The Relationship between Banking Competition and Stability in Developing Countries: The Case of Libya

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Abstract:

In our paper, we examined the relationship between non-performing loans, as a measure of stability, and concentration, as a measure of competition, in the Libyan banking sector. We used aggregate quarterly data for the 15 commercial banks in the country during the period 2002-2013. A broad set of tests were conducted to measure the relationship between the two variables, and alternative robustness tests were conducted to assure our core finding that less competition in the banking sector leads to a more resilient banking sector. Thus, our results offer empirical support against "competition–stability" theory and conform to the "competition–fragility" literature. We conclude by recommending the need to inspect in more detail (on a bank by bank level) the relationship between competition and fragility in developing countries in general and in Libya in particular.

Keywords: Banking Competition, Financial Stability, Oil exporting countries, MENA, Libya.

JEL Classification: C50, C58, G21, G28**.**

1. Introduction

Finance institutions represent the grease that keeps every economy up and running, and this is why banks' behaviour and healthy functioning is of interest to both scholars and professionals. There has been enormous amount publications on the effect of competition in the sector on its stability. Unlike any other industry, a high level of competition is considered to be dangerous as it jeopardizes the stability of the sector by promoting risky behaviour. Consequently, there is almost a unified voice to the issue of finding the balanced formula between competition and stability. In this regard, Regulators always find themselves facing the dilemma of promoting financial stability by restricting competition in the sector by different means.

Thus, there is a widespread view that permitting institutions to freely compete might endanger the sector's stability by leading to widespread panics and uncontrollable bank runs that can easily spread to the economy as a whole. Various financial turmoil's turned out to be more devastating than any other crisis in other sectors. As result, we observe various national and international laws and regulations that lead to the limitation of the financial sector in general, and the banking sector in specific. The aim of these regulations is mainly to ensure the stability of the banking sector, and some argue that the most important job of regulators is to ensure the stability of the sector (Canoy 2001).

The debate in this matter is still far from conclusive; some argue that, due to the small margin of profits in competitive environments, banks tend to take on risky investments and endanger the safety of the sector as a whole (Smith 1984). This study supports the view that a competitive banking sector tends to be more vulnerable than an uncompetitive one. Other papers, (Caminal and Matutes 2002), claim that banks with monopolistic powers are more prone to take on risky projects. They argue that these banks enjoy excess liquidity that might mislead them of their financial position and the danger of the projects that they normally finance.

Measuring competition has taking various form, as we will see later on. The oldest measurement of competition is the level of concentration reflected in the Herfindahl-Hirschman Index. This procedure has been heavily criticized by the literature (Bikker 2004). Bikker claims that the level of concentration might be a misleading indicator for competition in small economies where the number of banks is relatively small. Most of the recent literature (Berger and others 2004) is now differentiating between the two terms, but none of those paper conducted analysis to measure the effect of competitive behaviour in the banking sector on its stability. Nevertheless, we notice that the these papers are including proxies for the regulatory environment that banks operate in.

This paper should be the first one to shed light on this relationship in Libya, and possibly provoke the conduct of further studies on this issue. The remainder of the paper is organized as follows. We review the relevant literature on the links between competition and concentration in part (2). A summary on the Banking sector in Libya and its development during the period of study is presented in part (3). A detailed explanation of the methodology that we're going to employ, including the Herfindahl Index, is presented in part (4). In part (5) we present a summary of the data and it's descriptive statistics. Regression results and extra robustness tests are presented in section (6). Section (7) offers concluding remarks.

2. Literature review

As we briefly touched on above, the literature on the effect of competition in the banking sector on its stability is divided into two streams. The old traditional view considers a competitive banking sector to be more prone to a crisis than a less competitive one. Becker (2010) supports this claim by using the profit variable as a mean of comparison. He claims that in a highly competitive sector the profit margin will be very small for banks, and this will encourage them to take on more risky investments and, thus, endanger the stability of the sector. Becker also claims that a sector with fewer and larger bank is easier to monitor than a highly competitive sector with a larger amount of bank. This ability to monitor and audit those small banks will ensure that the sector stays safe and more stable. In his claim, Becker states that small competitive banks are always at risk of small margin profits, and their franchise values are affected by those small margins. That will always incentives them to take on riskier projects to increase their profit margin and, thus, gain some market power. (Vives (2001) adds to that by noting that high competition in the banking sector increases the possibility of bank's failures that most likely will spread to the real sector and cause a significant social cost. This, in return, will have a negative effect on the confidence of the customers on the banking sector. Canoy (2001) supports the above by claiming that in a less competitive market big banks have a legacy to keep. He adds that the only way for these big banks to keep their legacy is to keep on operating and avoid any risky projects that might endanger the existence of their institutions. These banks comply to the "too big to fail" principle.

In support to the above, Hellman, Mudroch, and Stiglitz (2000) show that a high level of competition incentivises financial institutions to take on riskier investment, but that an adequate capital requirement level and deposit rate ceilings can help restore cautious bank behaviour. Perotti and Suarez (2002) give more evidence to the competition-fragility literature. After they find that competition cause a less stable banking sector, they argue that, once banks start to go bankrupt, the authorities could encourage the existing banks to take over those banks and possibly gain some more market power. This approach is called the "last bank standing" approach. Perotti and Suarez conclude by their claim that the solution if a sector was competitive and it faced bank failures and instability would be for the regulators to promote takeovers of bankrupt institutions by existing banks, and that thus supports all of the above literature.

On an opposing stand, Boyd and De Nicolo argue against the above claims. As they state that a less competitive banking sector where banks each control a large size of the market share are more is less stable than a more competitive one. Where big banks in this market can charge customers higher interest rates. Those higher interest rates are more harder to pay, and they also only attract entrepreneurs with riskier projects an increase in the adverse selection problem, which will endanger the sector as a whole. They also add that the solution to the claims against the competitive banking sectors, where the use of the bank's own money in financing should help the stability of the sector. Boyd and De Nicolo argue that less competitive banking sectors are more prone to instability than more competitive banking sectors, and they advocate against the Concentration-stability Theorem.

Also, Fischer and Chenard (1997) investigate the relationship between stability, regulation, and liberalization. They find in their study that deregulating the banking sector increases systemic risk, and they relate that to intensified competition in the period following the deregulation and an increase in competition in the banking system under examination. Thus, they conclude that a banking sector with higher entry barriers and less competition, and with more active restrictions is less fragile and more stable.

Allen and Gale (2004), however, discuss that the effect of the degree of competition on the financial stability is many-sided and that a simple evaluation of the negative relationship between competition and stability is misleading. They review several articles related to the topic, and define the optimal level of competition resulting from each model. They conclude that all the models come with different results. They also find that, whenever deposit insurance is present or when banks start competing for deposits in the presence of increasing returns, competition between banks tends to weaken the health of the banking sector. Lastly, Allen and Gale draw attention to that fragility also depends on the structure of the interbank market. In this case, a small liquidity shock would spread faster and cause more damage in a competitive market where all banks are price takers. Similar to that paper, Boyd and others (2004) also argue that the banking crises depend on many other factors other than the level of competition in the banking sector of a certain country.

On a related matter, if we take the design of deposit insurance schemes into consideration, Cordella and Yeyati (1998) show that risk-based deposit insurance restrains risk-taking behaviour of financial institutions even in the presence of increased competition. Rather, monetary policy is a major determinant as well. Monopolistic banking systems are found to be more fragile if the rate of inflation is below a certain threshold, whereas more competitive banking markets are more vulnerable if inflation is above this threshold.

Schaeck (2006), ran a cross-country regression to evaluate how the competition affects the stability of the banking sector across 38 countries. Here we note that in further stages of the analysis, developing countries were excluded from the robustness tests for consistency reasons. He claimed that including those countries would distort the estimation due to the heterogeneity between the banking sectors in developing countries and the ones in developed countries.

Large degrees of government ownership, on the other hand, is accounted for in the literature and considered to hamper competitive when their share in those institutions is big. But some literature suggest a positive relationship between government ownership and time to crisis. However, empirical work by Barth, Caprio, and Levine (2004) suggests that the relationship between government ownership and bank fragility is not that straight forward.

In summary, we find that the literature on the relationship between competition and stability is far from conclusive. We find that the old dogma of a trade-off between competition and stability is challenged lately by various authors that we mentioned above. Nevertheless, empirical results are still wandering between those two views, and some of them even suggest that the relationship doesn't exist. Likewise, empirical research to date is largely dominated by studies on individual countries and mostly gives country-specific conclusions, which renders the literature and the findings drawn to date far from conclusive.

3. Libya's Banking Sector

In the last decade, we notice an increase of interest in the banking sectors of developing countries. Nevertheless, a large part of the studies in the literature are studies concerned with developed markets. There is still, nevertheless, a few empirical studies on emerging markets. The level and determinants of competitiveness of the banking system in developed economies is different from those in emerging economies as noted by (Fungáčová 2010). Therefore, the competition policies and rules used for developed countries cannot be taken from the shelves and presented as a model for emerging markets.

Similar to other countries in the region, the banking sector in Libya is the main provider of financial services to the economy. With 15 commercial banks totaling LYD 73.2 billion of assets (end of the end of 2013), the banking sector represents 81% of the total assets in the financial sector, as depicted in table (1). These banks can be subcategorized into 3 groups: 5 large State-owned banks (including 2 banks with a 19% stake owned by foreign strategic partners), 8 private owned banks (including 3 with foreign participation of 49%), and 2 joint banks held by the Libyan Government (51%) and foreign States (UAE and Qatar). The first group collects 90% of the deposit base in Libya.

Table 1: Overview of financial sector components

Sector	Total Assets (in billions)	% of total assets
Commercial Banks	73	81.0%
Specialized Credit Institutions	12.2	13.5%
Insurance Companies	0.8	0.9%
Pension Funds	3.3	3.7%
Stock Exchange	0.8	0.9%

Sources: Central Bank of Libya

Since commercial banks are the main institutions collecting Libyans' savings, their deposit base has considerably expanded during the last 10 years. However, this expansion owns more to the growing pace of Government budget expenses, which is reflected more by the high oil prices during that period, than to an active deposits conquest policy. It is worth noting that despite the licensing of new banks (from 9 to 15 between 2003 and 13), the number of branches per 100,000 adults has not significantly increased (from 11 to 13). With a credit to GDP ratio of 12.4%, the intermediation of the Libyan banking sector is far below the regional, which adversely affects competitiveness.

Financial Sector Liberalization

The last 10 years have witnessed a number of measures to liberalize the financial sector and reshape the banking system and to increase its contribution to economic growth. We will mention some of the key measures that might had influence the structure of the banking sector in Libya, and they are:

- **2005**: Liberalization of commercial banks' fees for services provided to customers, requirement made for commercial banks to establish written credit policy, strengthening of CBL supervision of commercial banks, especially after the issuance of the Law nº 1 of 2005 on banks. The end goal was to ensure the stability of economic activity, the financial safety of the banking system, as well as guaranteeing the rights of depositors. To achieve these goals, the Central Bank carries out inspections as well as off-site and on-site control of the operating commercial banks and their branches to ensure they comply with the provisions of the banking law and the decrees organizing banking activity. As part of Law nº 1 of 2005, two external auditors should review and audit banks' accounts as well as their financial statements.

- **2006***:* 15% of the Central Bank's shares in two of the largest three banks in the country were offered to public subscription and the banks were listed on the Libyan Stock Market in the following year. 40 regional banks were merged into the National Banking Corporation which became itself a commercial bank. The CBL authorized the Boards of Directors of commercial banks to close bank branches or merge them with other branches. To allow banks to employ highly competent staff, banks were given the freedom to set the remunerations of their employees. Issuance of a regulation on large exposures (total credits and facilities granted to one single borrower shall not exceed 20% of regulatory capital). Issuance of a Circular allowing banks to grant credits and facilities to foreign companies that are implementing projects in Libya up to 50% of the cost of the project to be financed.

- **2007**: Inception of the Libyan Stock Market

- **2008**: Issuance of a Circular setting further limits on credit concentration and establishing standards for credit risk management. Issuance of a Circular delineating the duties of the board of directors and those of the executive management.

We will use these dates to test for structural break in our models. Dummy variables can also contribute in evaluating the effect of government intervention.

4. Methodology

The NPLs is the ratio of nonperforming loans to total loans. Where a higher ratio means that there's riskier loan portfolio in the bank level. This index will be our anchor for stability in the banking sector in Libya.

We will employ the *Herfindahl Index* to measure the degree of concentration in the Libyan banking sector. This index has been widely calculated in many industries to calculate the level of concentration in those particular industries. Where the calculation takes the following form:

$$H = \sum_{i=1}^{N} s_i^2$$

where s_i is the market share of firm i in the market, and N is the number of firms. The Herfindahl Index (H) ranges from $1/N$ to one, where N is the number of firms in the market. The interpretation of the index should be as follows:

- An H below 0.01 (or 100) indicates a highly competitive index.
- An H below 0.15 (or 1,500) indicates an unconcentrated index.
- An H between 0.15 to 0.25 (or 1,500 to 2,500) indicates moderate concentration.
- An H above 0.25 (above 2,500) indicates high concentration.

Here, we note that there is a variety of other indices that are widely used to assess both the competition and stability of the banking sector. To name a few of these possible indices, and the reason why they were irrelevant to our analysis:

- The ***Lerner index***, which describes a firm market power. It is defined by:

$$L = \frac{P - MC}{P}$$

Where P is the market price set by the firm, in our case it would be the interest rate opposed by commercial banks on their customers, and MC is the firm marginal cost. The index ranges from a high of 1 to a low of 0, with higher numbers implying greater market power. For a perfectly competitive firm (where P=MC), L=0; such a firm has no market power.

Despite the superiority of the index, it was excluded from our analysis for various reasons: i) the inconsistency of income statements reported by commercial banks to the Central Bank of Libya; ii) the entry of almost 7 new banks to the sector, and the ongoing mergence of banks might give misleading indicators, as noted by some officials at the Central Bank of Libya.

- ***H-Statistic***:

The H-Statistic was created to diagnose which level of competition the market was in. recent papers (Bikker and Haaf (2002) and Bikker (2004)) have emphasized on the superiority of this index in measuring the level of competition than other previously used indices. These studies argue that the analytical superiority of the H-Statistic over previously used measures of competition is due to its formal derivation from profit-maximizing equilibrium conditions. Moreover, the statistic is robust with respect to the market since it only draws upon characteristics of reduced-form revenue equations at the firm level. Nevertheless, its limitation lies in the fact that the inferences based on the statistic are only valid if the market is in (or close to) equilibrium.

In the analysis, we will test for the stationary of the data to determine which model fits the data best, and will follow by cointegration tests to measure if the relationship between the variables is only temporary or permanent. Afterwards, we will test for structural breaks in the model using the Quandt & Andrews estimator to detect these breaks without knowing or assuming their period. Implementing shocks will also be useful for our analysis to measure the persistence of the effect of a shock in the covariate on the variable of interest.

5. Data and summary statistics

We focus in the empirical analysis on a set of 15 banks during the period 2002-2013 using quarterly data. We include in our analysis a set of macroeconomic variables that are expected to have effect on the NPL index. In this case, we will be able refine the model and pursue to measure the relationship of interest while controlling for other variable. In what follows, is the list of the added variables and their expected signs in the model:

- ***The coverage of foreign assets to money supply FA/MS****:* This variable is a large indicator of how much the monetary authority can protect the financial sector in general and the banking sector and the exchange rate in particular especially in developing countries. We're expecting a negative coefficient for this variable, but, nevertheless, it could also produce a negative coefficient depending on the characteristics of each banking sector.

- ***Credit to the economy***: we are including this variable as the aggregate credit granted by the banking sector in Libya to different agents in the economy. The sign of the coefficient should be negative for this variable, where granting more credit will inflate the denominator in the NPL ratio and will decrease the ratio as a whole.

- ***Inflation rate****:* the sign of the inflation rate should be positive. As an increase in the inflation rate will encourage banks to raise interest rates, and that will only encourage risky borrowers.

Descriptive statistics for the entire set of variables are presented in Table 2.

Table 2: Descriptive Statistics

	Mean	Std.Dev	Maximum	Minimum
NPL	25.2	4.91	35.5	17
Concentration	0.21	0.025	0.26	0.17
FA/MS	2.8	0.67	4.3	1.7
Credit	6,707.6	2,505.5	13,163.2	4,298.0
Inflation rate	3.5	7.1	26.9	-9.1

Source: Author's calculation based on data from the CBL

Correlation matrix

The correlation matrix will enable us to assess the correlation between the covariates and the variable of interest (NPL). The direction of the relationships should be indicated as well in the below table:

Table 3: Correlation and covariance Between Variables

Correlation	CONCENTRATION	COV	CREDIT	INFLATION	NPL
CONCENTRATION	(0.000599) 1.000000				

COV	(-0.003493)	(0.446066)			
	-0.213656	1.000000			
CREDIT	(44.74553)	(-112.8765)	(6146715.)		
	0.737237	-0.068168	1.000000		
INFLATION	(0.000538)	(0.014232)	(46.41028)	(0.004918)	
	0.313258	0.303873	0.266938	1.000000	
NPL	(-0.000987)	(-0.003914)	(-90.83514)	(-0.001154)	(0.002360)
	-0.830369	-0.120635	-0.754232	-0.338805	1.000000

Source: Author's calculation.
Terms in the brackets represent covariance between the variables.

Table 3 gives us the first indication of the correlation between all the variables in the model. We first highlight the analysis on coefficients related to the NPL variable; The coefficients of credit and the ratio of foreign reserves to money supply turned up with signs that were anticipated in the analysis above, on one hand. On the other hand, the sign of the inflation variable turned out with a conflicting sign than the one we anticipated. This might be attributed to the stability of the nominal interest rates charged by the commercial banks in Libya during the period of study. Nevertheless, further analysis will be conducted below to verify the significance of that result in the model. Also, we notice that the correlation sign of the relationship between the concentration variable and the NPL variable is negative, indicating that the decline in competition helped in assuring the stability of the banking sector. This might be a strong argument for the mergers of small banks that was promoted by the Central Bank of Libya in order to enhance the quality of human capital in the sector. But, as noted above, further testing will be implemented to verify these preliminary results.

We also notice a positive relationship between the concentration rate and the amount of credit granted to the domestic economy. This might be attributed to various reasons, including the expansionary fiscal policy that took place in this period, which in return provided the banking sector with large amounts of excess reserves. Also, inflation had a positive correlation with all the other variables that are in the model. Since the direction of the relationship is not clear at the moment, these signs have solid interpretation behind them given the high oil prices and the expansionary policies conducted in that period.

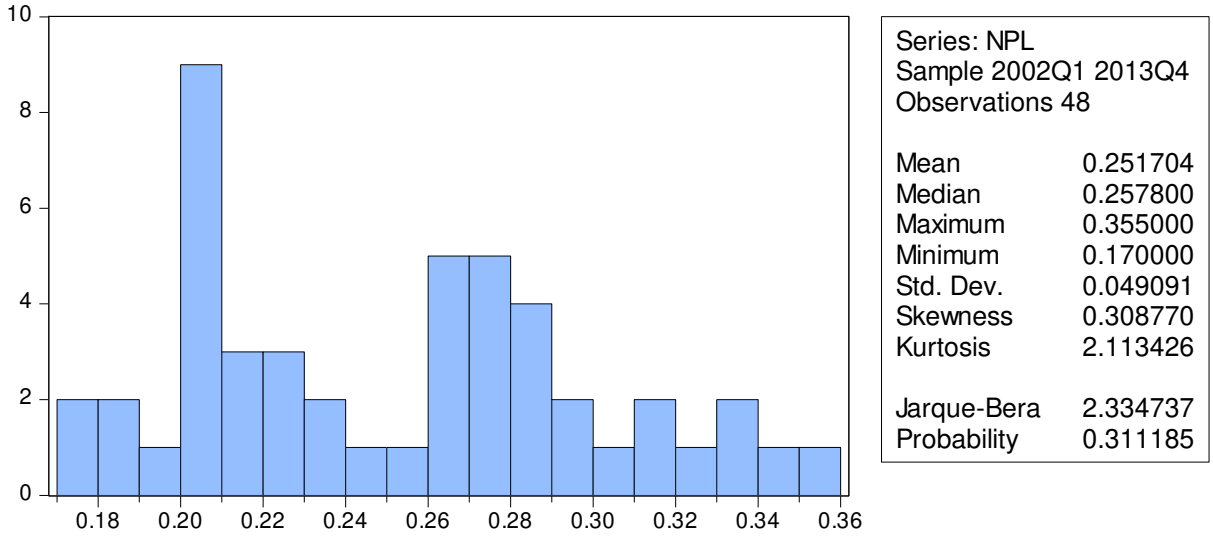
Normality

The next thing we are going to check for is the normality of the distribution of the Nonperforming Loans (NPL). It is likely to be normal. The histogram of the series is going to be plotted in order to see the distribution of the data. We employ the Jarque Bare test which is computed as:

$$JB = \frac{n}{6}\left(S^2 + \frac{1}{4}(K-3)^2\right)$$

where S is the skewness and K the kurtosis.

Figure 1: Descriptive Statistics of NPL

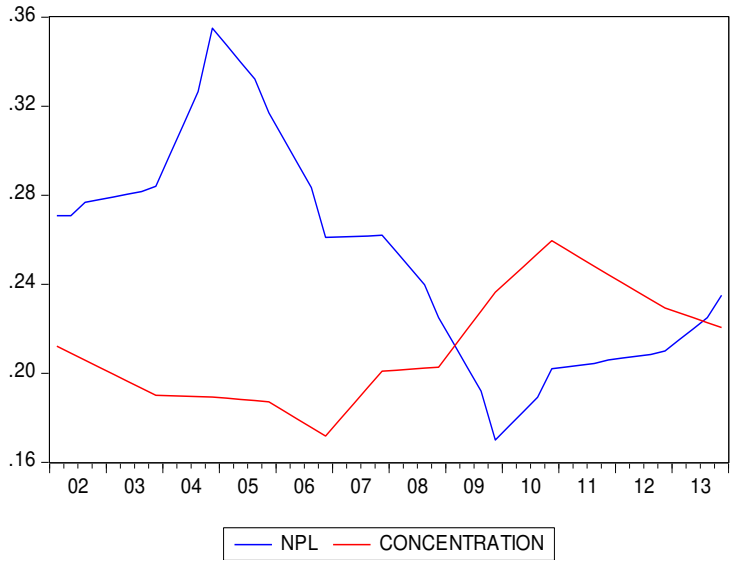


Source: Author's calculation.

As the p-value associated with the test 0.311185 is smaller than the significance level, we don't have statistically significant evidence to reject the null of normality. The Jarque Bera test follows asymptotically a chi-squared distribution.

Graphical Analysis

Figure 2: Evolution of NPL & Concentration



Source: Author's calculation.

Graph 2 plots the evolution of the NPL variable and the concentration variable. It's shown that the two series move in opposite directions, as indicated above in the correlation matrix table. We also note that the relationship changed during the period of reform (Q 02 2004- Q 02 2006). This may lead us to think that there was a possibility of a structural change occurring during that period. Just by observation, we cannot judge if these two time series are

stationary or not. Running the test for unit roots will enable us to determine whether these two series are stationary or not. This procedure will also be implemented on the other variables of the model.

Testing for stationarity in the series:

In this test we employ the Dickey-Fuller statistic. The regression model for the test can be written as follows:

$$\nabla y_t = (\rho - 1) y_{t-1} + u_t = \delta y_{t-1} + u_t$$

The null and the alternative to this test are stated as:

H_0: δ=o There is unit root
H : δ<o No unit root
The test statistic is: t = (γ/ se(γ))

After adding a drift to our analysis, we found strong evidence to reject the null hypothesis of the series suffering from a unit root regarding 4 variables (NPL, COV, Inflation, Concentration) at the I(0) level. While we found that the credit variable wasn't stationary at that level. The credit variable was stationary at the first difference level I(1). The detailed results are available in (appendix I).

Cointegration results:

We run a cointegration test on the two variables of interest (NPL, Concentration) to test if there exist a long-term relationship between the two. Using the cointegration assumption of a deterministic trend, the resulting Trace statistic and the max-Eigen statistic strongly rejected the null hypothesis of no cointegration between the two variables. Both statistics indicate that there is at least one cointegration equilibrium between the two variables (see appendix II).

6. Regression Results

Table 4: Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.649837	0.042966	15.12448	0.0000
COV	-0.022375	0.005390	-4.151355	0.0002
CONCENTRATION	-1.435985	0.207947	-6.905516	0.0000
INFLATION	0.034227	0.052402	0.653152	0.5171
D(CREDIT)	-4.99E-06	1.93E-06	-2.590824	0.0130

R-squared	0.813521	Mean dependent var	0.251704
Adjusted R-squared	0.796174	S.D. dependent var	0.049091
S.E. of regression	0.022163	Akaike info criterion	-4.682452

Sum squared resid	0.021122	Schwarz criterion	-4.487535
Log likelihood	117.3788	Hannan-Quinn criter.	-4.608792
F-statistic	46.89731	Prob(F-statistic)	0.000000

Source: Author's calculation.

The main Results of our regression model are presented in Table (4). The coefficients obtained from the model are reported in Specification along with their T-statistics and their significance level as well. Some complementary data is also shown in the table. The regression results show with signs that are consistent with the previous analysis that was conducted above.

We find that the concentration level (lack of competition) has a positive effect on the stability of the banking sector. The coefficient of the concentration variable is significant at the 1% level, and shows that whenever concentration increases by 1 percent this will lead to a reduction of NPL by 1.4 percent.

Also, the Foreign assets to money supply ratio (COV) variable has a negative sign as well. This leads us to presume that the healthier the sector is the more the borrowers and lenders are willing to renegotiate and restructure the debt term. Nevertheless, this might just be a country-specific phenomenon, and we cannot affirm this analysis without additional testing.

Credit granted to the economy shows with the expected sign and is also significant. However, as noted above this result is quite symmetric were credit constitutes the denominator of the NPL index and an increase in the denominator will directly lead to a decline in the ratio. We also note that the small size of the coefficient is attributed to the fact that we are regressing a ratio on an absolute variable.

The inflation rate coefficient turned out to be consistent with our previous results, having a negative sign. Nevertheless, it is insignificant. The lack of significance of some of the macroeconomic control variables (inflation) might be attributable to multicollinearity. Similar results were found in the study by Detragiache and Spilimbergo (2001). We choose to keep them in the equation to test our hypothesis regarding the relationship between competition and stability in the banking sector while the macroeconomic setting is controlled for and to capture the behaviour of the macroeconomic environment more dynamically.

We perform several robustness tests employing structural breaks tests on the residuals. We also perform an Impulse response test to measure to what extent and how long a shock in the concentration rate affects the behaviour of the NPL variable. In addition, we try to detect the presence of seasonal behaviour in the NPL variable which might give us more insight on its development.

First we start with a structural break test to see if the relationship has changed between the NPL variable and the concentration variable. As we have indicated earlier, there are some periods where we expect to have a large impact on the banking sector in Libya. Nevertheless, in our analysis for the structural break test we will first employ the Quandt and Andrews methodology of unknown structural breaks. Doing so will prevent us from predetermining when the structural change occurred, if ever.

Table 5: Quandt & Andrews Structural Break Test

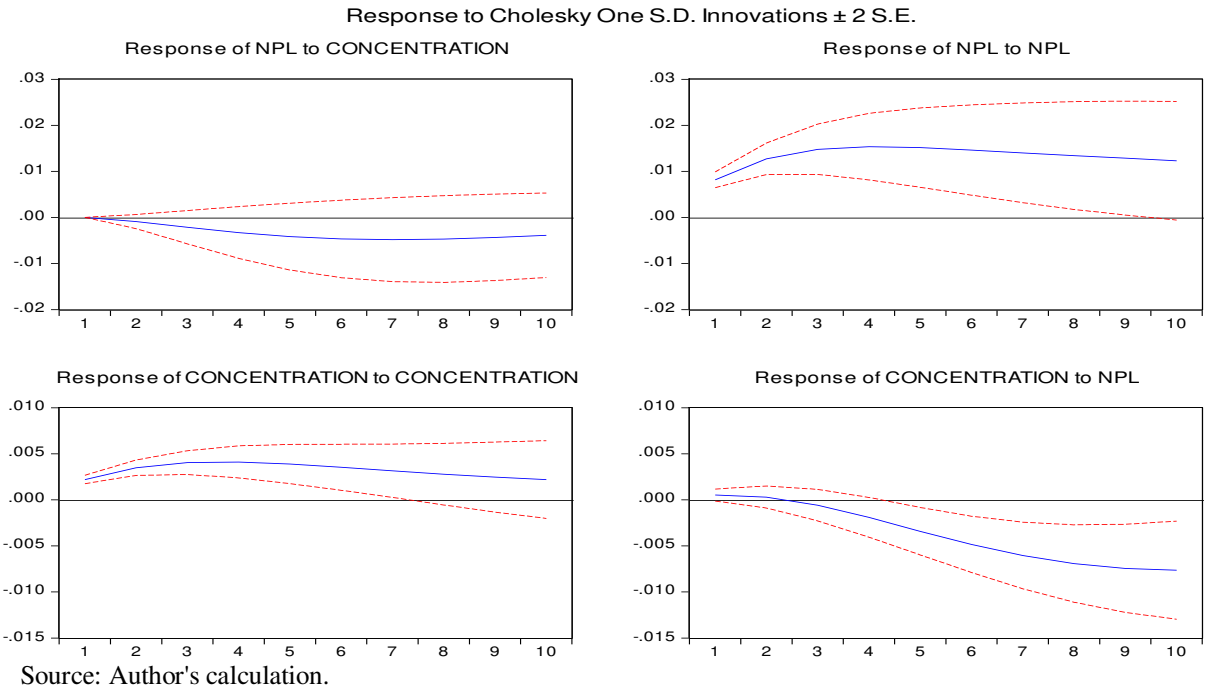
Statistic	Value	Prob.
Maximum LR F-statistic (2006Q1)	14.44658	0.0000
Maximum Wald F-statistic (2006Q1)	28.89316	0.0000
Exp LR F-statistic	4.995995	0.0001
Exp Wald F-statistic	11.79133	0.0001
Ave LR F-statistic	6.041549	0.0005
Ave Wald F-statistic	12.08310	0.0005

Null Hypothesis: No breakpoints within 15% trimmed data
Varying regressors: C CONCENTRATION
Equation Sample: 2002Q1 2013Q4
Test Sample: 2004Q1 2012Q1
Number of breaks compared: 33

All three tests of the Quandt and Andrews test indicate that there is a structural break in the data, with high probability. In addition, the first results indicate that the most probable structural point in the data is 01Q2006. This date goes in line with our first analysis of the reform measures that were taken during the period under examination. We also test the proposed structural point using the Chow structural break test for assurance, and the results affirm those in the Quandt and Andrews results (see appendix II).

Next, we impose a shock on the concentration variable and see what is the effect of such shock on the NPL's variable. In practice, a 5 percent shock to the concentration variable could be the acquisition of a medium-size bank by a big bank. Since our analysis is mainly concerned with the aggregate data, we will not make any further assumption.

Figure 3: Impulse Response Function

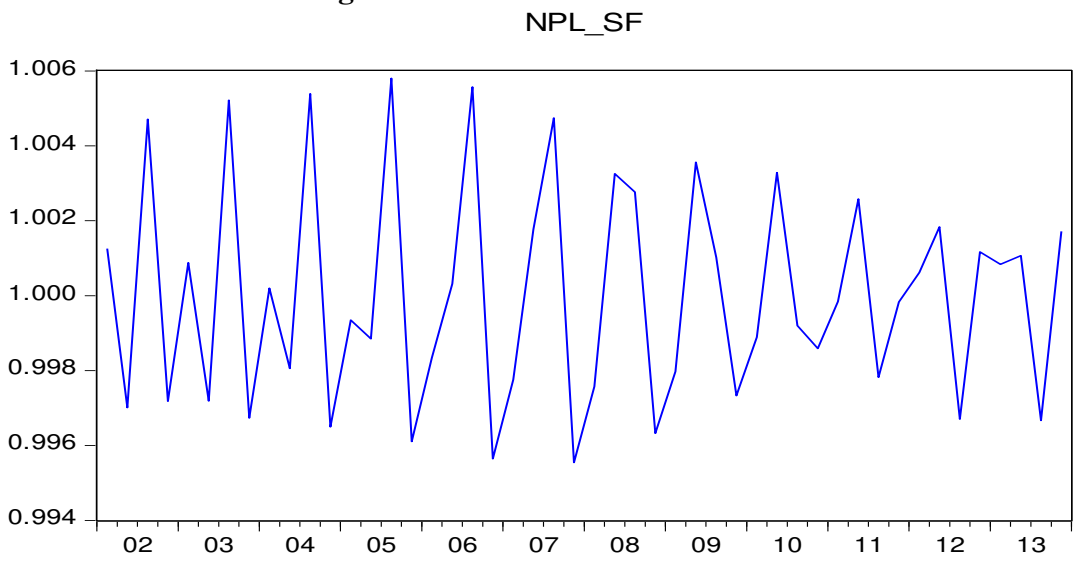


Source: Author's calculation.

Given the goals of this analysis, we will only focus on the Upper-left graph. Here we notice that a positive shock on the concentration will lead to a permanent decline in the NPL ratio by almost 1 percent. This result also comes in support to our pervious findings on the negative effect of concentration on the NPL ratio.

Lastly, we try to detect any seasonal patterns in the NPL's ratio variable. As shown in graph (4), we noticed a magnifying factor in the fourth quarter data. This can be explained by the fact that commercial banks in general, and government-owned banks in specific, were used to negotiating the restructure of loans and the repayment settlements by the end of each year. Nevertheless, we notice that this phenomenon started to die out by the end of the sample period. We also ran a regression of the seasonally adjusted NPL variable, and found out that the results were similar to the ones obtained from the original model. Details of the new model can be found in (appendix IV).

Figure 4: Seasonal Factor of NPL



Source: Author's calculation.

7. Conclusion and policy implication.

In our paper, we examined the relationship between Non-perfuming loans, as a measure of stability, and concentration, as a measure of competition, in the Libyan banking sector. We used aggregate quarterly data for the 15 commercial banks in the country during the period 2002-2013. A broad set of tests were conducted to measure the relationship between the two variables, and alternative robustness tests were conducted to assure our core finding that less competition in the banking sector leads to a more resilient banking sector. Thus, our results offer empirical support against "competition–stability" theory and conforms to the "competition–fragility" literature.

Also, we recommend the need to inspect in more detail (on a bank by bank level) the relationship between competition and fragility in developing countries in general, and in

Libya in particular. It is important to examine if alternative measures of competitive behaviour confirm our initial results and which levels of competition, if any, may be optimal to maintain a stable banking system.

In conclusion, we note that more detailed data on the banking sector in Libya would yield more fruitful analysis. Given the heterogeneous nature of the banking sector in Libya, it would be more beneficial to conduct the analysis on a bank by bank level. Comparison studies of "Big Vs. Small", Government-owned Vs. Private, and Domestic Vs. Foreign gives more in-depth on the structure of the banking sector, especially in developing countries.

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8- Appendices

Appendix I

Null Hypothesis: NPL has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.326779	0.0193
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INFLATION has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.853915	0.0048
Test critical values:	1% level	-3.581152	

	5% level	-2.926622
	10% level	-2.601424

*MacKinnon (1996) one-sided p-values.
This time-series is I(0).

Null Hypothesis: CONCENTRATION has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.410859	0.0156
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(CREDIT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.202995	0.0018
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

foreign assets to Money supply ratio

Null Hypothesis: COV has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.945584	0.0000
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Appendix II

Cointegration test between the concentration level and the Non-performing loans:

Date: 03/09/15 Time: 19:34
Sample (adjusted): 2002Q4 2013Q4
Included observations: 45 after adjustments

Trend assumption: Linear deterministic trend
Series: NPL CONCENTRATION
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.266909	17.54141	15.49471	0.0243
At most 1	0.076259	3.569538	3.841466	0.0588

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.266909	13.97187	14.26460	0.0555
At most 1	0.076259	3.569538	3.841466	0.0588

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Appendix III

Chow Breakpoint Test: 2006Q1
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: C COV CONCENTRATION INFLATION CREDIT
Equation Sample: 2002Q1 2013Q4

F-statistic	6.077124	Prob. F(5,37)	0.0003
Log likelihood ratio	28.77666	Prob. Chi-Square(5)	0.0000
Wald Statistic	30.38562	Prob. Chi-Square(5)	0.0000

Appendix IV

Dependent Variable: NPL_SA
Method: Least Squares
Date: 03/09/15 Time: 20:41
Sample: 2002Q1 2013Q4
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.649833	0.042985	15.11781	0.0000
COV	-0.022367	0.005392	-4.147948	0.0002
CONCENTRATION	-1.436175	0.208038	-6.903437	0.0000
CREDIT	-4.99E-06	1.93E-06	-2.588187	0.0131
INFLATION	0.034179	0.052425	0.651969	0.5179

R-squared	0.813381	Mean dependent var	0.251701
Adjusted R-squared	0.796021	S.D. dependent var	0.049094
S.E. of regression	0.022173	Akaike info criterion	-4.681584
Sum squared resid	0.021140	Schwarz criterion	-4.486668

Log likelihood	117.3580	Hannan-Quinn criter.	-4.607925
F-statistic	46.85389	Durbin-Watson stat	0.319843
Prob(F-statistic)	0.000000		