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A general equilibrium open economy model for emerging markets: Monetary policy with a dualistic labor market☆

Ashima Goyal *

Indira Gandhi Institute of Development Research, Gen. Vaidya Marg, Santosh Nagar, Goregaon (E), Mumbai 400 065, India

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ABSTRACT

An optimizing model of a small open emerging market economy (SOEME) with dualistic labor markets and two types of consumers, delivers a tractable model for monetary policy. Differences between the SOEME and the SOE are derived. Parameters depend on features of the labor market and on consumption inequality, and affect the natural interest rate, terms of trade and potential output. The supply curve turns out to be flatter and more volatile, with a larger number of shift factors, including policy-determined terms of trade. A simple basic version of the model is simulated in order to compare different policy targets in response to a cost shock. Flexible domestic inflation targeting gives the lowest volatility although there are trade-offs. Exchange rate volatility is relatively lower but still makes a major contribution to controlling inflation. Flexible CPI inflation targeting performs better when combined with some kind of managed floating. Inflation targeting has to be flexible. With more backward-looking behavior the policy response to a shock is reduced.

1. Introduction

In dynamic stochastic general equilibrium models with imperfect competition and nominal rigidities, monetary policy has substantial effects on real variables. The policy problem has been reduced to an elegant optimization subject to microfoundation based aggregate demand and supply curves with forward-looking behavior.[1] The coefficients of the equations satisfy the Lucas critique; derivation from basic technology, preferences and market structure makes them robust to policy changes. But the inclusion of frictions, and the emphasis on labor rather than capital, makes the framework applicable to the specific frictions and labor transition in emerging markets.

This paper analyzes the differences in results if the small open economy in Galí and Monacelli (2005), an open economy model in this genre, is an emerging market with a large share of less productive labor in the process of being absorbed into the modern sector. So there are two types of consumers and labor: above subsistence (R), and at subsistence (P). While the first are able to smooth consumption using international markets, those at subsistence cannot. Their intertemporal elasticity of consumption, productivity, and wages are lower and their labor supply elasticity is higher, compared to the first group,[2] because of their lower productivity. Inclusion of these two types partially addresses the Stiglitz objection below, even while enabling use of modern benchmark models.

> "The standard models taught in graduate schools in the U.S. and Europe are of limited relevance for developing countries. … more disturbing is that virtually all of the research uses full employment models, making the results of questionable relevance, e.g. in a country with 25% unemployment (Stiglitz, 2007)."

The optimizing labor supply decision, which drives unemployment in equilibrium models, cannot capture the dimensions of unemployment in a developing economy. Low productivity employment captures the major coping mechanism in a small open emerging market economy (SOEME), and helps model the transition path as employment in the productive modern sector raises the share of the R-type.

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* Tel.: +91 22 28416524; fax: +91 22 28402752.
E-mail address: ashima@igidr.ac.in.
URL: http://www.igidr.ac.in/~ashima.

[1] See Clarida et al. (1999) for a survey, and Clarida et al. (2001) for extension to an open economy. Woodford (2003) is a rigorous and comprehensive treatment.

[2] This subsistence-based definition makes the model suitable for analyzing populous emerging markets such as India and China.

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A simple version of the model is calibrated and simulated for a typical small open emerging market economy (SOEME). Optimal monetary policy responses to a cost shock are derived under different types of targeting. In order to focus on the labor market, simplifying assumptions of complete financial markets and perfect capital mobility are maintained. Capital account liberalization is making international risk sharing, which is an important element of the model, feasible for the better off in emerging markets. CES aggregation allows the micro diversity to be collapsed to macro aggregates, as is common in the literature.

The major theoretical results are: the aggregate supply curve derived for a SOEME is flatter compared to that of a mature small open economy (SOE), because of higher labor supply elasticity but is less stable, with more factors tending to shift it. The slope reduces as the economy becomes more open, but the reduction is relatively more for a SOE. In the SOEME, the real exchange rate is depreciated, and tends to appreciate as development brings it closer to purchasing power parity (PPP). But there are fluctuations on the way. Since income changes that affect the terms of trade are concentrated among the R-types, the terms of trade are more volatile. Therefore endogenous terms of trade make aggregate supply less elastic, especially for an almost closed economy with a large percentage of P-types. Hence there is a case for managed floating. Changing the exchange rate can counter some of the shifts in aggregate supply. This is demonstrated in a second derivation of aggregate demand and supply with policy-determined terms of trade.

Subsistence labor implies the average world income exceeds the SOEME per capita income. This defines a gap variable, which implies a trade surplus, partially explaining trade surpluses in many rapidly growing Asian SOEMEs. The dualistic structure adds consumption of the subsistence group, and the gap variable, as exogenous variables in addition to those in the SOE. They affect the natural rate of interest, potential output, and the equilibrium terms of trade, in general reducing the effect of the original exogenous variables, world output and technology, compared to the SOE. The interest elasticity of aggregate demand is lower but there are more factors tending to decrease the natural rate of interest, including expected appreciation of the terms of trade. The size of shocks to the natural interest rate also rises in a SOEME.

Dynamic simulations validate the model and the theoretical results. They show that flexible targeting of domestic inflation delivers the lowest volatility, with the least monetary contraction. There is an active use of exchange rate policy to lower the price impact of a cost shock, but fluctuations in the exchange rate are lower than under CPI and strict direct inflation targeting (DIT). CPI inflation targeting does almost as well as DIT when combined with some kind of managed floating. Pure inflation targeting is not optimal; a weight on output and on interest rate smoothing delivers better results. The exchange rate is not a separate target variable, but is one of the variables affecting inflation. Its effect on aggregate supply makes it a useful counter to a supply shock.

The structure of the paper is as follows. The model is developed in Section 2. Household optimization is in Section 2.1 and the firm in Section 2.2. Natural rates are derived in Section 3. The model is tested and optimal policy response to a cost shock simulated in Section 4, before Section 5 concludes. Derivations and proofs are in the appendices.

2. A small open emerging market model

The basic consumption Euler, household labor supply, risk sharing, aggregate equilibrium, and firms' profit maximization are derived as in Galí and Monacelli (2005) (GM) for a continuum of small open economies on the unit interval, but divided here into two types—emerging and mature markets.[3] Since each country is of measure zero, it takes world prices as given. The product market structure, technology and preferences of R-type consumers are the same across all economies. P-type consumers are assumed to be at a fixed subsistence wage, financed in part by transfers from R-types, mediated by the Government. They are willing to supply more labor hours to the modern sector at a wage epsilon above their opportunity cost, which is informal sector wages. Variables corresponding to a representative consumer in a mature economy have a superscript *i*, averages for the world economy as a whole are denoted by a superscript *, while in order to simplify the notation, superscripts are dropped for the representative consumer in the SOEME. Lower case letters are logs of the respective variables. Productivity shocks differ since emerging markets are in transition stages of upgrading technologies.

Given first order conditions (FOCs), risk sharing only for the R-type, exogenous subsistence level consumption of the P-type, and the aggregate demand supply equality across countries, the terms of trade, S_t, can be solved in terms of endogenous output, Y_t, and exogenous variables, world output, Y_t^* and the consumption of the P-type, $C_{P,t}$. Substituting out the terms of trade, and taking deviations of output from the natural output, to write the FOCs as functions of the output gap, $x_t = y_t - \overline{y}_t$, and domestic inflation, π_H, then gives the final form of the two aggregate supply (AS) and aggregate demand (AD) equations. The level where marginal cost is at its steady-state level defines the natural output $\overline{y}_t$. Low productivity, poor infrastructure and other distortions keep the natural output in the SOEME below world levels. Convergence to world levels is part of the process of development.

The subscript R or P for the intertemporal elasticity of consumption ($1/\sigma_i$) and labor supply elasticity ($1/\varphi_i$) indicates the consumer type; with any other subscript, or without one, it is the aggregate value. The population share of R is η, $0<\eta<1$. The share of foreign goods is, α, $0<\alpha<1$. The discount factor is β, so that $\rho \equiv \beta^{-1} - 1 = -\log\beta$ is the time discount rate; i_t is the riskless nominal interest rate; $\pi_t \equiv p_t - p_{t-1}$ is CPI (consumer price index) inflation (where $p_t \equiv \log P_t$); productivity is a_t. It is easy to derive $\pi_t = \pi_{H,t} + \alpha\Delta s_t$, where $s_t = p_{F,t} - p_{H,t}$ is the log effective terms of trade or price of foreign goods in terms of domestic goods and $\pi_{H,t}$ is domestic price inflation. These identities allow the transformation of consumer to domestic price inflation and vice versa. Consumer prices enter the consumer's maximand, but firms set producer or domestic prices.

The quadratic loss function (Eq. (1)) of the central bank (CB) is a weighted average of inflation, output and interest rate deviations from equilibrium values:

$$L = q_x x^2 + q_\pi \pi^2 + q_i i^2. \tag{1}$$

The last is a smoothing term that prevents large changes in the policy rate. The CB minimizes Eq. (1) subject to the AD (Eq. (2)) and AS (Eq. (3)). The dynamic AD equation for the SOEME is:

$$x_t = E_t\{x_{t+1}\} - \frac{1}{\sigma_D}\left(i_t - E_t\left\{\pi_{H,t+1}\right\} - \overline{rr}_t\right), \tag{2}$$

where:

$$\overline{rr}_t = \rho - \sigma_D\Gamma(1-\rho_a)a_t - \sigma_D(1-\eta+\Phi)E_t\left\{\Delta c_{P,t+1}\right\} + \sigma_D(\Theta-\Psi)E_t\left\{\Delta y^*_{t+1}\right\}$$

$$\Theta = \alpha(\varpi-\eta), d = \frac{1}{\sigma_D+\varphi}, \Gamma = \frac{(1+\varphi)}{\sigma_D+\varphi}, \Psi = \eta(\sigma-\sigma_D)d,$$

$$\sigma_D = \frac{\sigma_R}{(\eta(1-\alpha)+\varpi\alpha)}, \Phi = d((1-\eta)(\sigma-\sigma_D)), \varpi = \sigma_R + (1-\alpha)(\sigma_R-1).$$

The dynamic AS is:

$$\pi_{H,t} = \gamma_f\beta E_t\left\{\pi_{H,t+1}\right\} + \kappa_D x_t + \gamma_b\pi_{H,t-1} \quad \gamma_f + \gamma_b = 1. \tag{3}$$

[3] Our model is based on the small open economy models by Svensson (2000), and in particular Galí and Monacelli (2005) (henceforth GM). We try to keep as close as possible to the latter's formulation in order to facilitate systematic comparison of results.