ESTIMATING EXCESS LIQUIDITY DEMAND MODEL FOR PAPUA NEW GUINEA

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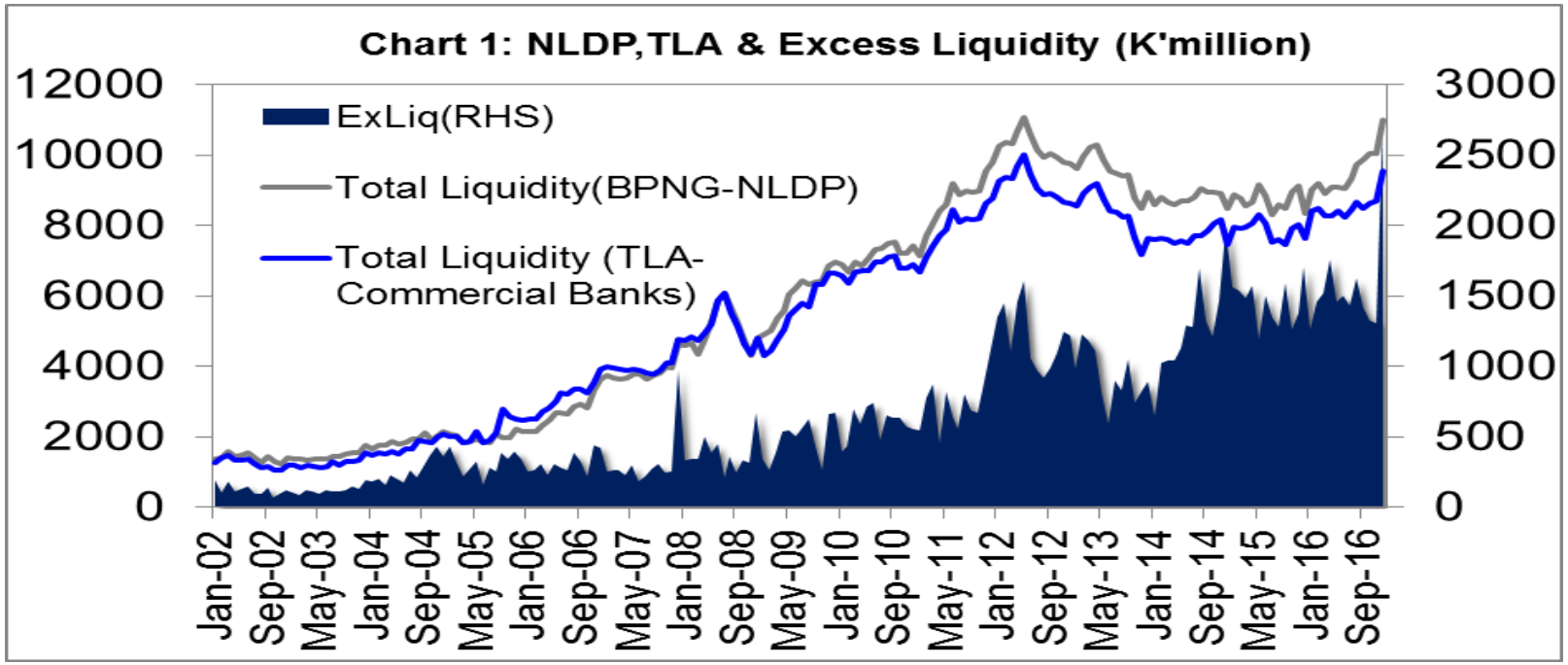
Outline

1. Introduction & Motivation
2. Literature Review
3. Data
4. Empirical Analysis
5. Conclusion & Policy Implication

1. Introduction: Background

- Excess liquidity has been a salient feature of the PNG banking system for over more than a decade. This has largely impacted the effectiveness of the transmission of monetary policy in PNG.
- Total Liquidity-NLDP (BPNG Liquid Liabilities) increased from K1.4 billion in 2002 to K11 billion in 2016. Total Liquidity-TLA (Commercial Bank Liquid Liabilities) increased from K1.1 billion to K9.5 billion over the same period. **Excess Liquidity increased from K117 million to K2.7 billion**



1. Introduction: What is excess liquidity?

✓ "quantity of reserves deposited at the Central Bank by deposit money banks plus cash in vaults (cash for daily operations)-minus minimum reserve requirement"-*Saxegaard(2006)*

✓*Vellodi et al (2012) Internal BPNG study adopted the measure:*

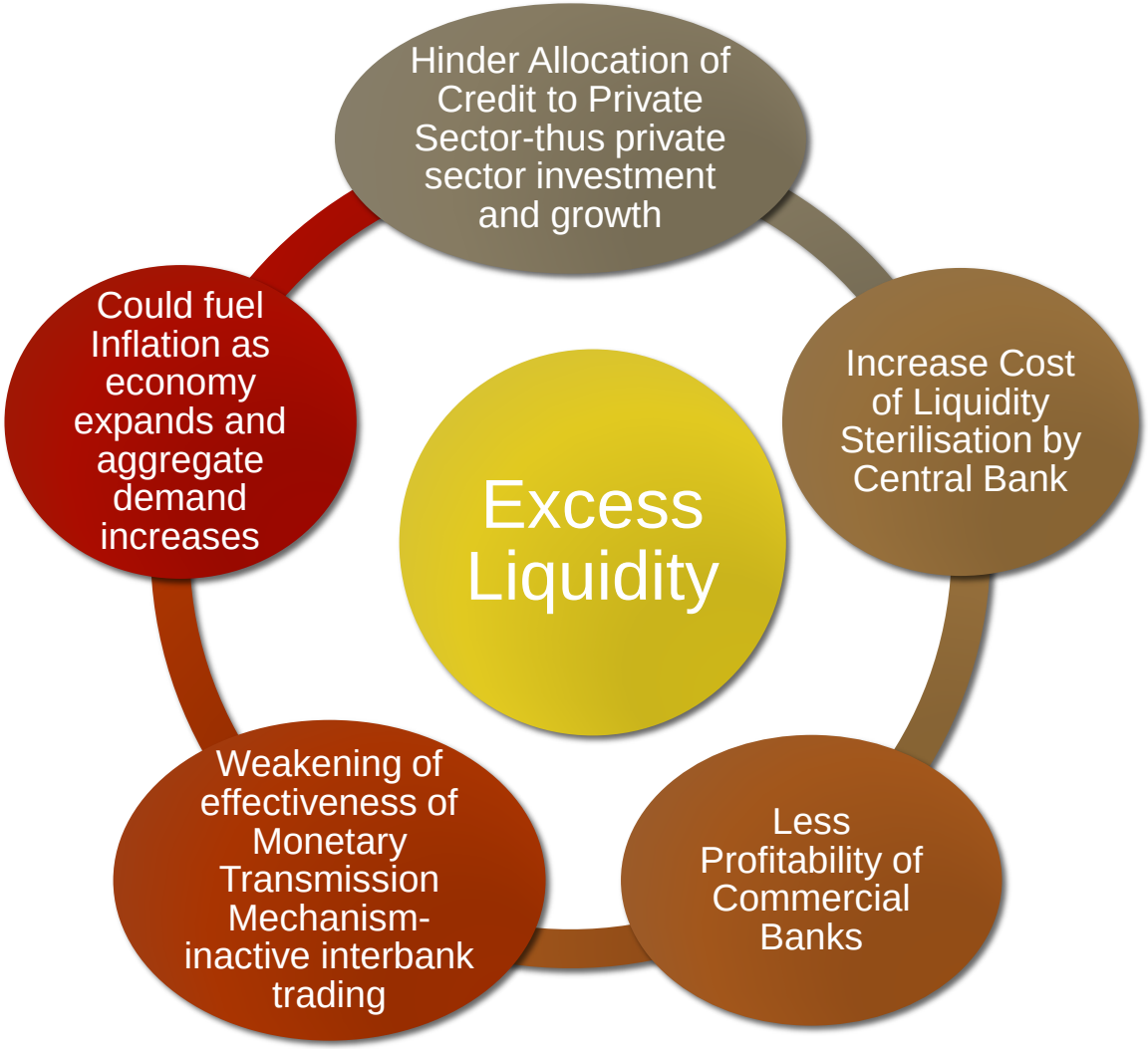
EXLIQ*=ESA+ (CRD-CRR) + Cash in Vaults

- The maintenance by banks of a higher level of funds than is normally required to meet their statutory reserve requirements and settlement balances (CBTT, 2005).

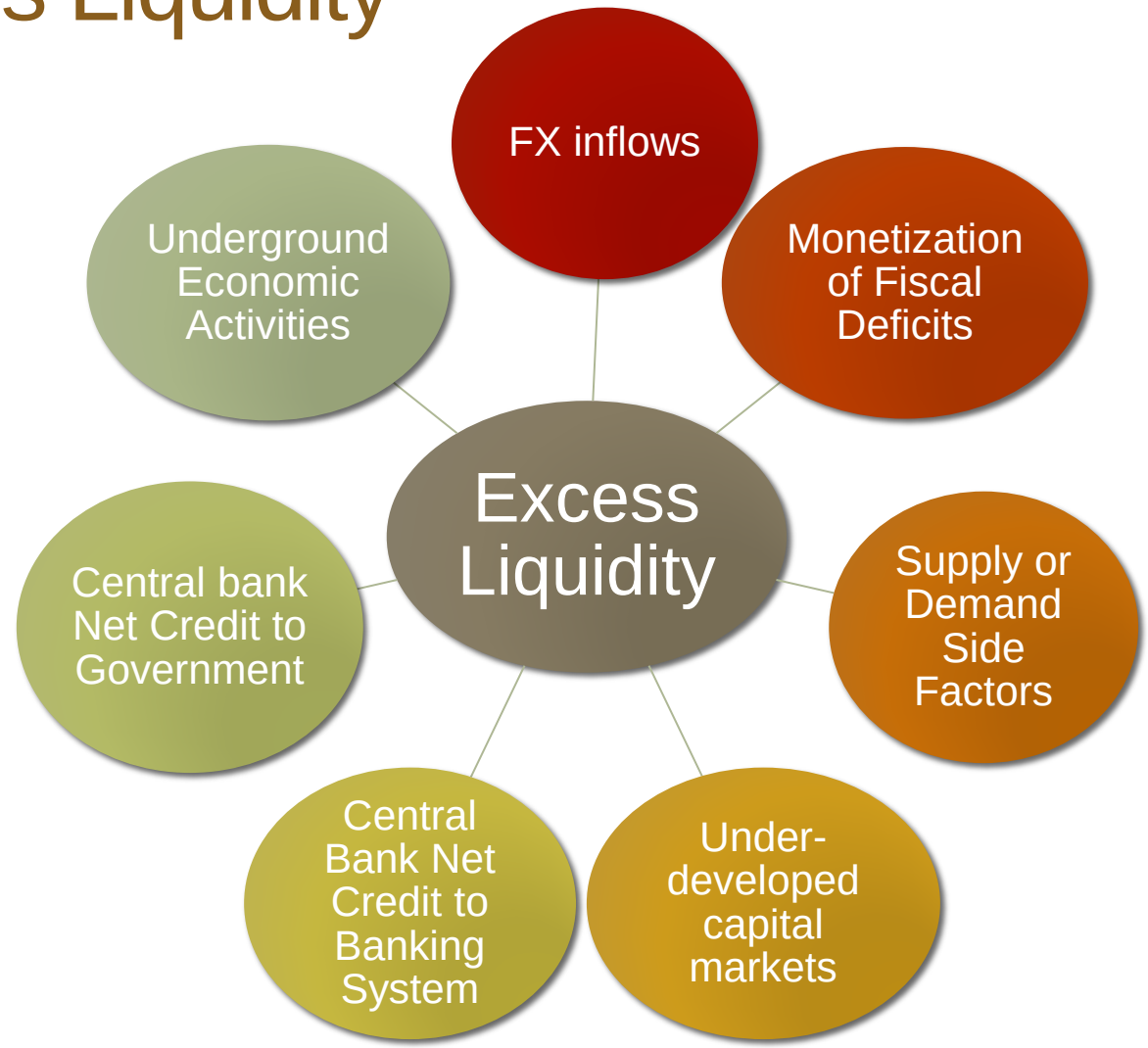
- The involuntary accumulation of liquid reserves by commercial banks (Agenor and El Aynaoui, 2008).

- Banks' holding of reserves over and above what they need for transactions purposes (Heenan, 2005).

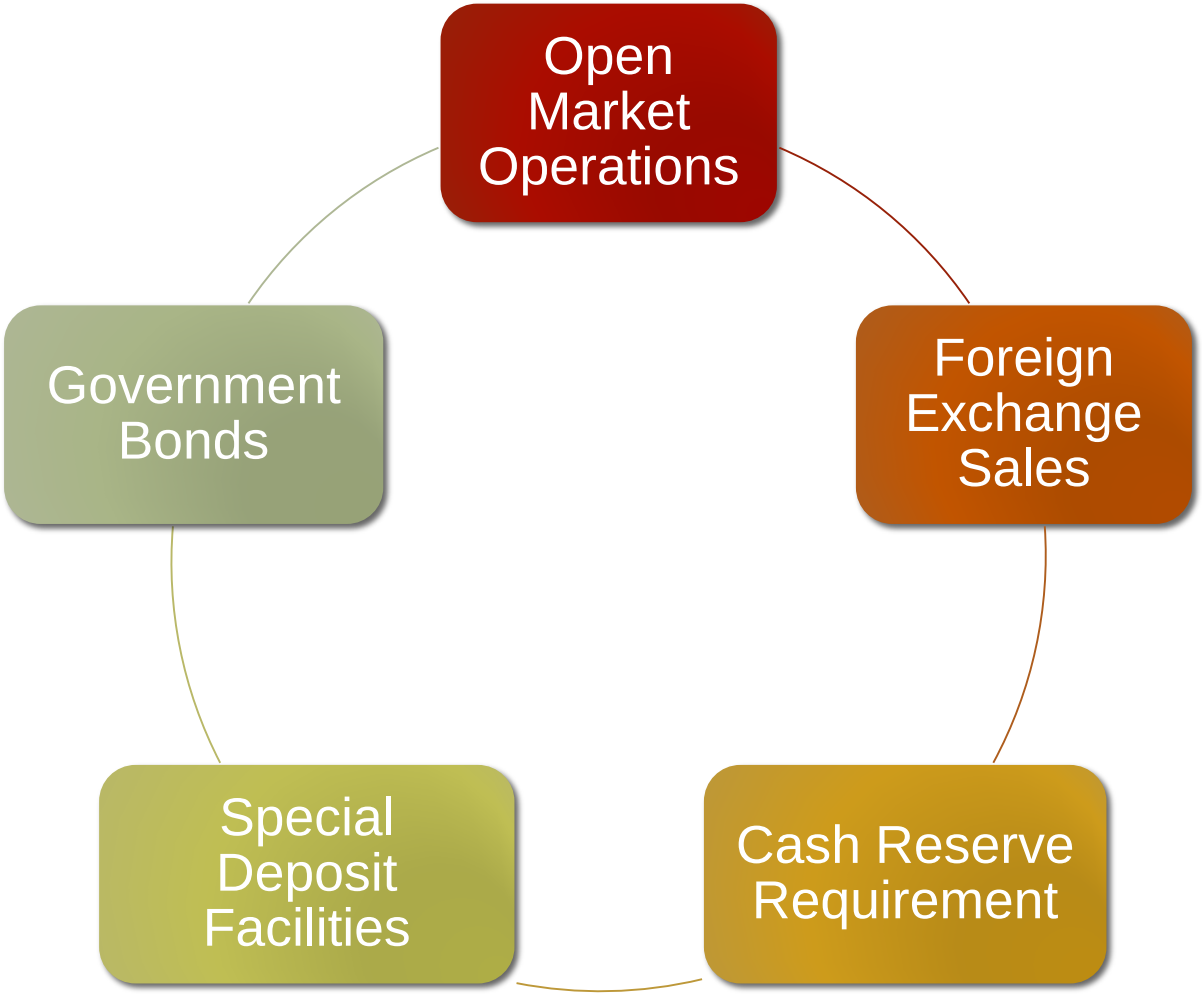
1. Introduction: Why study excess liquidity?



1. Introduction: Potential sources of Excess Liquidity



1. Liquidity Absorption Measures



1.Introduction: Objective/ Research Questions

- To establish key determinants of excess liquidity in Papua New Guinea.
- Is excess liquidity a demand-driven or a supply-side phenomena in the case of PNG?
- Does the current high excess liquidity level pose a threat to inflation in PNG?

2. Literature Review

Developed Countries

- Reserve Management Model
- Frost (1971)-Bank's Demand for Excess Reserves
- Baltensperger (1974) – The Precautionary Demand for Reserves.

Developing Countries

- Reserve Management Model
- Agenor et al.,(2004) The Credit Crunch in East Asia: What can Bank Excess Liquid Assets tell us?

- **Saxeguaard(2006)-Excess Liquidity and Effectiveness of Monetary Policy: Evidence from Sub-Saharan Africa**

- Aikaeli (2006) – Determinants of Excess Liquidity in Tanzanian Commercial Banks.

- Khemraj (2008) – Excess liquidity and the foreign currency constraint: the case of monetary management in Guyana.

3.Data

- Sample Period: 2002M1-2016M4
- Data Sources:
  - ✓BPNG Quarterly Economic Bulletin(QEB)
  - ✓BPNG Internal Data
  - ✓PNG National Statistics Office(NSO)
  - ✓World Development Index(WDI) Database-World Bank
  - ✓International Monetary Fund(IMF)-International Financial Statistics (IFS)
- Data trends and descriptions at back of slides for reference.
- All variables were transformed into logarithms(logs), imply elasticity of the empirical results
- Unit Root Test-most variables are stationary at first difference, I(1) except excess liquidity and output gap which are stationary at levels, I(0).

4. Empirical Analysis: Model Specification

- Employed Saxegaard (2006) model of excess liquidity.
- Saxeguaard (2006) extended the precautionary reserve demand model by Agenor et al(2004) to include both precautionary and involuntary factors.

$$\phi_1(L)Xliq_t = \phi_2(L)X_t + \phi_3(L)Y_t + z_t$$

Where,

- $Xliq_t$ ratio of excess reserves to total deposit
- X_t Precautionary excess reserve factors
- Y_t Involuntary excess reserve factors
- ε_{1t} error term
- $\phi_1,\ \phi_2, \phi_3$ are parameter estimates

4.Empirical Analysis: Model Specification

- $\phi j(L)$ are vectors of lag polynomials, such that

$\phi_1(L) = 1 - \phi_{11}L,$ and $\phi_j(L) = \phi_{j0} - \phi_{j1}L,\ j \geq 2$

- The vectors of precautionary (measures of volatility and uncertainty, theory-based) explanatory variables are specified as:

$$X_t = \{CRR, VOL_y, VOL_{cd}, VOL_{ps}, VOL_{gov}, PORT, Y_{hp}, REPO_R\}$$

- Where,
- CRR=Cash Reserve Requirement
- VOLy=Output Volatility
- VOLcd=Currency Volatility
- VOLps= Volatility of Private Sector Deposits
- VOLgov= Volatility of Government Deposits
- PORT= Ratio of demand to savings and term deposits
- Y_hp=Output Gap
- Repo_R=Repo rate

4.Empirical Analysis: Model Specification

- The involuntary (structural, cyclical, political, not theoretical) explanatory variables are specified as:

$$Y_t = \{DEP_{ps}, DEP_g, CRED_{ps}, CRED_g, R_l, FXNGDP, BOND, AID, OIL\}$$

Where,

- DEPps=Private Sector Deposits/NGDP
- DEPg=Government Deposits/NGDP
- CREDps=Credit to Private Sector/NGDP
- CREDg=Credit to Government/NGDP
- R_l= Weighted Average Lending Rate
- FXNGDP= Foreign Reserves/NGDP
- BOND=Domestic Debt Securities/NGDP
- AID=Aid Inflows/NGDP
- OIL=Oil Revenue/NGDP

4. Empirical Analysis-Model Specification

- Excess liquidity is further decomposed into precautionary and involuntary excess reserves level in the following method:

$$Xliq_t^{\,P} = a\hat{c} + \hat{\phi}_1^{\,P} Xliq_{t-1}^{\,P} + \hat{\phi}_2(L)X_t$$

$$Xliq_t^{\,I} = (1-a)\hat{c} + \hat{\phi}_1^{\,I} Xliq_{t-1}^{\,I} + \hat{\phi}_3(L)Y_t$$

- Where,
- $\hat{c}$ $\hat{\phi}_1, \hat{\phi}_2$, $\hat{\phi}_3$ are parameter estimates of the model
- $Xliq_t^{\,P}$ precautionary excess reserves
- $Xliq_t^{\,I}$ involuntary excess reserves
- a share of the estimated constant $\hat{c}$ given by the percentage of precautionary reserves held by the commercial banks. Here 35% prudential requirement of the banks is used as proxy
- $Xliq_{t-1}^{\,P}$ and $Xliq_{t-1}^{\,I}$ are one period lag excess liquidity

4. Empirical Analysis-Estimation Method

- ✓Employed General Methods of Moments(GMM) estimator to estimate the model
- ✓Selection of GMM is to correct for endogeneity bias (potentially caused by correlation of explanatory variables, and between the error terms; and, potential incorrect measurement of variables)
- ✓ Orthogonality condition given the set of instruments

$$E\left[(Xliq_t - \beta X_t)\middle| z_t\right] = 0$$

- Where,
- β is matrix of coefficients
- X_t is matrix of determinant variables including constant
- z_t vector of instruments, which includes one to four lags of all endogenous variables including *CRR, Repo_r, DEPps, DEPg, PORT, CREDps, CREDg, BOND, R_I* and the second to fourth lag of excess liquidity, and the exogenous variables (VOLy *,VOLcd , VOLps , VOLgov,Y_hp* , FXNGDP, AID, and OIL *)*.

4. Empirical Results-Summary

- **Excess Liquidity Demand Model**

$$Xliq_t = \underset{0.09}{-0.47}RR + \underset{0.08}{0.0009}Y\_hp - \underset{0.09}{0.02}VOL_y + \underset{0.04}{1.51}VOL_{cd} - \underset{0.00}{0.33}VOL_{ps} + \underset{0.01}{0.03}PORT$$
$$+ \underset{0.05}{0.49}DEP_{ps} + \underset{0.00}{0.60}DEP_g - \underset{0.06}{0.57}CRED_{ps} + \underset{0.05}{0.43}CRED_g + \underset{0.00}{0.43}FXNGDP - \underset{0.01}{0.45}BOND$$

Diagnostic Tests: R-squared 0.67, Adjusted R-squared 0.63, Durbin-Watson stat 1.77, No serial correlation up to lag 12

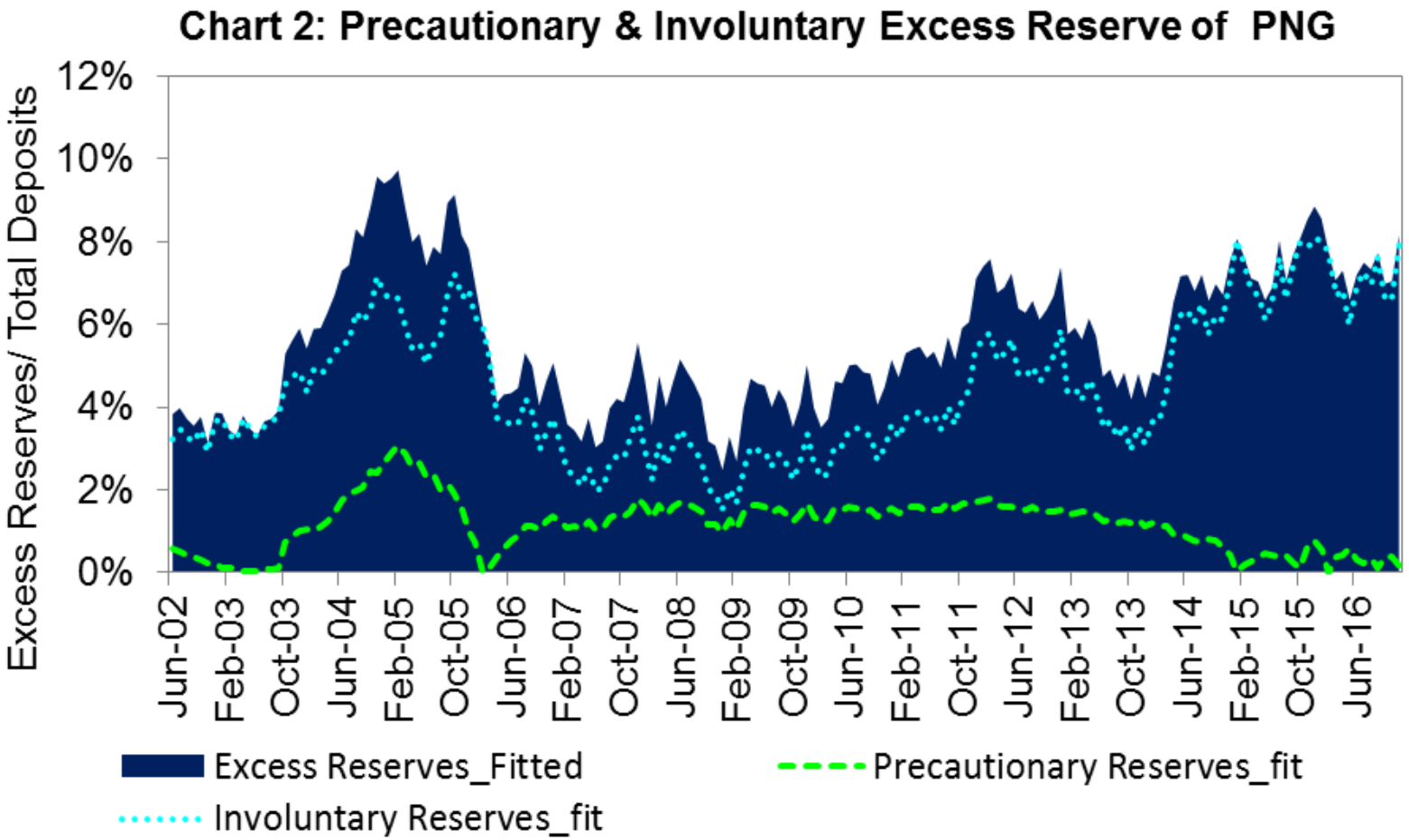
- A 1% increase in CRR will reduce excess liquidity by 0.47 %
- A 1% increase in demand for cash proxied by output gap will increase excess liquidity by a negligible 0.0009 %
- A 1% increase in economic uncertainty proxied by output volatility results in a decline in excess liquidity by 0.02 %
- A 1% increase in the liquidity risks (cash to deposit ratio) will increase excess liquidity by 1.51 %
- A 1% increase in volatility of private sector deposits (uncertainty) will result in a decline in excess liquidity by 0.33 percent
- A 1% increase in volatility of short-term deposits to long term deposits will result in an increase in excess liquidity of 0.03 percent.

4. Empirical Results-Summary

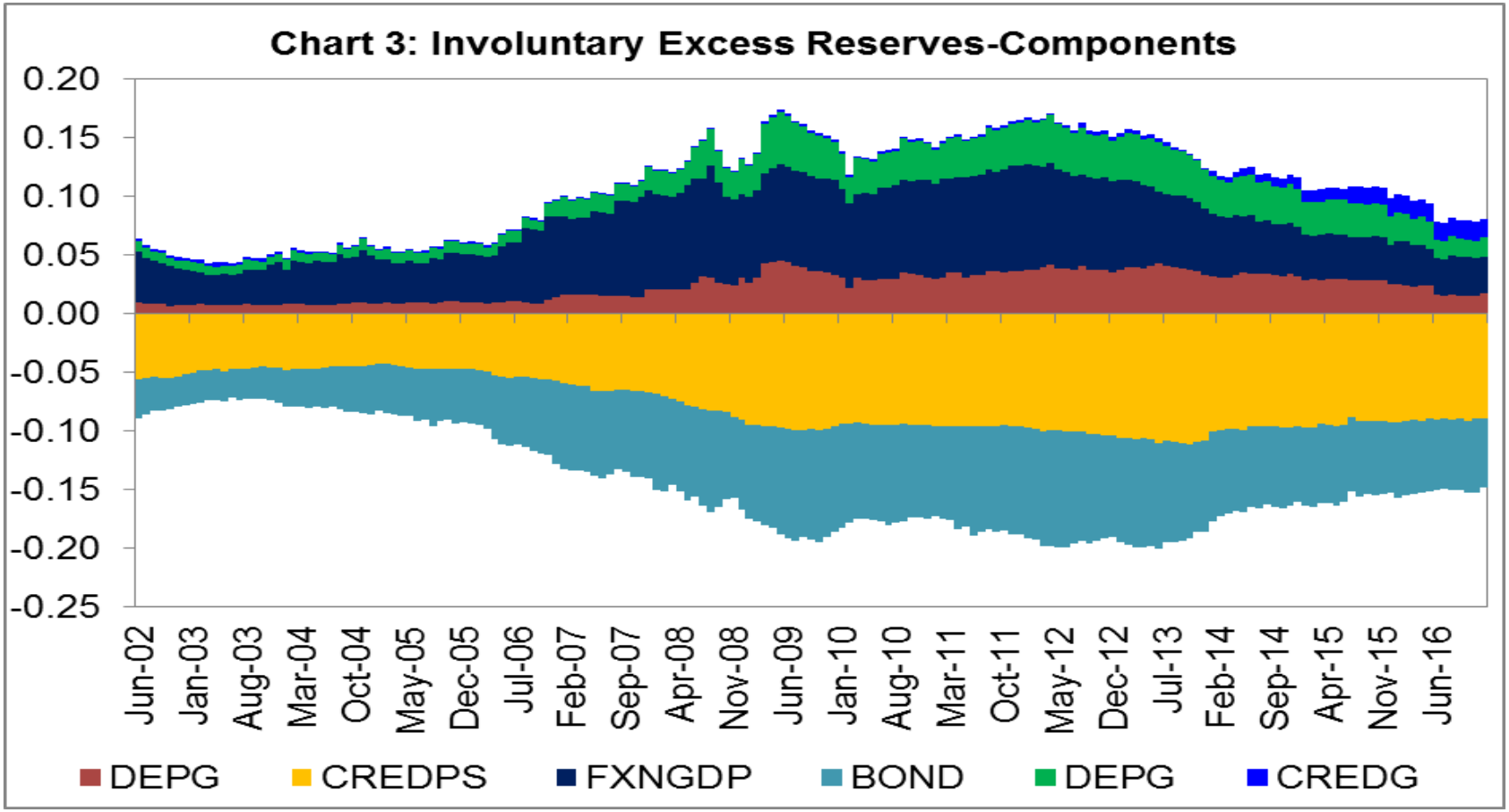
$$\underset{0.05}{+0.49}\,DEP_{ps} \underset{0.00}{+0.60}\,DEP_{g} \underset{0.06}{-0.57}\,CRED_{ps} \underset{0.05}{+0.43}\,CRED_{g} \underset{0.00}{+0.43}\,FXNGDP \underset{0.01}{-0.45}\,BOND$$

- A 1% increase in private sector deposits will increase excess liquidity by 0.49 %, on average
- A 1% increase in government deposits will increase excess liquidity by 0.60 %, on average
- A 1% increase in private sector credit will result in a decline in excess liquidity by 0.57 %, on average
- A 1% increase in government credit will increase excess liquidity by 0.43 %, on average
- A 1% increase in foreign exchange reserves will increase excess liquidity by 0.43%, on average
- A 1% increase in investment in government securities will reduce excess liquidity by 0.45%, on average.

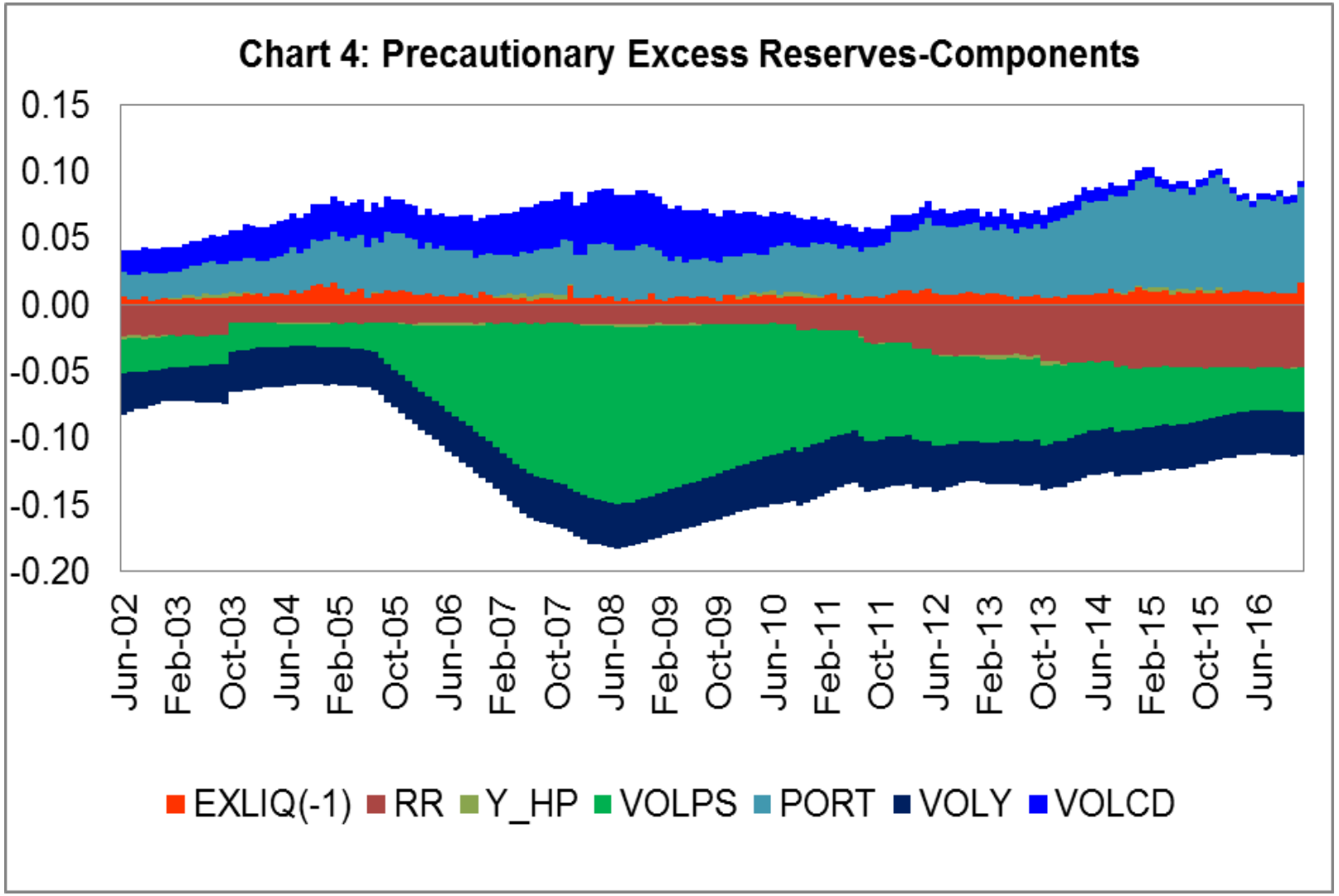
4.Empirical Results-Summary



4.Empirical Results-Summary



4.Empirical Results-Summary



5.Conclusion & Policy Implication

- Excess reserves (liquidity) in PNG is mainly influenced by involuntary factors including private sector and government deposits, credit to private sector and government, investment in domestic securities market, and the accumulation of the foreign exchange reserves.

- Precautionary component of excess reserves contribute a smaller proportion and include mainly volatility in private sector deposits, volatility of cash to deposit ratio and the cash reserve requirement.

- The build-up of excess liquidity in PNG is a demand-induced phenomenon. This implies that the current build-up of excess reserves is driven largely by the reduction in aggregate demand.

- This means that a sudden increase in aggregate demand in the economy could result in an increase in the demand for loans, hence, excess liquidity is likely to be translated to increased private sector credit growth, and in turn, exert upward pressure on the price level.

- This however, is subject to further empirical investigation especially for PNG, although the relationship has been established for some other related countries, for example Saxegaard(2006) for Sub-Saharan African economies.

5. Conclusion & Policy Implication

- BPNG should focus its efforts on influencing the key determinants of excess liquidity identified in the model in order to influence the levels of excess liquidity in the banking system. Aim should be to create scarcity in the system so that loanable funds market can function effectively to assist the transmission of monetary policy.

- For example, since excess liquidity in PNG is demand-induced,

i. Investable projects should be encouraged to stimulate private sector demand for loans.

ii. Adequate FX inflows into FX market is needed with exchange rate not too depreciated that would discourage import demand which in turn result in liquidity overhang in the banking system-Recent increase in foreign exchange intervention (2nd half of 2018 to early 2019) assisted to diffuse some liquidity

iii. Cost of borrowing could also be assessed and reviewed to drive demand for loan

iv. Alternative savings options should also be promoted to attract private sector deposits. For example, TAP facility for BPNG.

v. Transfer of government trust accounts at the commercial banks to BPNG. Government's Public Money Management Regulation Act (PMMR) assisted diffusion of some liquidity in the banking system but was not sufficient to generate the level of scarcity that would trigger the use of interbank money market *(March MPS 2019)*.

vi. Structural and regulatory constraints should be addressed in the long-term to ensure liquidity is not kept idle in commercial banks but are channelled out for productive use. E.g. Banks collateral requirements

vii. Increase options for entry of banks to encourage competition and banking sector deepening in the long run.

END OF PRESENTATION

Thank you!!

3.Data

Table 1. Variables, definition and sources	
Variable	**Description**
EXLIQ	Ratio of Excess Reserves to Total Deposits
CRR	Ratio of Required Cash Reserve to Total Deposit at Commercial Banks
VOLY	5year Moving Averages of the Standard Deviations of the Output gap
VOLCD	5year Moving Averages of the Standard Deviations of the Cash to Deposit Ratio
VOLPS	5year Moving Averages of the Standard Deviations of Private Deposits divided by the 5 year Moving Average of Private Sector Deposits
VOLGOV	5year Moving Averages of the Standard Deviations of Government Deposits divided by the 5 year Moving Average of Government Deposits
PORT	Ratio of Demand to Savings & Term Deposits
Y_hp	Output Gap-Percentage Deviation of Actual RGDP from T rend RGDP (Trend Calculated using HP Filter in Eviews Statistical program)
Repo_R	Repurchase Agreement(Repo) Rate-Percentage
DEPps	Ratio of Private Sector Deposits to Nominal Gross Domestic Product
DEPg	Ratio of Government Deposits to Nominal Gross Domestic Product
CREDps	Ratio of Private Sector Credit to Nominal Gross Domestic Product
CREDg	Ratio of Public Sector (Government) Credit to Nominal Gross Domestic Product
BOND	Ratio of Securitized Domestic Debt to Nominal Gross Domestic Product
AID	Ratio of Aid Inflows to Nominal Gross Domestic Product
OIL	Ratio of Oil Exports to Nominal Gross Domestic Product
RL	Commercial Bank Weighted Average Lending Rate(in percentage)
FXNGDP	Ratio of Foreign Exchange Reserves to Nominal GDP

3.Data

Chart 2: Required Reserves Ratio(CRR)

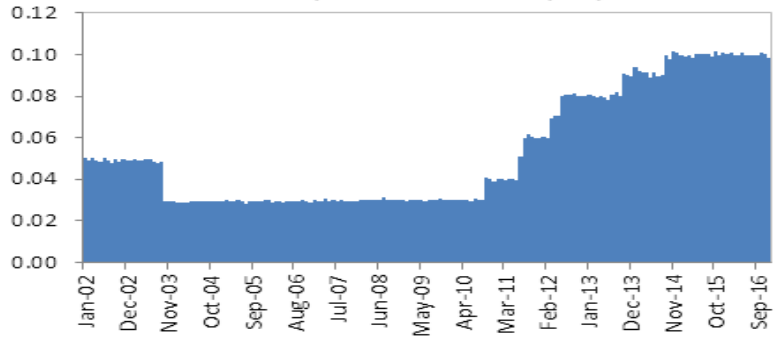


Chart 3: Output Gap Volatility (VOLy)

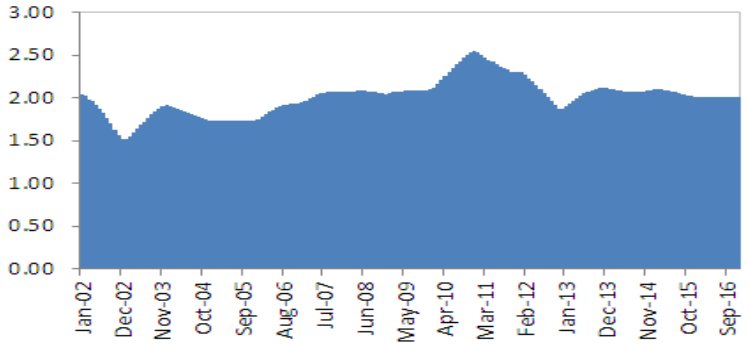


Chart 4: Cash to Deposit Volatility (VOLcd)

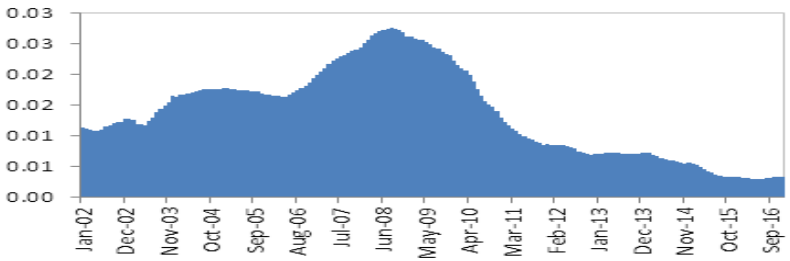


Chart 5: Volatility of Private Sector Deposit (VOLps)

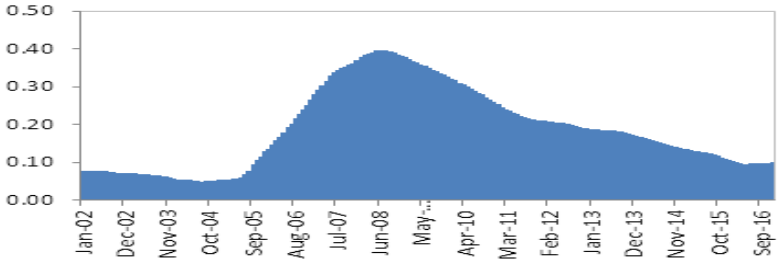


Chart 6: Volatility of Public Sector(Government) Deposits (VOLgov)

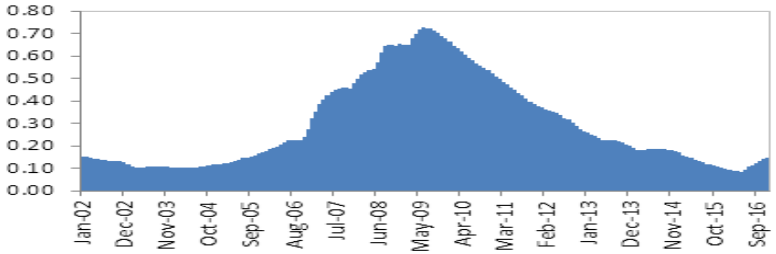
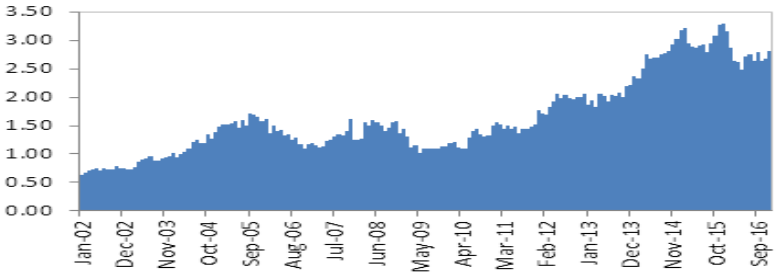


Chart 7: Ratio of Demand to Savings Deposits (PORT)



3.Data

Chart 8: Output Gap (percentage) (Y_hp)

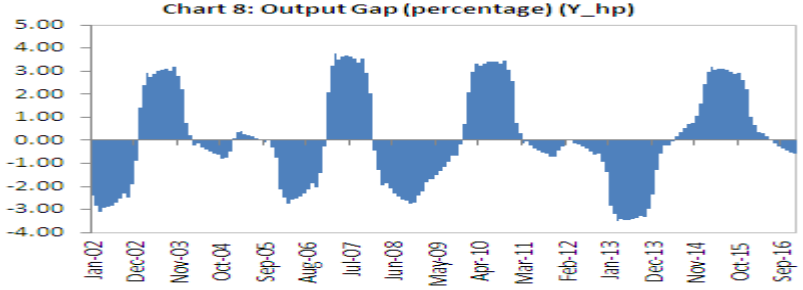


Chart 9: Repo Rate/100 (Repo_r)

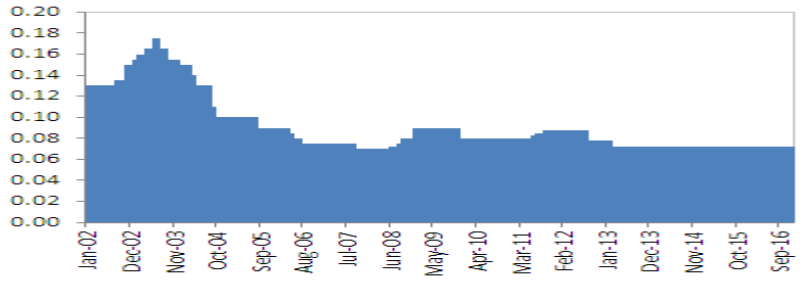


Chart 10: Ratio of Private Sector Deposit to Nominal GDP (Dep_ps)

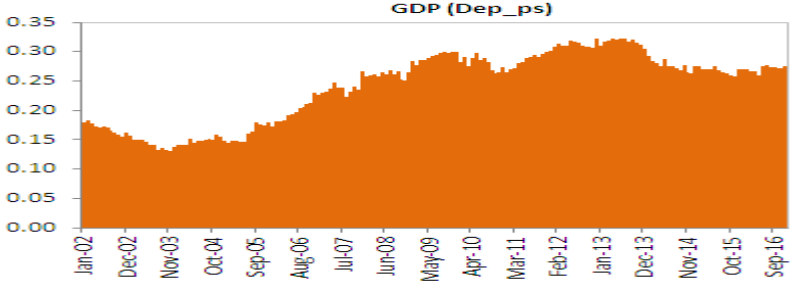


Chart 11: Ratio of Government Deposit to Nominal GDP (Dep_g)

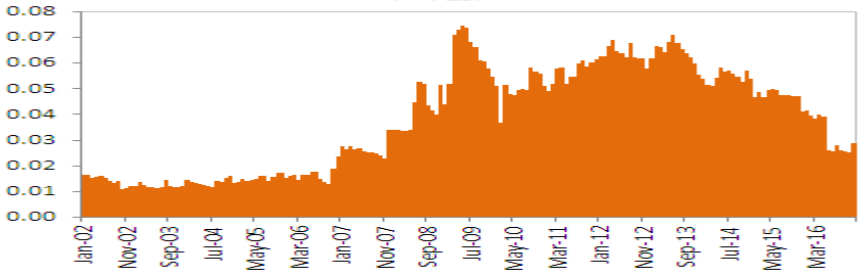


Chart 12: Ratio of Private Sector Credit to Nominal GDP(CRED_p)

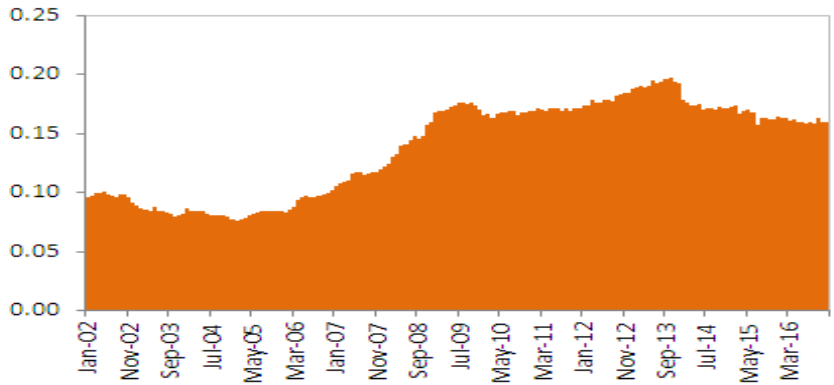
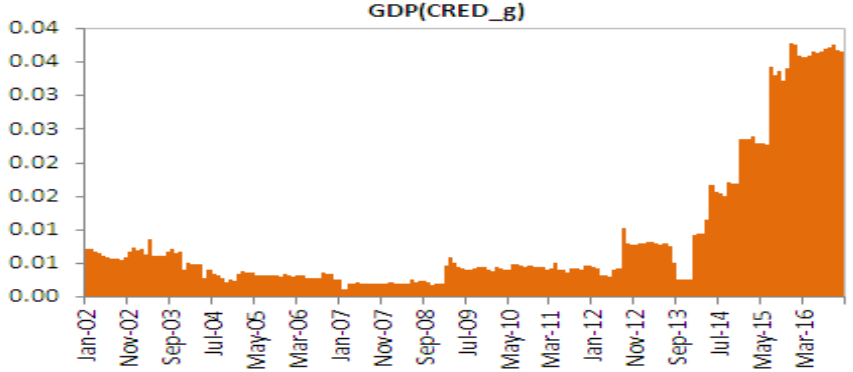


Chart 13: Ratio of Government Credit to Nominal GDP(CRED_g)



3.Data

Chart 14: Ratio of Domestic Debt to Nominal GDP(BOND)

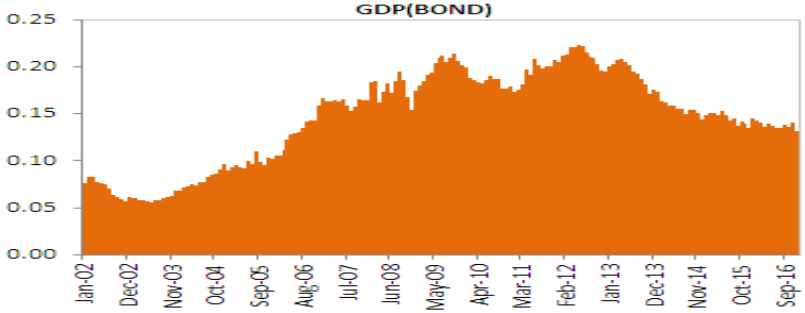


Chart 15: Ratio of Aid Inflow to Nominal GDP(AID)

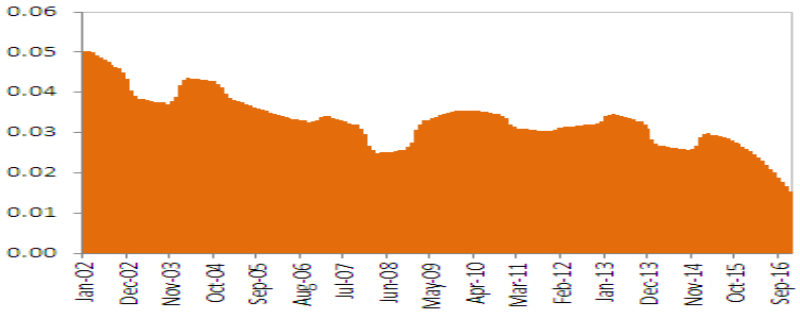


Chart 16: Ratio of Oil Export Revenue to Nominal GDP(OIL)

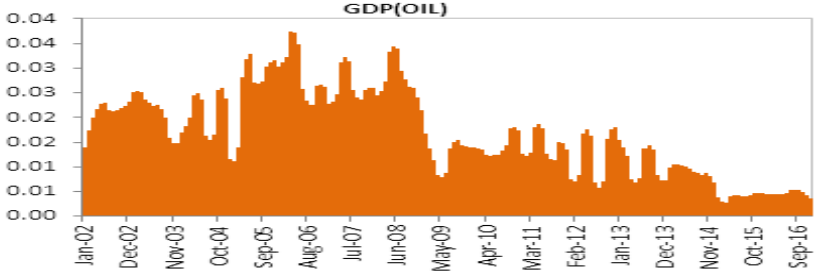


Chart 17: Weighted Average Lending Rate/100 (RL)

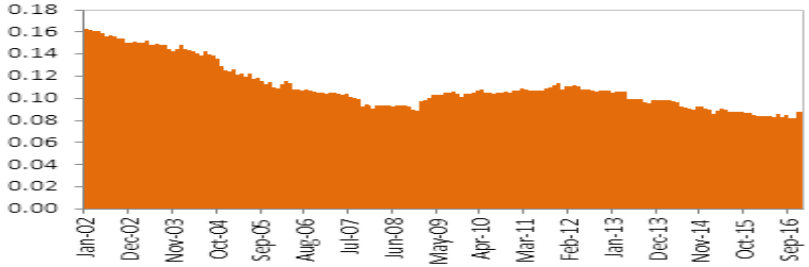
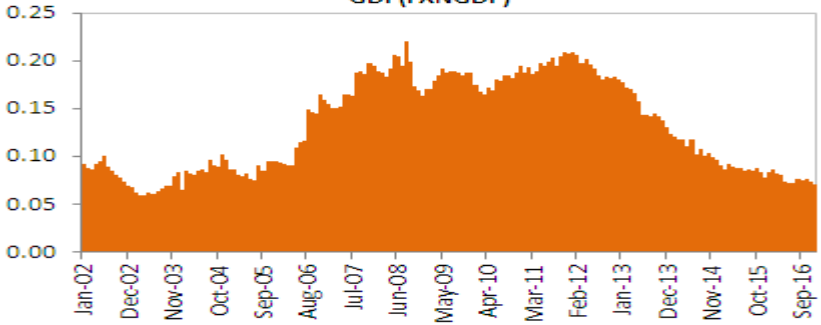


Chart 18: Ratio of Foreign Exchange Reserves to Nominal GDP(FXNGDP)



4.Empirical Results-Summary

Table 2: Estimated GMM Excess Reserves Model for PNG		
Variable	Coefficient	Std. Error
C	0.07	0.070
CRR	**-0.47***	0.280
REPO_R	-0.21	0.154
Y_HP	**0.001***	0.001
VOLY	-0.02*	0.010
VOLCD	**1.51****	0.728
VOLPS	**-0.33*****	0.069
VOLGOV	0.03	0.030
PORT	**0.03****	0.010
DEPPS	**0.49*****	0.252
DEPG	**0.60*****	0.197
CREDPS	**-0.57***	0.303
CREDG	**0.43****	0.215
RL	0.11	0.444
FXNGDP	**0.43*****	0.096
BOND	**-0.45****	0.175
AID	-0.59	0.479
OIL	-0.26	0.194
EXLIQ(-1)	0.13	0.082

R-squared	**0.67**
Adjusted R-squared	**0.63**
Durbin-Watson stat	**1.77**
J-statistic	21.07
Prob(J-statistic)	0.86

1.*,,*** significance of coefficients at 10, 5 and 1 percent, respectively**

2. Estimation weighting matrix: HAC (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

3.Standard errors & covariance computed using HAC weighting matrix (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

4.Instrument specification: CRR(-1 TO -4) REPO_R(-1 TO -4) PORT(-1 TO -4) DEPG(-1 TO -4) DEPPS(-1 TO -4) CREDPS(-1 TO -4) CREDG(-1 TO -4) BOND(-1 TO -4) RL(-1 TO -4) C EXLIQ(-2 TO -4) Y_HP VOLY VOLCD VOLPS VOLGOV FXNGDP AID OIL

5. Constant is added to the instrument list