation of NIM

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</tr>
</thead>
<tbody>
<tr>
<td>Attijari Bank</td>
<td>0.0331</td>
<td>0.0376</td>
<td>0.0443</td>
<td>0.0453</td>
<td>0.0453</td>
<td>0.0433</td>
<td>0.0436</td>
<td>0.0490</td>
<td>0.0507</td>
<td>0.0495</td>
<td>4.42%</td>
</tr>
<tr>
<td>ATB</td>
<td>0.0392</td>
<td>0.0382</td>
<td>0.0366</td>
<td>0.0371</td>
<td>0.0327</td>
<td>0.0359</td>
<td>0.0338</td>
<td>0.0344</td>
<td>0.0343</td>
<td>0.0034</td>
<td>3.25%</td>
</tr>
<tr>
<td>Amen Bank</td>
<td>0.0433</td>
<td>0.0409</td>
<td>0.0416</td>
<td>0.0403</td>
<td>0.0348</td>
<td>0.0354</td>
<td>0.0309</td>
<td>0.0307</td>
<td>0.0345</td>
<td>0.0316</td>
<td>3.64%</td>
</tr>
<tr>
<td>BH</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.00%</td>
</tr>
<tr>
<td>BIAT</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0010</td>
<td>0.0001</td>
<td>0.0548</td>
<td>0.0562</td>
<td>0.0542</td>
<td>0.0552</td>
<td>0.0612</td>
<td>2.83%</td>
</tr>
<tr>
<td>BNA</td>
<td>0.0354</td>
<td>0.0392</td>
<td>0.0379</td>
<td>0.0390</td>
<td>0.0428</td>
<td>0.0418</td>
<td>0.0359</td>
<td>0.0375</td>
<td>0.0424</td>
<td>0.0431</td>
<td>3.95%</td>
</tr>
<tr>
<td>BT</td>
<td>0.0524</td>
<td>0.0610</td>
<td>0.0561</td>
<td>0.0524</td>
<td>0.0508</td>
<td>0.0470</td>
<td>0.0452</td>
<td>0.0431</td>
<td>0.0470</td>
<td>0.0488</td>
<td>5.04%</td>
</tr>
<tr>
<td>STB</td>
<td>0.0327</td>
<td>0.0388</td>
<td>0.0405</td>
<td>0.0384</td>
<td>0.0410</td>
<td>0.0360</td>
<td>0.0315</td>
<td>0.0299</td>
<td>0.0352</td>
<td>0.0357</td>
<td>3.60%</td>
</tr>
<tr>
<td>UBCI</td>
<td>0.0568</td>
<td>0.0537</td>
<td>0.0545</td>
<td>0.0551</td>
<td>0.0523</td>
<td>0.0495</td>
<td>0.0491</td>
<td>0.0496</td>
<td>0.0515</td>
<td>0.0530</td>
<td>5.25%</td>
</tr>
<tr>
<td>UIB</td>
<td>0.0426</td>
<td>0.0400</td>
<td>0.0394</td>
<td>0.0428</td>
<td>0.0436</td>
<td>0.0430</td>
<td>0.0471</td>
<td>0.0477</td>
<td>0.0508</td>
<td>0.0489</td>
<td>4.46%</td>
</tr>
<tr>
<td>Average</td>
<td>3.36%</td>
<td>3.49%</td>
<td>3.51%</td>
<td>3.51%</td>
<td>3.43%</td>
<td>3.87%</td>
<td>3.73%</td>
<td>3.76%</td>
<td>4.02%</td>
<td>3.75%</td>
<td>3.64%</td>
</tr>
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</table>

BIAT is the most profitable bank in the selected years, as its NIM increased from 0.0001 MD in 2006 to 0.0612 MD in 2015, an increase of 0.0611 MD. It is also noted that Attijari Bank, BT, and UBCI represent the most profitable banks during the period 2006-2015. However, BH is the least profitable bank, since it has a zero NIM coefficient because of the nullity of its net banking income.

From 2006 to 2010, the NIM of the banks declined from 3.36% in 2006 to 3.43% in 2010. The NIM reached 4.02% at the end of 2014, due to a noticeable improvement in the Net Banking Income (NBI), which increased to 251280MD, while it decreased from 4.02% in 2014 to 3.75% in 2015.
It is to be noted that during the period 2006-2015, the Banks' net interest margin (NIM) was satisfactorily profitable with an average of 3.64% which is higher than the central bank's prudential standard of 1%.

- ROA = Net Income /Total assets

(2.2)

The Return on Assets (ROA): shows the percentage of how profitable a company's assets are in generating revenue. In the banking sector, ROA is very important because it effectively measures assets performance. It gives an indication of the capital intensity of the bank, which will depend on the industry; i.e. banks that require large initial investments will generally have lower return on assets. Income from the different operations does not include taxes and interest-related expenses.

In the present work, the value of a company's assets close to its market value is a significant indicator of profitability because the majority of assets in the banking sector have a book value similar to their market value.

This ratio has been chosen as a measure of the profitability of Tunisian banks, and it has been preferred to the return on equity (ROE), because in developing countries banks operate with low equity. On the other hand, we used the ratio Profit / Total Assets (ROA) to avoid the problem of negative equity.

Table 3. The Bank Calculation of ROA

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</tr>
</thead>
<tbody>
<tr>
<td>Attijari Bank</td>
<td>0.91%</td>
<td>0.82%</td>
<td>1.05%</td>
<td>1.24%</td>
<td>1.12%</td>
<td>1.16%</td>
<td>1.17%</td>
<td>0.89%</td>
<td>1.38%</td>
<td>1.20%</td>
<td>1.09%</td>
</tr>
<tr>
<td>ATB</td>
<td>1.06%</td>
<td>1.10%</td>
<td>1.07%</td>
<td>1.27%</td>
<td>1.20%</td>
<td>1.33%</td>
<td>0.77%</td>
<td>1.09%</td>
<td>0.98%</td>
<td>1.06%</td>
<td>1.09%</td>
</tr>
<tr>
<td>Amen Bank</td>
<td>1.02%</td>
<td>1.19%</td>
<td>1.30%</td>
<td>1.44%</td>
<td>1.77%</td>
<td>0.90%</td>
<td>0.76%</td>
<td>0.98%</td>
<td>1.67%</td>
<td>1.39%</td>
<td>1.24%</td>
</tr>
<tr>
<td>BH</td>
<td>0.66%</td>
<td>0.76%</td>
<td>1.30%</td>
<td>1.24%</td>
<td>1.03%</td>
<td>0.62%</td>
<td>0.26%</td>
<td>0.31%</td>
<td>-2.96%</td>
<td>0.80%</td>
<td>0.40%</td>
</tr>
<tr>
<td>BIAT</td>
<td>0.52%</td>
<td>0.51%</td>
<td>0.44%</td>
<td>0.61%</td>
<td>0.97%</td>
<td>0.73%</td>
<td>0.68%</td>
<td>1.19%</td>
<td>0.87%</td>
<td>1.17%</td>
<td>0.77%</td>
</tr>
<tr>
<td>BNA</td>
<td>0.19%</td>
<td>0.36%</td>
<td>0.60%</td>
<td>0.57%</td>
<td>0.66%</td>
<td>0.73%</td>
<td>0.53%</td>
<td>0.57%</td>
<td>0.19%</td>
<td>0.64%</td>
<td>0.50%</td>
</tr>
<tr>
<td>BT</td>
<td>2.10%</td>
<td>2.30%</td>
<td>3.10%</td>
<td>2.80%</td>
<td>2.53%</td>
<td>1.90%</td>
<td>1.80%</td>
<td>1.80%</td>
<td>1.90%</td>
<td>2.20%</td>
<td>2.24%</td>
</tr>
<tr>
<td>STB</td>
<td>0.82%</td>
<td>0.46%</td>
<td>0.62%</td>
<td>0.56%</td>
<td>0.68%</td>
<td>0.22%</td>
<td>0.16%</td>
<td>-1.65%</td>
<td>-7.39%</td>
<td>0.29%</td>
<td>-0.52%</td>
</tr>
<tr>
<td>UBCI</td>
<td>0.58%</td>
<td>0.96%</td>
<td>1.16%</td>
<td>1.43%</td>
<td>1.27%</td>
<td>1.02%</td>
<td>0.93%</td>
<td>0.47%</td>
<td>0.75%</td>
<td>1.07%</td>
<td>0.96%</td>
</tr>
<tr>
<td>UIB</td>
<td>0%</td>
<td>-0.09%</td>
<td>-0.35%</td>
<td>0.04%</td>
<td>0.31%</td>
<td>0.65%</td>
<td>0.71%</td>
<td>1.31%</td>
<td>1.05%</td>
<td>1.20%</td>
<td>-0.52%</td>
</tr>
<tr>
<td>Average</td>
<td>0.79%</td>
<td>0.84%</td>
<td>0.03%</td>
<td>1.12%</td>
<td>1.15%</td>
<td>0.93%</td>
<td>0.78%</td>
<td>0.70%</td>
<td>-0.16%</td>
<td>1.10%</td>
<td>0.73%</td>
</tr>
</tbody>
</table>

On the basis of the results presented in Table 3, it can be seen that BT is the most profitable bank in the selected years, as its ROA rose from 2.10% in 2006 to 2.20% in 2015, with a 10% increase.

Amen Bank and Attijari Bank, on the other hand, surpassed the industry average with a healthier balance sheet structure and reached 1.39% and 1.20% in 2015, respectively.

By contrast, STB is the least profitable bank, as it experienced a decline in asset return from 0.82% in 2006 to 0.29% in 2015 due to poor profitability.

The average asset return coefficient for the group of banks studied varied between 2006 and 2015, rising from 0.79% to 1.10%.

During the period 2006-2015, the Tunisian banks witnessed an unsatisfactory profitability of their assets with a general average equal to 0.73% i.e. lower than the prudential norm fixed by the central bank that is equal to 1%.

3.2.2. The Explanatory Variables:

In this respect, we adopted these two indicators (profitability ratios, banks' assets) as variables that
are dependent on the econometric model, which we will try to explain by several determinants that proved
to be relevant in previously developed researches. These potential determinants are grouped into
managerial variables, specific to the bank as well as macroeconomic and macro-financial factors.
- Managerial or organizational variables:
  These variables include bank loan ratio, equity ratio, bank operating expenses, and bank size.
- Ratio Banking operating expenses = Total operating expenses / Total assets (2.3)
  This ratio (fgactf) is used to provide information on costs variance in banking system. It reflects the
  importance of employment as well as wages and salaries.
  - Capitalization = Equity / Total assets (2.4)
    The increase of the capital-to-assets ratio (kxactf) implies a reduction in the need for external
    financing and thus a better profitability is achieved. It’s worthy to note that the best capitalized banks face
    lower bankruptcy costs and therefore lower financing costs.
    - Size of the bank = log (Total assets) (2.5)
      The size of the bank (log_Total_asset) is also introduced as an independent variable to explain the
      size related to economies and diseconomies of scale. The financial theory suggests that the total of bank
      assets is used as a proxy for the size of the bank.
      Nevertheless, since the dependent variables of the model namely; ROA and NIM, are deflated by
      total assets, the natural logarithm of the total assets will be appropriate before being included in the
      models.
      - Credit = Total customer loans / Total assets (2.6)
        The bank's main activity is the collection of deposits and the granting of loans. These loans present
        the major part of the bank’s profitability. The loan ratio relates the total of credits granted to total assets
        (crdactf) which may be an approximation of the credit risk that reflects the fact that debtors do not want
        or cannot repay their debts.
      - The macro- economic factors
        These macro- economic factors are the economic growth and inflation.
      - Inflation = Inflation rate (2.7)
        Previous studies suggested a positive association between inflation and bank profitability. High
        inflation rates are generally associated with high interest rates on loans and, consequently, high banking
        income.
        However, if inflation is unanticipated and banks are slow in adjusting their interest rates, there will
        be a possibility that banks costs may rise more than the banks revenues. Thus, the unanticipated inflation
        negatively affects the bank's profitability.
      - Economic growth = log (GDP) (2.8)
        GDP growth is a macroeconomic factor often used as an indicator of the improvement of individual
        wealth that is assimilated to the standards of living. With reference to the well-developed literature on the
        association between economic growth and the profitability of the financial sector, GDP growth (log_gdp
        _reel) is expected to have a positive impact on the bank's profitability.
      - The macro- financial factors
        These factors include the bank concentration, size of the capital market, size of the banking sector
        and the relative size of the capital market that is relative to the banking sector.
      - Size of the capital market = Market capitalization / GDP (2.9)
        This ratio (mkxpib) is measured by the market capitalization ratio divided by GDP, which is a proxy
        for the development of the financial market and is used to measure the size of the capital market.
        - Concentration = Total assets of the 3 largest banks / Total assets of the banking sector (2.10)
          A concentrated market is often associated with high interest margin returns. Concentration (CONC) is
          assumed to be the fraction of banking assets held by the three major commercial banks in the country.
        - The size of the banking sector = total assets of the banking sector / GDP (2.11) (2.11)
          The size of the banking sector is measured by the total asset ratio of the banking sector divided by the
          GDP.
          - The relative size of the capital market relative to the banking sector = market capitalization /
            total banking assets (2.12)
          This ratio (mkxactf) refers to the market where the transactions on financial assets are carried out as well
          as their derivatives.
3.3. The Econometric Modeling:

Based on studies on the profitability of a number of banks in both countries with developed financial systems and emerging ones, this study focuses on the empirical analysis of the impact of managerial, macroeconomic and macro-financial changes on the performance of Tunisian banks between 2006 and 2015.

Using a panel data methodology and referring to a model combining individual fixed effects as well random effects, we will show the diversity of responses of the Tunisian banking system to the variations of certain determinants. In this study, we use the same empirical model as Ben Naceur (2003)’s, which is a linear equation that links the performance measures to a variety of factors and computed as follows:

$$\text{Per}_{it} = f (\text{CB}_{it} + \text{M}_t + \text{SF}_t)$$

(3.1)

Where:

$\text{Per}_{it}$: represents two alternative performance measures for the firm i during the period t;
$\text{CB}_{it}$: are bank variables for bank i at time t;
$\text{M}_t$: are macro-economic variables;
$\text{SF}_t$: are measures of financial structure indicators.

Even though the main objective of this empirical analysis is to check the relationship between the indicators of profitability (NIM and ROA) and the characteristics of these banking indicators, macroeconomic variables and structure indicators were included to study the profitability of banks in Tunisia.

3.3.1. Individual Fixed Effect Model

Within the framework of the econometric modeling, one considers the fixed individual effects as well as the random effects.

The modeling of the fixed effects is simpler and defined according to the following regression model:

$$Y_{it} = \alpha_i + \beta'X_{it} + \epsilon_{it}$$

(3.2)

Where:

i = 1, ..., n et t = 1, ..., T

$Y_{it}$: indicates the dependent variables,
$X_{it}$: determines the vector of k independent variables,
$\alpha_i$: are constant coefficients specific to each bank,
$\epsilon_{it}$: refers to residual terms.

The presence of coefficients $\alpha_i$ assumes that differences across the considered banks appear by means of differences in the constant term. These individual coefficients are estimated together with the vector of coefficients $\beta$.

Having as objective to validate the fixed effects specification, the question is to prove, according to the empirical application, that the individual coefficients $\alpha_i$, are not all equal, where i=1, ..., n.

This corresponds to the following joint null hypothesis:

$$H_0: \alpha_1 = \alpha_2 = \alpha_3 = \ldots = \alpha_n = \alpha$$

(3.3)

The alternative hypothesis which is more interesting should rather be accepted if we want to distinguish between the situations in each bank considered in the sample and confirm the existence of certain heterogeneity across banks.

The appropriate statistical test is that of Fisher with a degree of freedom $(n - 1; \sum^{m} T - n - k)$ under the null hypothesis. This test is defined as follows:

$$F = \frac{\text{SCR}_0 - \text{SCR}_1}{\text{SCR}_1} \sum_{i=1}^{n} T_i - n - k$$

\[ n - 1 \]

(3.4)

Where SCRO refers to the sum of squared residuals provided by the estimation of the constrained model under the null hypothesis H0 (which assumes that no individual specific coefficients are considered).
By contrast, \( \text{SER1} \) refers to the sum of squared residuals relative to the fixed effects model (equation (3.2)).

### 3.3.2. Random effects model

In the case of random effects model, the equation is defined as follows:

\[
Y_{it} = \alpha i + \sum_{i=1}^{n} \beta_i X_{it} + \epsilon_{it} \tag{3.5}
\]

Where:

\[
\begin{align*}
\{ i = 1, \ldots, n \} ; \quad \{ \alpha i \in R \} \\
\{ t = 1, \ldots, T \} ; \quad \{ \beta_i \in R \}
\end{align*}
\]

\( \epsilon_{it} = \mu_i + \vartheta_{it} \) : reflect the error component disturbances.

The individual specific effects are random and distributed normally \((\mu_i \rightarrow N (0, \sigma^2_{\mu}))\). They are independent of the residual terms \(\vartheta_{it}\) which are also distributed normally \((\vartheta_{it} \rightarrow N (0, \sigma^2_{\vartheta}))\).

The estimation of the model is conducted by the feasible generalized least squares method (MCG). First, convergent estimations of the variances \(\sigma^2_{\vartheta}\) and \(\sigma^2_{\mu}\) are needed. They are obtained by the following formulas:

\[
\hat{\sigma}^2_{\vartheta} = \frac{\sum_{i=1}^{n} \sum_{t=1}^{T_i} \left( \hat{\epsilon}_{it} - \hat{\theta}_i \right)^2}{\sum_{i=1}^{n} T_i - N - k} \tag{3.6}
\]

\[
\hat{\sigma}^2_{\mu} = \frac{1}{N - k} \sum_{i=1}^{n} \left( \bar{Y}_{i} - \bar{\hat{\beta}}_b^i \bar{X}_i \right)^2 - \frac{1}{T_i} \hat{\sigma}^2_{\vartheta} \tag{3.7}
\]

Where:

\( \hat{\epsilon}_{it} \) : refers to the residuals issued from the estimation of the fixed effects model.

\( \bar{\hat{\epsilon}}_i \) : refers to individual means of these residuals over each time period relative to each bank.

\( \bar{Y}_i \) : indicates the residuals issued from the estimation of the regression of unit savages.

\( \hat{\beta}_b^i \) : refers to the inter-estimators.

The second step is to estimate our regression model using the ordinary least squares method:

\[
Y_{it} + \left( \sqrt{\hat{\theta}_i} - 1 \right) y_i = \beta' \left( X_{it} + \left( \sqrt{\hat{\theta}_i} - 1 \right) X_i \right) + \epsilon_{it} + \left( \sqrt{\hat{\theta}_i} - 1 \right) \epsilon_i \tag{3.8}
\]

With:

\[
\hat{\theta}_i = \frac{\hat{\sigma}^2_{\vartheta}}{\hat{\sigma}^2_{\vartheta} + T_i \hat{\sigma}^2_{\mu}} ; \quad i = 1, \ldots, N \tag{3.9}
\]
The last step is to perform the Hausman specification test which allows compare the two categories of specifications. It is proved that, under the null hypothesis, the estimates of two equations (3.2) and (3.5) cannot differ systematically since they both conform. Therefore, this test can be based on difference. Similarly, under the null hypothesis, the Hausman statistics is asymptotically distributed according to the Chi-two law of degree of freedom k, denoted as follows:

\[ H = (\hat{\beta}_{GLS} - \hat{\beta}_F)' \left( \hat{\Sigma}(\hat{\beta}_F) - \hat{\Sigma}(\hat{\beta}_{GLS}) \right)^{-1} (\hat{\beta}_{GLS} - \hat{\beta}_F) \]  

(3.10)

Where

\[ \hat{\beta}_{GLS} \]: indicates the random effects models.
\[ \hat{\beta}_F \]: refers to the estimates of the fixed effects.
\[ \hat{\Sigma} \]: are the corresponding variance-covariance matrices of these estimated coefficients.

4. Empirical Results Validation:

This section will present the empirical results on the determinants of profitability as measured by the two indicators described above, namely; return on assets (ROA) and net interest margins (NIM). The interpretations of the results obtained will allow us to explain the significance and magnitude of the estimated relations.

4.1. Statistical Analysis

In this step, we will present a descriptive statistical study of a data panel (2006 -2015) and a study of the correlation between the variables of our model.


In this section, we present the empirical results for the whole sample between 2006 and 2015 for the determinants of the profitability of the return on assets and the net interest margins in the Tunisian banking industry.

An overall statistical description of the explained and explanatory variables used in our model is obtained from Table 4.

<table>
<thead>
<tr>
<th>Stats</th>
<th>N</th>
<th>Median</th>
<th>Standard</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROA</td>
<td>100</td>
<td>0.727100</td>
<td>1.578897</td>
<td>-10.3500</td>
<td>3.100000</td>
</tr>
<tr>
<td>NIM</td>
<td>100</td>
<td>0.036410</td>
<td>0.017380</td>
<td>3.44E-05</td>
<td>0.061186</td>
</tr>
<tr>
<td>Fgactf</td>
<td>100</td>
<td>0.021212</td>
<td>0.102069</td>
<td>-0.039013</td>
<td>1.000000</td>
</tr>
<tr>
<td>Kxactf</td>
<td>100</td>
<td>0.084469</td>
<td>0.034565</td>
<td>-0.016225</td>
<td>0.174818</td>
</tr>
<tr>
<td>Crdactf</td>
<td>100</td>
<td>0.092592</td>
<td>0.224576</td>
<td>5.37E-07</td>
<td>0.803586</td>
</tr>
<tr>
<td>Log_total_asset</td>
<td>100</td>
<td>16.20252</td>
<td>2.612423</td>
<td>14.00791</td>
<td>22.55603</td>
</tr>
<tr>
<td>Log_pib_real</td>
<td>100</td>
<td>24.82013</td>
<td>0.090944</td>
<td>24.64522</td>
<td>24.94316</td>
</tr>
<tr>
<td>Inflation</td>
<td>100</td>
<td>0.042000</td>
<td>0.010512</td>
<td>0.020000</td>
<td>0.058000</td>
</tr>
<tr>
<td>Actfpib</td>
<td>100</td>
<td>0.104797</td>
<td>0.047213</td>
<td>5.71E-05</td>
<td>0.168440</td>
</tr>
<tr>
<td>Conc</td>
<td>100</td>
<td>764.5480</td>
<td>1044.023</td>
<td>0.000000</td>
<td>3492.000</td>
</tr>
<tr>
<td>Mkxpib</td>
<td>100</td>
<td>2773.801</td>
<td>19600.49</td>
<td>2.00E-09</td>
<td>151599.6</td>
</tr>
<tr>
<td>Mkxactf</td>
<td>100</td>
<td>26.31780</td>
<td>129.7604</td>
<td>0.000000</td>
<td>1307.000</td>
</tr>
</tbody>
</table>

Table 4 includes the statistical indicators of the sample data during the period of research (2006-2015). Over this period, the average of the net interest margin (NIM) is 0.036410, the banking efficiency (fgactf) is 0.021212 and the ROA is 0.727100.

With reference to table 4, it can be noted that:

The mean distribution of the NIM variable is 0.036410. This dispersion is determined by the maximum
value and by the minimum value which are respectively 0.061186 and 3.44E-05, and by the standard deviation which is 1.73%.

The mean distribution of the ROA variable is 0.727100. This dispersion is determined by the maximum value and the minimum value which are respectively 3.100000 and -10.35000, and by the standard deviation which is 1.578897.

4.1.2. A study of the correlation between variables

To test the degree of correlation between the variables, we use the correlation matrix of the main variables and the control variables, which are presented in Table 5 below:

<table>
<thead>
<tr>
<th></th>
<th>ROA</th>
<th>NIM</th>
<th>FGAC_TF</th>
<th>KXAC_TF</th>
<th>CRDAC_TF</th>
<th>LOG_TOTAL</th>
<th>LOG_PIB_R</th>
<th>INF</th>
<th>ACTFP_IB</th>
<th>CONC</th>
<th>MKXP_IB</th>
<th>MKXA_CTF</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROA</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIM</td>
<td>0.160</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FGAC_TF</td>
<td>0.005</td>
<td>0.078</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KXAC_TF</td>
<td>0.575</td>
<td>0.239</td>
<td>0.150</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRDACITY</td>
<td>-0.298</td>
<td>0.036</td>
<td>-0.119</td>
<td>-0.231</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOG_TOTAL</td>
<td>-0.079</td>
<td>-0.895</td>
<td>-0.029</td>
<td>-0.165</td>
<td>-0.114</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOG_PIB_R</td>
<td>-0.010</td>
<td>0.093</td>
<td>-0.156</td>
<td>-0.189</td>
<td>0.013</td>
<td>0.004</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INF</td>
<td>-0.044</td>
<td>0.084</td>
<td>-0.170</td>
<td>-0.163</td>
<td>0.020</td>
<td>0.002</td>
<td>0.602</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACTFP_IB</td>
<td>-0.050</td>
<td>-0.028</td>
<td>0.068</td>
<td>0.063</td>
<td>0.003</td>
<td>-0.011</td>
<td>-0.533</td>
<td>-0.068</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONC</td>
<td>0.001</td>
<td>0.369</td>
<td>0.192</td>
<td>0.210</td>
<td>-0.063</td>
<td>-0.432</td>
<td>-0.568</td>
<td>-0.363</td>
<td>0.265</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MKXP_IB</td>
<td>0.050</td>
<td>0.150</td>
<td>0.009</td>
<td>0.090</td>
<td>-0.024</td>
<td>-0.105</td>
<td>-0.062</td>
<td>-0.016</td>
<td>0.170</td>
<td>0.341</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>MKXA_CTF</td>
<td>0.090</td>
<td>0.019</td>
<td>0.025</td>
<td>0.040</td>
<td>-0.066</td>
<td>-0.035</td>
<td>0.111</td>
<td>0.153</td>
<td>-0.057</td>
<td>-0.05</td>
<td>-0.001</td>
<td>1</td>
</tr>
</tbody>
</table>

The results show that no coefficient exceeds the tolerance limit (0.7), which does not pose a problem of multi-collinearity.

5. Results Interpretation

The regression tables include several specifications with a basic specification comprising a set of characteristic variables of the bank.

We will use the Hausman test (1978) to determine if our model is specified from a fixed or random effects panel. Then, we estimate the model chosen taking into account the variables presented in Table 4 which gives the following sensitivities which are represented in Table 9 and 15. Finally, we will use the
heteroscedasticity and autocorrelation test if they are detected.

5.1. The Estimation Results of the NIM Variable
The model of the NIM variable is computed as follows:

\[ NIM_{it} = c_i + \beta_1 t_{fgactf_{it}} + \beta_2 t_{kxactf_{it}} + \beta_3 t_{crdactf_{it}} + \beta_4 t_{log_total_actf_{it}} + \beta_5 t_{log_pib_reel_{it}} + \beta_6 t_{inflation_{it}} + \beta_7 t_{actfpib_{it}} + \beta_8 t_{conc_{it}} + \beta_9 t_{mkxpib_{it}} + \beta_{10} t_{mkxactf_{it}} + \epsilon_{it} \]

\( t \in [1,10] \); \( t \in [2006:1,2015:10] \)

- The specification test

In the following, we will test of presence of individual effects and the global significance of the model.

5.2. Testing the Presence of Individual Effects
This test allows us to detect the presence of individual effects. The assumptions of this test are as follows:

- H0 : \( \alpha_i = \alpha \) et \( \beta_i = \beta \) : homogeneity
- H1 : \( \alpha_i \neq \alpha \) et \( \beta_i \neq \beta \) : heterogeneity

Table 6 summarizes the result of the presence of individual effects:

<table>
<thead>
<tr>
<th>Table 6. Result of test of presence of individual effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>F(9,80)</td>
</tr>
<tr>
<td>Prob.(F)</td>
</tr>
</tbody>
</table>

Referring to the table above, we find out that the individual effects are present because Fisher's statistics is significant at 5% threshold, thus, the existence of an individual heterogeneity. This means that the constants are different for these ten banks and that all the coefficients of the model are statistically different from zero for these banks.

- Test of global significance of the model
This test makes it possible to determine the overall significance of our model. The hypotheses of this test are as follows:

- H0 : All the coefficients of the variables equal to zero
- H1 : All the coefficients of the variables are different from zero

Table 7. Result of the test of the global significance of the model

<table>
<thead>
<tr>
<th>Table 7. Result of the test of the global significance of the model</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistics</td>
</tr>
<tr>
<td>Prob(F-statistic)</td>
</tr>
</tbody>
</table>

According to table 7, Fisher's probability is less than 5%, hence the rejection of the null hypothesis, which denotes that our model is globally significant. The test of the overall significance of the model shows that all the coefficients of the model are statistically different from zero.

5.2.1. Estimations of the Factors Determining the Bank Profitability
The specification test shows that our model can be specified as a panel with individual effects. In order to estimate the determinants of the profitability of the Tunisian banks during the period from 2006 to 2015, we performed the estimation of the fixed effect model (Within estimator) and the estimation of the random effect model (Between estimator).

- Hausman Test
To choose between these two models with fixed and random effects, we apply the Hausman test. The assumptions of this test are as follows:

- H0 : The model has fixed effects
- H1 : The model has random effects

The table below summarizes the result of the Hausman test.
Table 8: Result of Hausman test

<table>
<thead>
<tr>
<th>Test Summary</th>
<th>Chi-sq. Statistics</th>
<th>Chi-sq.d.f</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.482264</td>
<td>10</td>
<td>0.9911</td>
</tr>
</tbody>
</table>

From this table we can draw the conclusion that the probability of the test is greater than 10% thus accepting H₀ which implies that the fixed effects model is preferable to the random effects model.

- Estimations of the fixed effects model
The table below summarizes the estimation results of the fixed effects model.

Table 9. Estimations result of the fixed effects model

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimation of the fixed effects model (Within)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
</tr>
<tr>
<td>Fgactf</td>
<td>0.009640</td>
</tr>
<tr>
<td>Kxactf</td>
<td>0.049860</td>
</tr>
<tr>
<td>Crdactf</td>
<td>-0.002864</td>
</tr>
<tr>
<td>Log_total_asset</td>
<td>0.005799</td>
</tr>
<tr>
<td>Log_pib_real</td>
<td>-0.015646</td>
</tr>
<tr>
<td>Inflation</td>
<td>0.110721</td>
</tr>
<tr>
<td>Actfpib</td>
<td>-0.005805</td>
</tr>
<tr>
<td>Conc</td>
<td>2.22E-07</td>
</tr>
<tr>
<td>Mkxpib</td>
<td>4.68E-08</td>
</tr>
<tr>
<td>Mkxactf</td>
<td>5.26E-06</td>
</tr>
<tr>
<td>R²</td>
<td>0.832903</td>
</tr>
<tr>
<td>Observation numbers</td>
<td>100</td>
</tr>
</tbody>
</table>

α= 1% ; α= 5% et α=10%

R² reflects the share of the intra-individual variability of the net interest margin (NIM) for each bank explained as a function of the explanatory variables, which represents 83% in the fixed effects model.

The estimation of the fixed effects model leads to the conclusion that the operating expenses variable (fgactf), the inflation rate (inflation), the size of the bank (log_total_actif) and the size of the capital market (mkxpib) have a positive and significant impact on the Net Interest Margin (NIM).

- Heteroscedasticity test
In order to test the heteroscedasticity, we used the Breusch-Pagan test. This test allows us to know whether the residual variance is constant or not.

The assumptions of this test are:
- H₀: Homoscedasticity
- H₁: Heteroscedasticity

The table below summarizes the result of the Heteroscedasticity test.

Table 10. Result of the Heteroscedasticity test

| Obs*R-squared | 8.218925 |
| Prob. Chi-Square(10) | 0.6075 |

By performing this test, we notice that the probability is equal to 0.6075. It is greater than 5% which allows us to accept the null hypothesis which confirms the presence of homoscedasticity, i.e. the variance of the residues is constant.

- Autocorrelation of errors test
The Breusch-Godfrey test was used to test the autocorrelation of errors.

The assumptions of this test are the following:
- H₀: absence of autocorrelation
- H₁: presence of autocorrelation
The table below summarizes the result of the autocorrelation error test:

<table>
<thead>
<tr>
<th></th>
<th>Result of the autocorrelation error test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obs*R-squared</td>
<td>0.52062</td>
</tr>
<tr>
<td>Prob. Chi-Square(2)</td>
<td>0.4875</td>
</tr>
</tbody>
</table>

Table 11 shows that the probability of Chi-Square (2) is equal to 0.4875 and greater than 5% hence the acceptance of the null hypothesis which confirms the absence of an autocorrelation of the errors. The results of these two tests show that our model is homoscedastic and without autocorrelation.

5.3. The Estimation Results of the ROA Variable

The model of the ROA variable is computed as follows:

\[
ROAi = c_i + \beta_1 f_{gactf} + \beta_2 k_{xactf} + \beta_3 c_{rdactf} + \beta_4 t \log_{total} + \beta_5 \log_{pib_reel} + 
\beta_6 t_{fstinflation} + \beta_7 t_{actf} + \beta_8 t_{conci} + \beta_9 t_{mkxpib} + \beta_{10 t} \mkxactf + \epsilon_t
\]

\(i \in [1,10] ; \ t \in [2006 : 2015 : 10]\)

- The specification test:
  In the following, we will perform the test of presence of individual effects and the test of the overall significance of the model.
  - Test of presence of individual effects
    This test allows us to detect the presence of individual effects. The assumptions of this test are as follows:
    - \(H_0: \alpha_i = \alpha \text{ et } \beta_i = \beta \) homogeneity
    - \(H_1: \alpha_i \neq \alpha \text{ et } \beta_i \neq \beta \) heterogeneity
    The table below mirrors the result of the presence of the individual effects.

<table>
<thead>
<tr>
<th></th>
<th>Result of test of presence of individual effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>F(9,80)</td>
<td>0.89</td>
</tr>
<tr>
<td>Prob(F)</td>
<td>0.5379</td>
</tr>
</tbody>
</table>

Referring to the table above, we note that there is no individual effects as Fisher's statistics is not significant at the 5% threshold, hence there is a presence of individual homogeneity which means that the constants are not different for these ten banks and that all the coefficients of our model are not statistically different from zero for these banks.

- Test of global significance of the model
  Performing this test will determine the overall significance of the model. The assumptions of this test are as follows:
  - \(H_0: \text{All the coefficients of the variables are equal to zero}\)
  - \(H_1: \text{All the coefficients of the variables are different from zero}\)

<table>
<thead>
<tr>
<th></th>
<th>Result of the test of the overall significance of the model</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>5.75</td>
</tr>
<tr>
<td>Prob(F-statistic)</td>
<td>0.000001 &lt;5%</td>
</tr>
</tbody>
</table>

According to the table 13, Fisher’s probability is inferior to 5%, thus the rejection of the null hypothesis. Therefore, our model is globally significant. This test shows that all the coefficients of the model are statistically different from zero.

6. Estimations of the Determinants of Bank Profitability

The specification test shows that our model can be specified as a panel with individual effects. In order to estimate the determinants of the profitability of ten Tunisian banks during the period from 2006 to 2015, we performed both the estimation of the fixed effect model (estimatorWithin) and the estimation
of the random effects model (estimator Between).

- **Hausman Test**

To choose among these two models with fixed effects and random effects, we applied the Hausman test. The assumptions of this test are as follows:

- **H₀**: the model is of fixed effects
- **H₁**: the model is of random effects

The table below summarizes the result of the Hausman test.

<table>
<thead>
<tr>
<th>Table 14: Hausman test result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hausman test for the ROA variable</strong></td>
</tr>
<tr>
<td>Test Summary</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

As reported in table 14 above, the probability of the test is greater than 10% thus the H₀ assumption is accepted, which implies that the fixed effects model is preferable to the random effects one.

- **Estimations of the fixed effects model**

The table below summarizes the estimations result of the fixed-effect model.

<table>
<thead>
<tr>
<th>Table 15: The estimations result of the fixed-effect model.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variables</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Fgactf</td>
</tr>
<tr>
<td>Kxactf</td>
</tr>
<tr>
<td>Crdactf</td>
</tr>
<tr>
<td>Log_total_actif</td>
</tr>
<tr>
<td>Log_pib_reel</td>
</tr>
<tr>
<td>Inflation</td>
</tr>
<tr>
<td>Actfpib</td>
</tr>
<tr>
<td>Conc</td>
</tr>
<tr>
<td>Mkxpib</td>
</tr>
<tr>
<td>Mxactf</td>
</tr>
<tr>
<td><strong>R²</strong></td>
</tr>
<tr>
<td><strong>Number of observations</strong></td>
</tr>
</tbody>
</table>

α= 1% ; α= 5% et α=10%

R² reflects the share of the intra-individual variability of the return on assets (ROA) for each bank based on the explanatory variables that account for 39% in the fixed effects model.

The estimation of the fixed effects model allows us to conclude that the equity variable (Kxactf) and the bank credit variable (Crdactf) have a positive and significant impact on the return on assets (ROA).

- **Heteroscedasticity test**

In order to test the heteroscedasticity, we used the Breusch-Pagan test. This test allows us to identify whether the residual variance is constant or not (see Appendix 7).

The assumptions of this test are as follows:

- **H₀**: Homoscedasticity
- **H₁**: Heteroscedasticity

The table below summarizes the result of Heteroscedasticity test.

<table>
<thead>
<tr>
<th>Table 16: Result of Heteroscedasticity test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Obs*R-squared</strong></td>
</tr>
<tr>
<td><strong>Prob. Chi-Square(10)</strong></td>
</tr>
</tbody>
</table>
By performing this test, we notice that the probability of Prob. Chi-Square (10) equals 0.4062. It is greater than 5% which allows us to accept the null hypothesis which confirms the presence of homoscedasticity, i.e. the variance of the residues is constant.

- Test of errors Autocorrelation
We used the Breusch-Godfrey test to test the autocorrelation of errors. The assumptions of this test are:

- $H_0$: absenceof autocorrelation
- $H_1$: presenceof autocorrelation

The table below summarizes the test result of errors autocorrelation.

<table>
<thead>
<tr>
<th>Obs*R-squared</th>
<th>0.720620</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prob.Chi-Square(2)</td>
<td>0.6975</td>
</tr>
</tbody>
</table>

We note from this table that the probability of Chi-Square (2) is equal to 0.6975 that is greater than 5% hence the acceptance of the null hypothesis which confirms the absence of autocorrelation of errors. The results of these two tests show that our model is homoscedastic and without autocorrelation.

7. Results Interpretations
This section presents the interpretations concerning the two indicators NIM and ROA.

7.1. Empirical Interpretations of the Determinants of Net Interest Margins
NIM

The empirical results concerning the indicators of net interest margins and its potential explanatory factors are shown in Table 9. Concerning the organizational determinants, the results show that bank operating expenses ($fgactf$) have a positive and significant impact on the interest margins. A policy of expenditure of net banking income (NBI) yields better profits for the banks, reflecting a control of operating costs. In other words, higher operating costs will result in increasing interest margins. These results indicate that the Tunisian banks in this study transfer part of their expenses to their borrowers and depositors. Differences in operating expenses may, therefore, result in differences in the volume of business or in the range and quality of services offered.

Referring to this study estimations, equity ($kxactf$), as a second organizational variable, has a positive effect on interest margins. The policy of compliance with international standards to avoid the risk of insolvency has prompted Tunisian banks to raise their capital, which has decreased the amounts of loans granted to individuals as well as the perceived interest margin.

Contrary to returns on assets, interest margins seem to positively respond to the strengthening of economies of scale measured by the logarithm of the bank ($log\_total\_actf$). The increase in this organizational variable, which is supposed to measure the size of the bank, seems to benefit Tunisian banks that have just completed massive reforms and diversified their products, which, in turn, has led to an increase in their interest income that is more than proportional to the increase in costs.

The empirical study of the impact of the macro-financial environment on the net interest margin of the Tunisian banks in our sample led to the results listed in table 9. According to our estimations, we came to the conclusion that the concentration movements ($conc$) lead the Tunisian banks to realize higher profits.

On the other hand, we find that the capital market variable ($mkxpib$) seems to positively and significantly affect the interest margins. The capital market offers the banking sector the opportunity to improve its profitability, which shows the existence of a complementarity between the two markets. Indeed and with reference to our estimations, there is an improvement in the size of the capital market, measured by the ratio of GDP to market capitalization ($mkxpib$). However, the growing transformation of the Tunisian financial system into a market based on direct finance seems to lower the bank interest margins. In recent years, Tunisian banks have become increasingly competitive with market finance, which consequently reduces their interest margins.

As for the macroeconomic variables and according to our estimations in Table 9, the variable ($log\_pib\_real$) shows a negative impact on the net interest margin. (This variable is not significant and with its
almost zero coefficient has no impact on net interest margins).

The inflation rate (inflation) is positively and significantly affected by the net interest margin. As for inflation, it creates conditions for high costs but also proportionately produces more substantial bank margins.

Empirical interpretations of the determinants of the return on assets ROA

The empirical interpretations of returns on assets as well as their potential determinants are shown in Table 15. As for managerial variables, ROA is negatively affected by bank operating expenses (fgactf) in our sample. Indeed, we noted that equity (kxactf), as the second managerial variable, has a positive effect on ROA. Any increase in equity would lead to an increase in bank profitability. Theoretically speaking, banks with higher capitals easily access the financing funds on the market because they are less risky.

The results of our empirical model as summarized in Table 15 indicated that the amount of the granted credits (crdactf) is positively affected by the profitability of the banks. An increase in bank loans would lead to an improvement in these banks profitability. The results in Table 15 mirror a negative relationship between the size of the bank (log_total_actif), as the last organizational variable, and the return on assets.

These econometric results reflect the reality of the Tunisian banks where grouping events initially had a tendency to improve profits, but they turn to affect them negatively. Moreover, our empirical result is consistent with the economic theory that economies of scale have a stimulating effect on the profits of small banks and a negative impact on the profitability of larger ones such as those in our sample.

The concentration movement (conc), as a macro-financial variable, supports the ROA (profitability) but degrades the NIM, on the other hand. This shows that banking competition is more beneficial in terms of interest margins than in the return on assets.

The development of the capital market (mkxpib), in turn, is positively influenced by the increase in bank profits. The expansion of the capital market offers banks the opportunity to improve their total profitability, in particular by improving the quality of information that enables them to increase the potential number of customers, thereby improving the banking activity and the return on assets. The results reported in Table 15 show an expansion of capital markets.

As for the macroeconomic variables, the economic growth and inflation appear to have a positive effect on the return on assets of the banks in our sample. The economic growth (log_pib_reel) of banks has a significant positive impact on the performance of the banking sector. It seems that Tunisian banking firms have benefited from the restructuring of the national economy through policies of structural reforms of the sector and the introduction of new techniques and technologies which tend to improve the banking level that still lag behind.

On the other hand, the inflation rate (inflation) has a positive coefficient, suggesting that banks try to profit in inflationary environments, as they can have high incomes during the period of inflation. It can be noted, however, that during this period the bank costs also rise.

8. Conclusion

Our analysis of the panel data allowed us to estimate the relationship between bank profitability (measured by returns on asset and net interest margins) and a variety of potentially explanatory factors classified as organizational, macro-financial and macro-economic for a cylindrical sample of ten Tunisian banks for the period ranging from the year 2006 to 2015.

As for the organizational variables, first, our estimated results gave the same effect of the general expenses on the return on assets and on the net interest margins. If the overhead costs lead to a deterioration in bank profits, these structural expenses make it possible to improve the gains in net interest margins and the returns on asset.

The credit policy of Tunisian banks is favorable in terms of both profitability and interest margins. Banking institutions appear to be able to maintain unprofitable credits as well as bad debts which allowed them to realize increasing interest margins and profits.

It is worth noting that an analysis of the impact of macro-financial variables on bank profitability in Tunisia showed that the concentration movements are more beneficial to the improvement of the profits of the Tunisian banks.

When it comes to the macroeconomic determinants, the profitability of Tunisian banks, whatever their method of measurement, responds positively to economic growth but negatively to the inflationary climate. GDP has a stimulating effect on the profitability of Tunisian banks, which are characterized by a
large volume of classified claims. In fact, inflation is the cause of lower structural expenditure but also the origin of lower interest margins and lower banking profits.

In a word, improving the profitability of Tunisian banks needs to be driven by the strengthening of banks' capitalization through national regulatory programs and by reducing the proportion of non-interest-bearing assets to bank lending. This improvement also requires an impulse of competition and a stimulation of the development of the capital market since banks and securities markets are complementary.

References


