The determinants of excess reserves in the banking system of Papua New Guinea

Thomas Wangi

Australian National University

The existence of excess reserves in the banking system is a common feature in developing countries (Agenor et al., 2004; Khemraj, 2009; Nguyen et al., 2015). The commercial banks hold unremunerated excess reserves for a number of reasons. Agenor et al. (2004) and Saxegaard (2006) identify them as precautionary and involuntary factors. From the macroeconomic perspective, the factors may have positive and negative impacts on demand for excess reserves. For example, Primus et al. (2014) suggest that increased government expenditure can lead to persistent accumulation of involuntary excess reserves in commercial banks. In Papua New Guinea (PNG) where the financial system is underdeveloped, commercial banks hold significant reserves in central bank accounts to meet unexpected liquidity shocks and regulatory requirements of Bank of PNG (BPNG), the central bank. However, excess reserves may have undesired implications on transmission of monetary policy, inflation, bank profitability and private sector lending.

There are several papers empirically studied the demand for bank excess reserves in developing economies. The studies of Agenor et al. (2004), Fielding and Shorthand (2005), Bathaluddin et al. (2012 and Nguyen et al. (2015) investigate precautionary reasons for holding excess reserves by commercial banks. Khemraj (2009), Hamma and Ejbari (2013) and Ukeje et al. (2015), on the other hand, explore precautionary and involuntary factors that influence excess reserves. Saxegaard (2006), however, examines the determinants of precautionary and involuntary excess reserves using separate models. In PNG, several reports have recognized the presence of excess reserves in the banking system (see, BPNG, 2016; IMF, 2017). However, to the best of my knowledge, there is no empirical study has been conducted to determine why profit-maximizing commercial banks hold unremunerated excess reserves in PNG. Therefore, this study aims to fill the research gap by investigating the dynamic effects of precautionary and involuntary factors on excess reserves.

To empirically investigate the determinants of excess reserves, careful consideration is given to the selection of explanatory variables and their relevance to PNG. The variable selection is based on previous studies (Agenor et al., 2004; Saxegaard, 2006; Khremjar, 2009; Anderson-Reid, 2011), data availability and domestic features such as monetary policy, financial system, banking activity and macroeconomic environment. In this study, the choice of the dependent variable is excess reserves (XRS) that commercial banks hold in excess of the required limit in central bank accounts. The independent variables are precautionary and involuntary factors that potentially influence demand for excess reserves in the banking system. The precautionary variables are the cash reserve requirement (CRR), discount rate (DCR) and volatility of demand deposits (VDD) while involuntary variables include foreign reserves (FER), private sector loans (PCR), private sector deposits (PSD) and treasury bill rate (TBR). The study uses monthly times series data from January 2002 to December 2017.

To effectively address the research question, this paper employs the autoregressive distributed lag (ARDL) model proposed by Pesaran et al. (2001). The ARDL framework is specified as follows:

$$\Delta XRS_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta XRS_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{2i} \Delta CRR_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{3i} \Delta DCR_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{4i} \Delta VDD_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{5i} \Delta FER_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{6i} \Delta PCR_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{7i} \Delta PSD_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{8i} \Delta TBR_{t\text{-}i} + \beta_1 XRS_{t-1} + \beta_2 CRR_{t-1} + \beta_3 DCR_{t-1} + \beta_4 VDD_{t-1} + \beta_5 FER_{t-1} + \beta_6 PCR_{t-1} + \beta_7 PSD_{t-1} + \beta_8 TBR_{t-1} + \delta_1 DUM_{XRS} + \varepsilon_t \quad (1)$$

where α_{1i}, α_{2i}, α_{3i}, α_{4i}, α_{5i}, α_{6i}, α_{7i} and α_{8i} are short-run dynamic elasticities, β_1, β_2, β_3, β_4, β_5, β_6, β_7 and β_8 are long-run coefficients, α_0 is the constant term, ε_t is a serially uncorrelated error term, $t-1$ is the lag structure, p and q are optimal lag orders of the independent and dependent variables respectively, t is a time script for the month, Δ is the first difference operator, and δ_1 is a coefficient on the dummy variable (DUM_{XRS}) which captures the structural break induced by capital inflows received from high commodity prices and resources boom on excess reserves. The dummy variable is derived from the breakpoint unit root analysis. The dummy variable takes 0 until December 2005 and 1 from January 2006 onwards. Equation (1) accounts for short-run and long-run effects and contemporaneous and lagged effects of the regressors.

In the framework described in equations (2), the ARDL bounds cointegration test is performed to determine the existence of a long-run relationship among the variables, assuming that all variables are endogenous. The bounds F-statistic developed by Pesaran et al. (2001) is used to test the joint significance of the coefficients. If the computed F-statistic is above the upper bound critical value, reject the null hypothesis of no cointegration. Similarly, if the computed F-statistic is below the lower bound critical value, do not reject the null hypothesis. However, if the computed F-statistic lies between lower and upper bounds, the test is considered inconclusive. The null hypothesis of a no long-run cointegration against the alternative of a long-run relationship is defined by

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$ (the long-run relationship does not exist)
H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq 0$ (the long-run relationship exists)

Once the long-run relationship between variables under investigation is established (that is, by rejecting the null hypothesis of no cointegration), equation (1) can be reparametrized to include the error correction term (ECT). That is, the short-run dynamics are incorporated in the long-run equation without losing long-run information. This in turn, makes endogeneity bias inconsequential in the model and generates consistent estimates. The error correction representation of the ARDL model is expressed as follows:

$$\Delta XRS_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta XRS_{t\text{-}i} + \sum_{i=i}^{q} \alpha_{2i} \Delta CRR_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{3i} \Delta DCR_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{4i} \Delta VDD_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{5i} \Delta FER_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{6i} \Delta PCR_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{7i} \Delta PSD_{t\text{-}i} + \sum_{i=1}^{q} \alpha_{8i} \Delta TBR_{t\text{-}i} + \delta_1 DUM_{XRS} + \lambda ECT_{t-1} + \varepsilon_t \quad (2)$$

where the coefficient (λ) of the error correction term indicates the speed of adjustment and long-run causality. The coefficient must be negative and statistically significant to ensure that the system convergence towards long-run equilibrium. According to Menegaki (2019), the highly significant coefficient on the error correction term confirms the existence of a long-run relationship between variables. The reparameterized equation (2) estimates the short-run dynamic interactions and the long-run relationship of the underlying variables through the ordinary least squares procedure.

The short-run and long-run coefficients of precautionary and involuntary variables were estimated to determine their respective impacts on excess reserves. In the long run, the findings reveal that the discount rate, foreign exchange reserves, private sector deposits, private sector credit and the treasury bill rate significantly influence excess reserves in commercial banks. However, the short-run results suggest that all variables except cash reserve requirement have significant impacts on excess reserve holdings. The findings strongly conclude that commercial banks hold unremunerated excess reserves for involuntary purposes, which supports the results of previous studies such as Khemraj (2009), Pontes and Murta (2012), Hamma and Ejbari (2013) and Ukeje et al. (2015). The long-run estimates of the main model are robust to the estimation results of the dynamic ordinary least squares (DOLS) and fully modified ordinary least squares (FMOLS) models.

An interesting finding worth considering in this study is the insignificant coefficient of cash reserve requirement. The empirical evidence clearly indicates that cash reserve requirement does not perform effectively to achieve sound reserves management in the banking system. The data from BPNG (2018) confirms that although the required reserves ratio was increased several times during the sample period, the level of excess reserves continued to remain high. Hence, further adjustment to the cash reserve ratio could distort the banking system. To make this policy variable more effective, BPNG may consider paying interest on the balances that commercial banks hold above the required limit, which will encourage banks to voluntarily transfer funds to their required reserves accounts at the central bank.

Key Words

Excess reserves, precautionary variables, involuntary variables, banking system, ARDL method