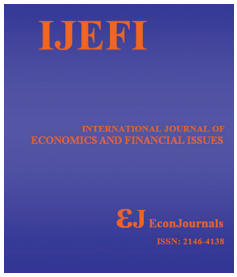

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The Economics of Bounced Checks in Lebanon

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ABSTRACT

The purpose of this paper is to identify the variables that determine or explain the supply of bounced checks, either issued in Lebanese pounds or issued in US dollars. This is an area that the extant empirical research fails to cover, and hence, this paper is, by itself, quite innovative. Four major explanatory variables are identified. Two of them are structural, and the other two are under the control of a bank on its own, and of the central bank, or at least of the Association of Banks. The high values of the goodness-of-fit, the favorable econometric diagnostics, and the failure to reject stability, all point to the same direction: The models have all the necessary characteristics to predict correctly bounced checks. In case actual bounced checks are consistently and persistently higher than those predicted by the models, corrective action can be taken to avert a financial crisis. The first action is that banks can control the amount of loans they extend to their clientele. And the second action is by a manipulation of interest rates. It is understood that these two actions should be used sparingly and only in a case of financial crisis.

Keywords: Bounced Checks, Multiple Regression Models, Econometric Prediction, Banks, Lebanon
JEL Classifications: C32, G21

1. INTRODUCTION

Bounced checks are mostly drawn checks without enough provision for cover. In the check clearing process some bounced checks may be due to a false signature, or to a bad or wrong wording of the check, or, even, to checks that are post-dated. Post-dated checks are illegal in Lebanon and can be presented for payment without delay and especially at any time before the recorded postponed date. It is impossible to disentangle the different categories of bounced checks. In this paper it is assumed that all bounced checks are checks without enough cover or provision. The other categories are left to be part of the regression intercept or part of the regression residual. If these other categories are part of the regression constant the bias and efficiency of the other regression coefficients are preserved. The problem arises if they are part of the residual, creating a classic case of errors in measurement. For this purpose the regression residuals will be extensively and intensively examined for any econometric anomalies by diagnostic tests.

The literature on bounced checks was initiated by Fusaro (2004, 2007, 2008, and 2009) and Fusaro and Ericson (2010) whose major concern was about overdraft protection. We found only one paper that considered the economics of bounced checks (Erdem and Tugcu, 2015). Unfortunately in this paper the thrust of the argument was to find evidence for bad ethics and its impact on the growth of the economy. Implicitly gross domestic product growth was assumed endogenous and bounced checks exogenous. The approach in this paper is to the opposite: Growth is exogenous and bounced checks are endogenous, the latter being the dependent variable that should be explained. A negative correlation of bounced checks with growth implies two opposite scenarios. One is that bad ethics adversely affect growth, like in Erdem and Tugcu (2015), or alternatively that bounced checks (or crime) increase when the economic outlook deteriorates. This is the scenario adopted in this paper. Besides a proxy for growth the regression equation includes other explanatory variables that economic theory predicts to have an influence on bounced checks. In short the purpose of this paper is to identify the determinants of the supply of bounced checks. A weak alternative to bounced checks is to borrow money overdraft. If borrowing is hampered then bounced checks substitute for the lack of funds, and ensure the deferment of payment. Hence the economic determinants of

bounced checks are closely related to those of borrowing, except that the effects are in the opposite direction. The data utilized in the analysis was made available by courtesy of the central bank of Lebanon, which carries out the clearance of all checks, and this data has not been published nor studied anywhere else.

The paper is organized as follows. In the next section, section 2, a brief overview of the legal aspects of checks in Lebanon is provided. In section 3 the explanatory variables, to the supply of bounced checks, will be identified and the theoretical models will be presented. Section 4 is the empirical part, and provides for the estimation results. It consists of two divisions. The first studies Lebanese pound bounced checks, and the second studies US dollar bounced checks. It is important to mention that the dollarization in Lebanon is very high exceeding the 60% mark. The last section summarizes the paper and concludes.

2. LEGAL ASPECTS

A check is a negotiable financial instrument issued by a drawer against a drawee, usually a bank, and to the order of a beneficiary. Article 409 of the Lebanese commercial code (LCC) states that the term "check" designates an instrument that carries no restrictions or conditions for the payment of a fixed amount of money, and that specifies the date and venue (place) of the issuance and the venue of the payment. But above all it should be signed by the drawer.

A check is issued only against a bank, the drawee, which should have enough funds within the disposal of the drawer, based upon express or implied contract with the drawer as regards to the use of funds via checks. A check can be issued to a particular beneficiary, or to his order, or even without the term "order," or to the holder, and any condition, like the mention of interest on the check, is void (articles 4/5 of LCC).

The check as a negotiable instrument can be transferred by endorsement at the back of the check without any conditions or restrictions (Article 420 LCC). It is payable at sight, and any condition to the contrary is void, even if the check is presented for payment prior to the stipulated date on the check. The drawer cannot object to the payment of the check except in case the check is lost or in case of bankruptcy. However, death of the drawer, or a loss of his legal capacity, will not affect the check (Article 428 of LCC).

The check is a special form of a bill of exchange, or commercial paper, as mentioned in the LCC whereby the drawee is a bank, and it is regulated by the LCC, by the penal code along with other administrative rules issued by the central bank. It is considered as a tool of payment enjoying almost an equal payment power as a banknote. Other negotiable instruments do not enjoy the privilege of protection by the penal code as the check does.

Article 666 of the penal code punishes any drawer by imprisonment from 3 months up to 3 years and by a fine ranging from one million Lebanese pounds (around 600 US dollars) till four million Lebanese pounds (around 2600 US dollars), if he issues a check without any prior payable provision or insufficient provision or who revokes the provision or partially revokes the provision or even makes a prevention of payment to the drawee other than in the cases mentioned in article 428 of the LCC. This punishment is not inflicted upon the drawer only, but the beneficiary is also subject to such punishment whenever he receives a check with prior knowledge that it is without provision (bounced check). It should be noted that the central bank has issued an administrative circular whereby any person who issues a bounced check will be registered on a "black list" which will prevent him from the issuance of future checks.

It has been realized in the past 10 years that individuals and legal entities receive checks with postponed date i.e. the check is actually issued on a date before the stipulated date on the check itself and negotiated within the financial market to be presented to the drawee at the mentioned date with a variable period of time between the two dates.

A bounced check can also be a check with a non-identical signature of the drawer, or a forged signature, or a check without signature, or a check with any other manipulated information.

3. THE MODEL

We have identified seven potential explanatory variables of bounced checks. The value of these bounced checks are denoted as log (bouncedlbp). The adjustment by log is by the natural log. It is known that log adjustment of variables that are trendy and strictly positive can eliminate skewness and stabilize the variance. Moreover since all variables are logged, including the explanatory ones, then the estimated coefficients are elasticities. Finally the change in logs is approximately a percentage change in decimal terms. For all these reasons a log-log functional form is better advised. As for the market in dollars, the logged value in dollars of bounced checks is denoted by log (bouncedusd). The definition, the theoretical relations with the dependent variable, and the expected impact signs are listed hereafter. The variables are defined for the supply of the Lebanese pound bounced checks but equivalent definitions for the variables that explain the supply of US dollar bounced checks can be determined. Hence instead of loans in Lebanese pounds the equivalent variable is loans in US dollars. Instead of the total amount of checks cleared in Lebanese pounds, the equivalent variable is the total amount of checks cleared in US dollars. And finally, instead of the total number of bounced checks in Lebanese pounds the equivalent variable is the total number of bounced checks in US dollars. All the other variables remain the same. The chosen variables are:

- Loans in Lebanese pounds to the private sector by the commercial banking system. Since borrowing is a substitute for issuing a bounced check, the relation ought to be negative, implying that the availability of loans reduces the incentives to write checks without enough provision. The relation would also be negative if more loans create more deposits which, in turn, replenish the pockets of the bank clientele and thereby reduce the propensity to issue bounced checks. However and contrariwise, if loans are extended to big corporations and to wealthy individuals, as is usually the case, the loans to the smaller clientele dry up sooner or later, and these

small borrowers resort to the issuance of bounced checks to compensate for the aridity of the funds. Moreover if loans and borrowings are high, many borrowers may reach the ceiling of their debt capacity, and in order to borrow more, and stretch their liquidity constraint, they resort to checks that they know will bounce. Therefore the expected sign on loans is an empirical question. In fact some of the variables that come next, and that will be included in the regressions, depend on the notion that loans by overdraft and bounced checks are substitutes and hence the overwhelming net expected sign of loans is likely to be predominately positive, ceteris paribus. A major contrary argument runs as follows. Banks are in the business of selling loans. More loans are equivalent to more sales for a private firm. With more sales uncollectible accounts inevitably increase. In the case of a bank uncollectible accounts are bounced checks. If this reasoning is true then there should be a positive relation between the amount of loans (sales) and bounced checks (uncollectible accounts). This variable is denoted as log (loanslbp) and it is also adjusted by taking natural logarithms.

- Weighted interest rate on US dollar deposits. A higher rate of interest on foreign deposits makes borrowing relatively more expensive in foreign currency, making borrowing in Lebanese pounds relatively less expensive. Since bounced checks are substitutes to borrowing in Lebanese pounds bounced checks in Lebanese pounds fall. So the expected relation is negative. This variable is denoted as log (iusd), and is also logged.
- Weighted interest rate on deposits in Lebanese pounds. A higher domestic interest rate makes borrowing more expensive, which encourages the issuance of bounced checks in Lebanese pounds, as long as bounced checks are substitutes to borrowing. This variable is denoted as log (ilbp), and it is logged as usual. Some may recommend that, instead of taking the domestic and foreign interest rates separately, taking the spread between them is more appropriate. Theoretically this is highly plausible for the case in Lebanon. However as we will see below the estimated coefficients on the two interest rates differ significantly in absolute values? Therefore taking the spread will result in a loss of precious information. Moreover and also theoretically the absolute value of the cross price elasticity is expected to be lower in value that the own price elasticity.
- The total amount of cleared checks in Lebanese pounds. This variable is a scale variable and measures the total pool of checks out of which a certain proportion will be in bounced checks. This implies a positive relation. However, this variable can be considered to be a proxy for economic activity, or a proxy for all transactions carried out in Lebanese pounds. The expected impact sign becomes negative: Better economic conditions reduce the supply of bounced checks. So the sign of the relation is ambiguous and should be estimated empirically. This variable is denoted as log (clearedlbp), and is also logged.
- Number of bounced checks. If the average amount of all bounced checks is stable and varies little a bigger number of bounced checks will lead to more bounced checks in total value. So the relation is expected to be positive. This variable is denoted as log (clearnumberlbp) and is also logged.
- Money supply M3. More deposits or currency will tend to make the bank clientele wealthier and so bounced checks ultimately diminish because of the existence of more liquidity in the system. This variable is denoted as log (M3), and it is taken in logs. The effect of money supply creation on liquidity may take some time and be delayed. This is a reasonable assumption but since the data is monthly, and not daily or weekly, we believe there is enough time for liquidity to adjust to M3.
- Coincident indicator. This variable, which is intended to measure consumer and business confidence, and therefore economic activity, should be negatively related to the amount of bounced checks. More business makes everybody better off and better positioned financially in the market. This variable is denoted log (ci), and clearly in logs.

The regression equation will take the following functional form for the market for checks in Lebanese pounds:

$$\log(\text{bouncedlbp}) = \alpha_0 + \alpha_1 \log(\text{loanslbp}) + \alpha_2 \log(\text{iusd}) + \alpha_3 \log(\text{ilbp}) + \alpha_4 \log(\text{clearlbp}) + \alpha_5 \log(\text{bouncednumberlbp}) + \alpha_6 \log(\text{M3}) + \alpha_7 \log(\text{ci}) + \epsilon$$

Where α_0 to α_7 are coefficients to be estimated, and the regression residual is ϵ. A similar regression is estimated for the market of US dollar checks. In this case the dependent variable is the log of the total value of the amount of bounced checks in US dollars log (bouncedusd), and the three different variables are the logs of the total loans in US dollars log (loansusd), the log of the number of checks cleared in US dollars log (clearusd), and the log of the number of bounced checks in US dollars log (bouncednumberusd). The regression equation will take the following functional form for the market for checks in US dollars:

$$\log(\text{bouncedusd}) = \beta_0 + \beta_1 \log(\text{loansusd}) + \beta_2 \log(\text{iusd}) + \beta_3 \log(\text{ilbp}) + \beta_4 \log(\text{clearusd}) + \beta_5 \log(\text{bouncednumberusd}) + \beta_6 \log(\text{M3}) + \beta_7 \log(\text{ci}) + \xi$$

All the variables are retrieved from the web site of the Lebanese central bank, except the data on bounced checks which was provided thankfully and gratefully by Mr. Najib Anwar Choucair, Executive Director, Head of Banking Department, Banque Du Liban, the central bank in Lebanon.

4. THE EMPIRICAL RESULTS

Table 1 presents the empirical results on the variables denominated in Lebanese pounds. Three regressions are carried out. The first one (Model 1) includes all seven explanatory variables identified in the previous section. The second one (Model 2) excludes the money supply and the coincident indicator which are found to be statistically insignificant in Model 1. The third one (Model 3) excludes from Model 1 the number of bounced checks and the coincident indicator. All variables are in natural logs in order to stabilize the variance, reduce the risk of heteroscedasticity, and obtain directly elasticities from the estimated coefficients.

Table 1: Estimation of the supply of bounced checks by OLS. The dependent variable is the natural log of the total value of bounced checks in billions of Lebanese pounds

Explanatory variables	Model 1	Model 2	Model 3
Constant	−11.2630 (3.5352)	−13.4794 (7.4191)	4.7980 (1.4146)
Log loans in LBP	0.5525 (2.4250)	0.3487 (3.3692)	1.3987 (5.2104)
Log interest rate on USD deposits	−0.3858 (2.0698)	−0.31376 (2.7667)	−0.9269 (4.0555)
Log interest rate on LBP deposits	1.6055 (3.7697)	1.3513 (3.8737)	2.2455 (4.1190)
Log value of cleared checks in LBP	0.3430 (2.1323)	0.3425 (2.5854)	0.4370 (2.0957)
Log number of bounced checks	0.7940 (8.7950)	0.7651 (10.536)	-
Log money supply M3	−0.5245 (1.1652)	-	−1.5640 (2.7718)
Log coincident indicator	0.2682 (1.0744)	-	-
Econometric diagnostics			
Adjusted R-square	0.8542	0.8532	0.7538
Durbin-Watson statistic	2.01676	2.01422	1.70329
Akaike information criterion	−1.457761	−1.467219	−0.942199
Ljung-Box Q-statistics on the residuals:			
Lag 3	0.082	0.108	0.361
Lag 6	0.112	0.160	0.622
Lag 12	0.479	0.564	0.469
Lag 24	0.629	0.555	0.718
Ljung-Box Q-statistics on the squares of the residuals:			
Lag 3	0.857	0.814	0.333
Lag 6	0.967	0.949	0.436
Lag 12	0.999	0.999	0.538
Lag 24	0.985	0.981	0.933
Jarque-Bera normality test on the residuals	0.00000	0.00000	0.16986
RESET test with 2nd and 3rd powers of fitted values	0.6625	0.6337	0.0949

The sample size is from January 2006 till October 2015, i.e., 118 monthly observations per variable. In parentheses are absolute t-statistics. LBP stands for Lebanese pounds. USD stands for the US dollar. The actual P values of the Q-statistics are reported. The actual P values of the Jarque-Bera tests are reported. The actual P values of the RESET stability tests are reported. OLS: Ordinary least square

In the three models all variables have statistically significant coefficients, except for two variables, the coincident indicator and the money supply M3, both in Model 1. An F-test on the joint significance of these two variables fails to reject the null of no significance with an actual P value of 0.2607. Therefore these two variables are omitted from Model 2 of Table 1. The R-squares are relatively high for regressions with monthly data ranging from 0.7538 (Model 3) to 0.8542 (Model 1). The signs of the coefficients are in accordance with most expectations. Loans in pounds have a positive relation with the dependent variable, which is the total value of bounced checks in Lebanese pounds. A one percent increase in loans increases the dependent variable by 0.553% (Model 1), by 0.349% (Model 2), and by 1.399% (Model 3). A one percent increase in the interest rate on US dollars, e.g. from 10% to 10.1%, decreases the dependent variable by 0.386% (Model 1), by 0.314% (Model 2), and by 0.927% (Model 3). A one percent increase in the interest rate on Lebanese pounds increases the dependent variable by 1.606% (Model 1), by 1.351% (Model 2), and by 2.246% (Model 3). A one percent increase in cleared checks in Lebanese pounds increases the dependent variable by 0.343% (Model 1), by 0.343% (Model 2), and by 0.437% (Model 3). A one percent increase in the number of bounced checks increases the dependent variable by 0.794% (Model 1), and by 0.765% (Model 2). A one percent increase in the money supply M3 decreases the dependent variable by 0.525% (Model 1), and by 1.564% (Model 3). The first coefficient is statistically insignificant. The coincident indicator does not enter the regression in Model 1 significantly, and carries anyway the wrong impact sign. The constants of the regressions carry no meaning since the independent variables are all in logs and can be equal to zero only for the value of 1, and not zero, which is pointless.

In order to differentiate the three models in Table 1 we have recourse to the Akaike information criterion (AIC). Although Model 1 has the highest adjusted R-square the AIC selects Model 2. Model 3 seems to have biased coefficients in regard to the other two models, maybe because one highly significant variable, the number of bounced checks, is omitted from the estimation. Table 1 reports also that all three models have well-behaved residuals. The Durbin-Watson statistic is satisfactory. Higher order serial correlation, tested by the Ljung-Box Q-statistics on the residuals, is absent. Higher order conditional heteroscedasticity, tested by the Ljung-Box Q-statistic on the squares of the residuals, is not a problem. We are using the same statistic to test for serial correlation and conditional heteroscedasticity, as measured by the Ljung-box Q-statistic, though the underlying variable is different. In one case it is the residual that is tested, and in the other case, it is the squares of the residuals that are tested. To differentiate the two and avoid confusion some call the heroscedasticity test as a Q^2-statistic. The RESET stability test finds evidence for stability. The only minor discrepancy is the non-normality of the residuals in Models 1 and 2 relative to Model 3, for which the null hypothesis of normality is not rejected. The Central Limit Theorem can be invoked for Models 1 and 2. The rest of the analysis dwells exclusively on Model 2.

Figure 1 reproduces the recursive residuals of Model 2. There are 3 major anomalous values that go beyond two standard errors. Since the sample size is 118 observations, this amounts to approximately 2.5% of the total, which corresponds to a confidence interval of 95% in a normal distribution.

Figure 2 reports the CUSUM graph for Model 2. All values are within the 95% bounds. This is an additional element of evidence

Figure 1: Recursive residuals of Model Regression 2 in Table 1

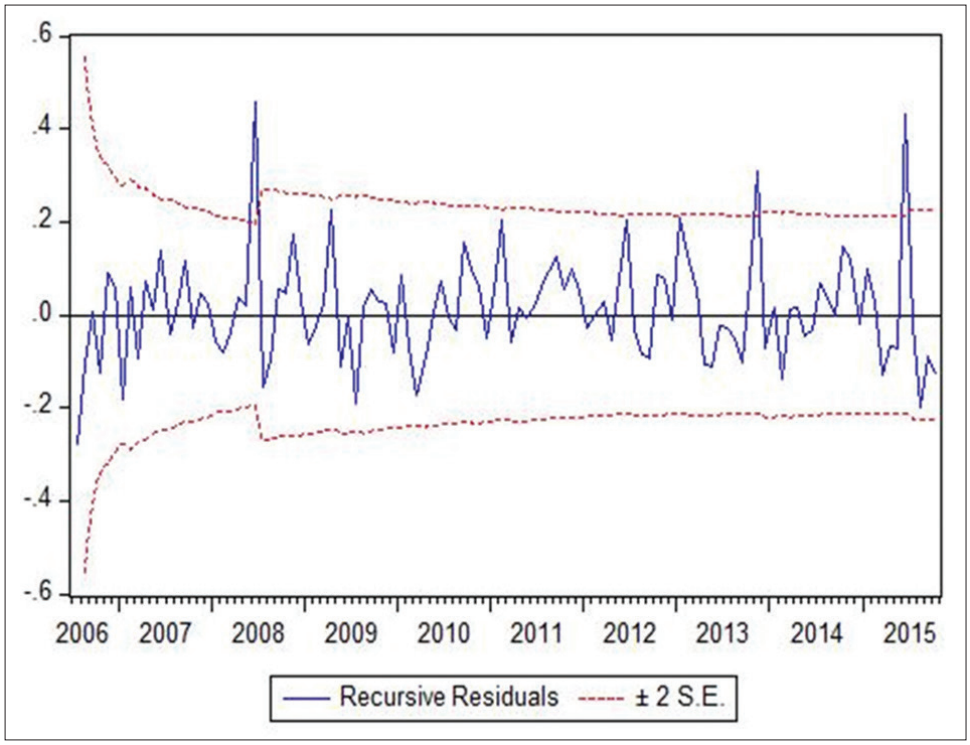
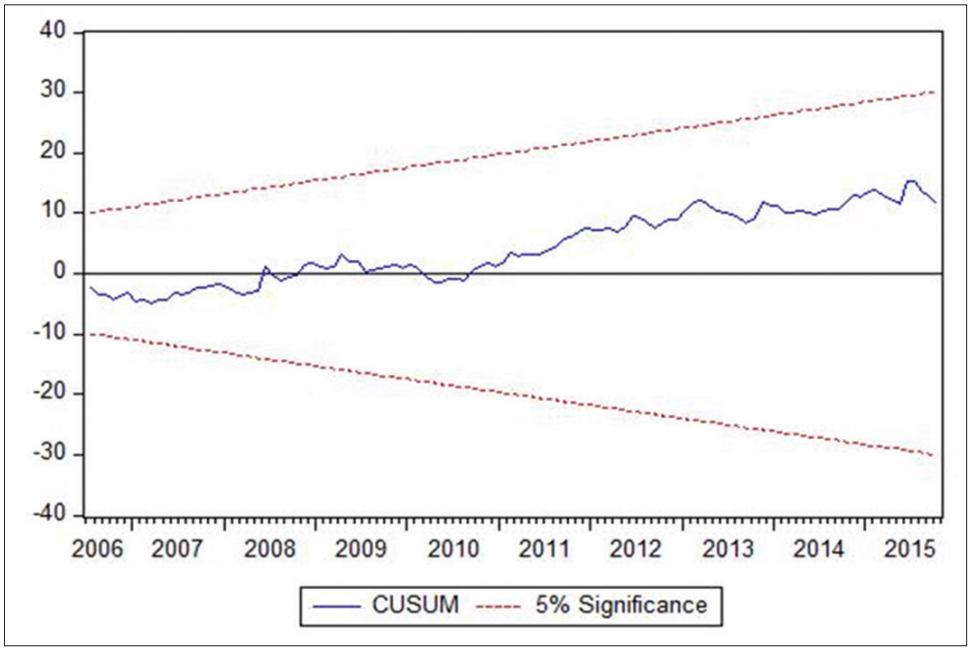


Figure 2: CUSUM of residuals of Model Regression 2 in Table 1



to stability and proper specification. Figure 3 reports the CUSUM of squares for Model 2. Again all values are within the bounds. This shows that heteroscedasticity is not present. Hence the regression in Model 2 has all of the required specifications, and can be relied upon to describe and predict the supply of bounced checks in Lebanon. Notably there is no necessity to estimate other econometric models, like robust least squares.

Table 2 presents the empirical results for the variables denominated in US dollars. Three models are carried out (Models 4, 5 and 6). Models 4 and 5 are ordinary least square while Model 6 is a robust least squares with adjustment to outliers in both the dependent and the independent variables (MM-estimation). Robust least squares was implemented because the other two models fail some econometric diagnostics. Four coefficients have insignificant t-statistics. These belong to the following variables: (a) The log of the weighted-average interest rate on US dollars, (2) the log of money supply M3, and (3) the log of the coincident indicator, and (4) the log of total loans in dollars. When an F-test is conducted on the joint significance of the first three variables, the null hypothesis

Figure 3: CUSUM of squares of the residuals of Model Regression 2 in Table 1

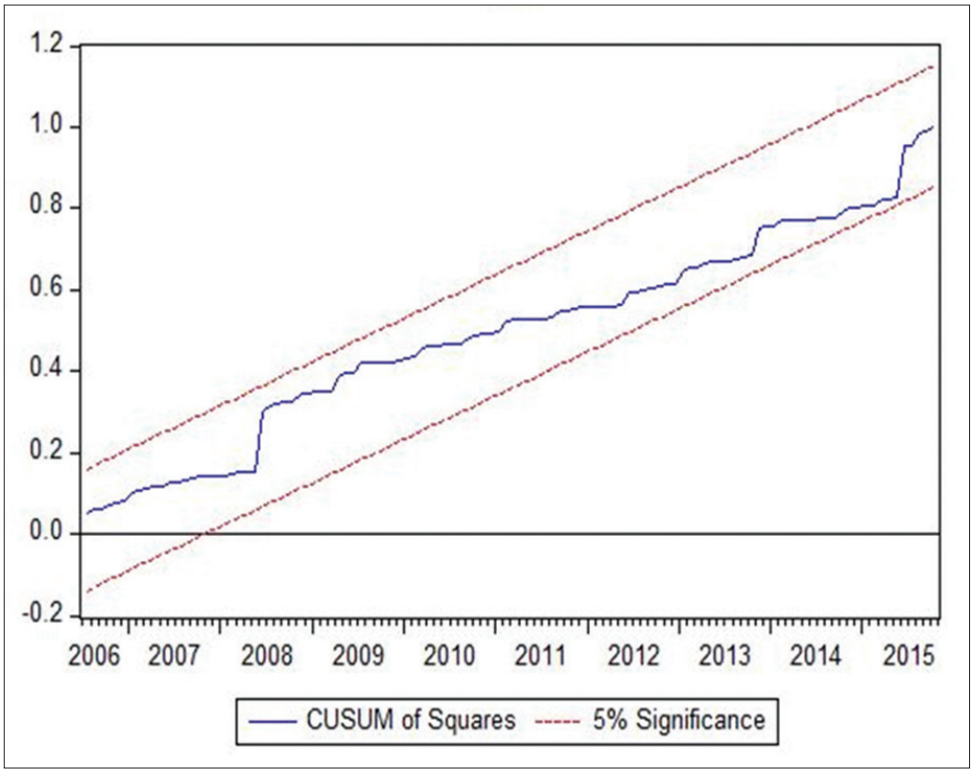


Table 2: Estimation of the supply of bounced checks by OLS (Models 4 and 5), and by MM-estimation of robust least squares (Model 6). The dependent variable is the log of bounced checks in millions of US dollars

Explanatory variables	Model 4	Model 5	Model 6
Constant	−21.229 (5.5442)	−16.157 (6.3357)	−16.809 (11.1231)
Log loans in USD	−0.2016 (0.4134)	0.6769 (4.8213)	0.8717 (10.4777)
Log interest rate on USD deposits	−0.0699 (0.3429)	-	-
Log interest rate on LBP deposits	1.1498 (3.0323)	0.8189 (2.3092)	0.9405 (4.4755)
Log total value of cleared checks in USD	0.5025 (4.0054)	0.62123 (7.1118)	0.4317 (8.3389)
Log of the number of USD bounced checks	0.7702 (7.5083)	0.7449 (8.6558)	0.7473 (14.654)
Log money supply M3	1.1381 (1.7979)	-	-
Log coincident indicator	0.1276 (0.4433)	-	-
Econometric diagnostics			
Adjusted R-square	0.8526	0.8480	0.7235
Adjusted Rw-squared	1.82879	1.70221	0.9561
Durbin-Watson statistic	1.006692	0.999672	-
Akaike information criterion			
Ljung-Box Q-statistics on the residuals:			
Lag 3	0.141	0.261	0.245
Lag 6	0.134	0.232	0.139
Lag 12	0.268	0.548	0.343
Lag 24	0.284	0.413	0.359
Ljung-Box Q-statistics on the squares of the residuals:			
Lag 3	0.788	0.939	0.966
Lag 6	0.899	0.784	0.807
Lag 12	0.994	0.987	0.993
Lag 24	0.942	0.933	0.954
Jarque-Bera normality test on the residuals	0.00000	0.00000	0.00000
RESET test with 2nd and 3rd powers of fitted values	0.2512	0.0639	-

OLS: Ordinary least square

of no significance fails to be rejected with an actual P value of 0.0939. This ANOVA F-test is based on what some call a Chow test. It relies on comparing the sum of squares of the restricted model, without the three variables, to the sum of squares of the unconstrained regression that include these three variables. Some also call this test as a Wald test. Three coefficients are statistically significantly different from zero in Model 4. These belong to (a) the log of the LBP stands for Lebanese pounds (LBP) interest rate, (b) the log of all US dollar checks cleared, and (c) the log of the number of US dollar checks that have bounced. Despite the

inclusion of three other variables these coefficients are not that far away from their corresponding coefficients in Models 5 and 6. These three coefficients are also highly significant statistically in Models 5 and 6. In Models 5 and 6 there is an additional variable that has a statistically significant coefficient and this is loans in US dollars. The impact sign is positive, as expected from the relation sales/uncollectible advanced earlier. A one percent increase in loans in US dollars increases the supply of US dollar bounced checks by 0.677% (Model 5), and by 0.872% (Model 6). A one percent increase in the interest rate on Lebanese pounds increases US dollar bounced checks by 1.150% (Model 4), 0.819% (Model 5), and 0.941% (Model 6). The positive signs on this variable may be misleading. In fact a higher interest rate on Lebanese pounds is an indicator that US dollar interest rates are going to rise, which leads to lower borrowings in US dollars and more financing by US dollar bounced checks. A one percent increase in the amount of US dollar checks cleared by the central bank increases US dollar bounced checks by 0.503% (Model 4), 0.621% (Model 5), and 0.432% (Model 6). The coefficient signs are as expected. A 1% increase in the number of US dollar bounced checks increases US dollar bounced checks by 0.770% (Model 4), 0.745% (Model 5), and 0.747% (Model 6). The signs of these coefficients remove the ambiguity of the expected signs.

Although Model 4 has a higher value for the AIC relative to Model 5, Models 5 and 6 are more reliable econometrically. There seems to be a multicollinearity problem in Model 4. Model 6 is also preferred to Model 5 because Model 6 adjusts for outliers in the dependent and independent variables and leaves in the regression the same variables as in Model 5. In fact the presence of outliers exists as Figure 4 for the recursive residuals of Model 5 shows. As a result the statistical significance, as evidenced by the t-statistics, is much higher in Model 6 than in Model 5, while the coefficient estimates vary little between these two models. Finally, there are no higher-order serial correlation and higher-order conditional heteroscedasticity in the residuals from all three models, as measured by the Ljung-Box Q-statistics on the residuals, and the Ljung-Box Q^2-statistics on the squares of the residuals. The only discrepancy is the rejection of normality of the residuals for these two models. Model 5, in addition, does not fail the stability test when the RESET test is applied.

These results added to the previous results for Lebanese pound variables ascertain two notions, Firstly banks can be considered firms that sell loans, and secondly bounced checks are a substitute for borrowing by overdraft. These two notions apply to the supply of Lebanese pound bounced checks and to the supply of US dollar bounced checks. The high values of the goodness-of-fit, the favorable econometric diagnostics on the residuals, and the failure to reject stability in the estimated models, all point to the same direction: The models are reliable and have all the necessary characteristics to predict correctly bounced checks.

Figure 4 depicts the recursive residuals of Model 5. There are four outliers out of 118 observations, which is as expected. Otherwise the graph is acceptable. Figures 5 and 6 reproduce the CUSUM and CUSUM of squares tests for the residuals in Model 5. While there is no evidence for the instability of the error term in Figure 5,

Figure 4: Recursive residuals of Model Regression 5 in Table 2

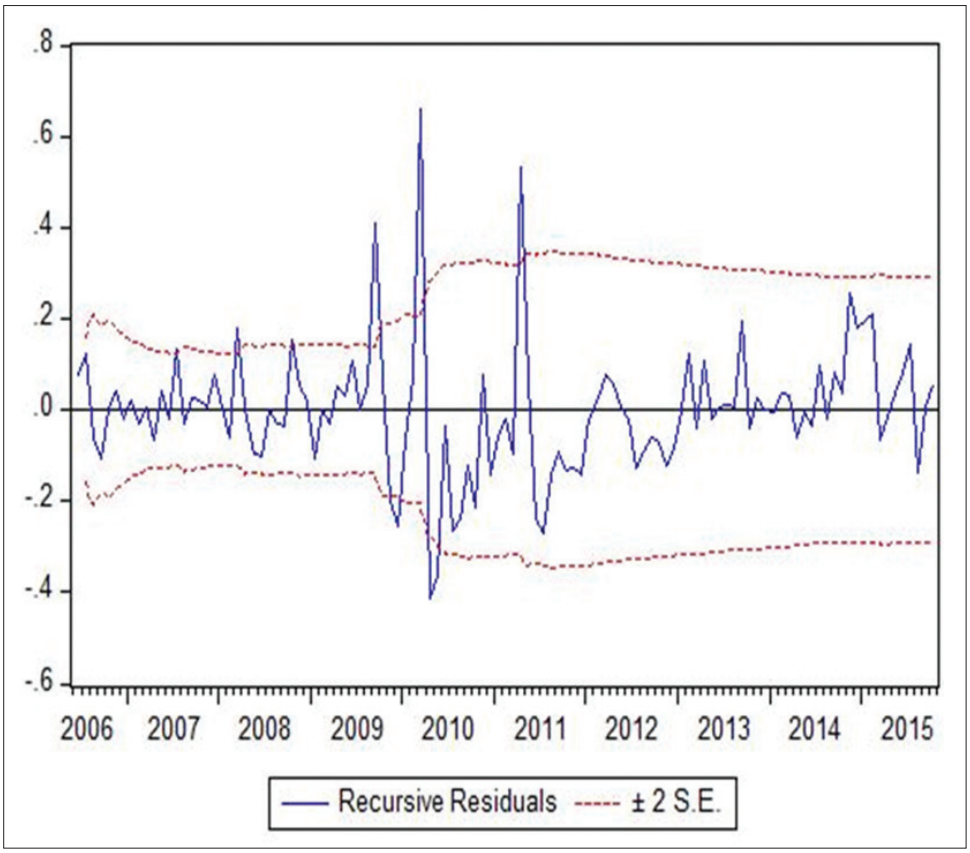


Figure 5: CUSUM of residuals of Model Regression 5 in Table 2

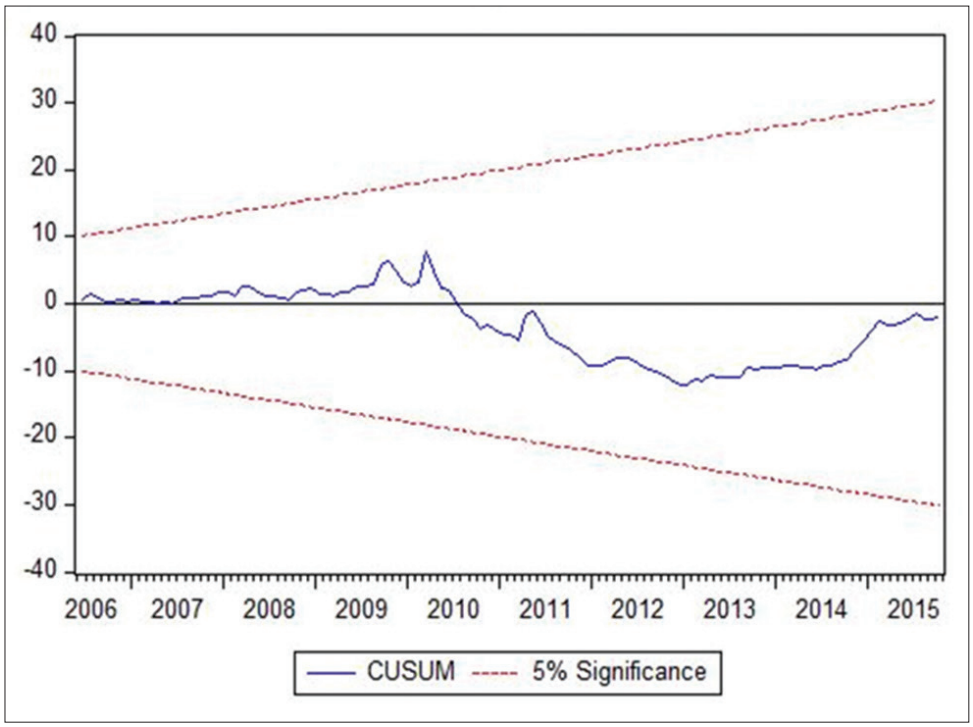
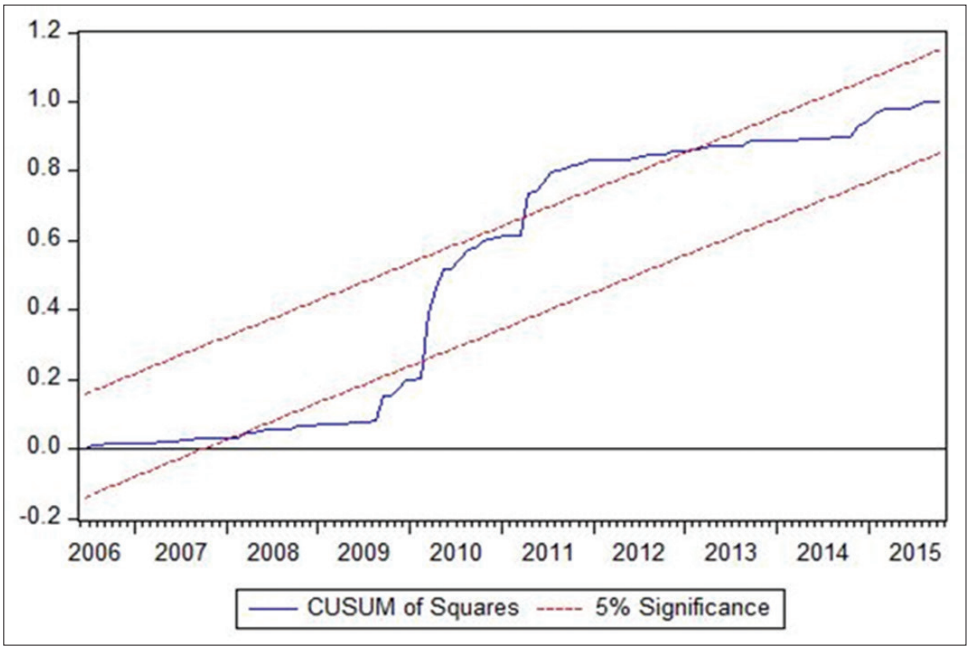


Figure 6: CUSUM of squares of the residuals of Model Regression 5 in Table 2



and therefore correct specification of the model is not rejected, Figure 6 shows some instability in the variance of the residuals. This shows that the behavior of bounced checks is different, and maybe less stable, when Lebanese pound bounced checks are compared to US dollar bounced checks.

The two models that were statistically well supported, Model 2 from Table 1 and Model 6 of Table 2, are now compared. The elasticity effect of respective loans is 0.349 for Model 2 and 0.872 for Model 6. Hence these elasticities are most probably different. The response of bounced checks to more loans is more elastic for the model in US dollars, relative to the model with LBP pounds. This implies that debt is a better substitute to bounced checks in the foreign currency market. The reason for such a higher elasticity is unclear. The elasticity on the interest rate on Lebanese pounds has the same sign in both models, and takes the following two values 1.351 (Model 2) and 0.941 (Model 6). Most probably these elasticities are different. In this case it is the elasticity of the Lebanese market to be more responsive that the one in the US dollar market. The scale effect on bounced checks, as proxied by the total amount of cleared checks, is 0.343 in the Lebanese market compared to 0.432 in the foreign US dollar

market. There is a high likelihood that these elasticities are statistically not different. Finally the number of bounced checks has surprisingly the same elasticity: 0.765 (Model 2), and 0.747 (Model 6). As a conclusion it seems that the two markets are partially segregated, and may be subject to different influences, although not to different variables. It is noteworthy that although Model 6 is preferred to Model 5, the magnitudes of the coefficients are quite close. For example the loan elasticity is 0.677 (Model 5) and 0.872 (Model 6). The interest elasticties are respectively 0.819 and 0.941. The scale effect is also similar being respectively 0.621 and 0.432. And the effects of the number of bounced checks in US dollars are also very close, being 0.745 and 0.747. Even the intercepts are close, being respectively −16.16 and −16.81. The major departure between Model 5 and Model 6 is the t-statistics that are consistently higher in Model 6.

5. CONCLUSION

This paper studies the determinants of the supply of bounced checks, whether denominated in Lebanese pounds or in US dollars. One should remember that the dollarization rate in Lebanon is relatively high, exceeding 60%. This means that the amount and value of checks in US dollars that circulate in the economy are substantial. It was found that four variables help in explaining the supply of bounced checks. Two of these variables are structural, like the number of bounced checks and the total value of cleared checks, and are not under the control of the banking institution. Two other variables are controllable, and they are the amount of loans granted, and the Lebanese interest rate. One special feature of the results is that reducing the interest rate on the Lebanese pounds serves to reduce bounced checks, whether denominated in Lebanese pounds or in US dollars. The two general models estimated for bounced checks can be used to predict a "normal" value for bounced checks, given the magnitude of the explanatory variables. If this "normal" value does not accord with the actual value corrective action can be forthcoming. For example if bounced checks consistently and persistently overshoot their "normal" values, this initiates a signal of financial crisis, the central bank may restrict the flow of the money supply, or banks may either reduce the amount of loans granted to the economy, or reduce the interest rate levels by collusion with other banks or even by collusion with the central bank. Such remedial action should be enough to avert the crisis and should be used only sparingly, because it may scare away depositors.

Since this paper has innovated by studying a subject matter that has not attracted the attention of researchers, an avenue for future research is to estimate the same models for other countries, or, maybe, to a different period. One limitation of the analysis is that bounced checks include checks issued with good faith but with a false signature, or by contradicting the labels. Since these bona facie checks will show up as part of the intercept or the residual, an extensive and intensive analysis of the regression residuals is warranted. Fortunately it is found that in general the regression residuals are well-behaved. The model selected to represent the Lebanese segment of the market fails statistically no econometric diagnostics, whereas the model for the US dollar segment of the market may be improved. It was also discovered that the responsiveness of the dependent variable is in general less elastic in the Lebanese segment which implies that the two markets are effectively segregated. One surprising finding is that the US dollar segment of the market responds positively to the Lebanese interest rate and is not affected by the US dollar interest rate.

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