
The Interaction of Monetary and Fiscal Policy: Evidence from Belize

Authors: Candice Soutar and Rumile Arana

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Overview

- Motivation & Background
- Literature Review
- Methodology & Data
- Preliminary Results

Section I: Motivation & Background



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Historical Review... Monetary Policy

- The Central Bank Act (rev. 2011) enshrined monetary policy activities as one of the Bank's primary objectives
- It lists the goal of monetary policy is to:
 - Foster monetary stability, especially stability of the exchange rate
 - Promote credit and exchange conditions conducive to the growth of the economy of Belize
- Monetary policy targets commercial banks' liquidity through the Bank's management of the monetary base (reserve balances).
- Adjustments through the manipulation of reserve requirements are expected to affect credit growth, money supply, international reserves and GDP.
- There have been fifteen monetary policy changes made between 1990 and 2010, with the following results in the pertinent variables:
 - Loan growth (60%), statutory liquidity (60%), and cash liquidity (86%), gross reserves (47%) and GDP growth (25%,)

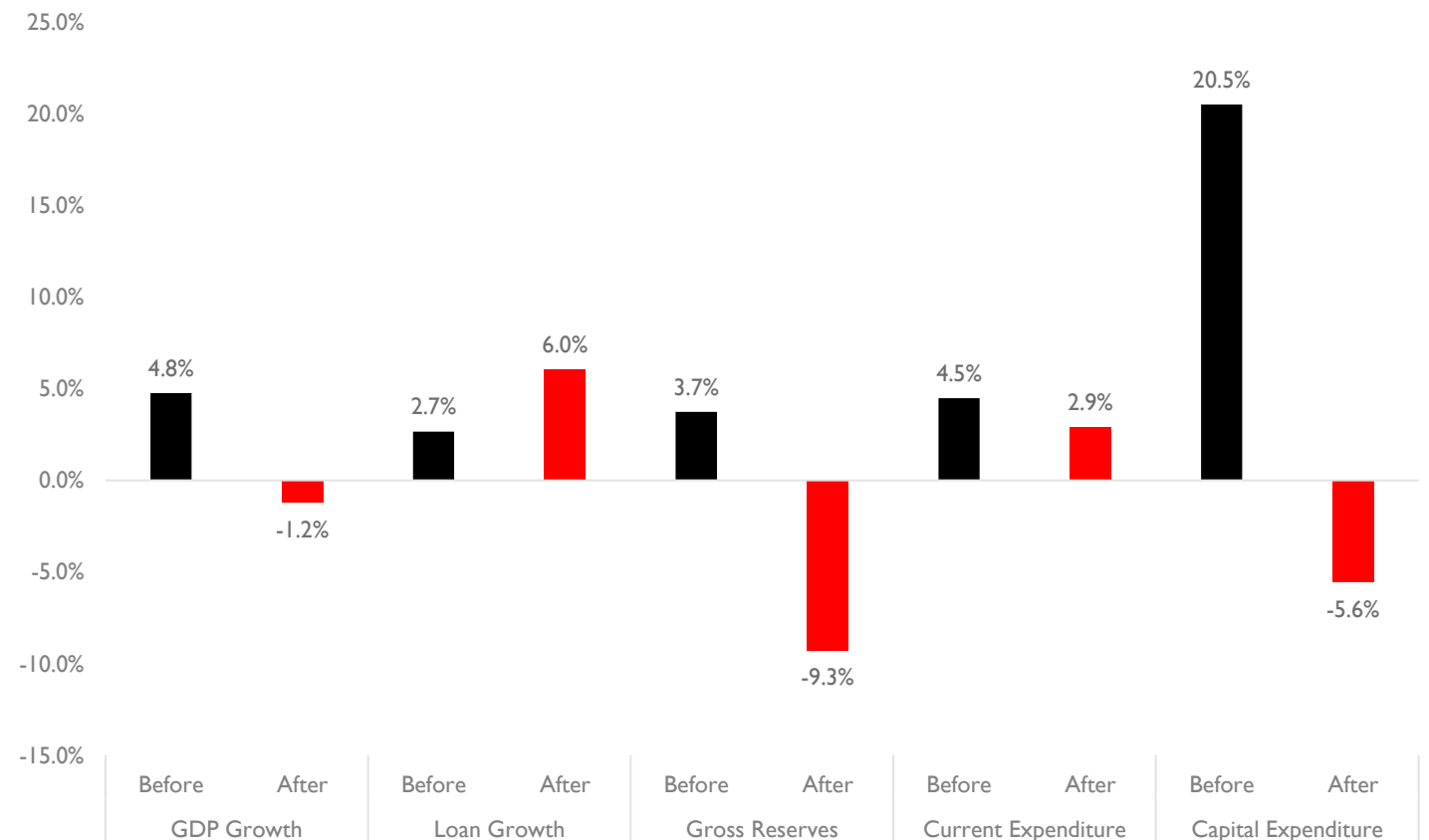
Monetary Policy Changes & Impact on Observed Variables (1990 – 2010)

Date	Policy Variable Change:		Expected change in:						
	Statutory Liquidity	Cash Liquidity	Δ^2	GDP ³	Loans	For. Reserves	Import Cover	Stat Liq	Cash Liq ³
1991Q3	28 to 25	7 to 6	Green		1	1	1	1	
1992Q4	25 to 27	6 to 7	Red		1	0	0	0	
1993Q4	27 to 28	n.a.	Green		1	0	0	0	
1995Q1	28 to 24	7 to 5	Green	0	0	0	0	1	
1995Q4	24 to 26	5 to 7	Red	0	0	0	0	1	
1998Q4	26 to 24	7 to 5	Green	1	1	1	1	1	
2000Q2	n.a.	5 to 3	Green	0	0	1	1	0	
2001Q1	n.a.	3 to 4	Red	0	0	0	0	0	
2002Q4	n.a.	4 to 6	Red	0	0	0	0	1	1
2004Q2	24 to 19	n.a.	Green	0	1	1	1	1	0
2004Q4	19 to 20	6 to 7	Red	0	1	1	1	1	1
2005Q2	20 to 21	7 to 8	Red	1	0	0	0	0	1
2006Q1	21 to 22	8 to 9	Red	0	1	1	1	1	1
2006Q3	22 to 23	9 to 10	Red	1	1	1	1	0	1
2010Q2	n.a.	10 to 8.5	Green	0	1	0	0	1	4 1

Historical Review... Monetary Policy

- Of note in these instances of expansionary monetary policy:
 - Loan growth and that of gross foreign reserves respond according to expectations
 - Fiscal activities after the expansionary change in monetary policy counter the policy measures
 - GDP growth follows the fiscal path
- When contractionary policies are undertaken, the aforementioned variables respond in an opposite manner

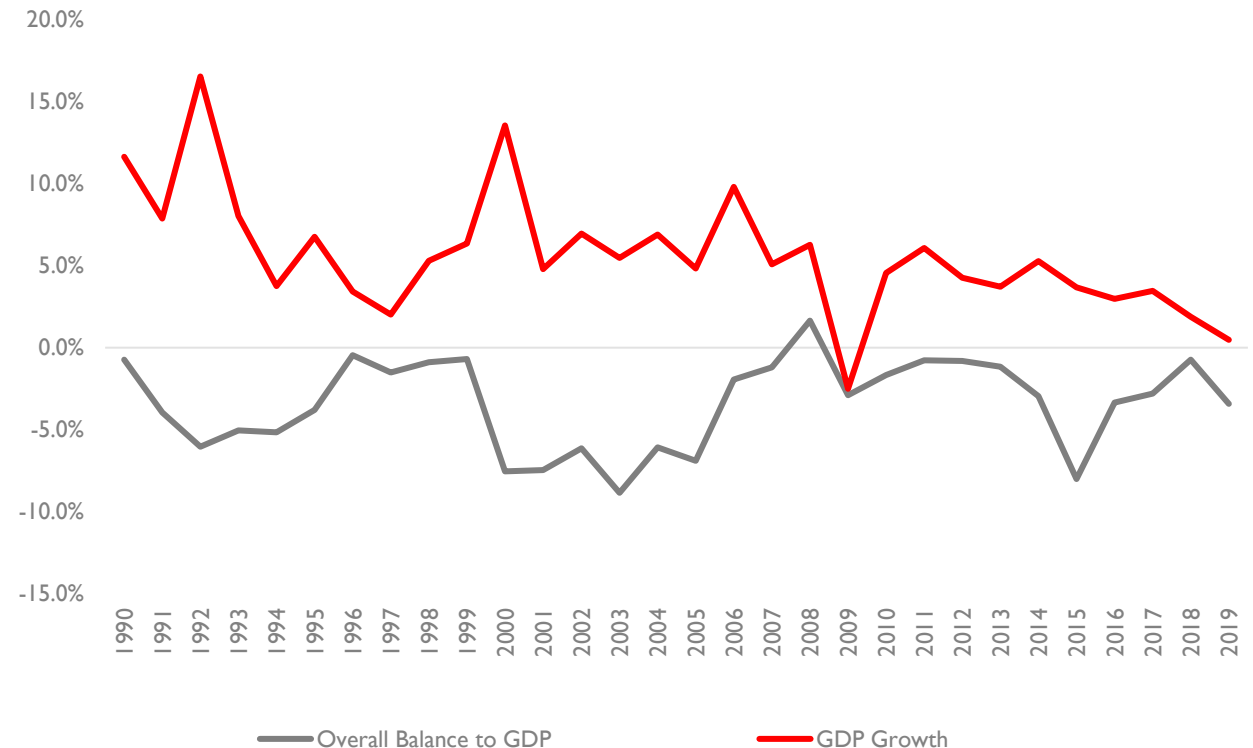
Growth In variables Before and After Expansionary Monetary Policy (1990 -2010)



Historical Review... Fiscal Policy

- Belize has struggled with maintaining strong fiscal positions since its independence given the following:
 - Belize's low and declining trend output growth (Halving of average growth between 2000 and 2019),
 - The country's near-maxed tax capacity (Roberts et al, 2018)
 - Fairly large public sector with its corresponding outlay costs.
- The fiscal deficit has averaged 3.7% of GDP over the past five years.

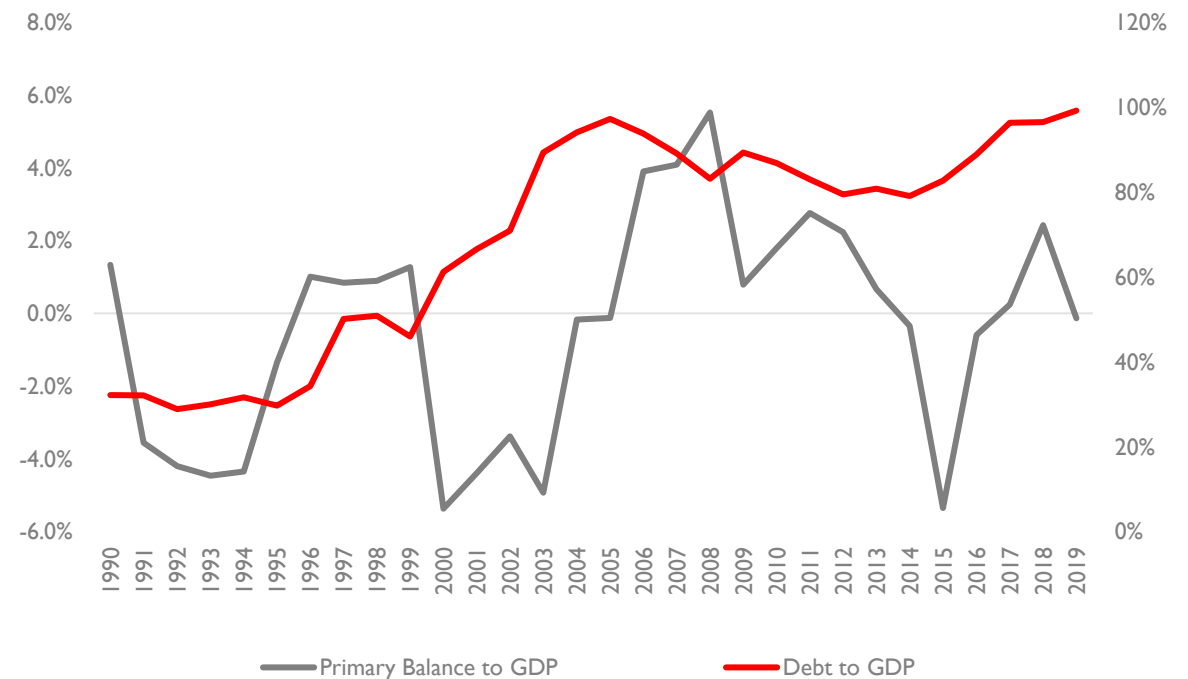
Belize's Overall Fiscal Balance to GDP vs GDP Growth (1990 – 2019)



Historical Review... Debt Sustainability???

- Recurring fiscal deficits have led to an increased accumulation of debt.
- Initially the growth in public liabilities was through the external market however in the past five years the domestic market has become more significant
- Given the need for public sector outlays recent Fiscal adjustment has mainly come through three external debt restructurings (2006, 2013, 2017),
- At 2019-end, total public sector debt remained stubbornly high at 99.7% of GDP.

Belize's Primary Balance to GDP vs Total Debt to GDP (1990 – 2019)





Why is this Important...

- The fiscal authorities have been more “dominant” than the Central Bank in the Belizean economy given:
 - Legal provisions enshrined in the Central Bank of Belize Act that has opened a window for quasi-fiscal activities and potential government influence
 - The size and required expenditure to sustain the activities of the public sector
 - The impact of fiscal activities outweigh monetary policy in its impact on economic growth (Soutar, 2019; Arana, 2019)
- The activities of the fiscal authority is a very important issue in an economy with increasing public sector liabilities and persistent fiscal imbalances
- Fiscal dominance in the Belizean economy has been acknowledged, but has never been empirically assessed for the country

Section II: Literature Review



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Relationship Between Policy Decisions...

- Sargent and Wallace (1981) describe monetary-fiscal standoff as a coordination game between fiscal and monetary authorities. If the central bank moves first, they can impose discipline on the fiscal authority (Monetary Dominant) and if the fiscal authority makes the first move the opposite is true and the economy can be deemed fiscally dominant.
- Aiyagari and Gertler (1985) put forward a two-period overlapping generations model to explain how fiscal and monetary interdependence ultimately affects the ability of monetary policy to control inflation. In a Ricardian regime, government sets taxes to fully back debt; and in a non-Ricardian a portion of that debt has to be backed by the monetary authorities' inflationary-prompting money creation
- Leeper (1991) describes this non Ricardian situation as one where an active fiscal policy exists while a passive monetary policy occurs concurrently.

Selected Studies and Results

Author	Market Studied	Time Period	Methodology & Main Variables	Results
Carlos De Resende (2007)	OECD (18) & Developing Nations (20)	(A) 1950 - 2004	Panel Dynamic Ordinary Least Squares (OLS) on money supply, household consumption and debt	Fiscal Dominance is more common in Developing Countries than in the OECD Nations. Debt plays a minor role in price determination
Henning Bohn (1998)	United States	(A) 1916 - 1995	OLS on primary budget surplus, temporary budget spending, business cycle indicator and debt	US Primary surplus reacts positively to debt-GDP ratio showing that the fiscal authorities are satisfying the intertemporal budget constraint
Luis Catao and Marco Terrones (2003)	107 Countries	(A) 1960 - 2001	ARDL pooled mean group estimator on inflation, money supply, overall budget balance, openness and oil prices	Fiscal deficits are positively associated with inflation in high-inflation and developing country with a weaker results among advanced economies
Edda Zoli (2005)	Emerging Markets (8)	(Q) and (M) 1990 - 2005	VAR between primary balance to GDP ratio and debt to GDP; OLS on nominal interest rate, inflation, output gap, primary balance noinal exchange rate ; Event studies	Mixed results for fiscal dominance hypothesis using VAR methodology. No sign of fiscal policy impacting the monetary policy reaction function. In the event studies, it has been shown that fiscal policy has an impact on sovereign spreads and exchange rates
Antonio Afonso, Jose Alves and Raquel Balhote (2019)	European Union (28)	(A) 1970 -2015	Panel OLS fixed Effects, Two staged least squares estimation on current account primary balance, debt, output gap, interest rate, inflation, monet supply and real effective exchange rate	Primary balance increase when debt levels increase; monetary authorities assume a larger role in economic stabilization in periods of higher debt accumulation

Section III: Methodology & Data



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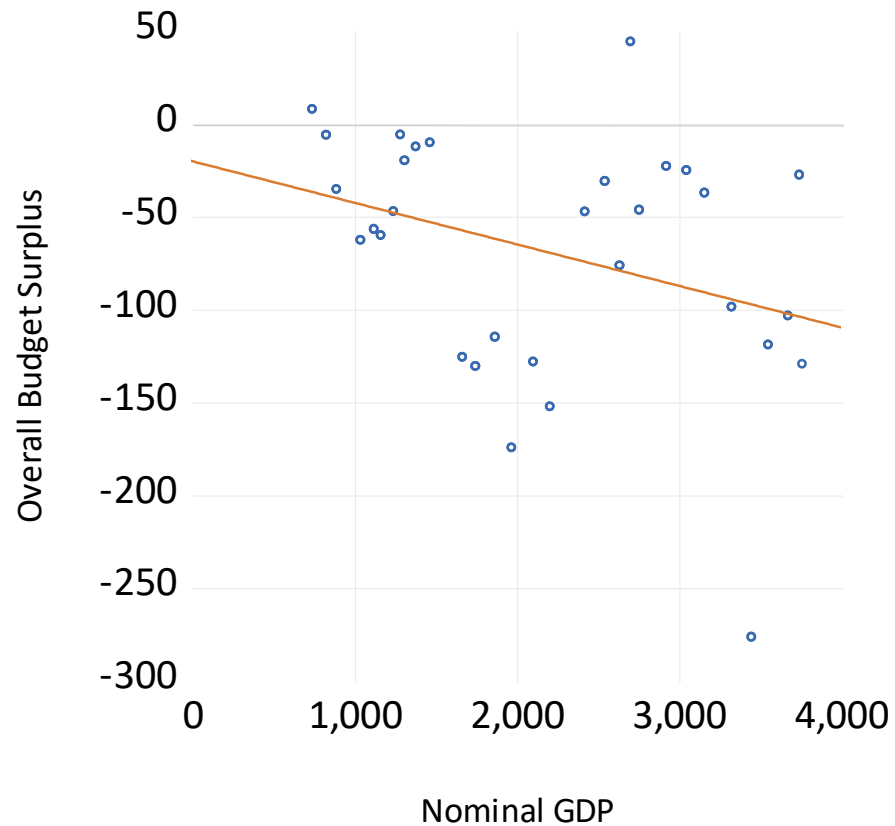
Data & Transformations

- Main variables utilized in assessing the relationship between monetary and fiscal policy (degree of fiscal dominance) include:
 - Primary Balance to GDP
 - Debt to GDP Ratio
- Remainder of the data were used for monetary & fiscal policy reaction function and in identifying the impact of fiscal policy on the macroeconomy
- A quarterly time series was employed from 1986Q1 to 2019Q4
- Variables underwent a logarithmic transformation or in the case of primary balance (negative values) were normalized to GDP

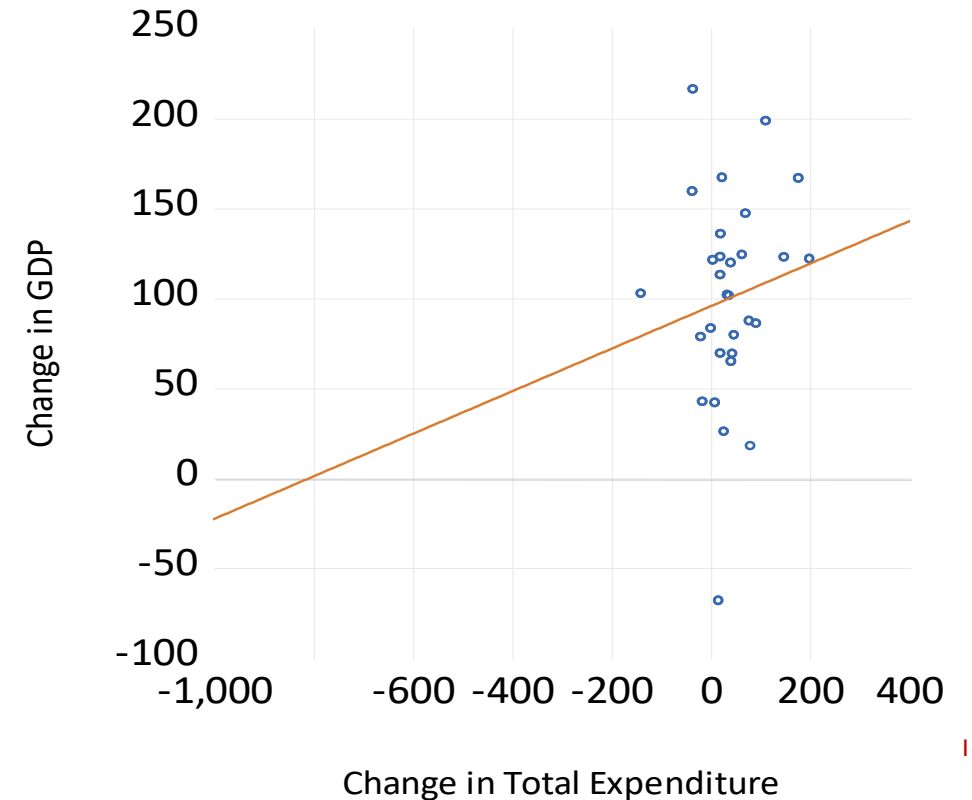
Variables	Definition	Source
Reserve Cash Ratio	Required cash reserves as a percentage of deposit liabilities	Central Bank of Belize
Debt to GDP Ratio	Outstanding Debt Stock as a percentage of Nominal GDP	Ministry of Finance & Statistical Institute of Belize
Primary Balance to GDP Ratio	Central Government Primary Balance as a percentage of Nominal GDP	Ministry of Finance & Statistical Institute of Belize
Overall Balance to GDP Ratio	Central Government Overall Balance as a percentage of Nominal GDP	Ministry of Finance & Statistical Institute of Belize
Inflation	Percentage change in Consumer Price Index (2011 = 100)	Statistical Institute of Belize
Money Supply (M2)	Narrow money plus quasi money balances	Central Bank of Belize Statistical Digest
Import Prices	US Export Price Index (2000 = 100)	FRED Database
Oil Prices	WTI oil spot prices in USD/barrel	US Energy Information Administration (EIA)
Output Gap	GDP as a percentage of potential GDP	Statistical Institute of Belize
Private Sector Credit	Net credit to the private sector	Statistical Institute of Belize
Consumption	Household private consumption	Statistical Institute of Belize
Foreign Reserves	Net Foreign Asset position of the Central Bank of Belize	Central Bank of Belize Statistical Digest
Temporary Government Spending	Central Government capital expenditure	Ministry of Finance
Central Bank Financing	Central Bank credit to Central Government	Central Bank of Belize Statistical Digest

Fiscal Policy and The Belizean Economy..

Deterioration in the Overall Fiscal Balance has been associated with higher GDP ...

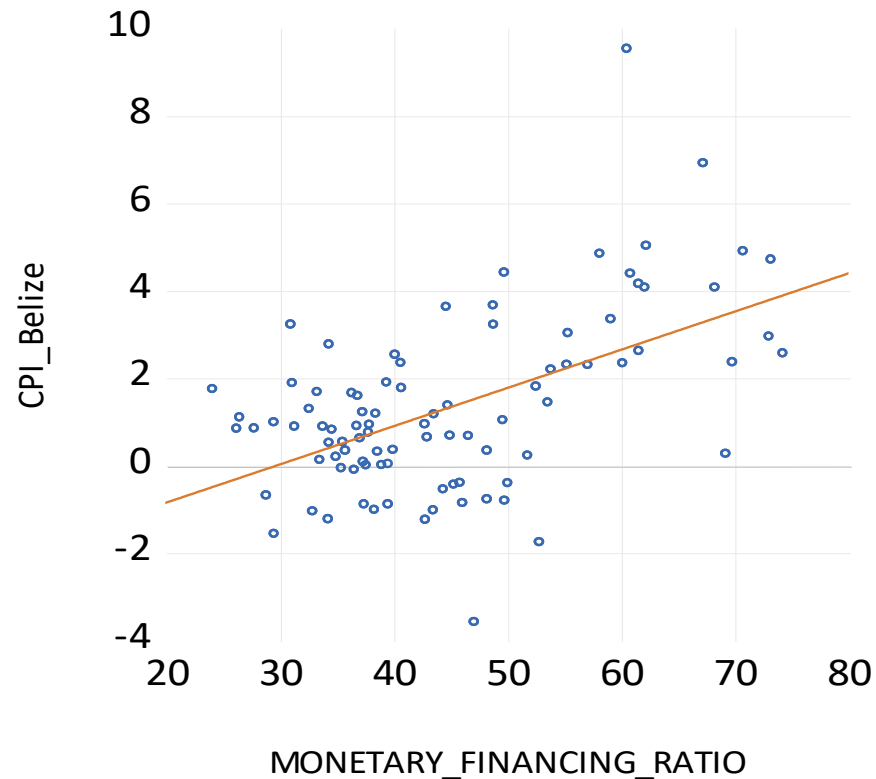


... the picture is even clearer when examining fiscal outlays.

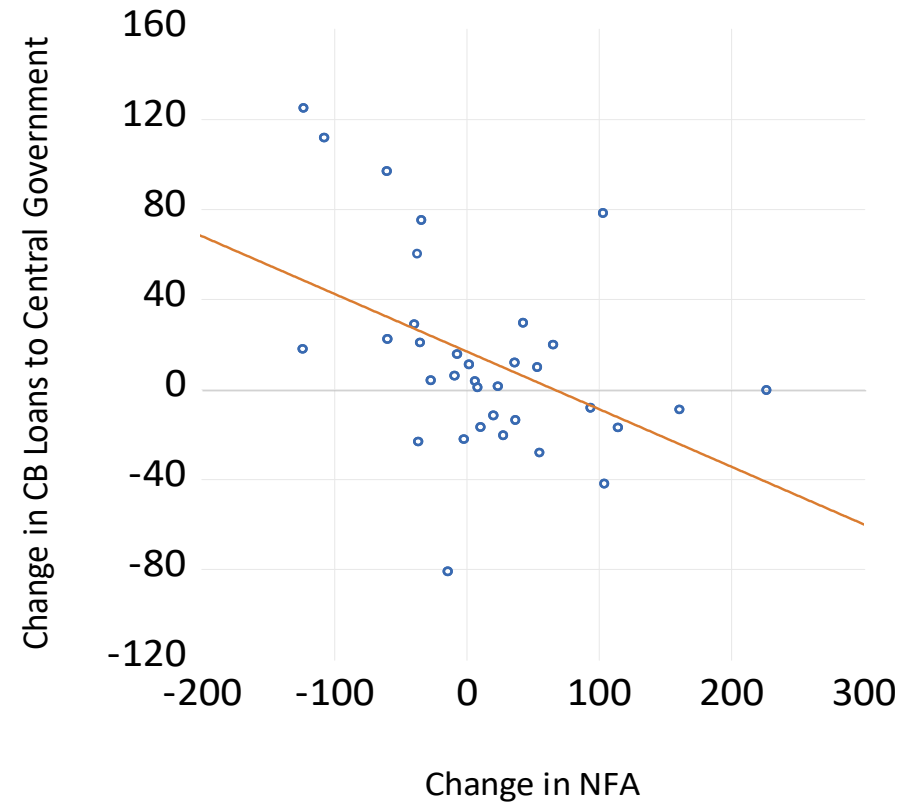


Fiscal Policy Impact (continued)

However Central Bank financing seems to have an inflationary impact...

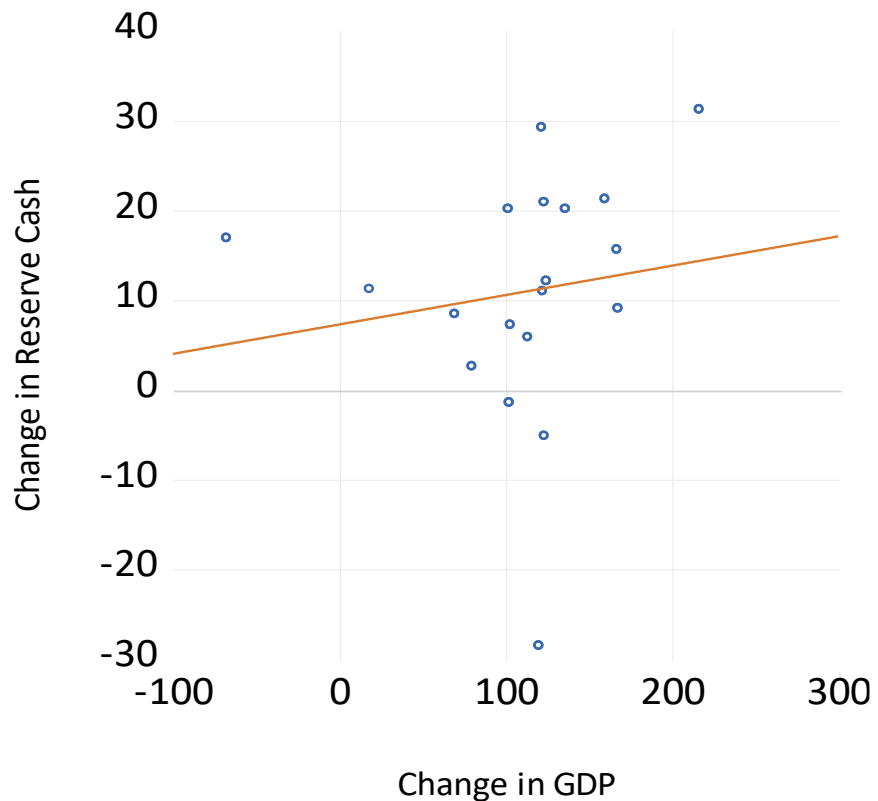


... and is further associated with a deterioration of the NFA position as well.

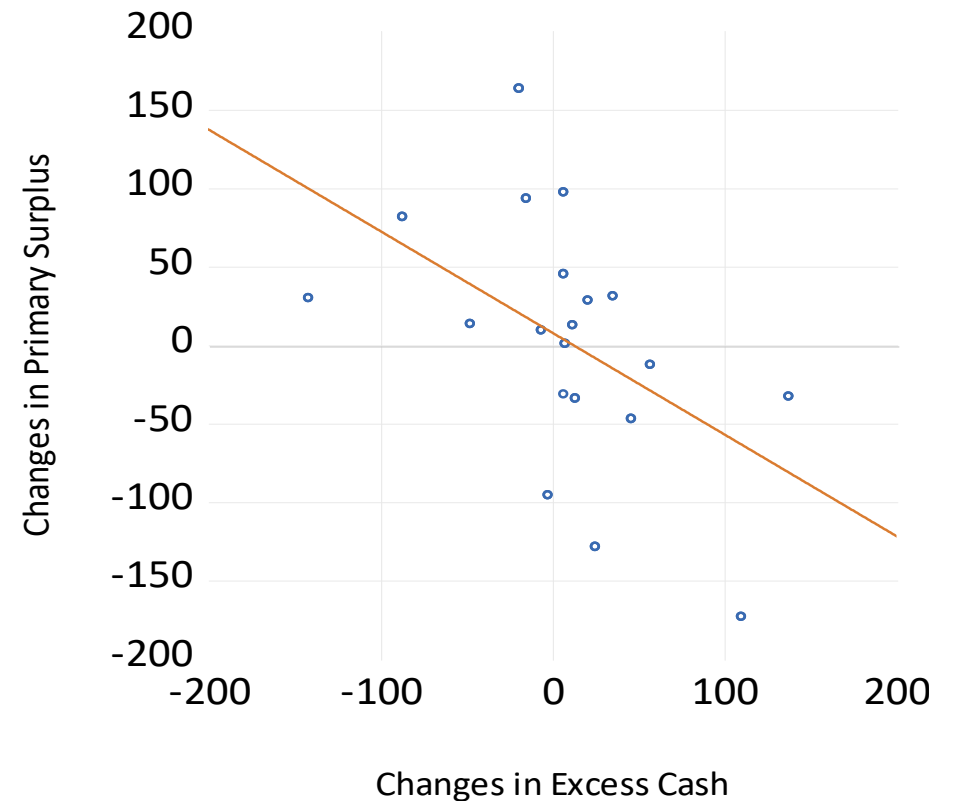


Monetary Policy and The Belizean Economy

Changes in Reserve cash have been associated with increased economic growth...



...and expansionary changes in fiscal policy are associated with increasing excess cash.



Establishing Fiscal Dominance: ARDL & VAR Approach

ARDL Estimations

- Using the De Resende(2007) methodology the authors estimated the degree of fiscal dominance by calculating the fraction of outstanding debt, k , backed by current and future primary surpluses
- $M2 = \beta_0 + \beta_1 * Consumption_{t-i} + \beta_2 * Debt\ to\ GDP_{t-i} + \mu$
 - Where $\beta_2 = -(1 - k)$
- Applying the methodology of Afonso et al (2019) the authors estimated fiscal and monetary policy reaction functions
- $PBal = \beta_0 + \beta_1 * PBal_{t-i} + \beta_2 * CapEx_{t-i} + \beta_3 * Gap_{t-i} + \beta_4 * Debt\ to\ GDP_{t-i} + \mu$
- $RCR = \beta_0 + \beta_1 * RCR_{t-i} + \beta_2 * Gap_{t-i} + \beta_3 * M2_{t-i} + \beta_4 * FRes_{t-i} + \mu$

VAR Estimation

- Drawing on the methodology of Bali (2005) a VAR model was estimated to test if Central Government's primary balance responds to changes in their liabilities and vice versa
- $\Delta PBal_t = \beta_0 + \sum \beta_1 * \Delta PBal_{t-i} + \sum \beta_2 * \Delta Debt\ to\ GDP_{t-i} + \mu$
- $\Delta Debt_t = \alpha_0 + \sum \alpha_1 * \Delta PBal_{t-i} + \sum \alpha_2 * \Delta Debt\ to\ GDP_{t-i} + \varepsilon$

Impact of Fiscal Policy: ARDL Approach

ARDL Estimations

- Drawing on the methodology of Catao and Terrones (2003) and Hendry (1995) the impact of fiscal policy on inflation was investigated:
$$Infl = \beta_0 + \beta_1 * CenBankFin_{t-i} + \beta_2 * M2_{t-i} + \beta_3 * Fiscal_{Bal}_{t-i} + \beta_4 * Oil_{t-i} + \beta_5 * Agri_{t-i} + \beta_6 * US_exp_index_{t-i} + \beta_7 * T_Bill_rate_{t-i} + \beta_8 * Output_gap_{t-i} + \mu$$
- Applying the methodology of Branch and Jordan (2005), the authors investigate the impact of fiscal policy on international reserves
$$NFA = \beta_0 + \beta_1 * Cred_{t-i} + \beta_2 * GDP_{t-i} + \beta_3 * PB_{t-i} + \beta_4 * RCR_{t-i} + \beta_5 * QM_{t-i} + \mu$$

Section IV: Preliminary Results



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Fiscal Dominance: De Resende

Long Run Estimation Results of the De Resende Model

Dependent Variable -Money Supply (M2)

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D_DGDP	-0.346395	0.194054	-1.785048	0.0825
LCON	1.050879	0.124866	8.416078	0.0000
C	8.075520	0.786885	10.26265	0.0000

$$EC = LM2 - (-0.3464 \cdot D_DGDP + 1.0509 \cdot LCON + 8.0755)$$

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	5.835373	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5
Finite Sample: n=50				
Actual Sample Size	48	10%	2.788	3.513
		5%	3.368	4.178
		1%	4.695	5.758
Finite Sample: n=45				
		10%	2.788	3.54
		5%	3.368	4.203
		1%	4.8	5.725

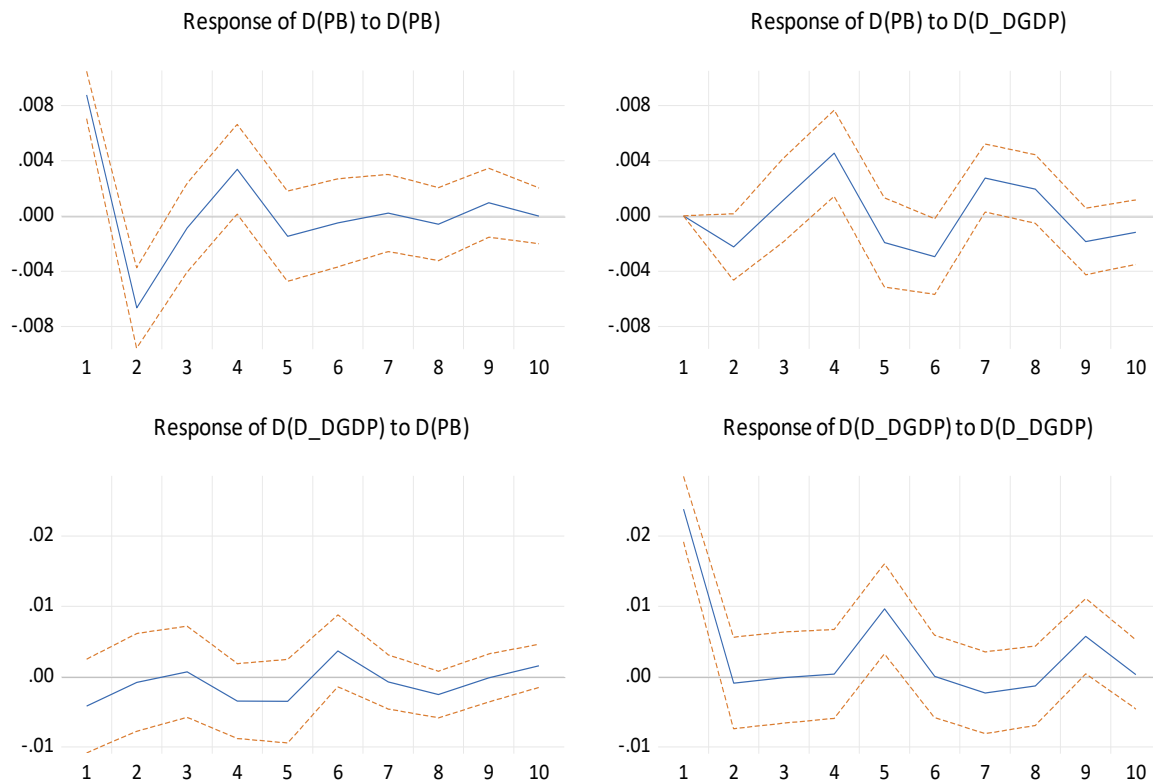
ARDL Results

- Evidence of fiscal dominance established between 2007 and 2019...
 - $k = 1 - 0.346395 = 0.653605$
 - Prior to this period, the fiscal authorities were able to source external debt, hence there wasn't a large percentage of domestic debt from the Central Bank
- The bounds test indicates that there is a cointegrating relationship between the variables
- The error correction terms is negative and significant in the short run model
- Diagnostic checks were carried out and indicate a stable model as well
- DOLS estimation provides robustness check of results

Fiscal Dominance: VAR Approach

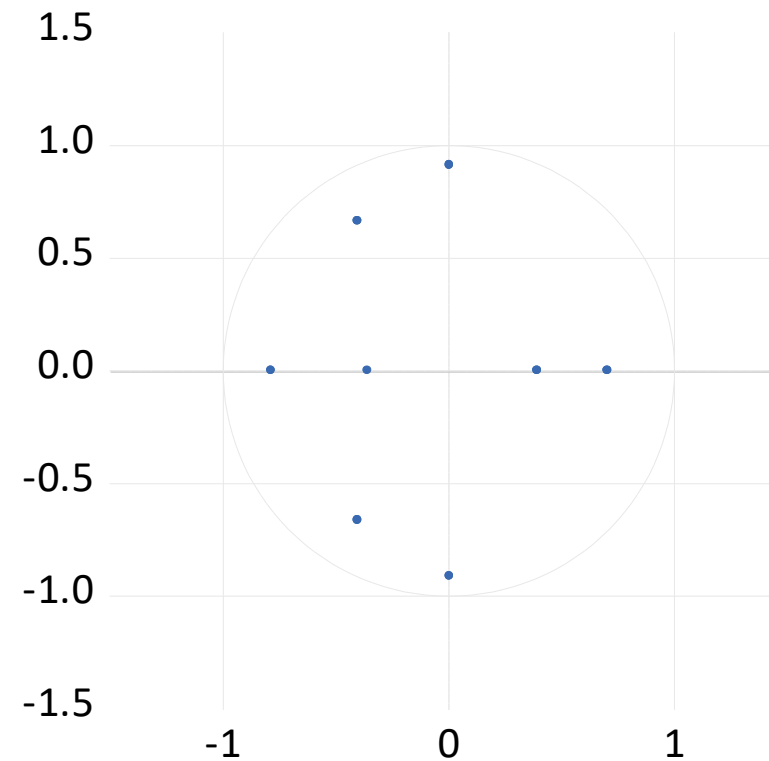
Results of Bivariate VAR Impulse Response Function

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.



VAR Stability Assessment

Inverse Roots of AR Characteristic Polynomial



Fiscal Policy Response Function: ARDL

Long Run Estimation of Fiscal Policy Response Function: Dependent Variable - Primary Balance to GDP

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D_DGDP	0.020637	0.014209	1.452457	0.1542
LCAP	-0.010304	0.003205	-3.215333	0.0026
LFRES	-0.003583	0.004169	-0.859452	0.3952
LRCR	-0.016504	0.022497	-0.733587	0.4675
C	-0.032528	0.032015	-1.016022	0.3157
EC = PB - (0.0206*D_DGDP -0.0103*LCAP -0.0036*LFRES -0.0165*LRCR -0.0325)				
F-Bounds Test Null Hypothesis: No levels relationship				
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic k	10.05166 4	Asymptotic: n=1000		
		10%	2.2	3.09
		5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Actual Sample Size	56	Finite Sample: n=60		
		10%	2.323	3.273
		5%	2.743	3.792
		1%	3.71	4.965
		Finite Sample: n=55		
10%	2.345	3.28		
5%	2.763	3.813		
1%	3.738	4.947		

Short Run Estimation of Fiscal Policy Response Function: Dependent Variable - Δ Primary Balance to GDP

ECM Regression Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PB(-1))	0.272704	0.116541	2.339978	0.0244
D(PB(-2))	0.091940	0.105140	0.874449	0.3871
D(PB(-3))	0.219643	0.081753	2.686681	0.0105
D(D_DGDP)	-0.068628	0.027873	-2.462151	0.0182
D(D_DGDP(-1))	-0.072394	0.030146	-2.401472	0.0211
D(D_DGDP(-2))	-0.049244	0.030861	-1.595679	0.1184
D(D_DGDP(-3))	0.068806	0.030797	2.234215	0.0311
D(LFRES)	0.041455	0.007948	5.215481	0.0000
D(LFRES(-1))	0.022537	0.007493	3.007776	0.0045
D(LFRES(-2))	0.018333	0.006374	2.876154	0.0064
CointEq(-1)*	-1.228763	0.149175	-8.237031	0.0000
R-squared	0.872824	Mean dependent var	-0.000317	
Adjusted R-squared	0.844563	S.D. dependent var	0.012940	
S.E. of regression	0.005101	Akaike info criterion	-7.544400	
Sum squared resid	0.001171	Schwarz criterion	-7.146563	
Log likelihood	222.2432	Hannan-Quinn criter.	-7.390159	
Durbin-Watson stat	2.073606			

Monetary Policy Response Function: ARDL

Long Run Estimation of Monetary Policy Response Function: Dependent Variable – Reserve Cash Ratio

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
N_FR_GDP	-0.735027	0.122837	-5.983766	0.0000
LM2	0.901667	0.104347	8.641078	0.0000
GAP	-7.082021	4.019417	-1.761952	0.0898
PB	11.37528	3.937189	2.889187	0.0077
C	-11.83378	1.221055	-9.691439	0.0000
EC = LRRCR - (-0.7350*N_FR_GDP + 0.9017*LM2 -7.0820*GAP + 11.3753*PB -11.8338)				
F-Bounds Test Null Hypothesis: No levels relationship				
Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	7.554338	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Finite Sample: n=50				
Actual Sample Size	48	10%	2.372	3.32
		5%	2.823	3.872
		1%	3.845	5.15
Finite Sample: n=45				
		10%	2.402	3.345
		5%	2.85	3.905
		1%	3.892	5.173

Short Run Estimation of Monetary Policy Response Function: Dependent Variable - Δ Reserve Cash Ratio

ECM Regression Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRCR(-1))	0.119978	0.099690	1.203512	0.2396
D(LRCR(-2))	0.227895	0.099777	2.284038	0.0308
D(N_FR_GDP)	-0.016773	0.052076	-0.322092	0.7500
D(N_FR_GDP(-1))	0.327799	0.062605	5.236010	0.0000
D(N_FR_GDP(-2))	0.223630	0.053229	4.201319	0.0003
D(LM2)	-0.888646	0.482356	-1.842306	0.0769
D(LM2(-1))	-3.095153	0.521789	-5.931811	0.0000
D(LM2(-2))	-0.357016	0.521995	-0.683944	0.5001
D(LM2(-3))	-0.981123	0.490356	-2.000839	0.0560
D(GAP)	-1.646478	0.304849	-5.400961	0.0000
D(GAP(-1))	1.844221	0.307693	5.993706	0.0000
D(PB)	1.264814	0.971666	1.301696	0.2044
D(PB(-1))	-5.741261	1.491342	-3.849729	0.0007
D(PB(-2))	-3.731374	1.380410	-2.703091	0.0119
D(PB(-3))	-2.298977	1.128051	-2.038008	0.0518
DUMMY	0.058919	0.030831	1.911051	0.0671
CointEq(-1)*	-0.539956	0.073450	-7.351365	0.0000
R-squared	0.741101	Mean dependent var	0.011055	
Adjusted R-squared	0.607476	S.D. dependent var	0.115359	
S.E. of regression	0.072274	Akaike info criterion	-2.145577	
Sum squared resid	0.161931	Schwarz criterion	-1.482860	
Log likelihood	68.49385	Hannan-Quinn criter.	-1.895135	
Durbin-Watson stat	2.229184			

Fiscal Impact on Inflation & Reserves

ARDL Estimation of Inflation Dynamics

Dependent Variable – Change in CPI

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCBL	0.035328	0.014093	2.506785	0.0166
M2_GDP	0.162555	0.036238	4.485714	0.0001
LWTI	0.087070	0.025064	3.473883	0.0013
LTBRATE	-0.068401	0.014041	-4.871691	0.0000
LIM_IN	0.294948	0.105487	2.796069	0.0081
LAGRIC	-0.098029	0.038672	-2.534912	0.0155
C	1.465819	0.596500	2.457367	0.0187

$$EC = LCPI - (0.0353*LCBL + 0.1626*M2_GDP + 0.0871*LWTI - 0.0684 *LTBRATE + 0.2949*LIM_IN - 0.0980*LAGRIC + 1.4658)$$

F-Bounds Test Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	10.20782	10%	1.99	2.94
k	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99
Finite Sample: n=60				
		10%	2.114	3.153
		5%	2.456	3.598
		1%	3.293	4.615
Finite Sample: n=55				
		10%	2.139	3.204
		5%	2.49	3.658
		1%	3.33	4.708

ARDL Estimation of Foreign Reserves

Dependent Variable: Foreign Reserves of Central Bank

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCRED	-1.273008	1.560642	-0.815695	0.4202
LGDP_SA	-0.605718	1.838032	-0.329547	0.7437
PB	21.99657	5.958538	3.691605	0.0008
LRRCR	-0.690000	0.303650	-2.272355	0.0293
LQM	3.414775	0.840022	4.065101	0.0003
C	-21.58999	3.280849	-6.580612	0.0000

$$EC = LNFA - (-1.2730*LCRED - 0.6057*LGDP_SA + 21.9966*PB - 0.6900 *LRRCR + 3.4148*LQM - 21.5900)$$

F-Bounds Test Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	19.75381	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
Finite Sample: n=55				
		10%	2.226	3.241
		5%	2.617	3.743
		1%	3.543	4.839
Finite Sample: n=50				
		10%	2.259	3.264
		5%	2.67	3.781
		1%	3.593	4.981



What's next...

- Refining the analysis of the impact of fiscal policy on the macroeconomy with a focus on international reserves
- Estimating a panel regression model to analyze the impact of fiscal variables on international reserves
- Methods that may improve the robustness of the results

Thank You



CENTRAL BANK
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PO Box 852
Belize City
Belize
Central America



+1 501 233-6194



centralbank.org.bz