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Monetary Policy and Economic Growth in Lebanon

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Abstract: The central bank of Lebanon adopted exchange rate targeting in 1994 and it has exploited several instruments (particularly interest rate) since then to stimulate foreign financial inflows. This study aims at testing the impact of this strategy on economic performance and welfare in both the short- and long-run. In this regard, we exploit monthly data covering the period January 2002-June 2017 and implement cointegration analysis and VEC model. The empirical results suggest that monetary tools exploited by the central bank of Lebanon depress economic growth in the long-run. Moreover, despite their importance for external balance, financial inflows may hinder economic activity in both short- and long-run. On the other hand, monetary policy transmission channels through bank credit and capital play a constructive role for GDP growth.

Keywords: Monetary policy transmission channels; Financial Inflows; Economic growth; Vector Error Correction Model.

JEL Classifications: E51, E58, O42.

1. Introduction

The contribution of monetary policy to economic growth has long been the subject of theoretical and empirical research, in addition to policy debate.¹ This topic has attracted increasing interest and there have been continuous calls from politicians and academics for monetary policy to dedicate more focus on growth.

¹ For an overview of the literature on the impact of monetary policy on economic growth, see Twinoburyo and Odhiambo (2018).

Bollard and Hunt (2005) argue that a central bank that is concerned with the short-run volatility of economic variables such as real output and real exchange rate, can indeed contribute to economic welfare by creating a stable and more certain environment for the decision making of private agents. In this regard, monetary policy influences the cycle not only by directly affecting aggregate demand and supply but also by shaping expectations. According to these authors, a high and variable inflation has adverse consequences for both welfare and growth, thus the creation of a low and stable inflation environment is the first and foremost contribution that a central bank can make to long-run living standards. This is because increased uncertainty due to high and variable inflation impairs the efficiency of the price mechanism and could reduce productivity and economic growth.

Theories have indicated that an easing monetary policy leads to higher inflation, which is very likely to have a negative effect on long-term growth. Thus, central banks usually try to preserve price stability through controlling the level of money supply and interest rates. However, the scope of this role may be restricted by the aim to achieve other objectives, the nature of monetary policy transmission mechanisms or by other factors such as the nature of fiscal and economic policies.

Monetary policy may have far-reaching impact on financing conditions in the economy by controlling the availability and the costs of credit. It also influences expectations about the future direction of economic activity and prices, thus affecting the prices of goods, asset prices, exchange rates as well as consumption and investment (Papademos, 2003). In addition to its effect on investment and consumption, monetary policy can affect the environment for private sector decisions and hence guides an efficient allocation of society's (scarce) resources. Finally, a central bank can affect real economic activity by using its balance sheet to adjust the allocation of bank credit. Through lending to private sector entities or by buying the securities of these entities, a central bank can cause more resources to flow to the economic sectors.

This study aims at contributing to the research of whether monetary policy can contribute to the achievement of high and sustainable growth, by exploiting a case study (Lebanon) where monetary policy plays a dominant role in shaping monetary, banking, and financial landscape, as well as economic landscape due to the absence of medium- and long-term fiscal and economic policies. The monetary policy in Lebanon has two complementary conduits: (1) exchange rate targeting, and (2) adopting attractive interest rates to stimulate foreign financial inflows.

By implementing cointegration analysis and Vector Error Correction model on monthly data covering the period January 2002-June 2017, we found that the execution of the monetary policy in Lebanon had a negative impact on economic growth, directly through the adopted tools (interest rate and money supply) and indirectly through the effect of financial inflows. This suggests that monetary policy must pay attention to the consequences of the adopted strategies on long-term economic growth and welfare.

This research is structured as follows. In the following section we shed light on some aspects of monetary policy in Lebanon. In Section 3 we present an overview of related literature. Section 4 presents the empirical methodology and the exploited variables. Section 5 includes an illustration of the dataset. The empirical results of the study are presented and discussed in Section 6. Finally, Section 7 reports the conclusions and some policy implications.

2. Monetary policy in Lebanon: objectives and conduct

In its conduct of monetary policy, the central bank of Lebanon (known as Banque du Liban – BdL) focuses on stabilising the Lebanese pound (LBP) which has been pegged to the US dollar since December 1997. This necessitates holding sufficient foreign currency reserves by BdL to intervene in the foreign exchange market when necessary, where these reserves equalled to \$36.77 billion in October 2017, representing about 75% of Lebanon's GDP. These large reserves have improved the confidence in the banking system and increased its ability to attract an increasing amount of foreign deposits (see Awdeh, 2018).

BdL also conducts its monetary policy by defining two operational targets: (1) the spread between foreign-currency deposit rates and those on international markets, in order to attract capital to the country to finance the current account deficit and external debt; (2) the spread between LBP interest rates and dollar interest rates in Lebanon, to promote deposits in LBP (Poddar et al., 2006). Accordingly, domestic interest rates respond to changes in international rates.² This policy has changed considerably the structure of bank deposits base in Lebanon over the past 2 decades and resulted in a considerable increase in LBP time de-

² Poddar et al. (2006) show that the degree of pass-through from international benchmark rates to interest rates in Lebanon is substantial, and global benchmark interest rates are an important element in the determination of interest rates in Lebanon. Particularly, the impact of changes in international interest rates on the government's borrowing costs is substantial, with a pass-through of 70%. Awdeh (2018) also shows that USD 3-month LIBOR rate is a major determinant of both debit and credit interest rate in Lebanon.

posits and foreign currency deposits (see Appendix A). Foreign financial inflows have led to an expansion of bank deposits base, which became key element to ensuring continued government financing. With high government debt exceeding 140% of GDP and largely held by domestic commercial banks (funded mainly by deposits), their continued funding is an important gauge to the viability of the Lebanese financing model (Finger and Hesse, 2009).

Nevertheless, these inflows have negative repercussions represented by the fact that BdL constantly faces the risk that these large inflows fuel higher fiscal imbalances, increased trade and current account deficits, asset bubbles, and generate appreciation in the exchange rate with deterioration in trade competitiveness (World Bank, 2012). This forces BdL to sterilise the excess liquidity through issuing LBP denominated certificates of deposits and via compulsory reserves in LBP (25% on demand deposits and 15% on term deposits) and reserves in foreign currencies (15% of all customers' deposits in foreign currency). This has ballooned bank deposits at BdL, which equalled to 46.7% of total sector's assets and 189.2% of its claims on the resident private sector in October 2017.

For more than 2 decades, financial inflows represented the lifeline for the Lebanese economy because it suffers large and persistent trade deficits. BdL adopts several measures to stimulate these financial inflows mainly by preserving "attractive" interest rates as explained above. Even following the 2007-2008 international financial crisis, BdL kept interest rates high, raising the spread between domestic and international rates, which resulted in large foreign financial inflows.

This structure of interest rates has contributed to the shaping of the economy in Lebanon. Dibeh (2008) found that real interest rates had a significant impact on the dynamics of the business cycle in Lebanon, particularly between 1993 and 2002. According to the interest rate transmission channel view, high interest rates should result in lowering both investment and consumption, thereby directly affecting economic activity.

Finally, on the bank lending front, BdL has introduced several successful measures to promote credit to the resident private sector and help banks improve the use of their excess liquidity. These measures included special schemes such as interest payment subsidisations and mandatory reserve exemptions. These schemes focused on main economic sectors, such as agriculture, industry, tourism and housing. According to the World Bank (2012), these schemes represented more than 50% of total lending in agriculture, tourism, housing, and industry. And without these schemes, some sectors would have been deprived from lending,

particularly agriculture where more than 95% of loans to this sector are disbursed through these special schemes.

3. Literature review

The relationship between monetary policy and economic growth has been the subject of extensive research for a long time, but captured greater attention particularly in the 1960s. Tobin (1965) showed in a simple model where agents save for future consumption only out of their current income, either by holding money balances or investing in real capital assets. Money growth leads to a higher rate of inflation that reduces the rate of return on money and induces a portfolio shift in favour of real capital. This generates an increase in capital stock and higher level of output in the long-run. Tobin's analysis contested the super-neutrality of money by relying on a straightforward mechanism related to the role of money as both an asset and a store of wealth. Nevertheless, over the last five decades, the theories regarding the relationship between money, inflation and growth have challenged Tobin's finding.

In early 1960s, Milton Friedman and his followers published a series of studies advocating a strong effect of money on economic activity. These studies directed economic research into two directions: (1) detecting the importance of money for economic activity, and (2) developing a better understanding of channels through which monetary policy affects aggregate demand (Mishkin, 2010). In the following, we present some of these channels.

3.1 The interest rate channels

According to this view, an expansionary monetary policy leads to a fall in real interest rates, which in turn lowers the cost of capital, causing a rise in investment spending, thereby leading to an increase in aggregate demand and a rise in output. Conversely, an increase in interest rates translates into an increase in investment cost of capital because financing through debt becomes more expensive. This discourages corporations and households from investment, thereby reducing output.

This view also argues that consumer decisions about housing and consumer durable expenditure are investment decisions, making the interest-rate channel of monetary transmission applicable equally to consumer spending. An interest rate increase alters consumption, and current saving for future consumption becomes more profitable than current consumption. This reduces current con-

sumption, leading to a decrease in output and inflation. The interest rate channel operates more through decreases in real interest rate than nominal interest rate and real long-term interest rate seems to have more impact on spending than short-term interest rate (Boivin et al., 2010).

3.2 The exchange rate effects on net exports

The exchange rate is an important transmission mechanism of monetary policy since – depending on the nature of shocks – it affects both inflation and aggregate demand, particularly in a small open economy (Krušković, 2017). According to the theory of uncovered interest rate parity, an interest rate increase should translate into appreciation of exchange rate. As a result, the prices of imported goods in domestic currency decrease and prices of exported goods in foreign currency increase. This boosts imports and reduces exports. Conversely, when real interest rates fall, domestic assets dominated in local currency become less attractive relative to those denominated in foreign currencies. As a result, the value of local currency assets relative to other currency assets falls, and results in local currency depreciation. A lower value of local currency makes domestic goods cheaper than foreign goods, thereby causing a rise in net exports and aggregate output (Bryant et al., 1993)

3.3 The wealth effects

This view considers how consumer balance sheets affect their spending decisions. Using the life cycle hypothesis of consumption, Modigliani (1971) theorises that consumers smooth out their consumption over time. According to the author, consumption spending is determined by the lifetime resources of consumers, not just their today's income. An important component of consumers' lifetime resources is their financial wealth and common stocks represent a major component of this wealth. When stock prices increase, the value of financial wealth increases, thereby increasing the lifetime resources of consumers, resulting in a rise in consumption. On the other hand, a decrease in stock (or other assets) prices lowers household wealth. According to the life-cycle theory, this should decrease consumption.

3.4 The credit channel

This transmission mechanism is based on the paradigm of asymmetric information in financial markets (Bernanke and Gertler, 1995). This view suggests that two types of monetary transmission channels arise as a result of information

asymmetry in credit markets: monetary policy transmission channels operating through the effect on bank lending, and those operating through effects on borrowers' balance sheets. Thus, credit channels can be divided into channels based on bank's own balance sheets and balance sheets of other agents.

3.4.1 The bank lending channel

The bank lending channel states that banks play a particular role in the financial system because they are well suited to solve the asymmetric information problems in credit markets. Because of banks' special role, certain borrowers do not have access to credit markets unless they borrow from banks. Conditional on no perfect substitutability of retail bank deposits with other sources of funds, the bank lending channel states that an expansionary monetary policy increases bank reserves and bank deposits, thus increasing the quantity of available bank loans. Because many borrowers depend on bank loans to finance their activities, this increase in loans results in a rise in investment and consumption. On the other hand, a tight monetary policy reduces bank reserves, thereby decreasing credit supply (Bernanke and Blinder, 1988; Kashyap and Stein, 2000).

3.4.2 The balance sheet channel

This channel states that the lower the net worth of firms, the more severe the moral hazard and adverse selection problems in lending to these firms (Gertler and Gilchrist, 1994). Lower net worth means that banks have less collateral for their loans, so their potential losses from adverse selection are higher. Besides, lower net worth of firms increases the moral hazard problem because a lower equity gives firm owners more incentive to engage in risky projects. Taking on more risky projects increases the likelihood that banks will not be paid back. Thus, a decrease in firms' net worth leads to a decrease in lending, hence in investment spending. It is argued that monetary policy can affect firms' balance sheets, where an expansionary monetary policy that causes a rise in stock prices, raises the net worth of firms and leads to higher investment spending.

Finally, it is worth noting that many researchers and practitioners argue that monetary policy cannot improve economic performance, whereas a poor one could indeed damage economic activity. For instance, Lacker (2014) states that monetary policy does not affect growth in the long-term, while a poor monetary policy that leads to high and widely varying inflation can impede economic growth in a number of ways. Firstly, high and variable inflation can interfere with the ability of relative prices to provide the right signals to guide the alloca-

tion of productive resources to their highest-valued uses. Secondly, a poor monetary policy can limit the economy's real performance by encouraging people to – wastefully – spend resources trying to avoid holding money. Resources devoted to economising on money holdings are resources that could otherwise have been spent on the production of goods and services.

4. Empirical methodology

4.1 Model specifications

This study exploits time series econometrics, which are represented by Vector Error Correction (VEC) or Vector Auto Regressive (VAR) models. These models can reveal the association between dependent and independent variables while treating variables as endogenous and exogenous at the same time in the VEC/VAR system. Moreover, these frameworks can reveal the existence and the direction of any causal effect running between the variables. VEC models have one more advantage over VAR models since they can disclose short-run and long-run associations among the variables, while the VAR models are only able to show the short-run relationships.

The selection between VAR and VEC is based on conditions and tests which should be performed beforehand. The first test is detecting the possible existence of unit roots in the exploited variables. The second test is detecting the existence of cointegrating equation(s) linking these variables. In case variables do not include unit root (i.e. they are stationary), a VAR system is appropriate. Conversely, if: (1) they do include unit root (i.e. non-stationary) and are integrated of same order, and (2) a cointegrating equation(s) link them, then, a VEC system is suitable.

To test for variables stationarity we adopt the Augmented Dickey-Fuller (ADF) test. To test for series cointegration, we adopt the Johansen-Fisher cointegration test.

4.2 Variables specifications

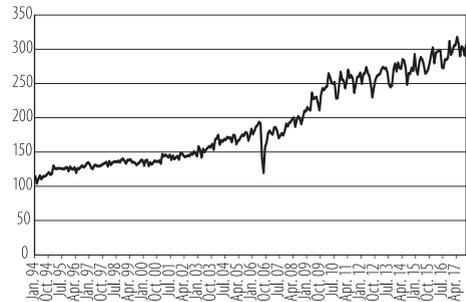
4.2.1 The dependent variable

In 1994, BdL adopted a composite indicator named Banque du Liban Coincident Index which gives an approximation to GDP, without being a substitute for it. It is

composed of 7 economic variables reflecting the economic activity in Lebanon and computed from the sum of these variables, weighted according to their importance, as follows: electricity production (with a weight of 18.6% in the index), oil derivative imports (with a weight of 18.2%), cement deliveries (with a weight of 16.5%), passenger flows (with a weight of 11.0%), foreign trade (imports and exports) (with a weight of 11.8%), cleared checks (with a weight of 12.0%), and money stocks (M3) (with a weight of 12.0%). The BdL

Coincident Index is strongly correlated with real GDP growth and proved over the past years that it gives an accurate estimate of GDP and remains a reliable proxy of economic growth in Lebanon (Jad, 2016). Figure 1 shows the development of the Coincident Index between January 1994 and October 2017.

Figure 1: Coincident Index



Source: done by the author based on BdL data.

4.2.2 The explanatory variables

We test the effect of monetary policy on economic growth in Lebanon through 2 channels: (1) directly through monetary policy tools, and (2) indirectly through the effect of financial inflows.

The first channel is represented by the following variables, which are controlled/affected by BdL: (1) interest rate, represented by the LBP weighted-average deposit rate (DEP_RATE); (2) money supply, represented by M2; (3) banking sector aggregate capital (CAPITAL); and (4) banking sector aggregate claims on resident private sector (PRIV_CLAIM).

The second channel is represented by variables which are affected directly or indirectly by foreign financial inflows and could reveal the effect of these inflows on the economic growth in Lebanon (see World Bank, 2012, p. 24). These variables are: (1) the deposits of non-resident private sector (NON_RESID_DEP); (2) net public debt (PUB_DEBT); and (3) merchandise imports (IMPORTS).

5. Data

The exploited variables are monthly and cover the period January 2002-June 2017, i.e. 186 months. The source of data is BdL's database. Note that COINC_INDEX is an index with an initial value of 100, and the values of all independent variables are in LBP trillions, except DEP_RATE in percentage. Table 1 presents some summary statistics of the exploited variables.

Table 1: Variables descriptive statistics

| | COINC_INDEX | DEP_RATE | M2 | NON_RESID_DEP | CAPITAL | PRIV_CLAIM | PUB_DEBT | IMPORTS |
|--------------|-------------|----------|--------|---------------|---------|------------|----------|---------|
| Mean | 221.416 | 6.755 | 46.624 | 25.9623 | 3.299 | 42.359 | 66.302 | 1.890 |
| Median | 229.000 | 6.770 | 47.584 | 23.0894 | 2.875 | 35.284 | 65.713 | 2.075 |
| Maximum | 317.600 | 10.650 | 83.099 | 52.4142 | 5.429 | 79.577 | 100.514 | 4.219 |
| Minimum | 119.800 | 5.370 | 15.836 | 8.39990 | 1.049 | 21.798 | 40.731 | 0.404 |
| Std. Dev. | 51.547 | 1.374 | 22.529 | 14.3095 | 1.508 | 19.542 | 16.572 | 0.705 |
| Observations | 186 | 186 | 186 | 186 | 186 | 186 | 186 | 186 |

Notes: COINC_INDEX is an index with initial value of 100 in 1993. DEP_RATE is in percentage. M2, NON_RESID_DEP, CAPITAL, PRIV_CLAIM, PUB_DEBT and IMPORTS are in LBP trillions.

6. Empirical Results

6.1 Variables stationary test

We test for series stationarity using the Augmented Dickey-Fuller test (ADF). Since we do not know *a priori* whether these series contain an intercept, an intercept and a trend, or none, we perform the ADF tests for the 3 scenarios and the results are included in Table 2. These results suggest that all exploited variables are non-stationary at level, but stationary in first deference. Consequently, they are all integrated of level one.³

³ We have repeated the test using the Philip-Perron (PP) unit root test and obtained exactly the same conclusion.

Table 2: Augmented Dickey-Fuller unit root test

| | In level, with: | | | In first difference, with: | | | Integration level |
|---------------|-------------------|---------------------|--------------------|----------------------------|---------------------|---------------------|-------------------|
| | Intercept | Intercept and trend | None | Intercept | Intercept and trend | None | |
| COINC_INDEX | -0.224 (0.931) | -5.559* (0.000) | 4.675 (1.000) | -9.747* (0.000) | -9.716* (0.000) | -10.039* (0.000) | 1 |
| DEP_RATE | -2.477 (0.122) | -2.477 (0.305) | -2.477* (0.032) | -10.274* (0.000) | -10.399* (0.000) | -10.090* (0.000) | 1 |
| M2 | 0.226 (0.973) | -1.785 (0.708) | 3.256 (0.999) | -8.466* (0.000) | 8.483* (0.000) | -3.571* (0.004) | 1 |
| NON_RESID_DEP | 1.534 (0.999) | -1.923 (0.638) | 5.349 (1.000) | -14.880* (0.000) | -15.230* (0.000) | -12.938* (0.000) | 1 |
| CAPITAL | -0.757 (0.828) | -2.489 (0.333) | 1.779 (0.981) | -13.763* (0.000) | -13.728* (0.000) | -13.410* (0.000) | 1 |
| PRIV_CLAIM | 4.841 (1.000) | -2.807 (0.196) | 12.283 (1.000) | -6.250* (0.000) | -11.993* (0.000) | -1.347 (0.164) | 1 |
| PUB_DEBT | 2.939 (1.000) | 0.279 (0.998) | 10.068 (1.000) | -17.129* (0.000) | -17.726* (0.000) | -2.131* (0.032) | 1 |
| IMPORTS | -1.654 (0.452) | -2.039 (0.575) | 0.372 (0.791) | -15.449* (0.000) | -15.456* (0.000) | -15.421* (0.000) | 1 |

Notes: * denotes significant at the 5% level. P-values in parentheses.

6.2 Variables co-integration test

After performing the unit root tests on all the variables, we are able now to perform the cointegration test between the variables, in order to detect the existence of cointegrating equation(s) linking them. But firstly, the lag length included in the test must be determined. Appendix B presents the lag-lengths as reported by different criteria. We follow the Schwarz Criterion that suggests adding 2 lags to the system. We then adopt the Johansen-Fisher cointegration test and the results are reported in Table 3. Both the Trace statistic and the Max-Eigen statistic suggest the existence of 3 cointegrating equations. Consequently, we can proceed with a Vector Error Correction Model.

Table 3: Johansen-Fisher co-integration test

| Hypothesized No. of CE(s) | Trace Statistic | Prob. | Max-Eigen Statistic | Prob. |
|---------------------------|-----------------|-------|---------------------|-------|
| None * | 261.898 | 0.000 | 92.676 | 0.000 |
| At most 1 | 169.221 | 0.000 | 55.995 | 0.003 |
| At most 2 | 113.226 | 0.001 | 44.875 | 0.013 |
| At most 3 | 68.350 | 0.065 | 27.833 | 0.221 |
| At most 4 | 40.516 | 0.204 | 19.178 | 0.400 |
| At most 5 | 21.338 | 0.336 | 9.570 | 0.783 |
| At most 6 | 11.767 | 0.168 | 8.500 | 0.330 |
| At most 7 | 3.266 | 0.070 | 3.266 | 0.070 |

Notes: Series COINC_INDEX DEP_RATE M2 NON_RESID_DEP CAPITAL PRIV_CLAIM PUB_DEBT IMPORTS. Included observations: 183 after adjustments. Lags interval (in first differences): 1 to 2. Trace test and Max-Eigen value tests indicate 3 cointegrating eqn(s) at the 5% level.

6.3 Vector Error Correction Model estimates

We estimate a VEC system that is formed of one long-run equation and several short-run equations, which are presented in Table 4. Before we proceed in analysing the long-run and the short-run equations' results, we test for the potential existence of residuals autocorrelation using the Portmanteau test. The results included in Appendix C suggest the absence of such a problem.

6.3.1 The long-run relationship

The results of the VECM long-run equation are reported in Panel A of Table 4. Firstly, interest rate represented by the weighted-average deposit rates affects negatively and significantly (at the 1% level) the economic growth in Lebanon, in the long-run. Therefore, the relative high interest rates in Lebanon on both local and foreign currencies seem to depress economic activities through impeding investment and lowering consumption. These high interest rates are translated into high cost of borrowing and cost of capital, thus discouraging investment. Therefore, adopting such high interest rates is harmful for economic growth in the long-run.

Money supply is also negatively associated with economic developments proxied by the Coincident Index. Therefore, an increase in money supply may have been associated with an increase in inflation, which deteriorates economic growth. Another possible explanation for this negative association between M2 and COINC_INDEX is the following. Sight and time LBP deposits represent a large

part of M2 (94.6% in October 2017), and at the same time Lebanese banks record low loan-to-deposit ratios where a large proportion of these deposits are kept at BdL as reserves. This negative impact of money supply on economic growth is consistent with Bhattacharya (2003) who found that output fluctuations in Lebanon between 1971 and 2000 were predominantly the result of aggregate money supply or demand shocks.

The sector's aggregate claims on resident private sector-to-resident private sector deposits ratio recorded 39.7% in October 2017. Besides, claims on both resident private sector and public sector-to-total deposits ratio (excluding non-resident financial institutions deposits) stood at 49.8% in October 2017. On the other hand, the sector's aggregate reserves-to-total assets ratio recorded 46.9%, where 94.7% of these reserves were deposited at BdL (source: BdL database).

Therefore, a large part of bank deposits are held at BdL and represent large leakages out of the system, i.e. money earned but not injected in the economy. Consequently, an increase in LBP deposits (and thus in M2) results in more money earned but not injected in the system, which deprives the productive economic sectors from these funds and results in a lower economic growth. In fact, World Bank (2012) raised a question about the optimal level of international reserves to be held by BdL, which should depend on balancing the holding cost of reserves against the benefits deriving from lower interest spreads.

The non-resident private sector deposits show to be negatively associated with the Coincident Index, and significant at the edge of 10% level. This may show that despite their important and constructive role in improving Lebanon's external balance, expanding banking sector deposit base, and boosting BdL's foreign reserves, these deposits represent a burden on economic development in the long-run. One drawback of these deposits is that they eventually result in financial outflows represented by the interest payments they involve. We note that a considerable proportion of non-resident deposits is fuelled by remittance inflows from the widely spread Lebanese diaspora. These remittances are large in both absolute and relative terms (i.e. in volume and as percentage of GDP) and play a crucial role in the social development of recipient households. Nevertheless, on macro level, the substantial dependency on these financial resources may have had repercussions on economic growth in Lebanon. In this regard, World Bank (2012) argues that salary competition from the GCC countries and the increase in prices in Lebanon are two major reasons behind the scarcity of skilled labor, which is massively migrating. The report adds that a vicious circle seems to be in place with foreign inflows increasing the incentive to migrate and migration increasing foreign inflows which are partly invested in educating new candidates

to migration. The composition of these foreign financial inflows and their final use do not seem to be helpful for employment in Lebanon.

CAPITAL has a positive and significant impact on economic growth suggesting that higher capitalisation allows banks to extend more credit to the economy. This adds evidence to the existence of a long-run monetary policy transmission channel through bank capital.

Lending to the resident private sector does add value to economic activity in the long-run, where an increase in credit to the private sector increases investment and consumption, and eventually boosts Lebanon's GDP in the long-run. This provides support to the quantity theory of credit whereby credit creation and allocation decisions affect the real economy. This also proves the existence of a long-run credit channel where BdL's ability to guide bank lending can lead to better economic growth. However, what could be more important than extending loans is the appropriate allocation of loans, where sectors producing non-traded goods benefit from the largest part of banking intermediation that is skewed in favour of certain sectors and does not promote broad based growth and development. For instance, by the end of 2016, loans to resident private sector equaled to 25% of total sector's assets (source: BdL database). Of these loans, 32.4% went to trade and services sector, 30.6% were consumer loans (of which 18.6% are housing loans), 18.0% to construction sector, 9.8% to industry, 5.6% to financial intermediation, 1.2% to agriculture, and 2.6% to other sectors (source: Association of Banks in Lebanon). In fact, the access to lending of agriculture, industry and innovative activities remains very limited and would have been more difficult without BdL's special schemes cited earlier.

Public debt shows to be a significant impediment to economic performance in Lebanon in the long-run, as PUB_DEBT is negatively and significantly (at the 1% level) associated with COINC_INDEX. Therefore, the high indebtedness resulted from continuous budget deficit forces the government to dedicate large sums of public revenues to service debt, which lowers government's spending capability on infrastructure and social services. We note here that the ease and the availability of borrowing from local banks over the past 25 years may have participated in delaying budget and fiscal reforms in Lebanon.

Finally, due to the fact that the majority of domestic capital is invested in the real estate sector, services sector and government securities, or deposited in banks instead of being invested in the productive economic sectors, Lebanon relies heavily on imports and suffers large and persistent trade deficit. This deficit deteriorates economic growth in the long-run which is shown by the negative and significant (at the 1% level) impact of IMPORTS on COINC_INDEX.

Table 4: Vector Error Correction Model Estimates

| Panel A: the co-integrating equation | | | | | | | | |
|--------------------------------------|-----------------------|------------------------|-----------------------|--------------------|---------------------|--------------------|-----------------------|------------------------|
| | COINC_INDEX(-1) | DEP_RATE(-1) | M2(-1) | NON_RESID_DEP(-1) | CAPITAL(-1) | PRIV_CLAIM(-1) | PUB_DEBT(-1) | IMPORTS(-1) |
| | 1.000 | -10.059*** [-2.557] | -1.703*** [-3.107] | -2.237 [-1.638] | 16.318** [2.164] | 2.053* [1.833] | -1.428*** [-3.413] | -70.384*** [-9.862] |
| Panel B: the short-term equations | | | | | | | | |
| | D(COINC_INDEX) | D(DEP_RATE) | D(M2) | D(NON_RESID_DEP) | D(CAPITAL) | D(PRIV_CLAIM) | D(PUB_DEBT) | D(IMPORTS) |
| CointEq1 | -0.203*** [-4.224] | -0.001 [-1.544] | -0.005 [-1.632] | 0.001 [0.280] | -0.001 [-1.328] | -0.005 [-2.970] | -0.004 [-1.892] | 0.009 [5.894] |
| D(COINC_INDEX(-1)) | -0.002 [-0.034] | 0.0004 [0.373] | 0.0004 [0.094] | 0.011 [2.259] | 0.001 [1.271] | 0.007 [2.565] | 0.005 [1.448] | -0.009 [-3.958] |
| D(COINC_INDEX(-2)) | -0.124* [-1.698] | 0.0002 [0.223] | -0.008 [-1.759] | 0.003 [0.647] | 0.003 [3.180] | 0.001 [0.281] | -0.003 [-0.852] | -0.007 [-3.295] |
| D(DEP_RATE(-1)) | -2.032 [-0.360] | 0.036 [0.437] | 1.438 [3.807] | 0.211 [0.585] | -0.120 [-1.422] | -0.234 [-1.038] | 0.166 [0.562] | 0.280 [1.556] |
| D(DEP_RATE(-2)) | -3.047 [-0.579] | 0.113 [1.472] | -0.485 [-1.377] | -0.098 [-0.292] | -0.060 [-0.761] | -0.094 [-0.448] | 0.426 [1.546] | 0.263 [1.565] |
| D(M2(-1)) | 0.453 [0.351] | -0.113 [-6.007] | 0.680 [7.855] | 0.123 [1.486] | -0.011 [-0.592] | -0.087 [-1.689] | -0.076 [-1.123] | 0.054 [1.306] |
| D(M2(-2)) | -1.319 [-0.973] | 0.001 [0.097] | -0.108 [-1.190] | 0.005 [0.066] | -0.022 [-1.126] | -0.002 [-0.041] | 0.058 [0.817] | 0.112 [2.601] |
| D(NON_RESID_DEP(-1)) | -1.932 [-1.482] | 0.007 [0.404] | -0.147 [-1.682] | -0.177 [-2.118] | -0.010 [-0.512] | 0.029 [0.567] | -0.022 [-0.332] | 0.026 [0.637] |
| D(NON_RESID_DEP(-2)) | -2.787** [-2.162] | 0.011 [0.634] | -0.039 [-0.453] | 0.016 [0.200] | -0.017 [-0.918] | -0.098 [-1.915] | -0.001 [-0.015] | -0.054 [-1.324] |
| D(CAPITAL(-1)) | 4.179 [0.803] | -0.019 [-0.251] | -1.158 [-3.326] | -0.485 [-1.455] | -0.025 [-0.320] | -0.173 [-0.832] | -0.208 [-0.764] | -0.141 [-0.850] |
| D(CAPITAL(-2)) | 8.943* [1.663] | -0.191 [-2.438] | 0.870 [2.415] | -0.297 [-0.861] | -0.013 [-0.164] | -0.023 [-0.107] | 0.1061 [0.377] | 0.363 [2.110] |
| D(PRIV_CLAIM(-1)) | -0.256 [-0.134] | 0.041 [1.489] | 0.065 [0.510] | 0.227 [1.855] | 0.010 [0.357] | 0.146 [1.913] | -0.015 [-0.156] | 0.178 [2.927] |
| D(PRIV_CLAIM(-2)) | 4.242** [2.195] | 0.001 [0.037] | 0.005 [0.040] | 0.118 [0.955] | 0.044 [1.528] | 0.221 [2.857] | -0.159 [-1.578] | 0.004 [0.079] |
| D(PUB_DEBT(-1)) | 1.577 [1.049] | 0.073 [3.355] | -0.215 [-2.143] | -0.017 [-0.181] | -0.004 [-0.196] | -0.009 [-0.152] | -0.273 [-3.477] | 0.040 [0.841] |
| D(PUB_DEBT(-2)) | 3.321** [2.181] | 0.010 [0.484] | 0.090 [0.886] | 0.015 [0.155] | -0.002 [-0.101] | 0.001 [0.019] | -0.097 [-1.225] | 0.054 [1.116] |
| D(IMPORTS(-1)) | 1.543 [0.494] | -0.035 [-0.770] | -0.281 [-1.347] | 0.266 [1.332] | -0.022 [-0.474] | -0.322 [-2.579] | -0.258 [-1.584] | -0.195 [-1.958] |
| D(IMPORTS(-2)) | -2.038 [-0.806] | -0.016 [-0.446] | -0.023 [-0.139] | 0.074 [0.456] | -0.003 [-0.103] | -0.186 [-1.837] | -0.144 [-1.089] | -0.033 [-0.417] |
| C | 1.723 [1.237] | -0.021 [-1.050] | 0.256 [2.752] | 0.125 [1.399] | 0.020 [0.957] | 0.239 [4.299] | 0.524 [7.188] | -0.104 [-2.350] |
| R-squared | 0.342 | 0.333 | 0.424 | 0.142 | 0.093 | 0.205 | 0.139 | 0.459 |
| F-statistic | 5.060 | 4.852 | 7.151 | 1.618 | 1.004 | 2.512 | 1.575 | 8.267 |
| DW stat. | 2.186 | 2.015 | 1.969 | 2.011 | 2.067 | 2.027 | 1.967 | 1.981 |
| Observations | 184 | 184 | 184 | 184 | 184 | 184 | 184 | 184 |

Notes: t-statistics in []. ***, **, * denote significant at the 1%, 5% and 10% levels respectively.

6.3.2 The short-run relationship

The VEC system's short-term equations are included in Panel B of Table 4, with COINC_INDEX equation in the second column. Firstly, the coefficient of the cointegrating equation is negative and significant at the 1% level. Therefore, the model converges to a long-run equilibrium with a speed of adjustment of 20.34% per period. Turning to the effect of individual variables, we observe the following.

Firstly, both interest rate and money supply lost their impact recorded in the long-run equation. Therefore, these monetary tools do not show to have a quick and short-run impact on economic growth in Lebanon. Despite the fact that interest rate and money supply showed to be negatively associated with economic growth over the studied period, the lack of a short-run impact may suggest that they have a delayed effect. Consequently, these 2 tools may not be useful to affect economic conditions in the short-run as their impact may need several months to materialise and direct economic activities as required.

NON_RESID_DEP affects negatively COINC_INDEX in the short-run, complementing its long-run effect shown above. Thus, this variable results in depressing economic growth in both the short- and the long-run, where its negative effect emerges immediately and extends over a long period. This result may show the necessity to revise the strategy aiming at continuously attracting financial inflows as they show to have an adverse effect. In fact, the weakness of financial markets in general and capital markets in particular in Lebanon obstruct an efficient management of these foreign inflows. Consequently, these inflows put pressures on monetary policies and lead to an accumulation of reserves and obstruct the efficient channelling of resources to the economy and building up broad-based growth potentials. Moreover, the considerable reliance on these financial inflows may have contributed to delaying the needed economic structural reforms in Lebanon.

Consistent with the long-run effect, bank capital has a constructive role in boosting economic activities in Lebanon in the short-run. Thus, an increase in capital allows banks to expand their credit immediately proving the importance of the high capital levels held by Lebanese banks. Similarly, the long-run positive effect of credit on economic growth is supplemented with a short-run positive effect, suggesting the existence of a short- and long-run credit transmission channel. Thus, BdL's actions and policies regarding a (guided) expansion of credit can improve economic conditions in Lebanon.

With contrast to the finding in the long-run equation, public debt shows to have a positive short-term impact on economic growth. This may suggest that the government borrowing is dedicated to spending on wages and other current expenditures, which is translated into a short-term positive impact on economic activity through boosting consumption. But in the long-run, the accumulated debt has resulted in deteriorating economic growth as shown in the previous section.

Finally, imports do not affect economic growth in the short-run, and their negative impact on the Coincident Index needs several periods to take place.

We extend our analysis of the short-run equation and detect the possible existence of a Granger Causality effect running from the exploited independent variables towards COINC_INDEX. The results reported in Table 5 show that NON_RESID_DEP does have a causal effect on COINC_INDEX, suggesting that an increase in the former can predict a decrease in the latter in the short-run. Secondly, an increase in bank credit to the resident private sector causes an increase in economic growth in the short-run. Thirdly, an increase in borrowing by the government (PUB_DEBT) is expected to cause a short-run increase in COINC_INDEX. On the other hand, the other variables do not show to have a causal effect on economic growth.

Table 5: VEC Granger Causality/Block Exogeneity Wald Tests.
Dependent variable: D(COINC_INDEX)

| Excluded | Chi-sq | df | Prob. |
|------------------|--------|----|---------|
| D(DEP_RATE) | 0.573 | 2 | 0.750 |
| D(M2) | 0.948 | 2 | 0.622 |
| D(NON_RESID_DEP) | 6.133 | 2 | 0.046** |
| D(CAPITAL) | 3.421 | 2 | 0.180 |
| D(PRIV_CLAIM) | 5.019 | 2 | 0.081* |
| D(PUB_DEBT) | 5.162 | 2 | 0.075* |
| D(IMPORTS) | 2.147 | 2 | 0.341 |
| All | 28.240 | 14 | 0.013** |

Notes: ** and * denote significant at the 5% and 10% levels respectively.

Included observations: 183.

6.4 The impulse response functions

Figure 2 plots the impulse responses of COINC_INDEX to unexpected shocks to the independent variables with a simulation period of 12 months. The response of COINC_INDEX to a one standard deviation shock on interest rate is slightly

6.5 COINC_INDEX variance decomposition

An additional analysis is performed in this section, represented by analysing the participation of each explanatory variable in the variability of COINC_INDEX. The results of COINC_INDEX variance decomposition are reported in Table 6.

While COINC_INDEX is 100.00% responsible about its variation in period 1, the percentage declines to 63.05 in period 10, and continues its decline to period 180, with a minimum of 47.62%. Regarding the relative importance of the explanatory variables in explaining the variability of COINC_INDEX we observe the following. The share of DEP_RATE increased from 2.23% in period 10 to 4.95% in period 180, the share of M2 increased from 2.57% to 4.35%, the share of PRIV_CLAIM increased from 0.25% to 0.48%, the share of PUB_DEBT increased from 5.82% to 7.81%, while the share of IMPORTS recorded the highest increase: 33.83% in period 180 versus 24.06% in period 10. Conversely, the share of NON_RESID_DEP declined from 1.21% to 0.72%, and the share of CAPITAL declined from 0.85% to 0.24%. These results show that IMPORTS has the highest importance in explaining the variability of economic growth in Lebanon, followed by PUB_DEBT. The other variables have lower ability to explain the variability of the Coincident Index.

Table 6: Variance decomposition of COINC_INDEX

| Period | S.E. | COINC_INDEX | DEP_RATE | M2 | NON_RESID_DEP | CAPITAL | PRIV_CLAIM | PUB_DEBT | IMPORTS |
|--------|--------|-------------|----------|-------|---------------|---------|------------|----------|---------|
| 1 | 9.181 | 100.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 10 | 22.548 | 63.051 | 2.227 | 2.567 | 1.207 | 0.847 | 0.253 | 5.818 | 24.025 |
| 20 | 30.454 | 55.796 | 3.498 | 3.400 | 0.981 | 0.563 | 0.335 | 6.775 | 28.648 |
| 30 | 36.691 | 52.907 | 4.011 | 3.737 | 0.888 | 0.447 | 0.385 | 7.143 | 30.478 |
| 40 | 42.012 | 51.383 | 4.282 | 3.914 | 0.839 | 0.386 | 0.413 | 7.336 | 31.443 |
| 50 | 46.730 | 50.443 | 4.449 | 4.024 | 0.809 | 0.349 | 0.429 | 7.455 | 32.038 |
| 60 | 51.014 | 49.806 | 4.562 | 4.098 | 0.788 | 0.323 | 0.441 | 7.536 | 32.442 |
| 70 | 54.965 | 49.345 | 4.644 | 4.152 | 0.773 | 0.305 | 0.449 | 7.595 | 32.733 |
| 80 | 58.651 | 48.996 | 4.706 | 4.192 | 0.762 | 0.291 | 0.455 | 7.639 | 32.954 |
| 90 | 62.118 | 48.723 | 4.755 | 4.224 | 0.753 | 0.280 | 0.460 | 7.673 | 33.127 |
| 100 | 65.402 | 48.504 | 4.794 | 4.250 | 0.746 | 0.271 | 0.464 | 7.701 | 33.266 |
| 110 | 68.529 | 48.324 | 4.826 | 4.271 | 0.740 | 0.264 | 0.467 | 7.724 | 33.380 |
| 120 | 71.519 | 48.173 | 4.853 | 4.288 | 0.736 | 0.258 | 0.470 | 7.743 | 33.475 |
| 130 | 74.389 | 48.045 | 4.875 | 4.303 | 0.732 | 0.253 | 0.472 | 7.759 | 33.556 |
| 140 | 77.152 | 47.935 | 4.895 | 4.316 | 0.728 | 0.248 | 0.474 | 7.773 | 33.626 |
| 150 | 79.819 | 47.839 | 4.912 | 4.327 | 0.725 | 0.244 | 0.476 | 7.786 | 33.687 |
| 160 | 82.401 | 47.756 | 4.927 | 4.337 | 0.722 | 0.241 | 0.477 | 7.796 | 33.740 |
| 170 | 84.904 | 47.682 | 4.940 | 4.346 | 0.720 | 0.238 | 0.479 | 7.806 | 33.786 |
| 180 | 87.335 | 47.616 | 4.952 | 4.353 | 0.718 | 0.235 | 0.480 | 7.814 | 33.828 |

7. Conclusions and policy implications

Due to the absence of medium- and long-term fiscal and economic policies, the monetary policy in Lebanon plays a dominant role in shaping monetary, financial, and economic landscape. The central bank of Lebanon adopted exchange rate targeting in 1994 and has pegged the Lebanese pound to the U.S. dollar since end-1997, a strategy that requires holding sufficient foreign currency reserves. Therefore, the central bank uses the spread between local and international interest rates, in addition to some non-traditional practices recently in order to attract foreign financial inflows. This practice has proved to be very successful in attracting large financial inflows that expanded banking sector deposits, heightened central bank reserves, and improved current account balance for more than two decades. Nevertheless, this strategy has had serious repercussions on economic growth in Lebanon. This was detected by using cointegration analysis and Vector Error Correction system on a dataset of monthly monetary, banking and economic variables between January 2002 and June 2017.

The empirical analysis was conducted to detect the impact of the central bank strategy on economic growth through two channels: directly via monetary tools and banking variables, and indirectly via the association between financial inflows and some macroeconomic variables.

Regarding the direct channel, the monetary tools (interest rate and money supply) show to have a long-run negative impact on economic growth. Therefore, interest rate may have obstructed both investment and consumption (according to the interest rate channel) and increased government cost of borrowing. Furthermore, money supply may have resulted in high inflation, which hindered economic performance. The negative effect of money supply may also be linked to a high leakage of funds out of the economy (i.e. money earned but not injected in the economy), where a large proportion of bank deposits is kept at the central bank. Furthermore, aggregate money supply or demand shocks have resulted in real output fluctuations (Bhattacharya, 2003). Conversely, bank credit and capital show to have a short- and long-run constructive impact on GDP growth, proving the existence of transmission channel through these two variables.

As for the indirect channel, we found that the inflow of foreign capital may have deteriorated economic activity. This was concluded due to the negative short- and long-run association between the deposits of non-resident private sector and economic growth. This relationship was also complemented with a long-run negative effect of public debt and imports on GDP growth.

These findings may call for considering the repercussions of the adopted monetary strategies on economic growth, and suggest the necessity to balance between preserving currency stability and improving economic performance and welfare. Finally, it is worth noting that in a dollarized economy, asymmetric shocks cannot be solely corrected by changes in the monetary policy or the exchange rate policy, particularly if the fiscal policy does not play a countercyclical role in shaping this adjustment (Mitrović-Mijatović and Ivanović, 2017). Therefore, the adjustment must be made through structural reforms that can increase the flexibility of the economy and the relative price and wage adjustments.

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Appendix A: the development of monetary aggregates in Lebanon (LBP trillions) – end year

| | M1 | M2 | M3 | M4 | M2 – M1 | M3 – M2 |
|-----------|-------|--------|--------|--------|---------|---------|
| 1993 | 1.14 | 5.31 | 15.68 | 16.79 | 4.17 | 10.37 |
| 1994 | 1.44 | 8.59 | 19.65 | 21.55 | 7.15 | 11.06 |
| 1995 | 1.56 | 9.66 | 22.88 | 26.23 | 8.10 | 13.22 |
| 1996 | 1.75 | 14.00 | 29.24 | 33.71 | 12.25 | 15.24 |
| 1997 | 1.93 | 14.53 | 34.90 | 40.78 | 12.60 | 20.37 |
| 1998 | 2.05 | 16.55 | 40.51 | 45.78 | 14.50 | 23.96 |
| 1999 | 2.26 | 20.24 | 44.99 | 51.29 | 17.98 | 24.75 |
| 2000 | 2.39 | 19.49 | 49.29 | 55.99 | 17.10 | 29.80 |
| 2001 | 2.38 | 17.46 | 53.34 | 59.47 | 15.08 | 35.88 |
| 2002 | 2.57 | 20.58 | 57.33 | 64.70 | 18.02 | 36.75 |
| 2003 | 2.85 | 26.23 | 64.69 | 70.30 | 23.39 | 38.46 |
| 2004 | 3.03 | 25.98 | 71.31 | 74.81 | 22.95 | 45.33 |
| 2005 | 2.95 | 24.46 | 74.45 | 77.77 | 21.51 | 49.98 |
| 2006 | 3.32 | 23.48 | 80.24 | 84.55 | 20.16 | 56.77 |
| 2007 | 3.58 | 24.83 | 90.20 | 95.81 | 21.25 | 65.37 |
| 2008 | 4.27 | 37.32 | 103.51 | 109.41 | 33.06 | 66.18 |
| 2009 | 4.84 | 51.49 | 123.73 | 131.09 | 46.65 | 72.24 |
| 2010 | 5.73 | 59.40 | 138.91 | 146.82 | 53.67 | 79.51 |
| 2011 | 6.14 | 58.64 | 146.58 | 154.37 | 52.50 | 87.93 |
| 2012 | 7.10 | 65.08 | 156.80 | 164.68 | 57.97 | 91.72 |
| 2013 | 7.62 | 68.75 | 167.57 | 176.81 | 61.13 | 98.82 |
| 2014 | 8.30 | 73.40 | 177.40 | 187.83 | 65.10 | 104.00 |
| 2015 | 9.04 | 78.62 | 186.36 | 197.37 | 69.58 | 107.74 |
| 2016 | 10.16 | 82.43 | 200.19 | 210.99 | 72.27 | 117.76 |
| 2017* | 10.25 | 83.02 | 209.06 | 220.10 | 72.77 | 126.03 |
| 2017/1993 | 8.96X | 15.64X | 13.33X | 13.11X | 17.47X | 12.15X |

Notes: M1 = currency in circulation + sight deposits in LBP. M2 = M1 + time deposits in LBP. M3 = M2 + deposits in foreign currencies + other financial liabilities. M4 = M3 + treasury bills held by the non-banking system. * October.

Appendix B: VAR Lag Order Selection Criteria

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|-----|-----------|----------|-----------|---------|---------|---------|
| 0 | -2957.099 | NA | 4064790 | 33.315 | 33.458 | 33.373 |
| 1 | -936.439 | 3836.983 | 1.15e-05 | 11.330 | 12.617* | 11.852* |
| 2 | -844.094 | 167.051 | 8.41e-06* | 11.012* | 13.443 | 11.998 |
| 3 | -794.428 | 85.3798* | 9.98e-06 | 11.173 | 14.748 | 12.623 |
| 4 | -748.901 | 74.174 | 1.25e-05 | 11.380 | 16.099 | 13.294 |
| 5 | -710.711 | 58.786 | 1.73e-05 | 11.670 | 17.533 | 14.048 |
| 6 | -674.700 | 52.196 | 2.49e-05 | 11.985 | 18.992 | 14.826 |
| 7 | -625.934 | 66.299 | 3.17e-05 | 12.156 | 20.307 | 15.462 |
| 8 | -567.588 | 74.080 | 3.72e-05 | 12.220 | 21.515 | 15.989 |

Notes: * indicates lag order selected by the criterion. Endogenous variables: COINC_INDEX, DEP_RATE, M2, NON_RESID_DEP, CAPITAL, PRIV_CLAIM, PUB_DEBT, IMPORTS. Exogenous variables: C. Included observations: 178.

Appendix C: VEC Residual Portmanteau Tests for Autocorrelations

| Lags | Q-Stat | Prob. | Adj Q-Stat | Prob. | df |
|------|--------|---------|------------|---------|-------|
| 1 | 1 | 5.913 | NA* | 5.946 | NA* |
| 2 | 2 | 22.329 | NA* | 22.543 | NA* |
| 3 | 3 | 79.808 | 0.998 | 80.980 | 0.997 |
| 4 | 4 | 143.458 | 0.988 | 146.052 | 0.982 |
| 5 | 5 | 182.602 | 0.999 | 186.295 | 0.998 |
| 6 | 6 | 247.804 | 0.997 | 253.708 | 0.993 |
| 7 | 7 | 307.096 | 0.996 | 315.358 | 0.989 |
| 8 | 8 | 368.249 | 0.994 | 379.307 | 0.983 |
| 9 | 9 | 470.356 | 0.856 | 486.695 | 0.702 |
| 10 | 10 | 539.993 | 0.795 | 560.357 | 0.582 |
| 11 | 11 | 609.705 | 0.731 | 634.528 | 0.464 |
| 12 | 12 | 701.611 | 0.433 | 732.883 | 0.161 |

Notes: Null Hypothesis: no residual autocorrelations up to lag h. The test is valid only for lags larger than the VAR lag order. Included observations: 183.