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Original Research Article

The Impact of the Credit Crunch and Shadow Economy on Economic Growth in Libya: Evidence from ARDL

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Abstract

The study investigates the impact of the credit crunch and shadow economy on economic growth in the Libyan banking sector using an autoregressive distributed lag (ARDL) approach for hypotheses testing. The proxy for economic growth is GDP in current price growth; the annual negative change of ratio for total credit in a commercial bank to GDP in current value is the indicator for credit crunch; and complete economic transactions or activities outside of conventional banking system as a ratio to GDP as a proxy for shadow economy. We transform the dataset into log-linear before data analysis for standardisation and consistency. The empirical evidence from this study shows the existence of a credit crunch and shadow economy in the banking sector in Libya. Results from ARDL analysis reveal that there is a profound impact of the credit crunch and shadow economy on economic growth. We also find that the shadow economy is thriving in the existence of a credit crunch despite the effort by the government to increase the money supply M2 in the banking sector. The liquidity problem caused by the credit crunch in the banking sector is significantly related to the shadow economy. Though the shadow economy contributes to economic growth without government intervention, it can deprive the money supply and the people's trust in the banking sector.

Keywords: Credit Crunch, Shadow Economy, Economic Growth, Autoregressive Distributed Lag (ARDL), Libya.

JEL Classification: E51, L25, L10, G21.

INTRODUCTION

The banking sector plays a significant role in stimulating economic growth and development, as a transmission channel for capital resource provision to the real sector economy. It provides access to financial services and improves the efficiency of other financial intermediaries in a stable macro-economic environment. An inefficient banking sector may lead to liquidity problems as a result of the credit crunch and shadow economy. Academic scholars have identified some plausible reasons for credit crunch in the literature that include the collapse of the “financial bubble” in 2008 as a part of a more significant structural phenomenon [1]; intellectual monopolisation of the economy as one of the reasons for the economic shock [2]; the evidence of a middle-term business cycle [3]; and financial innovations in competitive banking system [4]. The 2007-2009 credit crunch which began in July 2007 in the United States as a result of the loss of confidence in mortgage securities [5, 6] and later spread to Europe and the Far East was having its toll on the global economy. Credit crunch without a proper remedial policy usually leads to the formation of a shadow economy to fill up the vacuum in the money supply and capital market as what is happening in the newly independent countries in Europe, several Latin American countries, and Libya.

Credit crunch refers to a sudden reduction in the availability of loans or abrupt contraction of the situations required to get a loan from the banking sector, which generally involves a decrease in the availability of credit independent of a rise in official interest rates. From a theoretical perspective, credit crunch episodes are defined as significant shifts in the supply side of loanable funds or bank credits when a tightening of credit conditions occurs [7]. While, liquidity crisis is an indicator of underlying problems in its practices and, therefore, an investment risk. In both developed and emerging economies, widespread disruptions in credit in the banking services are constraining household spending and curtailing production and trade in the economy [8]. In many

industrialised countries today, unemployment rates are on the rise as a result of the massive job losses in several establishments due to the credit crunch in the banking sector. In the light of these developments, frantic efforts are being made by policymakers of industrialised economies to arrest the crisis and its devastating effects, using monetary and fiscal policy tools. However, it appears the most potent instruments are the economic policy tools. In developing economies, there are fewer lagged-effects from liquidity crises by the fact that these economies are not fully integrated into the global financial market [9]. Furthermore, the indicators from the effects of the credit crunch in an economy - declining commodity prices in oil and non-oil commodity sectors; the collapsed of the global trade that hits negative values which are expected to continue due to protectionist backlash and drying up of trade finance; and disappearing capital flows and thus reducing the economic performance of a nation [10-12]. Some LDCs even think that the credit crunch is a problem only for key industrialised countries in North America, Europe, and South-East Asia and not for peripheral economies such as theirs [13].

However, it appears the likely credit crunch propelled external shocks to developing regions is not extensively discussed in the literature. In the case of Libya, the economic crisis and the rapid rise of the shadow economy since 2014 provide a significant impact on the vulnerability of Libyans. As hinted by Mezran and Varvelli [14], liquidity crisis could be traced back when the frozen funds abroad were released, and the new banknotes were printed in the UK and injected into the economy coupled with the domestic policies being introduced to increase the domestic liquidity, such as cash withdrawal limits. The rules have temporarily restored the public trust in the banking sector, but it further produced a prolonged liquidity crisis that has had severe implications, notably enabling the growth of the shadow economy and significantly undercutting people's purchasing power. Troug and Sbia [15] see the liquidity problem as a result of the prolonged government budget deficit, restrictive banking policies, peripheral security, and precarious political conditions pave the way for an acute shortage of liquidity. Also, Cavusoglu and Alsabr [16] and Cevik and Teksoz [17] argue that inflation is a severe challenge and inability of the government to pay the salaries that contribute to the credit crunch in Libya. The growing gap between official and black-market exchange rates also have placed additional strain on the budget and aggravated inflation in the Libyan economy [18]. The lack of transparency and accountability in the banking sector has also eroded the consumers' trust that leads to unsustainable economic development in Libya. Lastly, the issue of militias and the warlords that heavily involved in the shadow economy activities, engaging in financial fraud, extortion, and robbery are making the matter worse.

The shadow economy refers to all economic activities which are outside from the Government monitoring system for monetary, regulatory, and institutional purposes [11]. By nature, it is difficult to measure and record shadow economy, as agents engaged in that informal economic activities try to remain hidden. Likewise, total economic activities, including official and unofficial production of goods and services, is essential in the design of economic policies that respond to fluctuations and economic development over time and across space. For our study, the shadow economy reflects mostly legal, financial and productive activities that are outside from formal banking sector, if recorded, would contribute to national GDP; therefore the definition of the shadow economy in our study tries to avoid illegal or criminal activities, do-it-yourself, or other household activities. However, the measure of shadow economy will still be as a ratio of the total informal economic activities to the national GDP as proposed by Schneider [12]. Medina and Schneider [11] provide the status of the shadow economy in most of the countries in the world, including Libya from the year 1991 to 2015 (24 years period).

The impact of the shadow economy on economic growth in the literature is scanty. Shadow economy may reduce the tax revenue to the Government, and insufficient tax revenue that may lead to inflationary financing in the banking and financial sector which causes the economic growth to fall [19]. The existence of shadow economy will provide wrong indicators in the official statistics for macroeconomic policy decision [20]. However, in developed economies, the shadow economy has a positive impact on the economic growth [21]; as compared to transition countries which decrease the economic growth [22]. While the study by Schneider and Enste [23] revealed that the impact of the shadow economy on economic growth remained ambiguous. There is a limited study on the evidence of credit crunch and shadow economy in Libya, and its impact on economic growth.

The objective of this paper is, therefore, to establish evidence on the existence of the credit crunch and shadow economy in the banking sector that lead to the prolonged economic crisis in Libya, which has started since the fall of Muamar Ghaddafi regime in 2011. In light of that, this study also investigates the impact of the credit crunch and shadow economy in the banking sector on the GDP growth of the Libyan economy. The paper consists of four sections. The first section discusses the introduction and background of the study. Section two elaborates the literature review, which is debating the causes of liquidity crisis and credit crunch by previous researches, and its empirical evidence. Section 3 specifies the research methodology and model specification. The discussion on findings is in section 4, and section 5 concludes the paper.

LITERATURE REVIEW

Liquidity crisis and credit crunch phenomena in the economy have been discussed actively by the previous researchers in the last decades [24-27, 10, 28]. The credit crunch is characterised by tightening of the loanable supply in the financial market, that will reduce the investment, productivity, employment, and thus the economic growth. The academic scholars have identified a significant factor that caused a liquidity crisis in an economy, based on a simple framework with some desirable attributes, namely holding liquidity [29]. Holding liquidity is one of the monetary policies available to address the credit crunch and liquidity crises due to a shortage in the supply of the loanable funds in the financial market. Financial institutions may choose to leave themselves illiquid and therefore vulnerable to crises even if such crises happen with positive probability. This situation does not infer that illiquidity and crunches are always an unavoidable consequence of an optimal plan, as we illustrate below, distortions can affect distributions and hence susceptibility to disasters. Local banks have two types of creditors: domestic depositors and foreign lenders. The interaction between them can increase to a rich set of consequences, with the size and maturity of loans from abroad signifying a great deal. This is particularly important in light of the previous Arab's experience (global recession resulting fall in world oil price), in which capital inflows are massive before the crisis, and a run by foreign creditors caused much (but not all) the trouble faced by local banks.

Crises have real paraphernalia, in divergence with first and second-generation models [29]. The abandoned projects or left unfinished due to lack of financing suffer costly insolvency that can cause illiquid banks to suffer real losses and become de facto insolvent. If this happens, the government's policy can matter in two ways**.** First, the procedure can plausibly help the bank relax some of the constraints placed by the situation for instance, by using the government's power to tax and borrow, making resources available to the bank when they are needed most. Second, the policy can attempt to offset misrepresentations in the credit or loanable supply market that lead to the liquidity crises. Justinano, Primiceri, and Tambalotti [30] take a quantitative perspective to appraise the effects of a leveraging and deleveraging cycle in a stochastic business cycle model on the causes of the credit crunch, based on two types of households. In a different perspective, Huo and Rios Rull [31] employ a Bewley model to study a practical implication of liquidity crises on the matching of the employment and working hours in the labour market. While Rognlie, Shleifer, and Simsek [24] work on the after-effect of credit crunch through a model with an explicit treatment of housing and residential investment, in which the overinvestment in housing during the boom causes a slow recovery after a credit crunch. The effects of credit crunch and liquidity crises could also be studied on the mitigating role of monetary policy [32], and on the part of macroprudential measures in extenuating the effects of a debt-driven liquidity trap in work [28, 33]. They argue that there is a relationship between monetary policy and credit crunch. However, there are limited studies on the evidence of liquidity crisis, and the credit crunch has been reported in Arab countries over the past decades, especially in Libya.

The Arab countries were among the first to feel the heat of the financial crisis, and they responded earlier than other non-oil producing countries by adopting an open approach with their citizens about the implications of the crisis. Officials in the GCC, to varying degrees, have been keen to update their citizens concerning the proposed measures. On the other hand, burdened by skyrocketing budget deficits, countries in the North African countries such as Algeria, Morocco, Mauritania, Tunisia, and Libya which affected by series of economic and political issues and the Middle East countries like Egypt, Jordan, Lebanon, Syria, and Yemen are lost in a vicious circle of arbitrary policy decisions. They suffer from weak institutions and have limited resources to allocate to potential "rescue packages" to address the credit crisis. However, these imperfections do exist and are more relevant to Libya. Accordingly, the theoretical underpinnings that determine the credit crunch in developing markets will also apply to the Libyan context.

Economic activity that falls outside the purview of government accounting is called the shadow economy. The shadow banking system involves a web of specialised financial institutions that conduct credit, maturity, and liquidity transformations without direct and explicit access to public backstops [34]. The present studies on shadow economy converge on the existence of the disagreements in the shadow banking players, and what a shadow bank is set to continue in the post-crisis regulatory politics. First, the term 'shadow' banking is widely seen as an unfortunate choice, since it is being used to describe a vital part of the financial system. Shadow banks in the form of mortgage giants and non-bank financial institutions have been part of the system of capitalist financing for most of the twentieth-century period. The regulators empowered their emergence and facilitated by the government, and these non-banking institutions have been playing an important role in the credit intermediation process [35]. Second, there is a wide recognition that the shadow banking system plays an important role to provide financial stability in the global financial crises and credit crunch [25-27]. In a similar manner, but supporting the role of the shadow market, Nesvetailova [10] argues that shadow banking is the best seen as the organic institutional infrastructure of financialized capitalism based on debt and geared towards futurity, and to fill the gap in the provision of credit.

There is inconclusive debate on the impact of shadow economy on the economic development and growth. Positive impact proponents posit that, a substantial reduction of the shadow economy leads to a significant increase in tax revenues in the economy and therefore to a greater quantity and quality of public goods and services, which ultimately stimulate economic growth. In negative impact perspective, the shadow economy decreases government revenue and distorts official indicators (such as growth, unemployment, income distribution, etc.), thereby prompting public sector decisions, producing changes in individual incentives and remuneration factors, etc. A study by Loayza [36] presents a simple macroeconomic endogenous growth model whose production technology depends on congestible public services. The determinants and effects of the informal sector are studied, where excessive taxes and regulations are imposed by governments and where the capability to enforce compliance is low. The model concludes that in economies where (1) the statutory tax burden is larger than the optimal tax burden, and where (2) the enforcement of compliance is too weak, the increase of the relative size of the shadow economy generates a reduction of economic growth. Depending on the prevailing view of the informal sector, one might also come to the opposite conclusion.

In the neoclassical view, the underground economy is optimal in the sense that it responds to the economic environment's demand for urban services and small-scale manufacturing. From this point of view, the informal sector provides the economy with a dynamic and entrepreneurial spirit and can lead to more competition, higher efficiency and strong boundaries and limits for government activities. On the other side, the positive ''side effects'' of shadow economy activities must be considered. Empirical findings of Schneider [37] show clearly that over 66 percent of the earnings in the shadow economy are rather immediately spent in the official sector. The positive effects of this expenditure for economic growth and for the (indirect) tax revenues must be taken into account as well. Bhattacharyya [38, 39] found clear evidence for the United Kingdom (1960–84) that the shadow economy has a significant effect on consumer expenditures that leads to reduction in the economic growth.

Numerous studies that have showed that stable economic growth would prevent credit crunch from happening because it led to the credit growth [40-44, 6, 8, 45]. The credit boom in some transitional economies is strong enough to raise concerns about whether this trend is simply a manifestation of convergence to the average credit levels in advanced nations, or whether it is a case of excessive growth, posing a risk to macroeconomic and financial stability [46, 44]. Repullo and Saurina [47] argue that per capita GDP growth works better than the credit-to-GDP gap as a signaling variable of excessive macro-financial imbalances. A recent guide by the European Systemic Risk Board (ESRB) suggests that overall signaling performance will be improved when the credit-to-GDP gap is combined with other variables, such as property price-to-income ratio, property price gaps, or the debt service-to-income ratio. Égert, Backé, and Zumer [41] use quarterly data on aggregate household consumption, government debt, short-term interest rates, unemployment, inflation, and GDP per capita as factors for the credit crunch. Finally, Geršl and Seidler [44] confirm a positive impact of economic performance (real GDP growth) on liquidity supply.

METHODOLOGY AND DATA

Theoretical Framework

One of the early studies discussing on the relationship between financial sector liquidity and economic growth and development may be in the study by Patrick [48]. The study states that causation runs from economic development to financial development. This view has been labeled "demand-following" with the lack of financial institutions in underdeveloped countries viewed as an indication of the low demand for their services. As economic growth occurs the direction of causality may reverse and a "supply-leading" relationship develops, where the efficiency gains associated with the intermediation process help stimulate continued economic growth in the later stages of a country's economic growth cycle. Thus, the more efficient the financial sector becomes, the more likely a country's scarce resources can be directed to their most productive use. As this occurs, economic growth can reach its full potential [49] for an excellent review of the literature regarding possible linkages or channels of influence between the financial market and economic growth.

Various researchers have empirically estimated the relationships between financial development and economic growth [50-52]. The research methods in some of the earlier researches were relatively oversimplification. For example, using simple correlation analysis, Lin [51] has found that causation ran from financial development to economic growth, i.e., a "supply-leading" relationship. In Odedokun [52] view, these earlier papers have neglected other growth-determining variables, such as the level of real investment, plus labour force and export growth. Hence, these early findings may likely be biased due to omitted variables. It is using an expanded model that includes several growth-determining variables, Odedokun analyses the economic and financial development status of several less-developed countries from mid-1960 to the late 1980s. Finally, Demirgüç-Kunt and Ross and Levine [50], among others, have introduced a new database of financial development indicators to evaluate or analyse the financial market performance. As an indicator of the size of the stock market, the stock market capitalisation to GDP ratio is used. To measure the activity or liquidity of stock markets, they used

stock market total value traded to GDP ratio. They also used the stock market turnover ratio as an efficiency indicator of stock markets because it measured the activity or liquidity of a stock market relative to its size.

The Model Specification

Consider the log-linear transformation of Cobb-Douglas production models for the impact of the credit crunch and shadow economy on economic growth nexus as follows:

$$LGrowth_t = \beta_0 + \beta_1 LCrunch_t + \beta_2 LShadow_t + \beta_3 LM2_t + \beta_4 LInf_t + \varepsilon_t \ldots\ldots\ldots\ldots (1)$$

where $LGrowth_t$ is natural logarithm of GDP growth in the period *t*, $LCrunch_t$ is natural logarithm of credit crunch in period *t*, $LShadow_t$ is natural logarithm of shadow economy in period *t*, $LM2_t$ is natural logarithm of money supply M2 in the banking sector in period *t*, $LInf_t$ is natural logarithm of inflation rate in period *t*, β are coefficients of the independent variables and intercept and ε_t is white noise or error terms in period *t*. Following Pesaran [53], the model in equation (1) is synthesized into a conditional vector error correction model (VECM), *ARDL(p, q_1, q_2, q_3, q_4)* for the economic growth and credit crunch model for hypothesis testing, and the result is

$$DLGrowth_t = a_0 + \delta_1 LGrowth_{t-1} + \delta_2 LCrunch_{t-1} + \delta_3 LShadow_{t-1} + \\ + \delta_4 LM2_{t-1} + \sum_{i=1}^{m} \delta_{5i} DLGrowth_{t-i} + \sum_{j=1}^{n} \delta_{6j} DLCrunch_{t-j} + \sum_{k=1}^{p} \delta_{7j} DLShadow_{t-k} \\ + \sum_{l=1}^{q} \delta_{8l} DLM2_{t-l} + \sum_{m=1}^{r} \delta_{9m} DLInf_{t-m} + \epsilon_{1t}; \text{ for } t = 1, 2, .., T. \ldots\ldots\ldots\ldots (2)$$

Where DL is a differential natural logarithm, a_0 is an intercept, δ_{ijklm} is coefficient of independent variables, and ϵ_t is new error terms. The equation (2) is to test for long-run hypotheses on the model, and the error correction model (ECM) for a short-run model is depicted in equation (3).

$$DLGrowth_t = \rho + \sum_{i=1}^{p} \delta_{1i} DLGrowth_{t-1} + \sum_{j=1}^{q} \delta_{2j} DLCrunch_{t-j} + \sum_{k=1}^{q} \delta_{3k} DLShadow_{t-k} \\ + \sum_{l=1}^{q} \delta_{4l} DLM2_{t-l} + \sum_{m=1}^{q} \delta_{5m} DLInf_{t-m} + \tau ecm_{t-1} + \vartheta_{1t}; \text{ for } t = 1, 2, .., T. \ldots\ldots\ldots (3)$$

Where ρ is intercept, ecm_{t-1} is error correction model variable, and τ is its short-run coefficient. The null hypothesis of long-run level relationship between the variables is to test its lagged coefficients as follows:

$$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$$

against

$$H_1: \delta_1 \neq 0, \delta_2 \neq 0, \delta_3 \neq 0, \delta_4 \neq 0, \delta_5 \neq 0$$

Bound testing procedure in the autoregressive distributed lag (ARDL) approach as discussed in Pesaran, Shin and Smith [54] is employed to test the hypotheses on level relationships for long-run for equation (3) and (5) and short-run ECM model for equations (4) and (6). The main advantage of using this ARDL approach is that the estimation can be conducted on variables irrespective of its integration whether the regressors are integrated *I(0)* or *I(1)* or both; the pretesting is not needed as in the typical cointegration analysis. Following Wan Omar, Hafizah, & Hussin [55], the first step in bound testing procedure is to estimate the ARDL models using ordinary least square (OLS) technique based on selected deterministic properties from the unit-root tests. The existence of the long-run relation between the regressors under investigation is tested by computing the *F*-statistic and its *p*-value for the significance test of the lagged levels of variables in the VECM form of the underlying ARDL model. The value of *F*-statistic is then compared with the upper and lower bounds critical value which is tabulated in Appendix-*B* in Pesaran & Pesaran [56]. If the computed *F*-statistic is higher than the tabulated critical values, then we shall reject the null hypothesis of no long-run relation between credit crunch, shadow economy and economic growth in Libya. We then proceed to test the hypothesis for each variable in the model concerning GDP growth.

In step two, we estimate the coefficients of the long-run relations and make inferences on its value to test the hypothesis with regards to the relationship between the independent variables and a dependent variable using equations (3) and (5). The number of optimum of lags length and selecting the order of *ARDL(p, q_1, q_2, q_3)* model is estimated using Akaike information criteria (AIC) before significance testing with *F*-statistic and *Wald*-statistic for long-run level relationships. The final step is to evaluate the short-run dynamic parameters using reduced ARDL specification

in equations (3) and (5). The hypothesis is positive if their regressors' coefficients are significant at more than a 90% confidence level.

Data Sources and Description

This study utilises time-series data from the reports published by the Central Bank of Libya, World Development Indicator of the World Bank, and the results from the shadow economy studies by Medina & Schneider [11] from the years 1991 to 2015 (refer to Table-1). The indicator of economic growth is the growth of GDP in Libyan Dinar as compared to the previous year in percentage, while the indicator of the credit crunch is the negative change of total credit at commercial banks. The shadow economy is estimated by Medina & Schneider [11] as a percentage of GDP. The money supply, M2 includes cash and checking deposit and certificate of deposit in the banking system to represent the liquidity in the banking sector. The other variable, an inflation rate that may affect the shadow economy and credit crunch is sourced from World Bank databank.

Table-1: Data Description and Sources

Variable	Description	Sources of Data
GDP growth	Indicator of economic growth in percentage per year (1966 to 2017).	Central Bank of Libya and the World Bank databank.
Credit Crunch	Changes in total credit at commercial banks as a ratio to gross domestic product (GDP).	Central Bank of Libya.
Shadow Economy	As a percentage/ratio to GDP	Medina & Schneider (2018) [11].
Money Supply, M2	Total money supply, M2 as a ratio to GDP.	Central Bank of Libya and the World Bank databank.
Inflation rate	Inflation rate per year	World Bank databank

The dataset for all the variables is only available from 1991 to 2015 from various sources, hence the ARDL analysis will be conducted from that 25 years period. The figures for all variables have been transformed into log-linear for standardization prior to conducting data analysis [[1]].

THE FINDINGS

Data Preliminaries

The trend of the credit crunch and shadow economy in the Libyan financial and banking sector is depicted in Figure-1. The credit crunch indicator, the negative growth in bank reserve is following closely with the pattern of indicator for shadow economy (as a percentage of GDP) for the last 25-year period from the year 1991 to 2015. This indicates preliminarily that, in the existence of the credit crunch, the shadow economy is thriving. The Central Bank of Libya (CBL) had introduced several remedial measures to overcome the liquidity problem as a result of the credit crunch, such as, increasing the money supply and reduced the statutory reserve of the commercial banks since the 1980s to dampen its effect on the economic growth. However, the liquidity problem was persisting in the Libyan economy until 2015. The vacuum left by the official banking system in the provision of credit was filled up by the shadow economy through cross-border financial transactions for trade and money exchange [57].

Since the change in the political system in 2011, the government had introduced laws (law no. 46 enacted in 2012) to support the implementation of Islamic banking and finance in the banking sector in Libya. Law number 46 in 2012 provides the provisions for the operation of Islamic banking activities, which has structurally changed the financing scheme in the country, and removes the Central Bank of Libya (CBL) of all its practical monetary policy tools, leaving it with traditional instruments, such as required reserve ratio in the commercial bank in order to control the money supply in the economy. Islamic banking laws also prohibit commercial banks from granting credit using traditional lending scheme based on an interest rate regime. The absence of Islamic money market is one of the major obstacles for the successful implementation of Islamic banking, in the prevention of credit crunch in the banking sector in Libya [58].

[1]For negative growth, we use formula, $x^* = x + \sqrt{x^2 + 1}$ as proposed by Johnson (1949) to transform into log-linear.

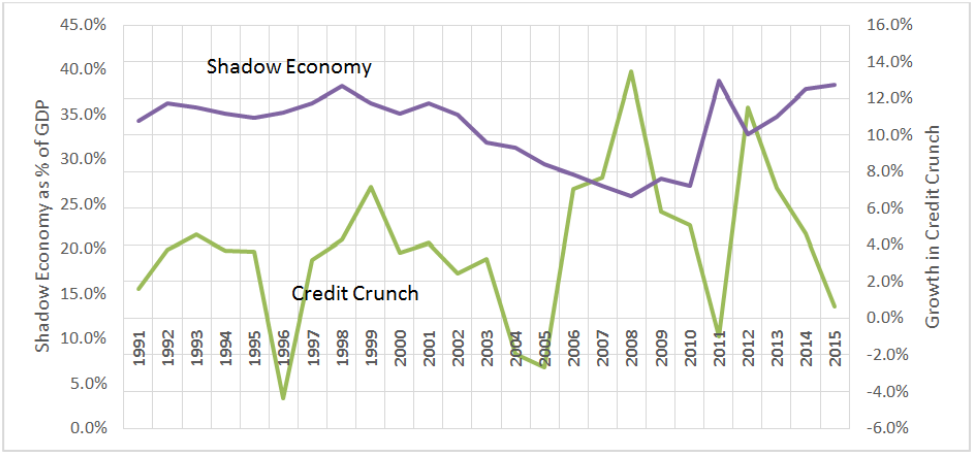

Fig-1: The Trend of Credit Crunch and Shadow Economy in Libya, 1991 to 2015

Figure-2 shows the trends of GDP growth, inflation, real interest rates, and money supply M2 in the Libyan economy from the year 1991 to 2015. Over the past 25 years period, the economic growth was not stable and experienced a prolonged recession since 2008, as shown by the top left panel. The existence of a credit crunch and shadow economy are evidenced by the figure and the reaction by the Central Bank of Libya to address the issue by increasing the money supply significantly in the banking sector since 2005. Therefore, the preliminaries result has shown that the existence of liquidity problem from the credit crunch in the banking sector, and the presence of shadow economy to fill up the vacuum in the credit market and money supply, especially for the foreign currencies exchange.

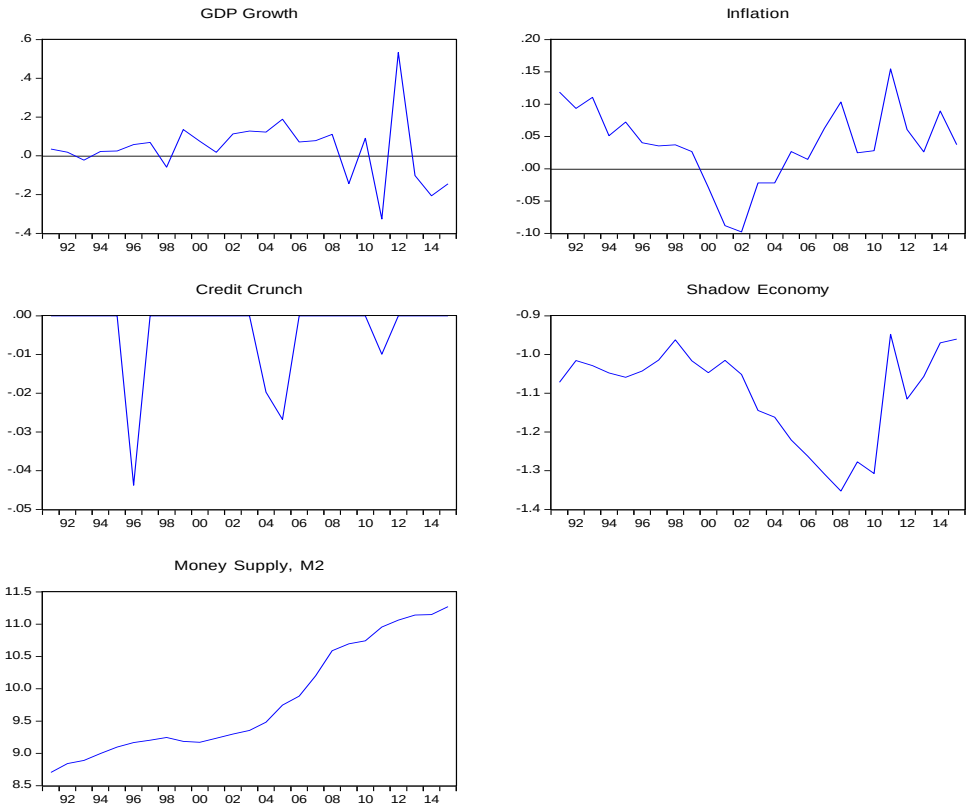

Fig-2: The Trends of GDP Growth, Credit Crunch, Shadow Economy, Money Supply M2, and Inflation Rates in Libya, 1991 to 2015 in log-linear form

Unit Root Tests

The first step in the ARDL approach is to conduct unit root tests for all the variables in the model. The purpose is to check the stationarity status of the variables and the order of its integration. This is to ensure that the integration of the variables in the model is not I(2) or I(d) to avoid spurious results, and the ARDL approach could not be applied to the model [53]. The lag length in the tests is automatically calculated by the system based on Akaike information criteria (AIC) but pegged to the maximum of 9 lags, the number of a lag assumption that is considered sufficient to remove

any serial correlation in the residual of the autoregression model [59]. The result of the unit root tests is presented in Table-2, which produces a mixed order of integration among the variables between intercept only and with trend and intercept models, using augmented Dickey-Fuller (ADF) test. The unit root result suggests that the model with intercept only should be used to proceed for the next step – bound testing.

Table-2: Unit Root Tests Using Augmented Dickey-Fuller (ADF) Test

Variable	With Trend and Intercept			With Intercept only		
	Level	1st Diff	I(d)	Level	1st Diff	I(d)
GDP Growth	-6.3291***		I(0)	-6.3489***		I(0)
Credit Crunch	-4.4514**		I(0)	-4.5033**		I(0)
Shadow Economy	-2.9935	-6.7240***	I(1)	-1.7831	-6.5741***	I(1)
Money Supply, M2	-2.9776	-2.8793	I(2)	0.3251	-2.7280*	I(1)
Inflation	-2.4934	-5.1579**	I(1)	-2.5562	-4.9882***	I(1)
Notes. * denotes significance at 10%, ** is significance at 5%, and *** is significance at 1%.						

Bound Testing and Hypotheses Results

We employ *Microfit version 5.0* to conduct bound testing on the ARDL model. The ARDL procedure for bound testing involves two stages – the first stage is to test the existence of the long-run relationship between the regressors under investigation by computing the *F-statistic* and *W-statistic* using OLS method for significance test of the lagged levels of the regressors in error correction form of the underlying ARDL model in the equations (3) and (5). The significance of the lagged level is determined by comparing the calculated *F-statistic* and *W-statistic* with the upper and lower tabulated critical values. Since the dataset is annual time series, as suggested by Pesaran [53] and Kumar Narayan [60], we use 2 and 3 as a maximum lag order for our ARDL model specification from 2000 to 2017 dataset. The second stage of bound testing is to estimate the coefficients of the long-run relations and make inferences about their values using the ARDL options. We can only proceed to conduct the second stage if and only if we are satisfied that the long-run relationship between the regressors is not spurious. In this stage, we will get the long-run and short-run relationship between the regressors, as well as the predictability of the model.

The overall result in stage one for ARDL model significance based on *F-statistic* and *p-value* estimation is presented in Table-3. The result for overall model as per equation 1 F_G (G | S, C, M2, Inf) is not statistically significant, suggesting that the impact of credit crunch and shadow economy on economic growth shall be in two separate models (refer to ARDL model F_G *(G | S, M2, Inf)* and F_G *(G | C, M2, Inf)*). Both ARDL models 2 and 3 in Table-3 produce significant results in terms of *F-statistic* and *p-value* for significant at 5% level and hence we reject the null hypothesis, meaning that there are level relationships between the variables in the growth models. The *F-statistic* for model 2 and 3 at 5.8483 and 4.7967 respectively are found to be above the lower and upper critical values at 2.711 to 3.800 respectively for 95% significant level as stipulated in Case-II [56]. The tests for other ARDL models fall below the lower bound of the critical value, and hence the null hypothesis that the level variables do not enter significantly into the equations for growth-crunch and growth-shadow economy ARDL models cannot be rejected. The above test results suggest that there exists a long-run relationship between *LGrowth*, *LCrunch*, *LM2*, and *LInf* for growth-crunch model, and between *LGrowth*, *LShadow*, *LM2*, and *LInf* for growth-shadow economy model, and variables *LCrunch*, *LShadow*, *LM2*, and *LInf* can be treated as the 'long-run forcing' variables for explanation of economic growth in the banking sector in Libya.

Table-3: Bound Testing Results for the ARDL Models

No.	ARDL Model	*F-Statistic[p-value]*	AIC Lag	Outcome
1.	F_G (G | S, C, M2, Inf)	2.7655 [.124]	2	Accept H_0
2.	F_G (G | C, M2, Inf)	5.8483[.013]	2	Reject H_0
3.	F_G (G | S, M2, Inf)	4.7967[.024]	2	Reject H_0
4.	F_S (S | G, C, M2, Inf)	3.2242[.093]	2	Reject H_0
5.	F_S (S | G, C)	1.5389[.255]	2	Accept H_0
6.	F_C(C|G, S, M2, Inf)	1.1187[.440]	2	Accept H_0
7.	Fc (C|G, M2, Inf)	1.6241[.250]	2	Accept H_0
8.	F_{M2} (M2 | G, C, S, Inf)	.72006[.632]	2	Accept H_0
9.	F_{Inf} (Inf | G, C, S, M2)	1.4378[.333]	2	Accept H_0
Notes. G = GDP growth. S = shadow economy. C = credit crunch. M2 = money supply. Inf = Inflation				

The result of the ARDL model for level relations between variables is presented in Table-4. The model uses AIC selection criterion to produce ARDL(1,2,1,2,2) model, reveals that the computed *F-statistic* at 244.2777 and *W-statistic* at 1221.4 respectively, are well above the upper critical value at 95% confident level (or 5% significance). DW-statistic is 2.7577 and Durbin's h-statistic is significant at 10% significant level, suggesting that, the model is free from autocorrelation problem. The coefficient of the credit crunch and shadow economy, as expected are negative and highly significant suggesting a strong effect of the credit crunch and shadow economy on the economic growth.

Table-4: The ARDL Model for Level Relations Between Variables

ARDL(1,2,1,2,2) selected based on Akaike Information Criterion			
Dependent variable is LGROWTH in Log-linear 21 observations used for estimation from 1993 to 2013			
Regressor	**Coefficient**	**Standard Error**	**T-Ratio[Prob]**
LGROWTH(-1)	-.26089	.039726	-6.5672[.000]
LCRUNCH	-1.4035	.47835	-2.9340[.019]
LCRUNCH(-1)	-2.2568	.43032	-5.2444[.001]
LCRUNCH(-2)	.74549	.44618	1.6709[.133]
LSHADOW	-1.1306	.077484	-14.5912[.000]
LSHADOW(-1)	1.5414	.076817	20.0660[.000]
LM2	.32179	.076087	4.2292[.003]
LM2(-1)	-.46021	.11538	-3.9887[.004]
LM2(-2)	.21846	.086085	2.5378[.035]
LINF	-.17716	.14235	-1.2446[.249]
LINF(-1)	.26122	.16764	1.5582[.158]
LINF(-2)	-.45374	.12594	-3.6027[.007]
INPT	-.25748	.095475	-2.6969[.027]
R-Squared	.99273	R-Bar-Squared	.98182
S.E. of Regression	.021383	F-Stat. F(12,8)	91.0193[.000]
Mean of Dependent Variable	.056689	S.D. of Dependent Variable	.15860
Residual Sum of Squares	.0036580	Equation Log-likelihood	61.0836
Akaike Info. Criterion	48.0836	Schwarz Bayesian Criterion	41.2942
DW-statistic	2.7577	Durbin's h-statistic	-1.7656[.077]
Testing for existence of a level relationship among the variables in the ARDL model			
F-statistic 95% Lower Bound	95% Upper B	90% Lower Bound	90% Upper Bound
244.2777 3.8114	5.3366	2.9946	4.3230
W-statistic 95% Lower Bound	95% Upper B	90% Lower Bound	90% Upper Bound
1221.4 19.0570	26.6829	14.9731	21.6148

The long-run effect of the credit crunch and shadow economy on the economic growth is conducted in stage two of the bound testing procedure, by estimating the long-run coefficients between the variables in the underlying ARDL models with chosen lag order of 2 and intercept only question model (see Table-5). The long-run growth and credit crunch equation from ARDL (1,2,1,2,2) estimation are displayed in equation (7), revealing that an increase of 1% in credit crunch in the banking sector and shadow economy will lead to approximately 2% decrease and 0.3% improvement in the economic growth respectively, *ceteris paribus* in long-run.

$$LGrowth_t = -.20421 - 2.3117LCrunch_t + .32582LShadow + 0.06348LM2_t - 0.29319LInf + \varepsilon_t \quad \cdots\cdots\cdots\cdots\cdots\cdots (7)$$

Table-5: Estimated Long Run Coefficient Using ARDL Approach

ARDL(1,2,1,2,2) selected based on Akaike Information Criterion			
Dependent variable is GROWTH in Log-linear 21 observations used for estimation from 1993 to 2013			
Regressor	**Coefficient**	**Std Error**	**T-Ratio[Prob]**
LCRUNCH	-2.3117	.65551	-3.5265[.008]
LSHADOW	.32582	.065461	4.9773[.001]
LM2	.063484	.0072138	8.8004[.000]
LINF	-.29319	.093894	-3.1226[.014]
INPT	-.20421	.076176	-2.6808[.028]

The ECM portrays the short-run dynamic coefficients associated with the long-run relationship of the ARDL model. Table 6 shows the result of ECM for short-run growth model with credit crunch and shadow economy in ARDL(1,2,1,2,2) using AIC selection criteria for lags of 2, which reveals significance of short-run coefficients all the regressors, except lagged credit crunch (*dLCRUNCH1*) and inflation (*dLINF*), to confirm the negative impact of credit crunch and shadow economy on economic growth in Libya. It reveals that the change coefficients of all the variables in the model are significant at a 5% level or less, justifying the lag choice of $p = 2$ for the ARDL estimation. The estimated *ECM* coefficient is -1.2609 (SE = .039726) is statistically high significant (*t-stat = -31.7398; p-value = 0.000*), has the correct negative sign and suggests a high speed of convergence to equilibrium in the current year once the long-run economic growth in equation (7) is shocked in the previous years. The model goodness of fit is a relatively excellent model with R-square at 99.3%, and the model has passed all the diagnostic tests which are automatically calculated by the system. The ECM result also shows that the negative sign of the short-run coefficient of the credit crunch (*LCrunch*) and shadow economy (*LShadow*) continue into the long-run relationship with economic growth.

Table-6: Error Correction Representation for the Selected ARDL Model

ARDL(1,2,1,2,2) selected based on Akaike Information Criterion			
Dependent variable is dLGROWTH 21 observations used for estimation from 1993 to 2013			
Regressor	**Coefficient**	**Standard Error**	**T-Ratio[Prob]**
dLCRUNCH	-1.4035	.47835	-2.9340[.013]
dLCRUNCH1	-.74549	.44618	-1.6709[.121]
dLSHADOW	-1.1306	.077484	-14.5912[.000]
dLM2	.32179	.076087	4.2292[.001]
dLM2(-1)	-.21846	.086085	-2.5378[.026]
dLINF	-.17716	.14235	-1.2446[.237]
dLINF1	.45374	.12594	3.6027[.004]
ecm(-1)	-1.2609	.039726	-31.7398[.000]
ecm = GROWTH + 2.3117*LCRUNCH -.32582*LSHADOW -.063484*LM2 + .29319*LINF + .20421*INPT			
R-Squared	.99760	R-Bar-Squared	.99401
S.E. of Regression	.021383	F-Stat. F(8,12)	416.4664[.000]
Mean of Dependent Var	-.0057371	S.D. of Dependent Variable	.27632
Residual Sum of Squares	.0036580	Equation Log-likelihood	61.0836
Akaike Info. Criterion	48.0836	Schwarz Bayesian Criterion	41.2942
DW-statistic	2.7577		

Table-7: Dynamic Forecast for the Level of LGrowth based on ARDL Regression

Based on 21 observations from 1993 to 2013. ARDL(1,2,1,2,2) selected using Akaike Information Criterion. Dependent variable in the ARDL model is GROWTH included with a lag of 1. List of other regressors in the ARDL model: LCRUNCH LCRUNCH(-1) LCRUNCH(-2) LSHADOW LSHADOW(-1) LM2 LM2(-1) LM2(-2) LINF LINF(-1) LINF(-2) INPT			
Observation	**Actual**	**Prediction**	**Error**
2014	-.20630	.076243	-.28255
2015	-.14454	.24926	-.39380
Summary Statistics for Residuals and Forecast Errors			
		Estimation Period	Forecast Period
		1993 to 2013	2014 to 2015
Mean		-.0000	-.33817
Mean Absolute		.0089058	.33817
Mean Sum Squares		.1742E-3	.11745
Root Mean Sum Squares		.013198	.34272

Stability Test and Predictive Power

However, the above error correction model cannot accurately forecast the rate of change of growth conditional on current and past changes in credit crunch and shadow economy as shown by the result from the dynamic forecast in Table-7, shows that the root mean squares of forecast error is more than 34% per year during 2014 to 2015 period as compared to 1% error for the estimation period from 1993 to 2013. Graphically, Figure-3 depicts the forecasting error of growth level

between two periods. ARDL model estimates with high accuracy in the estimation period from 1993 to 2013, but with more top error (34%) in the forecast period (2014 to 2015). The plots of the cumulative sum of recursive residuals (CUSUM) and cumulative sum of square (CUSUMSQ) of recursive residuals of the error correction model in Figure 4 and 5 reveals that the regression coefficients are generally stable over the sample period and do not show any evidence of a statistically significant break.

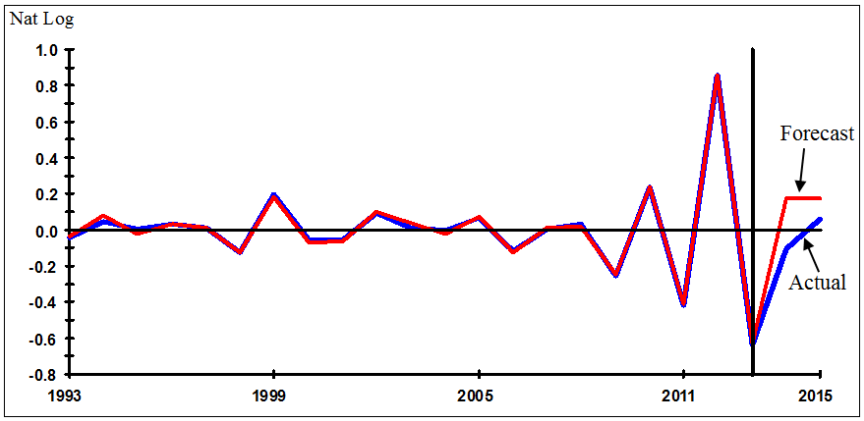

Fig-3: Dynamic Forecasts for the Change in GDP Growth

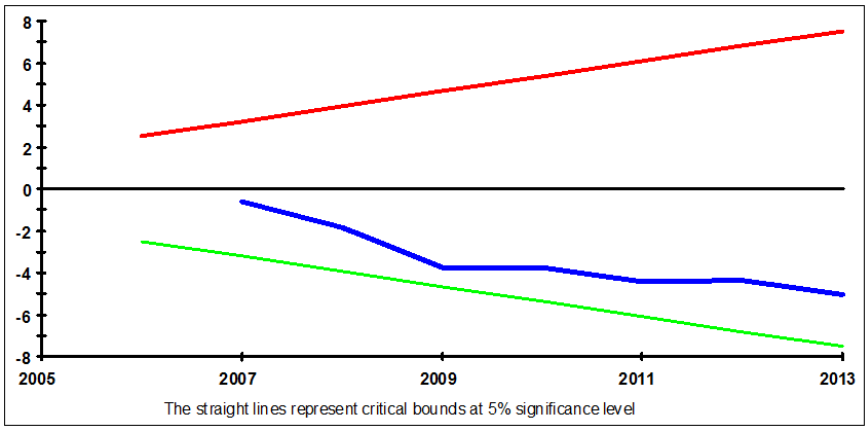

Fig-4: Plot of Cumulative Sum of Recursive Residuals

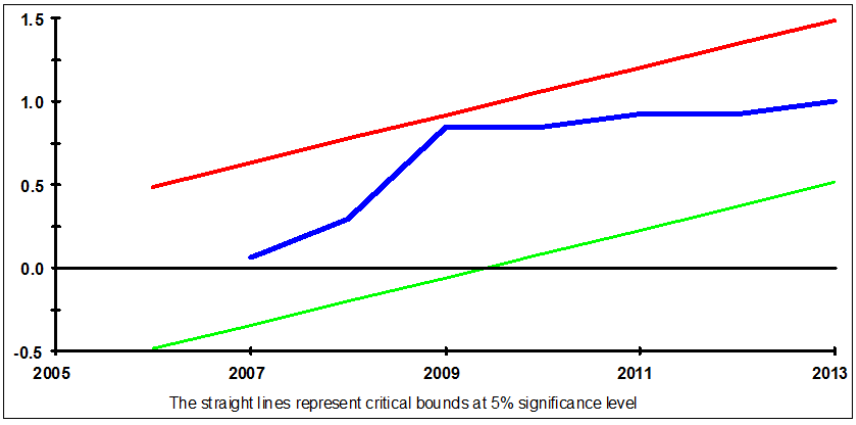

Fig-5: Plot of Cumulative Sum of Squares of Recursive Residuals

DISCUSSION AND POLICY IMPLICATION

This study provides empirical evidence on the existence of credit crunch and shadow economy in the banking sector in Libya and its profound impact on the economic growth using an autoregressive distributed lag approach for the 18-year dataset from the year 2000 to 2017. The issue of the credit crunch and shadow economy is related to capital formation which is one of the major factors in economic growth. In the existence of a credit crunch, banks and investors become wary of lending funds to individuals and corporations, which drives up the price of debt products for borrowers. Albeit increased capital may be a necessary concomitant of economic growth, but it is not a

sufficient condition, as economic growth itself also depends on other factors such as human resources and technology. The major causes of the credit crunch include a sudden increase in the interest rate, direct money controls by the government, and drying up of funds in the capital market. While, the shadow economy is the result of the excessive tax burden, government over-regulation of business, and poor performance by essential government bodies such as tax collection, judiciary, police, and other authorities.

Primary sources of the credit crunch are evidenced in the Libyan economy. Over the past two decades since the fall of Muammar Ghaddafi regime, the interest rate trend is very erratic and unstable, reaching to the maximum rate at 42% per year in 2009 and the minimum rate at -17.5% per annum in 2005 (see Reports by Central Bank of Libya, 2018). The government has imposed strict money controls in the banking sector, as a result the people lost confidence to the banking system, such that whenever the government servants received the credited salaries payment notification in their bank accounts, they rushed to the banks to immediately withdraw the money from the banking system, leaving shortage of cash in the banking system that led to drying up in the source of funds in the capital market.

Shadow economy is basically an economic activity that falls outside the purview of government accounting. Implicit in each, save for informal, is that these economic activities include conscious efforts to avoid official detection. Despite decades of study on the issue from an empirical and historical point of view, little agreement has been reached on the fundamental constructs that underlie the shadow economy [61]. The causes of the shadow economy in Libya are evidenced by the over-regulation of business and poor performance of the government authorities pertaining to the tax collection, the safety of the people and workers. More so after the fall of the Gadhafi regime in 2011, the size of the shadow economy had profoundly increased to the level that government control becomes very difficult and costly.

The results of cointegration analysis using the ARDL approach suggest that there is a significant level of relationships between the credit crunch and shadow economy in the banking sector on economic growth in Libya. All the selected variables in both growth models have been successfully tested with unit root tests for stationarity to avoid spurious regression, prior to conducting bound testing for the models. The cointegration test results for the joint null hypothesis from *F-statistic* and *W-statistic* support the existence of a long-run relationship between economic growth and credit crunch; and between economic growth and the shadow economy, when an appropriate lag length (*p*) is selected. Hence, the existence of a credit crunch and shadow economy in the banking sector in Libya was empirically confirmed, which was detrimental to economic growth. The results suggest that there are long-run relationships between credit crunch and shadow economy on economic growth, and the variables of the credit crunch, money supply M2, inflation and shadow economy could be treated as the long-run compelling variables in the banking and financial sector for the explaining of economic growth.

The results from the error correction model (ECM) for the short-run of the ARDL growth models provide further evidence of the existence of dynamic relationships between credit crunch, shadow economy and economic growth in Libya. The computed ECM coefficient for the credit crunch growth ARDL model, estimated at -1.2609 (SE = .039726) is highly statistically significant, has the correct negative sign, and suggests a very fast speed of convergence in the economy once shocked.

Pearson's correlation test between credit crunch and shadow economy reveals a high correlation at 0.926 which is significant at 0.01 level, suggesting the reason why there is no meaningful relationship in a growth regression model when both credit crunch and shadow economy variables are included. Correlation between the shadow economy and money market M2 variables is also highly significant at a coefficient value of 0.981. Hence, when there is a credit crunch in the banking and financial sector, then the shadow economy will be flourishing to fill the gap in the money market M2.

The above empirical results show the ineffective monetary policy in Libya during an economic crisis as a result of the credit crunch and shadow economy.

CONCLUSION

This paper provides empirical evidence on the existence of the credit crunch and shadow economy in the banking and financial sector, and the ineffectiveness of monetary policy in increasing the money supply to address the crisis. The results from ARDL also indicate the existence of behavioural relationships between credit crunch and shadow economy on economic growth, which suggests how much the level of economic growth will change when there are changes in the credit crunch and shadow economy in the banking and financial sector. Under normal circumstances, when there is a credit crunch in the banking sector, the government tends to use monetary policy by increasing the credit and money supply. During the economic crisis, however, the supply for money and credit is very tight; hence, the shadow economy is thriving.

The existence of a dynamic shadow economy may reflect the degree to which various existing economic policies are inappropriate or unproductive. Repressive tax and regulatory rules (or increase in the

tax burden or the degree and complexity of regulation over time) appear to drive economic agents from the formal sector into the unregulated shadow economy. What we can learn from this study is that the short-run and long-run estimates from the results may provide a simple barometer to reflect the degree of the actual occurrence in the banking and financial sector of the economy during the financial crisis.

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