Capital Requirements, Banking Supervision and Lending Behavior: Evidence from Tunisia

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Abstract

This paper represents a contribution to the still meager literature on the impact of prudential regulation bank behavior in Tunisia. It aims to examine the effect of the capital requirements on bank credits during the period from 1999 through 2010 and to assess the effectiveness of the banking supervision policy in containing banking system's risk. For this purpose a dynamic model is built and then an empirical regression is estimated. The results shows that regulatory capital framework has been binding bank lending in Tunisia during the period of study; well-capitalized banks have lent more than less-capitalized ones. Despite the apparent stringency of the bank regulator in Tunisia, banking supervision has been weakly effective in restraining banks' overall risk. Further strengthening of the banking supervision policy is still needed on the part of the central bank of Tunisia; i.e., the bank regulator.

Keywords: capital requirements, Basel Accords, dynamic model, banking supervision, non-performing loans.

JEL classification: C63, G21, G28

***** This paper is still a working paper. The author welcomes any comment or suggestion for the improvement of this paper

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1. Introduction

Since they were first adopted by the authorities in 1991, there were few research papers on prudential regulation, such as the capital requirements, and banks behavior in Tunisia. This paper is aiming to contribute to this literature by investigating the impact of Basel I implementation on the Tunisian banking system. We will examine the effect of the regulatory capital ratio on bank risk-taking during the period from 1999 to 2010 and assess the effectiveness of the banking supervision in containing this risk.

Throughout the 2000s, the Tunisian economy has been experiencing an accelerated easing in the monetary policy (see figure 1) that aimed to enhance the still insufficient growth of the real economy. Notwithstanding, this period in which two important reforms in banking regulation have been implemented by the government[1], it represents a more suitable time span to study the effect of the Basel regulatory capital ratio on banks behavior than before. In fact, it is conjectured that, during this period, Tunisian banks have become more accustomed with this internationally-inspired regulatory framework after its official implementation during the 1990s. Therefore, the examination of the banking supervision policy implemented by the bank regulator; i.e., the central bank of Tunisia, is expected to provide more interesting policy implications for policy makers. One of these policy issues might be institutional related to the design of the banking regulator with respect the the monetary policy authority; the issue of the combination of both functions by the same institution, i.e., the central bank of Tunisia ?

Outwardly, there does not appear any sign of a credit crunch during the period between 1999 and 2010 as it was the case in many countries after their adoption of the capital adequacy ratio regulation. Indeed, throughout this decade, bank credits have not ceased to increase steadily (see figure 2).

[1] Law 2001-65 on Lending Institutions and the central bank of Tunisia Law 2006-26.

Hence the questions that this paper aims to find some insights about are the following: Did the capital regulatory framework have any binding effect on bank credits ? In other words why there was no credit crunch in Tunisia like in other countries ? How effective the bank supervisor was, in containing the banking system's risk ?

The rest of the paper paper is organized as follows. The next section presents a literature review on capital regulation and its effect on bank behavior in several countries such as Tunisia. Section 3 exhibits the model which will represent the theoretical framework of the empirical work. This model is based on a micro-foundation analysis. Section 4 discusses the assumptions on which the empirical regression is determined. Section 5 presents the data and the related assumptions. Section 6, the results and the contribution of the paper are reported followed by several robustness tests. Section 6 concludes the paper and some policy implications are derived.

2. Literature Review

Since the commencement of the implementation of the capital measurement system – commonly referred to as the *Basle Capital Accord* – by developed countries in the early 1990s, many economists were interested in the impact of the *Risk-Based Capital Requirement* and other types of regulatory capital standards on the banking behavior, particularly lending. The underlying hypothesis tested is whether the pressure to meet the capital adequacy requirements could constrain banks from granting new loans as issuing new equity involves costs associated to the asymmetric information between investors and banks. The binding capital requirement applied on banks could cause a *credit crunch* and therefore harm seriously the real economy.

Bernanke et al. (1991) work constitutes a cornerstone paper in the c*redit crunch*

empirical literature. In their paper, they defined the *credit crunch* phenomenon as *"A significant leftward shift in the supply curve for bank loans, holding constant both the safe real interest rate and the quality of potential borrowers"*

Bernanke et al. find evidence in favor of a *capital crunch* occurrence in the U.S. in the early 1990s.[2] They argue that the *beginning-of-period* level of capital ratio was more stringent on the lending by small banks than large banks.

Peek and Rosengren (1995a) argue that the formal regulatory actions, such as capital requirements, have played a key role in the *credit crunch* of the early 1990s in New England. Using a simple static model, Peek and Rosengren (1995b) provide evidence that capital-constrained and unconstrained banks react *differently* to the changes in the federal funds rate. A major implication of their findings is that the financial situation of the banking sector should be taken into account by the monetary policymakers. In a third paper, Peek and Rosengren (1995c), in order to limit the effect of the loan demand shocks, adopt an interesting approach that consists in focusing on deposits (*liabilities*) rather than loans (*assets*) to test the *capital crunch* hypothesis. The authors find evidence of a *capital crunch* by obtaining a strong positive relationship between a bank's capital shock and the growth rate of its deposits. Peek and Rosengren insist on the need of a greater appreciation of the macroeconomic impact of the bank regulatory policy.

Conversely, Berger and Udell (1994) found that the *Risk-Based Capital* ratio (henceforth, the RBCR)[3] does not explain *much* of the credit supply between 1990 (first quarter) and 1992 (second quarter). According to these authors, the reduction in loan demand is primarily responsible for the observed fall in bank credits in the U.S. during the mentioned period. The one important methodological contribution, which

[2] Expression first used by Richard Syron who was a member of the Federal Reserve Board's monetary policy committee 1989-1994. In short capital crunch means a fall in bank capital.
[3] The Basel ratio and the risk-based capital ratio are used interchangeably.

differentiates their research work relatively to other papers, consists in including a *control period* in order to determine definitive conclusions about the existence a *credit crunch*.[4]

Honda et al (1995) show that the capital requirement ratio affected Japanese major banks' lending behavior. Woo (2003) and Watanabe (2007) the occurrence of a *capital crunch* in 1997 confirms this result

Using an intertemporal model, Guizani (2013) argue that during the period from 1999 through 2005, a credit crunch was taking place in Japan. Unlike the one occurred in 1997, this credit crunch is not attributed to a regulatory pressure but to a voluntary risk-reduction policy followed by an increasingly risk-averse Japanese banking system. Guizani (2013) points out that the major regulatory reforms implemented of the late 1990s, such as the prompt corrective action (the PCA) and the deposit insurance measures that aimed to banking system's distress of the mid-1990s, have reduced regulator's forbearance margin and reinforced banks' self-discipline.

Chiuri et al. (2002) examine a panel of data for 572 banks in 15 developing countries and find consistent evidence that the capital regulation induced an aggregate slowdown of bank credit. Barajas and Steiner (2002) looked at eight Latin American cases and report that, after Basel I has been introduced, banks switched the composition of their balance sheets towards less risky assets.

With regard to Tunisia there are very few published literature about the impact of Basel Accords on bank behavior. Note that the capital adequacy ratio, recommended by the Accords, has been implemented in Tunisia since 1996. Ben Naceur and Kandil (2013) using a panel data on bank balance sheets in five MENA countries including Tunisia, for the period from 1989 to 2003, examined the effect of the of the Basel I implementation on credit growth. Their panel model showed that Tunisian banks with

[4] They define the credit crunch as a reduction in the credit supply relative to the normal supply.

lower capital to assets ratio were able to expand more loans than well capitalized ones in the period that followed the implementation of the capital adequacy regulation. This result shows a laxity of the banking supervisor in coping with reckless banks. Boudriga et al. (2012) working on MENA countries banking data from (2002 – 2006) find that the capital adequacy ratio did not prevent banks from having high levels of delinquent loans. However, they demonstrate the importance of the institutional environment, particularly a sound regulatory quality, in reducing the percentage of bad loans in banks' balance sheets.

Ayadi et al. (2011), working on regulatory adequacy indices determined from the Bank Regulation and Supervision Surveys (developed by Barth et al. (2001) and revised in 2003 and 2007) conjecture that the soundness of capital capital adequacy ratios throughout the 2000s in South-Med countries, such as Tunisia, is attributed to the business models and the risk-aversion of the banking systems rather than the stringency of the capital requirements. Ben Naceur et al. (2011) note that improvements in regulatory and supervisory bodies in the MENA region would enhance banks performance.

3. Model

The empirical framework in this paper will be based on the following micro-foundation; where we build an intertemporal lending model of a representative banking firm. It is worth to mention that, according to Rochet (2008), in today's banking activity one–period models necessarily miss important consequences of bank solvency regulations. The intertemporal approach is widely adopted in the literature.[5]

This micro–foundation analysis reposes on the maximization of a regulatory–

[5] From an econometric point of view, dynamic models have the advantage of keeping away the problem of simultaneity that we can face with static models.

constrained profit function of a representative bank i. The first order condition–derived equation is then used to determine the loan–supply function. The same approach has been followed in Ogawa and Kitasaka (2000), Montgomery (2004) Montgomery and Shimizutani (2007) and Guizani (2013).

The theoretical approach consists in the maximization of *the profit function* of a bank i, under the subsequent two constraints:

1) *The balance sheet identity.*

2) *The prudential regulation constraint.*

3.1 Theoretical Framework

Consider a representative banking firm i that has the following balance sheet structure. For simplification purposes, all balance sheet variables are converted to their logarithmic values:

Assets	***Capital and Liabilities***
▪ *Loans (L)*	▪ *Capital (K)*
▪ *Securities (S)*	▪ *Position in Money Market (M)*
	▪ *Deposits (D)*

Thus, we have at time t the following balance sheet identity,

$$L_t + S_t = K_t + D_t + M_t \qquad t = 0\ldots. \infty \qquad (1)$$

The bank i, is assumed to be risk–neutral and pursue a profit maximization objective in a *perfectly competitive* credit market. Therefore, the interest rate, r^L, is considered as given. Moreover, the interest rates on the securities, r^S, the deposits, r^D, and the money market, r^C, are also assumed to be given.[6]

If the bank i is constrained by the prudential regulation, the following capital constraint a la Kashyap and Stein (1994) applies:

[6] The last argument is not illogical since interest rates on the money market are fixed by the Central Bank.

$$\mu L_t \leq K_t \tag{2}$$

Where: μ is risk–based capital ratio (RBCR).

According to the balance sheet structure, the representative bank i's revenue is composed by interest incomes on loans and securities:

$$r^L{}_t\, L_t \tag{3}$$

$$r^S{}_t\, S_t \tag{4}$$

In the other hand, the bank i is subject to the following costs:

a) Interests paid on deposits: $r_t^D D_t$ (5)

b) Interests paid on the position on the money market: $r_t^M M_t$ (6)

c) Cost of default on loans: $\theta_t L_t$ (7)

The theta, θ_t, is the percentage of defaults on loans that depends on some macroeconomic factors to be spelled out shortly below.[7]

d) Adjustment costs:[8] It is assumed that the bank i's adjustments costs have the following –quadratic–function

$$\frac{h}{2}\left(L_t - L_{t-1}\right)^2 \tag{8}$$

Where: h > 0

Statement of the optimization problem:

The profit of the representative bank i is the discounted sum of the future net cash flows. Hence, after taking into account equations (1) to (8), the profit function π

[7] With a purpose of simplification it is assumed that bank i's customers default on loans and not on interests' income. Therefore, θ applies only on the stock of loans and not on the underlying amount of interests.

[8] In addition to interest cost there are several costs associated with banking activities. Blackwell and Santomero (1982) and Stanhouse (1983) argue that if banks want to issue loans to the general public, then the banks must devote resources to the evaluation of the credit rating of the customer, as well, as the administration and monitoring of the loan during its duration. If there is a change in the amount of the loans issued by the banks, then the banks need to adjust the amount of the resources allocated to loan activities.

becomes as follows:

$$\pi_t = E\sum_{i=0}^{\infty} b^i \left[\left(r_{t+i}^L L_{t+i} + r_{t+i}^S S_{t+i} \right) - \begin{pmatrix} D_{t+i} r_{t+i}^D + r_{t+i}^M M_{t+i} + \theta_{t+i} L_{t+i} \\ + \frac{h}{2} \left(L_{t+i} - L_{t+i-1} \right)^2 \end{pmatrix} \right] \quad (9)$$

Where:

$i = 0 \ldots \infty$

Et[.]: mathematical expectation operator conditional on the information available in period t.

b is the discount factor assumed to be equal one when i = 0

Replacing M by its expression, $M_t = L_t + S_t - K_t - D_t$, the profit function (9) is then read:

$$\pi_t = E\sum_{i=0}^{\infty} b^i \left[\left(r_{t+i}^L L_{t+i} + r_{t+i}^S S_{t+i} \right) - \begin{pmatrix} D_{t+i} \left(r_{t+i}^D - r_{t+i}^M \right) + r_{t+i}^M L_{t+i} + r_{t+i}^M S_{t+i} - r_{t+i}^M K_{t+i} + \theta_{t+i} L_{t+i} \\ + \frac{h}{2} \left(L_{t+i} - L_{t+i-1} \right)^2 \end{pmatrix} \right] \quad (10)$$

Thus, the maximization of the bank i's profit function π under the prudential regulation constraint (2) can, mathematically, be stated as follows:

$$Max\pi_t = E\sum_{i=0}^{\infty} b^i \left[\left(r_{t+i}^L L_{t+i} + r_{t+i}^S S_{t+i} \right) - \begin{pmatrix} D_{t+i} \left(r_{t+i}^D - r_{t+i}^M \right) + r_{t+i}^M L_{t+i} + r_{t+i}^M S_{t+i} - r_{t+i}^M K_{t+i} + \theta_{t+i} L_{t+i} \\ + \frac{h}{2} \left(L_{t+i} - L_{t+i-1} \right)^2 \end{pmatrix} \right]$$

s/c

$$\mu L_t \leq K_t$$

The maximization of the profit function (10) subject to the prudential regulation constraint (2), yields the following Euler equation:

$$E\left[L_{t+1}\right] = \frac{(1+b)}{b} L_t - \frac{1}{b} L_{t-1} - \frac{1}{bh} \left(r_t^L - r_t^M \right) + \frac{1}{bh} \theta_t - \frac{\mu}{bh} \lambda_t \quad (11)$$

Where, λ_t, is the *Lagrange* multiplier associated with the prudential regulation constraint.

4. Empirical Model

4.1 Assumptions

With the purpose to estimate the model in equation (11), several additional assumptions have yet to be taken:

a – The cost of default on loans, θ, depends on some macroeconomic factors. In fact, a recessionary business cycle exerts pressures on the corporate sector's cash flows and harms, consequently, its creditworthiness and ability to reimburse its debts and arrears. As a result, the costs related to the default on loans jump during recessions.

According to the above analysis, the percentage of defaults on loans, θ, can be formulated as a function of the business cycle. To represent changes in business cycle the *GDP* growth rate is employed.

For the sake of simplification, it is assumed that θ is a linear function on GDP growth rates:

$$\theta_t = \theta\left(\frac{\Delta GDP}{GDP}\right)_t$$

Where: $$\frac{\partial \theta}{\partial\left(\frac{\Delta GDP}{GDP}\right)} < 0$$

b – The *Lagrange* multiplier, λ, in the equation (11), per se, is not observable and therefore must, for empirical purposes, be substituted by an observable proxy. The unobservable variable, λ, is interpreted as the marginal increase of the bank i's objective function – i.e., the profit function – when the inequality constraint, $\mu L \leq K$, is relaxed by one unit. The degree to which the inequality constraint is severe might be measured by how distant the observed capital adequacy ratio is from the required level (either 8% or 4%). It can be argued, hence, that as the risk–based capital ratio (the RBCR) goes downturn, as the *Lagrange* multiplier λ_t increases. Consequently, this argument justifies

the inclusion of the observable RBCR as a proxy of the unobservable ($-\lambda_t$) in the equation (11).

c – Finally, we assume that, on the basis of the information available in period t, the bank i forms its expectations rationally. Hence, the expected future lending level $E[L_{t+1}]$ can be substituted by the actual lending value L_{t+1} and a forecast error term $_{t+1}$; as follows: $E[L_{t+1}]= L_{t+1}+_{t+1}$

4.2 Regression

After considering the above-mentioned assumptions and rearranging the equation (11), we obtain the following regression:[9]

$$\left(\frac{\Delta L}{L}\right)_t = \beta_1\left(\frac{\Delta L}{L}\right)_{t-1} + \beta_2\left(r^L_{t-1} - r^M_{t-1}\right) + \beta_3 RBCR_{it-1} + \beta_4\left(\frac{\Delta GDP}{GDP}\right)_{t-1} + \xi_{it} \qquad (12)$$

Where:

$\beta_1 = \frac{1}{b}$; $\beta_2 = -\frac{1}{bh}$; $\beta_3 = \frac{\mu}{bh}$; $\beta_4 = \frac{1}{bh}$; ξ_{it} is an error term[10]

All the other variables in the equation (12) are already defined earlier.

5. Data Set Description

The sample chosen comprises all commercial and healthy banks continuously active between 1999 and 2010. Distressed and newly created banks that lack sufficient data are dropped from the sample. Also *development* banks[11] who changed their status to

[9] When rearranging the equation (11), we use the following approximation: $L_{it} - L_{it-1} \approx (\Delta L/L)_{it}$. Recall that L_{it} is the natural logarithm of the total amount of loans of the bank I at time t.

[10] It should be noted that the forecast error is uncorrelated with any variables contained in the bank's information set in period t under the rational expectation assumption. This property is very useful in solving the problems of endogeneity if the explanatory variables and especially the the simultaneity between lending level and capital adequacy ratios.

[11] Development banks are joint-venture banks between the Tunisian governments and other foreign governments. Unlike conventional banks, development banks were aiming to provide long-run finance.

commercial banks during the period of study are not taken in the sample.

In addition, following Hovakimian et al. (2003), observations below the first or above the ninety-ninth percentiles of all variables used in the estimation were dropped. This sample trimming allows us to neutralize the effects of extreme values.

Merged banks are treated as one entity for the entire sample period.[12] As a result, the retained sample includes 13 banks (5 state-owned banks[13] and 8 private banks) representing about 72 percent and 81 percent of total banks assets in 1999 and 2010 respectively. Table 1 exhibits the descriptive statistics of the sample data. The data contains a number of bank-observations between 152 and 156. During the period of study, the capital ratio mean of all banks was almost 14%; a ratio largely above the required minimum of 8%. However, the percentage of bad loans is quite high – with a percentage mean of 18.6% during the period. From 1999 until 2010, the economy has been experiencing positive growth rates in real terms, though insufficient.

Data sources are the financial statements of the sample banks as published by the Tunisian Professional Association of Banks and Financial Institutions (A.P.T.B.E.F.), the Central Bank of Tunisia's annual reports, and the World Bank country data.

6. Results

6.1. Baseline results

Tables 2 – column (1), provides the estimation results of the dynamic model (12) for all viable banks during the sample period between 1999 and 2010.[14]

The estimation method employed is the general method of moments technique (the GMM) as developed by Arellano and Bond (1991). The list of instruments used in

[12] Method employed by Peek and Rosengren in many of their research papers.
[13]The share of the state in Attijari Bank was sold to private shareholders in 2006.
[14] The software used for the econometric estimation is Stata.

the estimation include the lagged lending percentage changes; $\Delta\ln(L)$, the lagged interest rate differential; $(r^L - r^M)$, the lagged risk–based capital ratio; the RBC ratio, and the lagged GDP growth rate; the $\Delta\ln(GDP)$.

The capital-adequacy ratio coefficient estimate has the expected positive sign and is highly statistically significant in the regression. This finding shows that, during the period of study, lending decisions by Tunisian banks were constrained by capital regulatory requirements. Indeed, less–capitalized banks were more reluctant to grant new loans than well–capitalized ones. Obviously, few years after their official implementation by the authorities, the capital regulation framework has started binding Tunisian banks credits.

The coefficient estimate of the monetary policy variable, namely the interest rate differential, $(r^L - r^M)$, has theoretically the wrong positive sign but is highly significantly different from zero. Banks with higher interest rate margin have been lending more than those with lower interest margin.

Moreover, the estimations results point out that the lending behavior of Tunisian banks does not depend significantly on business cycle but it does depend positively and significantly on past realizations. This conservative behavior of the Tunisian financial institutions might explain the high percentage of accumulated non-performing loans in their balance sheets.

Overall, these findings suggest that, during the period from 1999 to 2010, bank lending in Tunisia was driven principally by supply-side factors rather than demand-side factors.[15]

However these results should be read with caution. In fact, despite the constraining effect of the regulatory capital framework, bank credits did not stop rising steadily during the period; during the ten-year period of study, the total amount of

[15] This finding contradicts Naceur and Kandil (2013) who attribute lending behavior of Tunisian banks during the period (1989 – 2003) to demand fluctuations related to the real growth and cost of borrowing.

Tunisian bank loans has more than doubled (see figure 2).

Thus, two important questions remain to be investigated further and to which the current findings can but only give a partial answer. These questions are the following: Is this apparently prudent lending behavior on the part of Tunisian banks, the result of, a stringent banking supervisor (i.e., the central bank of Tunisia) or a voluntary risk-reduction behavior? If the former is true, how efficient was the banking supervision stringency in retraining risk?

6.2. Stringent banking supervision or a voluntary risk-reduction behavior on the pat of Tunisian banks ?

Even though, bank lending in Tunisia did not stop rising during the 2000s, the regulatory minimum capital ratio (RBCR) did have, to certain extent, a disciplining effect on banks' risk-taking.

In this section we will investigate further this issue by examining whether this prudent behavior is the result of a strict banking supervision or merely a voluntary risk-reduction behavior on the part of increasingly risk-averse banks. In fact, according to the literature, the capital-adequacy ratio can mirror both attitudes.[16]

To do this test, we add a new variable to the model; i.e. The lagged percentage of the non-performing loans in total loans. It is expected that as the non-performing ratio in the balance sheet of a bank increases as the regulator becomes stricter and more careful in supervising this bank. Usually, in such a case, the Tunisian central bank (i.e., the banking supervisor) proceeds to an in-site supervision in addition to its regular off-site supervision.

After introduction of the non-performing loans in equation (12), the regression becomes as follows:

[16] Wagster (1999).

$$\left(\frac{\Delta L}{L}\right)_t = \beta_0 + \beta_1\left(\frac{\Delta L}{L}\right)_{t-1} + \beta_2\left(r^L_{t-1} - r^M_{t-1}\right) + \beta_3 RBCR_{it-1} + \beta_4\left(\frac{NPL}{L}\right)_{t-1} + \beta_5\left(\frac{\Delta GDP}{GDP}\right)_{t-1} + \xi_{it} \qquad (13)$$

Where:

NPL: the percentage of the non-performing loans in total loans

The estimation results are shown in table 2, column (2). The capital-adequacy ratio coefficient keeps its positive sign and is still highly statistically significant, confirming therefore the findings in the previous section. The non-performing loans coefficient has the right theoretical negative sign and is highly statistically significant. The more a bank holds delinquent loans, the less it is willing to lend.

This result demonstrates that the bank supervisor was to a certain extent stringent during the period between 1999 and 2010. This stringency might extend not only to non-performing loans alone but undoubtedly to other prudential regulation standards such as the capital-adequacy requirements. This finding contradicts, to some measure, a conjecture made by Ayadi et al. (2011) who attributed the soundness of south mediterranean banks to only their risk-averse business-model. Notwithstanding, we cannot entirely deny the voluntary risk-reduction behavior on the part of Tunisian banks, our findings provide strong evidence in favor of a banking supervision stringency. This finding represents a contribution of this paper to the literature.

The lagged GDP growth rate coefficient is now weakly significantly positive. The lagged lending change coefficient is still positive and significant. However, the interest rate margin coefficient is positive but no longer statistically significant.

These results reaffirm further that during the period between 1999 and 2010 bank lending pattern in Tunisia was to a large-scale driven by supply-side factors rather than demand-side factors. Tunisian bankers were to a certain extent taking into account their financial soundness and the quality of their balance sheet when making their lending

decisions. This precautionary behavior was made possible by a stringent supervisory policy from the regulator; i.e., the central bank of Tunisia.

However, it is important to note that this stringent supervisory policy is manifestly not sufficiently effective. In fact, in the light of the international standards, the percentage of non-performing loans is still judged very high (a percentage of two digits, see figure 3). This evidence reveals that despite the empirical proofs backing its stringency, the supervision policy is noticeably weakly effective during the period of study and further diligence is still needed from the central bank in this issue. Note that the IMF has requested in many occasions the Tunisian authorities to reinforce their banking supervision framework in order to reduce the burden of the banking system's delinquent assets.

6.3. Robustness Tests

In order to test the robustness of our results, the following robustness tests are implemented. The first test is a replication of Bernanke et al. (1991) approach and the second one is a time effect approach.

6.3.1. Bernanke at al. (1991) approach

We follow the same approach as in Bernanke et al. (1991) by, basically, using their model. For the banking supervision stringency test, we will add, in a second regression, the non-performing loans variable in order to fit the model to our empirical needs. The results are reported in table 3. The findings are qualitatively similar to our baseline results. In both regressions, the RBCR coefficient is positive and highly statistically significant, confirming consequently the binding effect of the regulatory capital ratio on credits. In the second regression, the nonperforming loans coefficient is negative and highly significant suggesting that the central bank was to certain extent following a strict banking supervision. The Bernanke et al. approach does not show a highly significant role of business cycles in shaping banking lending in Tunisia; the GDP

growth rate coefficient in both panel regressions is either insignificant or weakly significant.

The Bernanke et al approach endorse our findings and shows that, during the period between 1999 and 2010, bank credits in Tunisia were mainly driven by supply-side factors rather than demand-side factors.

6.3.2. Additional robustness test

We conduct an additional test to check the soundness of our baseline results. For this purpose, we include in the dynamic models (12) a dummy variable for each year of the period of study so as to check whether the positive and significant coefficient of the capital adequacy ratio captures unobservable shocks affecting all banks' risk-taking throughout the period.

Table 4, column (1), reports the results; overall, the findings are qualitatively unaltered; the capital-adequacy ratio keeps its positive and highly statistically significant coefficient.

When we include the time effect dummy variable in model (13), the results, as reported in table 4 – column (2) are generally unaltered; the RBCR coefficient is still highly positively significant showing a tightening role of capital ratio regulation in bank lending. However, the nonperforming loans coefficient become not significantly different than zero.

Note that the ABC bank data during the period have a relatively wider standard deviations than other banks especially in the main variables' data such as the percentage change in lending and the capital adequacy ratio. Fearing the inclusion of these data would compromise the consistency of the baseline results, we run the regressions above without the ABC bank data in order to test their robustness. The findings are qualitatively unaltered.

7. Conclusion

This paper represents a contribution to the weak literature on banking regulation in Tunisia. It examines the impact of the capital regulation on lending behavior during the period between 1999 and 2010. The empirical investigation provides evidence of a constraining effect of the capital adequacy ratio framework on bank credits. The more a bank's capitalization is sound and its assets are healthy, the more it is able to grant new loans. The effect of Basel capital regulation was extensively made possible by a stringent supervision policy on the part of the bank regulator; i.e., the central bank of Tunisia.

However, this finding should be taken with caution. Notwithstanding, the Tunisian regulator was to certain extent strict, this stringency can only be qualified as weakly effective. In fact, and in the light of the international standards, the percentage of non-performing loans in Tunisian banks' balance sheets has been persistently high during the period of study. This fact points out the need for a further reinforcement of the the banking supervision policy in order to improve significantly the quality of the banking system's assets. Macroeconomic objectives are most likely behind this supervisory *forbearance* on the part of the regulator. This policy might be beneficial when applied for a short period and during recessions, however, if it is kept for a longer time it would burden heavily the banking system with the accumulating unpaid credits. Being in the same time a monetary policy authority and a banking supervisor, the central bank of Tunisia has, obviously, missed making a good balance of both policies. This is likely because of its focus on short-run real economy objectives.

A tolerance of a high level of non-performing loans would put the banking system at a persistent threat of a systemic risk which consequently would have long run negative impacts on the economy as a whole and inevitably on taxpayers money. Would a separation of the banking supervision function from the central bank of Tunisia be a good

idea to solve this seemingly conflict of interests between the two missions; i.e., banking regulation and monetary policy ? This interesting question would be a good topic for future researches.

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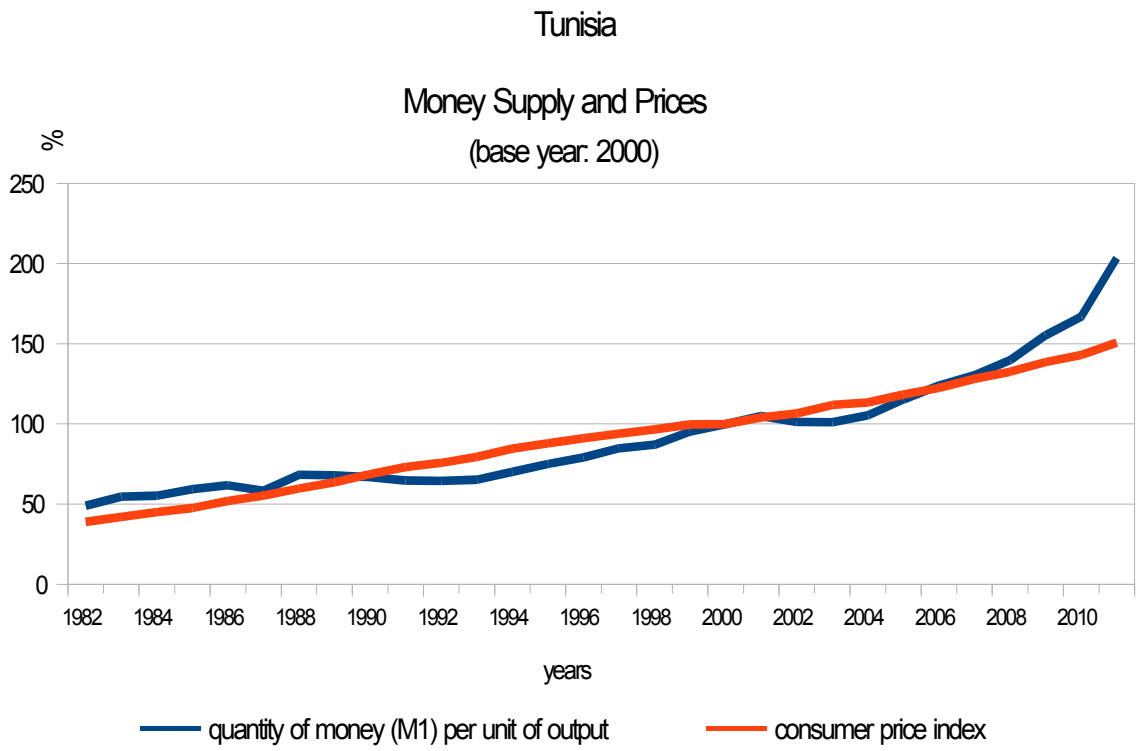
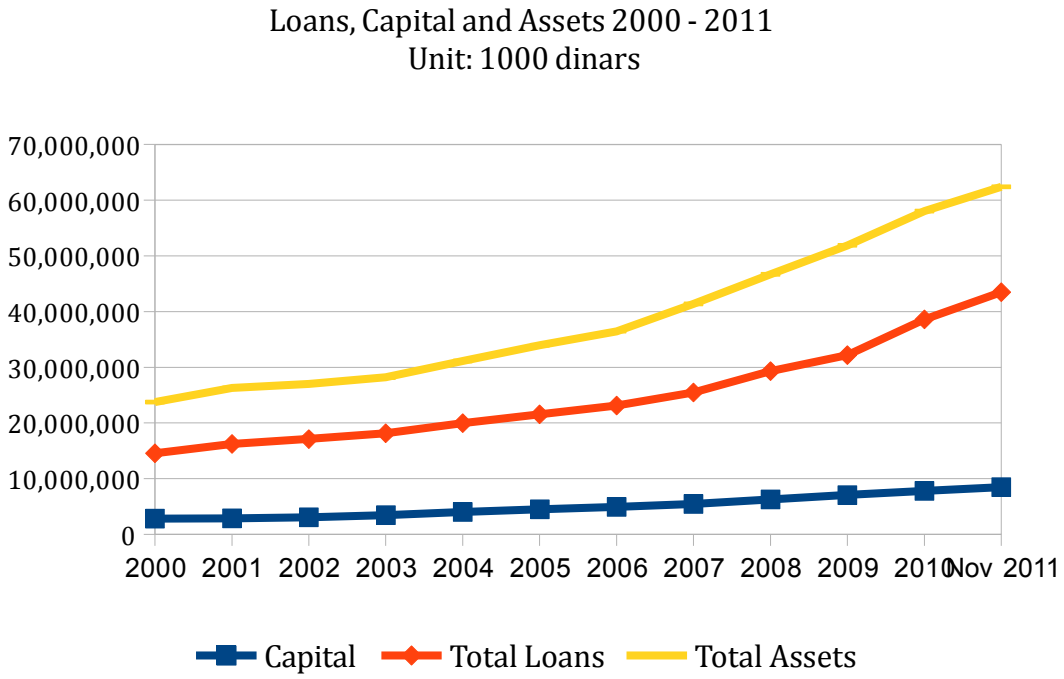
Figure 1. Monetary Policy and Prices (quantity of money M1 and CPI) in Tunisia (1982 – 2010)



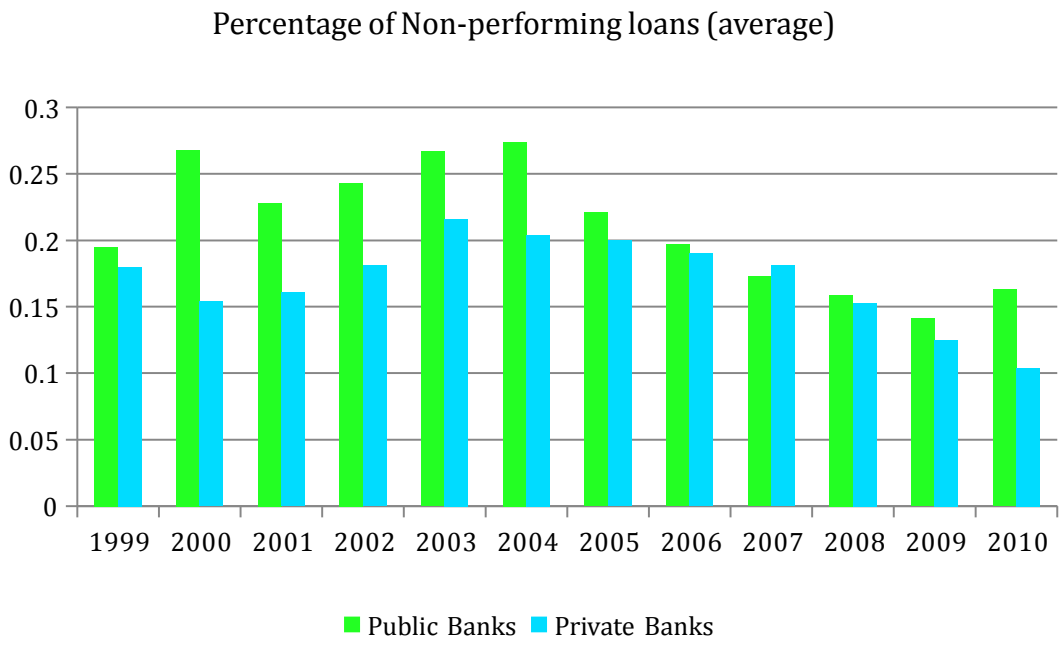
Source: National Institute of Statistics (the I.N.S.)

Figure 2. Loans, Capital and Total Assets (2000 – 2011)



Source: Central Bank of Tunisi (BCT)

Figure 3. Percentage of Non-performing loans (average)



Source: IMF reports

Table 1. Descriptive Statistics (1999 – 2010)

Variable	Obs	Mean	Std. Dev.	Min	Max
Lending percentage change	152	0.104	0.111	-0.187	0.638
Interest rate differential	156	0.022	0.026	-0.034	0.142
Capital Adequacy Ratio	152	0.138	0.076	0.018	0.751
Percentage of non-performing loans	156	0.1862	0.0475	0	0.274
GDP growth rate	156	0.046	0.013	0.018	0.063

Table 2. Dynamic Model

Lending change (ΔL/L)	**GMM (1)**	**GMM (2)**
Lagged lending change ($\Delta L/L$)	0.2027**	0.1562*
	(0.0846)	(0.0852)
Lagged interest rate differential ($r^L - r^M$)	2.8844**	1.9200
	(1.1605)	(1.1947)
Lagged capital adequacy ratio (RBCR)	1.1489***	1.3709***
	(0.3365)	(0.3420)
Lagged GDP growth rate (ΔGDP/GDP)	0.4809	0.8980*
	(0.4664)	(0.4821)
Lagged percentage of non-performing loans (NPL/L)		-0.6317***
		(0.2183)

Table 3. Panel-Random Effect Model

Lending change (ΔL/L)	**RE**	**RE**
Constant	0.01953 (0.0392)	0.1203*** (0.0436)
Lagged capital adequacy ratio (RBCR)	0.8015*** (0.2106)	1.0753*** (0.2072)
Lagged GDP growth rate (ΔGDP/GDP)	-0.5192 (0.6069)	0.4094 (0.6080)
Lagged percentage of non-performing loans (NPL/L)		-0.9448*** (0.2207)

Table 4. Dynamic Model With Dummy Variables

Lending change (ΔL/L)	**GMM (1)**	**GMM (2)**
Lagged lending change (ΔL/L)	0.2623*** (0.0889)	0.2634*** (0.0894)
Lagged interest rate differential ($r^L - r^M$)	2.1163* (1.1067)	2.1461* (1.1125)
Lagged capital adequacy ratio (RBCR)	0.9165*** (0.3273)	0.8916** (0.3509)
Lagged percentage of non-performing loans (ΔNPL/NPL)		0.0467 (0.4190)