

# **Reflections on Monetary Policy Choices in the Open Economy: Implications from an Optimizing Model**

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This paper was prepared for the Conference in Honor of John Taylor organized by the Federal Reserve Bank of Dallas, October 19-20, 2007.

# Optimal Monetary Policy in the Open Economy – CGG JME (2002) Model

- Two countries, each with staggered price setting and facing ‘cost push’ shocks that generate inflation inertia
- Home and foreign countries producing differentiated traded goods – terms of trade a key relative price
- International aggregate supply spillovers via marginal cost/optimal labor supply channel
- Follow Woodford and derive the central bank welfare function from taste, technology, and market clearing subject to the Calvo pricing constraint

## Key Results CGG (2002)

- Optimal monetary policy in each open economy can be written as a **Taylor Rule**, linear in the 'domestic' equilibrium real interest rate and the gap between domestic inflation and the inflation target.
- In general, there are **gains to international monetary policy cooperation**. Optimal monetary policy under cooperation can be written as Taylor rule in which the domestic as well as the foreign inflation gap enters the reaction function, as well as the equilibrium real interest rate.
- Optimal policy features a flexible exchange rate and the nominal exchange rate under optimal discretionary policy has a unit root as does the domestic price level and they are cointegrated. Optimal monetary policy produces a **'random walk' nominal exchange** rate because under discretion, the central bank cannot credibly commit to a price level target (but can only achieve a stationary inflation rate).

## This Paper uses CGG (2002) to Answer the Following Questions

How does the domestic neutral real interest depend on 'global' developments?

Is the Phillips curve trade off between inflation and domestic output better or worse in the open versus the closed economy?

Is the open economy IS flatter or steeper than in the closed economy (is there more bank per basis point in the open economy)?

Is 'potential GDP' a function of global developments, or only of domestic resources available and domestic productivity?

How – if at all - does openness influence the optimal monetary policy rule?

Is 'bad news' about inflation 'good news' for the exchange rate?

## Main Findings of this Paper

There will in general be a *spillover from foreign output to potential domestic output*. 'Trend' or potential output growth is not in general independent of global developments.

There will in general be a *spillover from foreign output growth to the domestic neutral real interest rate*. In our benchmark case this spillover is positive so faster foreign growth, whether due to potential growth or the business cycle, raises the neutral domestic real interest rate. Moreover, the more open the economy is, the larger is this effect of foreign growth on the domestic real interest rate and the smaller is the effect of domestic growth on the domestic real interest rate.

We show that *a more open economy has a flatter IS curve*, so that the central bank gets more bang out of every basis point buck by which it changes the policy rate in an open economy than in an otherwise identical closed economy.

We show that *a more open economy has a flatter Phillips curve* so that there is a smaller reduction in domestic inflation for any given decline in domestic output.

We show that *in a more open economy the optimal Taylor rule coefficient on expected inflation is smaller than in a more closed economy*, so that the central bank needs to lean less against the wind for any given inflation shock.

# Strategy

Simplify model to usual three equations

IS

AS

Policy Rule

Focus on benchmark case of central bank discretion with commitment to inflation target goal

Key parameter is  $1/\sigma$  which is intertemporal substitution elasticity.  
Assume  $1/\sigma < 1$

Other key parameter is  $\gamma$  which is share of imports in consumption basket. Larger is  $\gamma$  more open is economy.

## Open Economy IS Curve is Flatter

$$\tilde{y}_t = E_t\{\tilde{y}_{t+1}\} - \sigma_0^{-1} [r_t - E_t\{\pi_{t+1}\} - \bar{r}_t]$$

The open economy IS curve is *flatter* than in the closed economy so that the central bank gets *more 'bang' out of every basis point buck*.

This follows from the fact that

$$\sigma_0 = \sigma - \gamma(\sigma - 1)$$

less than  $\sigma$  and is decreasing in  $\gamma$

Intuitively, a rise in domestic real interest rates lowers aggregate demand through two channels in the open economy

aggregate consumption index falls

exports fall because of induced real exchange rate appreciation

However, this is not pre ordained in an optimizing model. If intertemporal substitution elasticity is high ( $\sigma < 1$ ), then open economy IS curve is steeper and central bank gets less bang out of every basis point buck.

Domestic Neutral Real Interest Rate is increasing in Foreign Output Growth

$$\bar{r}_t = \sigma_0 E_t \{ \Delta \bar{y}_{t+1} \} + \kappa_0 E_t \{ \Delta y_{t+1}^* \}$$

Domestic neutral real interest rate is increasing in growth in domestic potential output as well as growth in foreign output. Moreover, because  $\kappa_0 = \gamma(\sigma - 1)$  *the more open is the economy, the larger is this global spillover to the domestic neutral real interest rate.*

Again, this result is not baked in the cake in an optimizing model. If intertemporal substitution elasticity is high, there is a spillover from global growth to the neutral domestic real interest, but it is negative. Woodford (2007) has a nice discussion of this and related issues pertaining to monetary policy in the CGG (2002) open economy.

## Domestic Potential Output Depends on Foreign Output

$$\bar{y}_t = k^{-1} [(1 + \phi)a_t - \kappa_0 y_t^*]$$

In our benchmark case  $\kappa_0 = \gamma(\sigma - 1) > 0$  so that the spillover from foreign output to potential domestic output is negative.

The intuition is as follows. A rise in foreign output improves the home terms of trade and that raises the reward to work at the margin which would tend to boost domestic potential output. This is the substitution effect.

However, there is also an income effect because for any given amount of labor supply and nominal wages, households can consume more with an improved home terms of trade (and in equilibrium they must). This income effect will tend to reduce domestic labor supply and potential output.

When  $\sigma > 1$ , the income effect outweighs the substitution effect and domestic potential output goes down.

Note that when  $\sigma = 1$ , effects cancel and there is no spillover from foreign GDP to domestic potential output.

## Open Economy Phillips Curve is Flatter

$$\pi_t = \beta E_t\{\pi_{t+1}\} + \{\sigma(1-\gamma) + \gamma + \varphi\}\delta \tilde{y}_t + u_t$$

In our benchmark case, the open economy Phillips curve will be flatter than in the closed economy so that domestic inflation falls by less for any given decline in domestic output.

The intuition is as follows. The more open the economy, the smaller is the impact of a change in domestic output on the domestic consumption index and thus the marginal utility of consumption, so this tends to reduce the impact of domestic output on marginal cost. However, the more open the economy the greater is the impact on marginal cost of the terms of trade change that follows from a change in output. In our benchmark case, the income effect of the rise in output outweighs the induced effect of the terms of trade change, resulting in a flatter open economy Phillips curve.

## Taylor Rule is Optimal Monetary Policy in the CGG Open Economy

$$r_t = \overline{rr}_t + \left[ 1 + \frac{\xi \sigma_o (1 - \rho)}{\rho} \right] E_t \{ \pi_{t+1} \}$$

With loss function that is quadratic in domestic inflation and the output gap, the optimal policy can be written as a Taylor rule. Here  $\xi$  is a markup parameter and  $\rho$  is persistence in cost push shocks.

Recall that in our benchmark case,  $\sigma_o = \sigma - \gamma(\sigma - 1)$  is decreasing in  $\gamma$ , our index of openness. *Thus, a more open economy needs to lean less against the inflation wind than a closed economy.*

Intuition is that the more open economy has a flatter IS curve which means that the central bank gets more bang out of every basis point.

But there is More than one way to Write the Optimal Policy Rule

$$r_t = \bar{r}r_t + (\theta - 1)E_t\pi_{t+1} + \rho\{\Delta e_t - (\Delta y_t - \Delta y_t^*)\}$$

Optimal monetary policy is linear in the exogenous state variables, and this is unique. However, there is more than one way to write the rule in terms of endogenous variables. For example, the optimal policy rule in CGG (2002) can also be written as the above, which includes the rate of nominal exchange rate depreciation  $\Delta e$  and the domestic minus foreign output growth differential.

## Bad News about Inflation is Good News for the Exchange Rate – in this model AND in the data

When a shock pushes inflation above target, Taylor rule leads central bank to raise real interest rates today and in expectation in the future.

However, under discretion price level has a unit root as does the nominal exchange rate and they are co integrated. Thus in the long run, while inflation returns to target, the *price level* is higher than it would have been in the absence of the inflation shock. And thus in the long run the exchange rate is weaker.

So unambiguously, in this model, bad news about inflation is bad news for the long run level of the nominal exchange rate.

*However, under optimal policy, bad news about inflation is good news for the nominal exchange rate when it is released – that is, the nominal exchange rate appreciates on impact when inflation is higher than expected.*

Clarida and Waldman (2007) show that this effect is present in data for inflation targeters.

## Concluding Remarks

- In the real world, economies are open
- The benchmark framework for policy analysis should be the open economy macro model
- A theme that comes through loud and clear in Taylor *Macroeconomic Policy in a World Economy, 1993*.
- Key inputs to policy – the neutral real interest rate, potential output – are global general equilibrium outcomes
- Lucas critique is relevant: as economies become more open, empirical rules of thumb about IS and Phillips curves will break down.
- This agenda is already underway at a number of central banks, using increasingly sophisticated and more realistic models that feature incomplete pass through, home bias, fluctuating risk premiums.