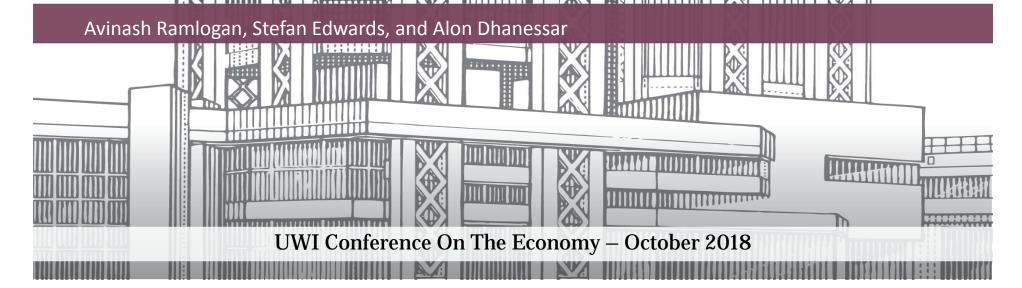


External Shocks and Monetary Policy Responses: The Central Bank of Trinidad and Tobago and its Operational Sphere





Outline

- 1. Introduction
- 2. Literature Review
- 3. Stylized Facts
- 4. Methodology and Estimation
- 5. Econometric Results and Discussion
- 6. Conclusion and Policy Considerations

Introduction

- Small economies are defined by their vulnerability to exogenous shocks, the impacts of which can be severe.
- T&T experienced 3 major energy price shocks over the past four decades.
 - Post-oil boom (mid-1980s); Global financial crisis (2008); Global oversupply (2015).
- A Central Bank's Operational Sphere allows it to influence short term financial markets.
- The Central Bank policy using indirect instruments must first affect the short-term behaviour of the financial sector before transmitting to any other economic sector.
- The paper seeks to determine if the CBTT exerts significant influence in its operational sphere - short term financial markets – by assessing the effects of an energy price shock, and evaluating the monetary policy responses.

Literature Review



- Bejarano, Hamann, and Rodriguez (2015 and 2016).
- Koh (2016)
- Ferrero and Seneca (2015)
- Tang, Wu, and Zhang (2009)
- Watson (2003)

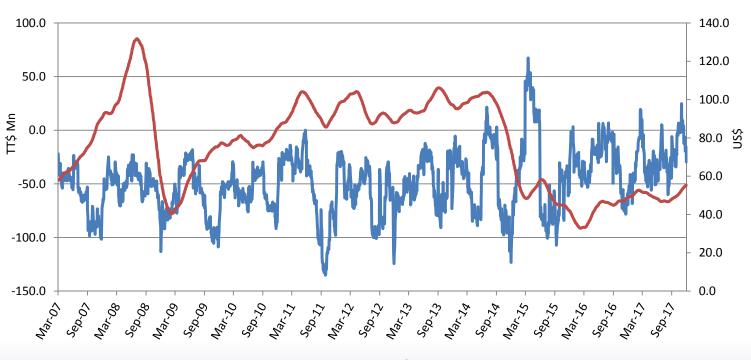


- Nchor, Klepáč, and Adamec (2016)
- Jbir and Zouari-Ghorbel (2009)



- Degiannakis, Filis and Arora (2017)
- Rizvi and Masih (2014)
- Arouri and Fouquau (2009)
- Arouri, Lahiani, and Nguyen (2011)

Chart 1: Trends in NDFIs and WTI



——Average Quarterly Change in Govt Balance (NDFIs) (\$M)

—Average Quarterly WTI (Right Axis)

Chart 2: Trends in Foreign Exchange Market

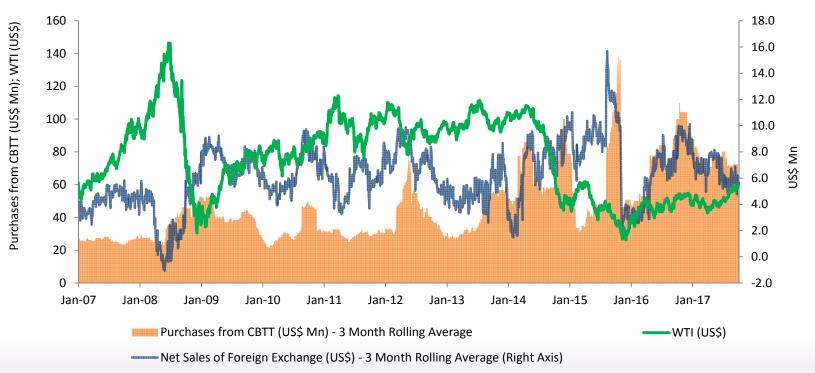


Chart 3: Trends in Inter Bank Activity and Commercial Bank Excess Reserves

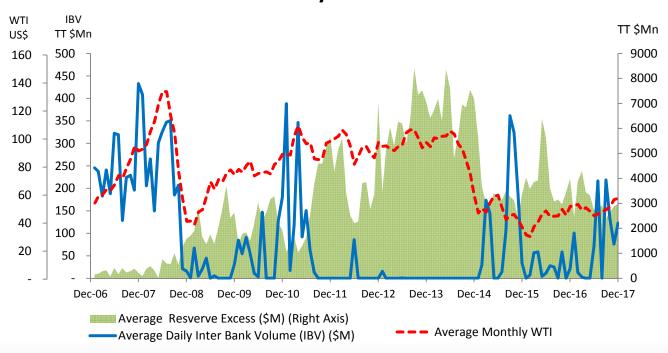
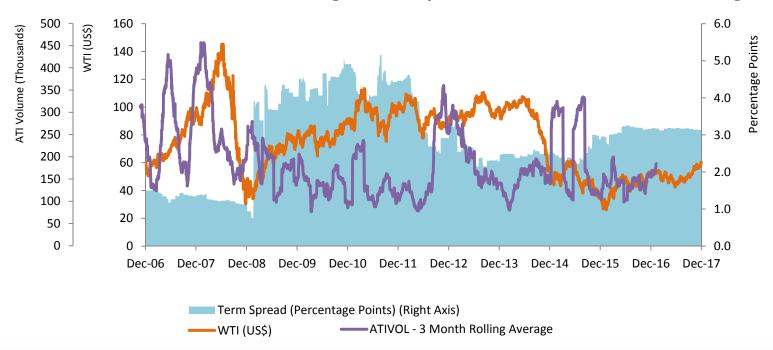


Chart 4: Trends in the Sovereign Term Spread and Stock Market Trading



Data

- A dataset of 10 variables is used in populating Y_t.
- The period spanned by the data is January 2007 December 2017, a total of 2709 daily observations per series.
- The data series were individually subject to transforms and scaling in order to minimise model instability.
- They are utilised in an order that represents our interpretation of the sequence in which they are affected by an external shock.

Y,=f[WTI, NETSALE, GOVBAL, OMO, INT, REPORATE, DXSL, TERM_S, ATIVOL, DSELR]+ ε,

Methodology and Estimation

$$Y_t = c + A_1 Y_{t-1} + ... + A_i Y_{t-1} + \varepsilon_t$$
 (Sims, 1980)

Sample pdf

Posterior pdf
$$\Rightarrow$$
 $g(\alpha | y) = [f(y | \alpha) g(\alpha)] / f(y)$ (Bayes, 1763)

Prior pdf

$$f(y_t \mid Y_{t-1}, \alpha) = N(y_t; \Sigma A_p y_{t-p}, \psi)$$
 (Karlsson, 2012)

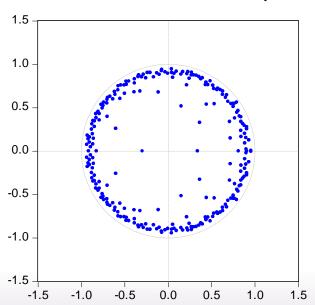
Methodology and Estimation

- Paper uses the Minnesota-Litterman (M-L) prior developed in Litterman (1979). It is based on three stylised facts about macroeconomic time series:
 - i) they are mainly characterised by trends (dominance of sample vs. prior info) i.e., 'overall tightness',
 - ii) the lags nearest to the present time affect the variable most i.e., 'lag decay' and,
 - iii) a variables own lags affect it more than those of other variables i.e., 'relative tightness'.
- Edit covariance matrix ψ to reflect these prior assumptions.
- The M-L prior imputes 'Bayesian shrinkage' toward a univariate random walk for each variable in the VAR.

Econometric Results and Discussion

 The unrestricted model was estimated with 25 lags and provided satisfactory results pertaining to stationarity and autocorrelation.

Inverse Roots of AR Characteristic Polynomial



VAR Residual Serial Correlation LM Tests

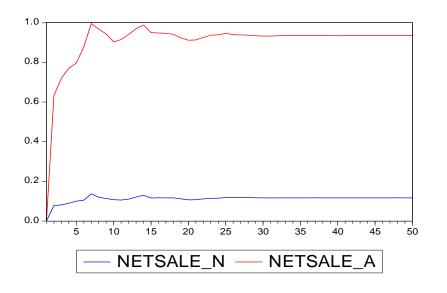
Null Hypothesis: no serial correlation at lag order h

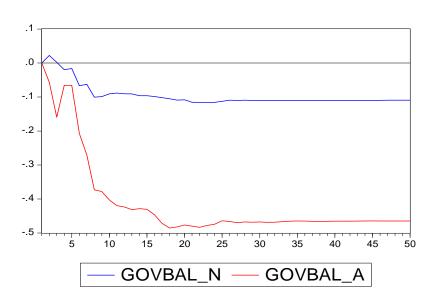
Date: 03/09/18 Time: 11:33 Sample: 1/03/2007 12/29/2017

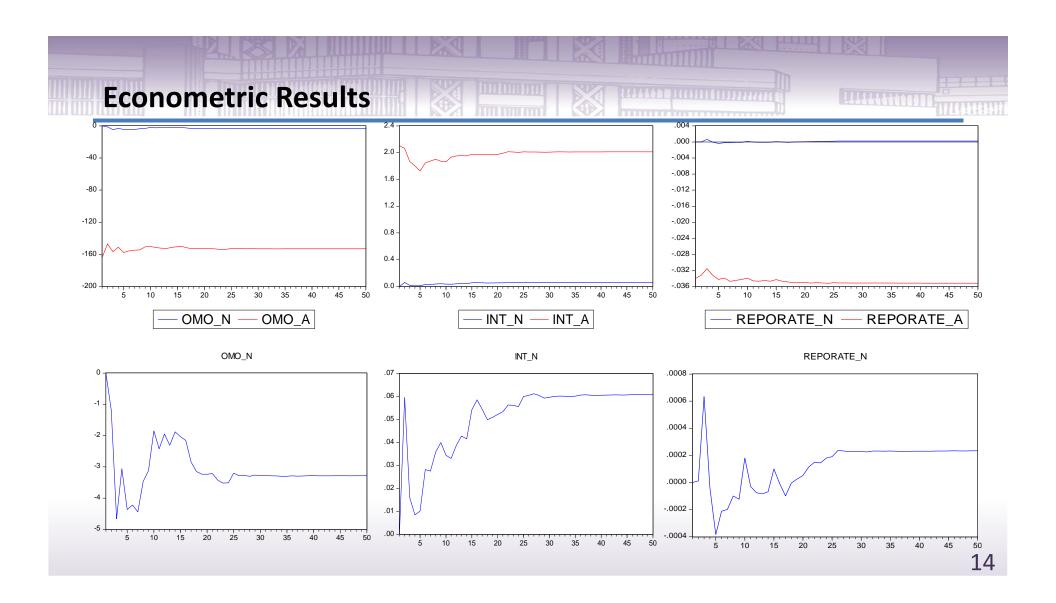
Lags	LM-Stat	Prob	Lags	LM-Stat	Prob
1	121.4988	0.0708	16	104.8713	0.3498
2	88.57024	0.7863	17	104.5113	0.3589
3	96.86539	0.5701	18	102.7618	0.4049
4	92.47525	0.6910	19	114.8839	0.1466
5	111.6161	0.2009	20	130.1347	0.0231
6	104.0598	0.3706	21	148.5324	0.0012
7	101.0039	0.4531	22	139.6501	0.0054
8	91.38994	0.7189	23	127.2684	0.0342
9	105.3017	0.3389	24	87.24214	0.8149
10	77.09969	0.9568	25	113.8464	0.1626
11	112.4434	0.1861			
12	130.4769	0.0220			
13	102.0022	0.4255			
14	103.2882	0.3909			
15	100.1022	0.4783			

Probs from chi-square with 100 df.

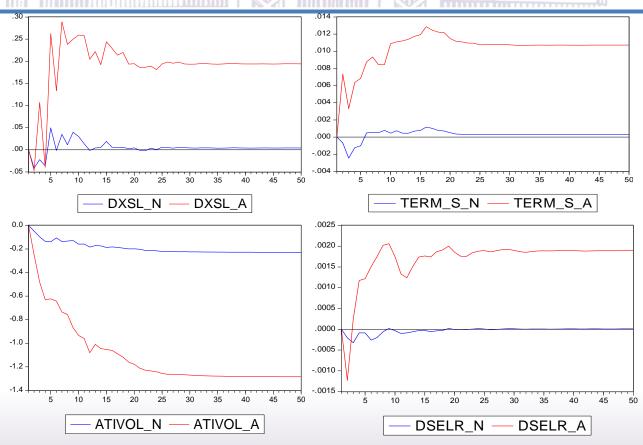
Econometric Results – Impulse Responses







Econometric Results



Discussion

Recap of Results:

- ☐ Response to Negative Oil Price Shock
 - With No Accommodative Policy Adjustment
 - ↑ Net Sales of Foreign Exchange
 - ↑ NDFIs
 - ↑ OMO maturities
 - ☐ ↑ Central Bank Intervention
 - ☐ ↑ Repo rate
 - □ ↑Liquidity
 - □ ↑Term Spread

 - FX appreciation → FX equilibrium

- ☐ Negative Oil Price Shock +
 - Accommodative Policy Adjustment

 - □ ↑ NDFIs
 - ↑ OMO maturities
 - ☐ ↑ Central Bank Intervention
 - ☐ **Ψ** Repo rate
 - ☐ **↑**Liquidity
 - □ ↑Term Spread
 - □ **Ψ** ATI volume
 - ☐ FX depreciation

Discussion (Cont'd)

- Deliberate monetary policy action by the Central Bank can significantly affect short term financial markets under a large commodity price shock i.e., NOT a fine tuner.
- But why the marked difference in the results for the two scenarios?
- Outcome resembles the 'Keynesian Trilemma' for small open economies (Obstfeld and Taylor, 1997).
- Capital account is open and exogenous, thus the Bank has the choice between exchange rate stability and domestic monetary policy.
- In adopting statistically large shifts to domestic monetary policy, control over the exchange rate in the model was ceded and depreciation occurred.

Conclusion and Policy Considerations

- The important consideration for the policymaker is that significant accommodative action can sow the seeds of its own currency depreciation, a situation shown in Ferrerro and Seneca (2015) above as one that is best avoided.
- Considering the main 'small-open-economy constraint', i.e., that the official reserves of a central bank are always and everywhere finite, the model suggests stability of the market for foreign currency seems to be an appropriate operational choice in the very short run.
- This however does not preclude the need for longer run flexibility in the foreign exchange market as per Rodrik (2008).

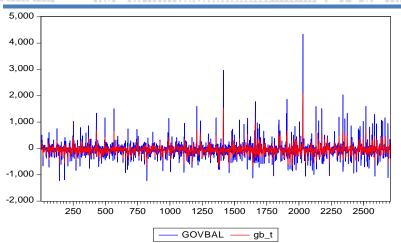


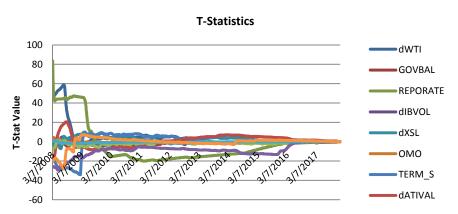
Thank You / Questions & Comments

Technical Appendix

- Normality taken to be asymptotic.
- Typical tests become overpowered with large datasets leading to failure i.e. rejection of the normality null.
- This is true even with Box-Cox and nonparametric (LOESS) transforms of the data or bootstrapping.
- Nevertheless, maximum likelihood estimation gives consistent estimates of coefficients and covariances asymptotically, and standard errors for coefficients can be based on OLS (Hamilton,1994 pp. 298-299).
- Main requirement to interpret IRF's is mean-zero errors.

Appendix (Cont'd)



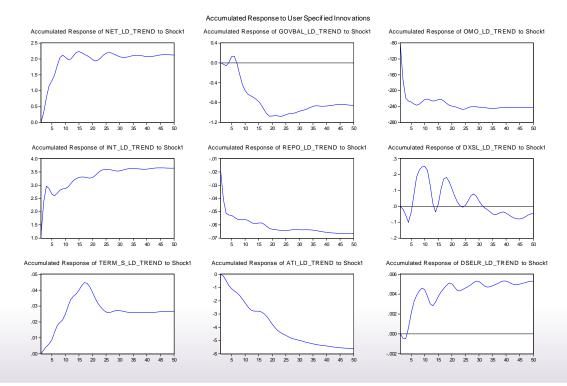


	ATIVOL_BOXCOX	DSELR_BOXCOX	NETSALE_BOXCOX	INT_BOXCOX
Mean	-0.518616	-0.499921	0.041345	-9.065274
Median	-0.175509	-0.499985	0.178476	-11.11111
Maximum	5.640256	-0.497901	3.530936	4.689169
Minimum	-11.11111	-0.500000	-11.11111	-11.11111
Std. Dev.	2.575859	0.000162	0.900530	4.648307
Skewness	-2.920442	4.288492	-1.832433	1.840839
Kurtosis	12.89377	29.09738	16.03532	4.414687
<mark>Jarque-Bera</mark>	<mark>11451.22</mark>	<mark>65464.83</mark>	<mark>15905.69</mark>	<mark>1349.491</mark>
Probability	0.000000	0.000000	0.000000	0.000000

	Mean-Zero Errors
RESID01	-0.000000000000000153
RESID02	0.000000000000007050
RESID03	-0.00000000000000379
RESID04	-0.00000000000055300
RESID05	0.00000000000013000
RESID06	-0.0000000000000000004
RESID07	-0.00000000000005430
RESID08	0.0000000000000000000000000000000000000
RESID09	-0.000000000000008280
RESID10	-0.000000000000000034

Appendix (Cont'd)

LOESS filtered impulse responses for the accommodation scenario



Appendix (Cont'd)

- The hyperparameters of the priors are set up to reflect that
 - i) the effect of the prior dominates the effect of sample information (λ_1 =0.1),
 - ii) the relative cross variable weights are low but existent (λ_2 =0.99) and
 - iii) lag decay is linear (λ_3 =1).