Modelling the Small Open Economy with Price-taker Rigidity

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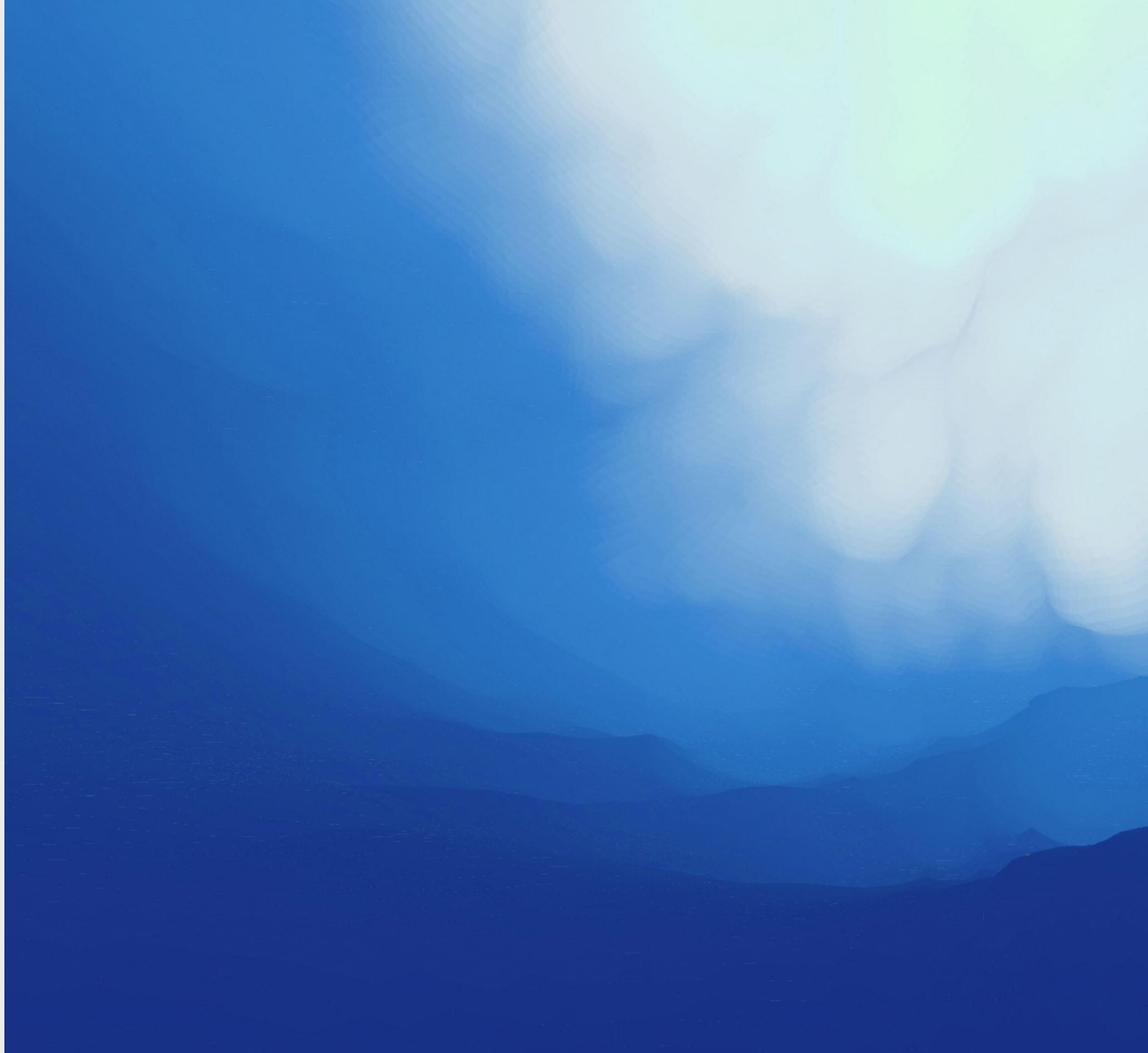

Introductory remarks

- Thanks for the invitation to participate.
- Happy to see that this conference continues as the premier economic research forum in the Caribbean. Congratulations to the Central Bank of the Bahamas and all those who organized this conference and best wishes for continued success of the conference
- I want to acknowledge Mr. Alfred Bhulai, an engineer, friend and colleague from the University of Guyana who assisted me with the math operations.

Objective

- This paper advances an open economy macroeconomic model that pushes the small-country assumption to the extreme of assuming that the small country is a price taker, not only for its traded goods, but in its domestic market as well.
- The initial justification for this analysis was with reference to the very small Caribbean countries
- However, I would argue that this model has increasing applicability in an increasingly integrated global economy in which even moderately sized economies face a more and more open policy environment
- Large countries like the US and China that had trade ratios in single digits a few decades ago now show much higher trade ratios.

Goods and Money markets integrated

- I originally took an interest in the open economy model with similar assumptions several decades ago
- This model goes a step further by considering the goods market and the money market in an integrated, simultaneous equations model

The Dornbusch Analysis

- Dornbusch, Rudiger (1980), *Open Economy Macroeconomics, Basic Books, Inc. Publishers, New York*, provides an authoritative analysis of the small open economy; a useful starting point of reference.
- Dornbusch's assumptions:
  - Economy completely specialized in the production of exportables,
  - p = eP*/P where p is the relative price that drives trade changes,
  - e domestic currency price of foreign currency
  - P* foreign currency price
  - P Domestic currency price
  - Both exports and imports are functions of relative prices: X = X(p); M = M(p, Y)

Key assumptions of our model

- Assumption that, abstracting from transportation costs and other such margins, domestic prices in a very small open economy are aligned to the international price level
- This reflects traditional price-taker behavior,
- Is consistent with microeconomic foundations in a traditional utility maximization context,
- The strong price-taker assumption seems apposite in the context of the pervasive current experience with international inflation

The Fixed Wage assumption

- Services are considered to be typical nontradables, but in the Caribbean major service sectors are tradables: Tourism, banking and other financial services,
- The main variable that underpins differences in the cost structures among nations is the wage level. This analysis treats the wage level as an exogenous social construct.
- Investment is a function separately of the interest rate as well as the profit ratio (P/W). For simplicity, there's the implicit assumption of a fixed wage level so that investment demand changes are positively related to the price level.

The model

- We develop an exploratory model based on the following assumptions:
- $S = S(Y, i)$; S: Saving, Y: GDP, i: interest rate. $S_Y > 0$, $S_i > 0$
- $T = T(Y)$; T: Taxes. $T_Y > 0$.
- $M = M(Y, P)$; M: Imports, P: the domestic price level. $M_Y > 0$, $M_P < 0$.
- $I = I(i, P)$, $I_i < 0$, $I_P > 0$ (since a higher price level with a fixed nominal wage represents a reduction in the real wage)
- $G = G_0$: Government spending (exogenous variable)
- $X = X_0$: Exports (exogenous variable; dependent on foreign factors)
- $L = L(Y,i,P)$ $L_Y > 0$, $L_i < 0$, $L_P > 0$. L: demand for money.
- Ms: Money supply

Some specifications

- $P = eP^*$,
  - Where P^* is the foreign country price level, and
  - e is the exchange rate, expressed in domestic currency.
  - Hence, a change in P may come about as a result of appreciation/depreciation of the domestic currency or a change in the international price level
- Investment (I) is a function of i (the interest rate) and W/P, the real wage, both being treated explicitly in the model. With W being held constant, any change in P directly impacts I in the form of a change in the profit ratio.
- $L_{Y:}$ Transactions demand for money, L_i Speculative demand, L_P transactions demand driven by higher prices

Goods market and Money Market Equilibria

- Starting from the equilibrium condition in goods and money markets:
  - $S + T + M = I + G + X$ Goods market equilibrium (1)
  - $L = Ms$ Money market equilibrium: Money demand (L) = money supply (2)
- We are interested in evaluating the effects of changes in government spending, the money supply and prices on GDP and interest rates.
- Taking an implicit function approach to (1) and (2), we get
  - $F^1(Y,i; G, Ms, P, X) = I(i,P) + G + X - S(Y,i) - T(Y) - M(Y,P) = 0,$ (3) and
  - $F^2(Y, I; P, Ms) = L(Y, i, P) - Ms = 0$ (4)

Conditions for the existence of the Implicit functions are met

- The partial derivatives of (3) and (4) are continuous and differentiable by assumption
- The partial derivatives of (3) and (4) with respect to the endogenous variables, Y and i yield the Jacobian as follows:

$$|J| = \begin{bmatrix} -S_Y - T_Y - M_Y & I_i - S_i \\ L_Y & L_i \end{bmatrix}$$

  - Which is resolved to give:
  - $-L_i.S_Y - L_i.T_Y - L_i.M_Y - L_Y.I_i + L_Y.S_i \neq 0$

- With the derivatives of (3) and (4) being continuous and the Jacobian being nonzero, the conditions for the existence of the implicit equilibrium functions are satisfied.

Effects of a Deficit Expansion on GDP

- Looking to get simultaneous solutions for change in Government spending on GDP and the interest rate, we start with the equations:
  - (5) $$\begin{bmatrix} -S_Y - T_Y - M_Y & I_i - S_i \\ L_Y & L_i \end{bmatrix} \begin{bmatrix} \partial Y/\partial G \\ \partial i/\partial G \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$
- From which we can calculate:
  - $$\frac{\partial Y}{\partial G} = \frac{-Li}{-Li.SY - Li.TY - Li.MY - LY.Ii + LY.Si} > 0$$
- Hence, the analysis yields an orthodox result for the impact of deficit spending on GDP

Effects of a Deficit Expansion on interest rates

- Equation (5):
  - $$\begin{bmatrix} -S_Y & -T_Y & -M_Y & I_i - S_i \\ L_Y & & & L_i \end{bmatrix} \begin{bmatrix} \partial Y/\partial G \\ \partial i/\partial G \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$
- Also yields the impact of government deficit spending on interest rates by calculating the value of the partial derivative:
  - $$\partial i/\partial G = \frac{L_Y}{-Li.SY - Li.TY - Li.MY - LY.Ii + LY.Si} > 0$$

Effect of Monetary Intervention on GDP

- For the purpose of generating the effects of monetary policy changes on GDP and interest rates, we start with the equation of the Jacobian multiplied by the vector of partial derivatives as follows:

- (6) $$\begin{bmatrix} -S_Y & -T_Y & -M_Y \\ L_Y & & \end{bmatrix} \begin{matrix} I_i - S_i \\ L_i \end{matrix} \begin{bmatrix} \partial Y/\partial Ms \\ \partial i/\partial Ms \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

- For the effect of monetary intervention on GDP, we calculate:
  - $\partial Y/\partial Ms = \dfrac{S_i - Ii}{-Li.SY - Li.TY - Li.MY - LY.Ii + LY.Si} > 0$

Effect of monetary intervention on interest rates

- For the relationship of monetary intervention on interest rates, solving equation (6) for $\frac{\partial i}{\partial Ms}$ we obtain:

$$\partial i/\partial Ms = \frac{-(SY + TY + MY)}{-Li.SY - Li.TY - Li.MY - LY.Ii + LY.Si} < 0$$

- Hence, monetary expansion is associated with a decline in interest rates.

Effect of Price level change on GDP

- Note that, given P = eP*, price level change may come either from international price shocks or exchange rate change. Additionally, exports are treated as exogenously determined and not affected by the exchange rate change.
- Taking the equation for the partial derivatives with respect to the price level,

$$(7)\begin{bmatrix} -S_Y & -T_Y & -M_Y & I_i - S_i \\ L_Y & & & L_i \end{bmatrix}\begin{bmatrix} \partial Y/\partial P \\ \partial i/\partial P \end{bmatrix} = \begin{bmatrix} M_P - IP \\ -LP \end{bmatrix}$$

- For the effect of a price level shock on GDP,

$$\partial Y/\partial P = \frac{L_P.Ii - LP.Si + MP.Li - IP.Li}{-Li.SY - Li.TY - Li.MY - LY.Ii + LY.Si}$$

- This impact can be either positive or negative depending on whether
  - $M_P.Li - IP.Li >$ or $< L_P.Ii - LP.Si$

Effect of Price Level change on Interest rates

- For the effect of a price level shock on interest rates, we obtain from equation (7):

$$\partial i/\partial P = \frac{-(LY.MP - LY.IP - LP.SY - LP.TY - LP.MY)}{-Li.SY - Li.TY - Li.MY - LY.Ii + LY.Si} > 0$$

- Therefore, our model predicts that a price level change, whether from international price shock or depreciation will cause positive interest rate change

Conclusions

- Our small-country, price-taker model yields mostly orthodox results of traditional policy instruments of deficit spending, monetary intervention and depreciation on GDP and interest rates.
- One departure from traditional outcomes is the finding that price change (possibly associated with depreciation of the currency) has ambiguous impact on GDP instead of the typical expectation of a contractionary impact of devaluation. We have to examine further the conditions necessary for the outcome to be positive or negative.
- It is possible to extend this framework to investigate the impact of policy changes on the trade balance, for example, and other areas of interest. In addition, the model may be adapted to treat specifically with natural resource-based countries and tourism-based countries.