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MODELING DEMAND RESPONSES TO POLICIES AND SHOCKS: AN APPLICATION TO SURINAME[1]

A. Introduction

1. **Modeling the effects of economic policies and external shocks on demand and output is important for policy analysis and forecasting.** The global crisis has refocused the attention of policy makers on the responses of demand and output to fiscal and monetary policy shocks as well as to international spillovers. These issues are also pertinent for Suriname, which recently suffered a large external shock from declining gold prices and is embarking on substantial policy tightening to ensure macro stability.

2. **The evidence on the impact of economic policies on economic activity has been mixed**. On the one hand, Giavazzi and Pagano (1990, 1996) have shown that fiscal consolidations could lead to confidence effects and higher output in the short run. On the other hand, other studies have provided evidence that cuts in spending and increases in taxes reduce output in the short-run (Blanchard and Perotti, 2002; Barro and Redlick, 2009). Recent findings indicate that fiscal multipliers have been positive and larger during the global crisis because of the zero lower bound constraints (Blanchard and Leigh, 2013). Overall, it appears that fiscal multipliers can be country, time and circumstance specific (Spilimbergo et al., 2009). Also, prior empirical studies have suggested that the responses of demand to monetary shocks can vary with the economy under investigation and its monetary framework (Angeloni et al., 2003).

3. **This chapter carries out an empirical analysis of the effects of policies and external shocks on economic activity in Suriname.** As empirical results tend to be country and circumstance-specific, it is important to research these issues with a specific focus on Suriname. There has been little research on these topics that is focused specifically on Suriname[2]

B. Empirical Strategy

4. **Our empirical analysis was constrained by data limitations**. Since monetary and fiscal policies affect activity by adjusting demand, empirical analysis should ideally be based on demand side GDP and its components. This helps establish a more direct link between policies and the channel through which they affect output. However, demand-side GDP for Suriname is currently not available. Thus, we proxied domestic demand by subtracting net exports taken from

[1] Prepared by Kalin Tintchev.

[2] Schmittmann (2013) constructs a high frequency output indicator for Suriname, which exploits the strong correlation between growth in GDP and credit.

BOP data from the level of nominal GDP from the supply-side estimates.[3] Although under this approach we can analyze aggregate demand we are unable to disentangle consumption and investment, which may respond differently to monetary and fiscal shocks. We then assess the impact of policies and other relevant variables on economic activity by combining their effects on domestic demand and on net exports.

5. **We model domestic demand and imports econometrically, but not exports**.[4] Exports are dominated by three commodities exported by a few large companies. Therefore, we forecast exports using firm-level projections of future volumes and WEO commodity price projections. However, domestic demand is modeled as a function of fiscal and monetary variables and exogenous factors. Imports are then modeled as a function of domestic demand and other relevant variables. Deflators for domestic demand, exports and imports are then used on the nominal variables to arrive at the real variables and to estimate real output.

6. **To model empirically domestic demand, we estimate a function of the following form:**

$$\Delta \ln(DD_t) = \beta_0 + \beta_1 \Delta \ln(SPE_t) + \beta_2 \Delta \ln(REV_t) + \beta_3 \Delta \ln(CRE_t) + \beta_4 \Delta \ln(EXP_t) + \varepsilon_t \qquad (1)$$

where *DD* is nominal domestic demand, *SPE* is fiscal expenditures, *REV* is fiscal non-mineral revenue, *CRE* is credit to the private sector, *EXP* is exports of goods and services, and ε is a standard white noise disturbance. To deal with possible non-stationarity of the variables in levels, we estimate the model in log differences. As fiscal mineral revenues are sizable and are driven by volatility in commodity prices, we use fiscal non-mineral revenues as the relevant fiscal revenue policy variable rather than total fiscal revenues. On the monetary side, we control for changes in credit. On the trade side, we control for changes in exports in order to measure the effects of external shocks on domestic demand. Such shocks are important in Suriname given its reliance on commodity exports.

7. **We estimate an import demand function with the following specification:**

$$\Delta \ln(IMP_t) = \delta_0 + \delta_1 \Delta \ln(IMP_{t-1}) + \delta_2 \Delta \ln(DD_t) + \delta_3 \ln(EXP_t) + \delta_4 \ln(NEER_t) + \mu_t \qquad (2)$$

where *IMP* are imports of goods and services, IMP_{t-1} are lagged imports, *DD* is nominal domestic demand, *EXP* are exports of goods and services, *NEER* is the nominal effective exchange rate, and μ is a white noise disturbance. All variables are in log differences. We fit the two equations using data for 1979-2013. We exclude from the estimation period the observations for 1993 because of

[3] The General Office of Statistics is working on the compilation of demand-side GDP estimates.

[4] For a similar econometric approach see for instance Barro and Redlick (2009).

a large spike in the series for that year that we attribute to the near-hyperinflation during this period.

C. Results

8. **As specified, some coefficient estimates in the two equations could suffer from endogeneity bias**. In the domestic demand equation, it is difficult for instance to ascertain causality between credit and demand. Although higher credit growth can fuel domestic demand, higher demand would also lead to higher credit growth. Hence, changes in credit could reflect both changes in credit policies and demand-side effects. Similarly, an increase in fiscal expenditures would lead to higher demand but higher demand would also result in higher revenues and spending. The same argument holds for fiscal revenues. However, exports appear to be exogenous in the model since they would affect domestic demand, but demand is unlikely to influence exports. As regards the import equation, imports could affect exports if they include capital goods that increase firms' export capacity. Also, both imports and exports could respond to a common price shock.

9. **To address possible endogeneity of some of the regressors, we perform instrumental variable estimation.** In the domestic demand equation, we treat fiscal expenditures, non-mineral revenues, and credit as endogenous variables and instrument for them with their first lags and other instruments. Our list of instruments includes oil, gold, and food prices, which are correlated with credit but will not be influenced by domestic demand. We also include the reserve requirement and lagged real GDP, which would affect the supply of credit. In the import equation, we treat exports as endogenous and use its lags as well as the prices of food, gold, and oil, and lagged real GDP as instruments. We estimate the two equations with two-stage least squares and heteroskedasticity and auto-correlation robust standard errors.

10. **As expected, the fiscal variables have statistically significant and economically meaningful effects.** The estimates indicate that both a negative shock to spending and a positive shock to non-mineral revenues lead to lower demand (Table 1). On the spending side, a 1 percent decrease in spending leads to a 0.43 percent decline in demand. On the revenue side, a 1 percent increase in non-mineral revenues reduces demand by 0.11 percent. The estimates indicate that fiscal tightening leads to lower output, implying limited confidence effects, which are consistent with Suriname's low debt levels. Second, changes in spending have a strong concurrent effect on demand, while the impact of non-mineral revenues is lagged. Third, demand appears much more sensitive to changes in spending than non-mineral revenues. Our estimates suggest that the spending multiplier is approximately four times larger than the non-mineral revenue multiplier. However, as non-mineral revenue is substantially smaller than total revenue (with mineral revenues comprising a large fraction of total revenue), this is not strictly comparable with cross-country studies of the differences between spending and revenue multipliers (e.g. Spilimbergo et al, 2009). The results are however broadly consistent with the theoretical argument that spending affects demand directly, while the effect of revenue

measures is indirect, through the adjustment of private consumption to changes in disposable income.

Table 1. Domestic Demand Equation 1/ 2/

Dependent Variable: Domestic Demand
Method: Two-stage Least Squares 3/
Sample: 1983-2013

Variable	Coefficient	Std. Error	t-Statistic	Probability
Fiscal expenditure (t)	0.426	0.20	2.11	0.04
Nonmineral revenue (t-1)	-0.110	0.02	-4.45	0.00
Credit (t)	0.565	0.12	4.56	0.00
Exports (t-1)	0.318	0.14	2.30	0.03
Constant	-0.053	0.03	-1.67	0.11
R-squared	0.91			
Adjusted R-squared	0.90			
F-statistic	50.6			
Prob(F-statistic)	0.00			

1/ All variables are in log differences.
2/ Heteroskedasticity and autocorrelation robust standard errors.
3/ Variables used as instruments include lagged expenditure, non-mineral revenue and credit, gold, oil and food prices, lagged real GDP and the reserve requirement in domestic currency.

11. **Our multipliers are not fully comparable with other studies because of differences in definitions**. In particular, our multipliers are calculated with respect to nominal domestic demand and hence will be larger than real output multipliers. This is because leakages through imports tend to reduce output multipliers, which is not the case for demand multipliers. Moreover, changes in nominal variables will tend to be larger than real changes because they reflect both price and quantity effects.

12. **The estimates are nonetheless broadly consistent with prior empirical findings.** Spending and revenue multipliers with similar values have been reported in a number of other empirical studies (Blanchard and Perotti, 2002; Al-Eyd and Barrell, 2005; Coronado et al., 2005; Freedman et al., 2008; Barro and Redlick, 2009). The estimates are also in line with guidance provided by the International Monetary Fund for small open economies, which recommends spending multipliers of 0.5 or less and revenue multipliers of half of that value (Spilimbergo et al., 2009). Spending multipliers for Barbados, Jamaica and Trinidad and Tobago range between 0.11 and 0.18 (Guy and Belgrave, 2012). However, they are based on real output and will be lower than our nominal estimates by definition. Moreover, these countries' higher debt may lead to higher confidence effects and smaller multipliers (Corsetti et al., 2012).

13. **The results also reveal a strong contemporaneous correlation between credit and demand, while the empirical link between exports and demand seems slightly weaker.** The

coefficient on credit is both statistically and economically significant. A negative credit shock of 1 percent leads to a fall in demand of about 0.6 percent. Shocks to exports also have a significant effect on domestic demand, as a negative export shock of 1 percent leads to a fall in demand of about 0.3 percent with a lag.

14. **The results for import demand point to a strong correlation between imports and exports.** The export variable is highly significant and explains a large fraction of the total variation in imports. An increase in exports of 1 percent is associated with a 0.61 percent increase in imports (Table 2). The empirical link between import and export fluctuations has been noted previously in the literature (Tuck, 2007). This link may be stronger in Suriname where a significant part of total imports may represent inputs into the production of major exporters in the extractive sector.

Table 2. Import Demand Equation 1/ 2/

Dependent Variable: Imports
Method: Two-stage Least Squares 3/
Sample: 1983-2013

Variable	Coefficient	Std. Error	t-Statistic	Probability
Domestic demand (t)	0.227	0.046	4.9	0.00
Imports (t-1)	0.154	0.135	1.1	0.26
Exports (t)	0.609	0.091	6.7	0.00
Nominal effective exchange rate (t)	0.216	0.130	1.7	0.11
Constant	-0.007	0.017	-0.4	0.69
R-squared	0.66			
Adjusted R-squared	0.61			
F-statistic	6.99			
Prob (F-statistic)	0.00			

1/ All variables are in log differences.
2/ Heteroskedasticity and autocorrelation robust standard errors.
3/ Variables used as instruments include lagged exports, gold, oil and food prices, and lagged real GDP.

15. **Imports also depend on domestic demand and relative prices.** Imports that are not offset by exports would add to the current account deficit. Such effects appear driven by changes in domestic demand and relative prices, which are statistically significant and have the expected sign. Our estimates suggest that an increase in demand of 1 percent leads to an increase in imports of 0.23 percent. The effect of the nominal effective exchange rate is also as expected, with a 1 percent appreciation leading to a 0.24 percent increase in imports.

D. Concluding Remarks

16. **The estimated equations provide useful inputs for preparing medium term economic forecasts for Suriname.** Staff's medium term forecasts for economic activity and the

external current account take into account WEO projections of commodity prices, information about the plans of the major commodity exporters, the fiscal and monetary policy outlook, and the estimated equations described above. Expert judgment however is always very important in evaluating and finalizing macro projections.

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