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Real business cycles in emerging economies: Turkish case ☆

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ABSTRACT

This paper attempts to answer the following question: Can a small-open-economy real business cycle (RBC) model driven by nonstationary productivity shocks explain business cycles in emerging economies? This question is addressed by estimating a dynamic stochastic general equilibrium model for Turkish economy using Bayesian methods in line with those suggested in the recent small open economy RBC literature. Results indicate that the standard RBC model driven by both stationary and nonstationary productivity shocks is not successful in replicating some of the key features of economic fluctuations. The alternative model with financial frictions provides a more realistic picture of business cycles.

1. Introduction

Recently a number of studies has explored the question of whether a small open economy real business cycle (RBC) model is able to reproduce observed patterns of macroeconomic fluctuations in developed and emerging market economies. In an influential article, Mendoza (1991) argued that a small open economy RBC model with moderate adjustment costs is able to mimic the behavior of post-war Canadian business cycles. The standard model used by Mendoza (1991) has been modified in several dimensions to explain empirical regularities characterizing business fluctuations in emerging market economies. The stylized facts of business cycles in emerging markets tend to be quite different from developed markets and pose a challenge for the RBC paradigm. Typically in these countries (1) consumption is more volatile than output, (2) trade balance is more strongly counter-cyclical and moderately persistent, (3) income and exports are generally highly volatile and (4) we observe large reversals in capital inflows, the so-called sudden stop phenomenon, during contractions (see for example Altug (2010, ch.6), Aguiar and Gopinath (2007)).

The standard open economy RBC model has two sources of shocks: a transitory productivity shock and a permanent productivity shock. The RBC approach postulates that permanent shocks are the primary source for the business cycle fluctuations in emerging economies. This is based on the permanent income hypothesis which mainly states that the response of consumption to a productivity shock will differ according to the persistence of shock. If the shock is transitory then households will increase savings and reduce consumption in anticipation of lower income in the future. If, on the other hand, the shock is permanent households will decide to smooth consumption and reduce savings. Since the income rises not only in the current period but also in the future, households will borrow against future income to finance current consumption and as a result the trade balance will deteriorate. Thus, shocks to trend productivity can potentially explain the coexistence of large trade deficits and consumption boom in emerging markets and the excess volatility of consumption over output.

Kydland and Zarazaga (2002) argued that an RBC model can account for Argentina's lost decade of economic depression. More recently, Aguiar and Gopinath (2007) estimated a small open economy RBC model that incorporates both transitory and permanent productivity shocks by GMM procedure using data from Mexico and Canada over 1980–2003. Their results indicate that the permanent productivity shock is more important than the transitory shock and the model is successful in replicating the Mexican tequila crisis. They argued that their results are robust to the inclusion of stochastic interest rate shocks and that the permanent shock is not simply a proxy for omitted interest rate movements. They also argued that the standard RBC model can account for business cycle facts in Mexico well.

The findings of Kydland and Zarazaga (2002) and Aguiar and Gopinath (2007) have been challenged by Garcia-Cicco et al. (2010) and Chang and Fernandez (2010). Garcia-Cicco et al. (2010) uses a longer data set over 1900–2005 for Mexico and Argentina on the grounds that short data sets may not be sufficient to identify structural parameters associated with productivity shocks. They argued that the standard RBC model is not successful in replicating observed characteristics in these countries. In particular, they show that the RBC model fails to capture excess volatility of consumption and observed correlations between trade balance to output ratio and aggregate demand components. In addition, the RBC model predicts that the trade balance to output ratio is a near random walk whereas in the data it has a geometrically decaying sample ACF and it is

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significantly more volatile than its empirical counterpart. They propose an alternative model in which the standard RBC model is augmented with a preference shock, a country risk premium shock and a domestic spending shock and found it to be more successful in replicating stylized facts in Argentine and Mexican data. They argued that adding financial imperfections diminishes the role of permanent productivity shock and also eliminates the near random walk behavior of trade balance to output ratio.

In a related paper, Chang and Fernandez (2010) compared stochastic trend model with financial frictions model using the same data set for Mexico in Aguiar and Gopinath (2007). They allow for two kinds of financial frictions: working capital requirement[1] and endogenous country spread. Their results suggest that financial frictions in emerging markets tend to amplify the effects of temporary productivity shocks. Unlike the findings of Aguiar and Gopinath (2007) their results favor the financial frictions model and that trend is not the cycle in emerging economies. Araujo (2012) examined the sources of economic fluctuations in Brazil using an RBC model with investment-specific shocks. He found that significant percentages of fluctuations in key macroeconomic variables can be explained by investment specific shocks whereas the standard RBC model is not successful in replicating observed facts.

In this paper, we investigate the efficacy of the small open economy RBC model to generate salient features of business cycle fluctuations in Turkey over the period 1987.Q1–2010.Q1. For this purpose we calibrate and estimate the baseline RBC model and its augmented version set up by Garcia-Cicco et al. (2010) including additional shocks and financial frictions using data on growth rates of output, consumption, investment and trade balance to output ratio. We employ recently developed Bayesian analysis methods to estimate the posterior distributions of structural parameters associated with shock processes.

This paper is organized as follows. Section 2 presents the baseline RBC model and a financial frictions model commonly used in related studies. Empirical methodology is summarized in Section 3. Section 4 presents the estimation results and evaluates the performance of the models. Finally, Section 5 concludes the study.

2. Models

2.1. Baseline RBC model

The standard small open economy RBC model is based on Mendoza (1991) and recently analyzed by Schmitt-Grohe and Uribe (2003), Aguiar and Gopinath (2007), Garcia-Cicco et al. (2010) and Chang and Fernandez (2010). The latter studies augmented the standard model of Mendoza (1991) with permanent productivity shocks and foreign interest rate shocks. In this section we provide the model with permanent productivity shocks as proposed by Garcia-Cicco et al. (2010). In this model the production technology of one final good in each discrete time period t is given by

$$Y_t = a_t K_t^{\alpha} (\Gamma_t h_t)^{1-\alpha}, \tag{1}$$

where Y_t denotes output, K_t denotes capital, h_t denotes hours worked and a_t and Γ_t are two separate productivity shocks. We follow the convention that the capital letters denote variables that have a trend in equilibrium whereas lower case letters represent that do not have a trend in equilibrium.

[1] In a model with working capital requirement interest rate shocks become a source of macroeconomic volatility through short-term credits advanced to firms by banks who borrow in international markets. Since firms do not have wealth they have to borrow working capital from banks to pay for the use of the factors of production (Oviedo, 2005).

The total factor productivity shock a_t is assumed to follow a stationary first-order autoregressive process in natural logarithms:

$$\log a_{t+1} = \rho_a \log a_t + \epsilon_{t+1}^a, \quad \epsilon_t^a \sim iid\ N\left(0, \sigma_a^2\right) \tag{2}$$

where $|\rho_a|<1$.

The variable Γ_t allows for labor-augmenting productivity growth in the model. It is assumed that the gross growth rate Γ_t follows a stochastic trend. More specifically, let g_t be the gross growth rate of Γ_t:

$$\Gamma_t = g_t \Gamma_{t-1}$$

The natural log of g_t follows a first-order autoregressive process:

$$\log\left(g_{t+1}/\mu_g\right) = \rho_g \log\left(g_t/\mu_g\right) + \epsilon_{t+1}^g, \quad \epsilon_t^g \sim iid\ N\left(0, \sigma_g^2\right) \tag{3}$$

where $|\rho_g|<1$ and μ_g is the deterministic gross growth rate of labor productivity growth. This implies that the level of productivity follows an AR(2) process with a unit root

$$\log \Gamma_{t+1} = \log \Gamma_t + \log g_t,$$

thus, shocks to labor productivity will be incorporated in $log\Gamma_t$ implying that such changes will be permanent. For example when $\varepsilon_t^g > 0$ then the growth rate of labor productivity will be above its long run mean and it will lead to permanent productivity improvement. In such a case, since the productivity level increases permanently, consistent with the permanent view of consumption, permanent income and consumption can increase more than current income. This can potentially explain why consumption volatility is higher in emerging economies compared to developed countries. Also, permanent view of consumption implies that representative household may want to issue debt in the world market to finance consumption in excess of current income leading to countercyclical current account (Chang and Fernandez, 2010).

The representative household is assumed to have the following preferences

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{\left(C_t - \theta \omega^{-1} \Gamma_{t-1} h_t^{\omega}\right)^{1-\gamma} - 1}{1-\gamma} \tag{4}$$

where $0<\beta<1$ is the discount factor, C_t is consumption and E is the expectation operator. The representative household faces the following period-by-period budget constraint:

$$\frac{D_{t+1}}{1+r_t} = D_t - Y_t + C_t + I_t + \frac{\phi}{2}\left(\frac{K_{t+1}}{K_t} - \mu_g\right)^2 K_t, \tag{5}$$

where D_{t+1} denotes the stock of debt[2] in period t, r_t denotes the domestic interest rate on bonds held between periods t and $t+1$ and I_t denotes gross investment. The last term allows for quadratic capital adjustment costs and ϕ is the cost adjustment parameter. The capital stock evolves according to

$$K_{t+1} = (1-\delta)K_t + I_t \tag{6}$$

where $\delta \in [0, 1)$ denotes the depreciation rate of capital.

Households face the following domestic interest rate on foreign borrowing which is defined as the sum of world interest rate and country's risk premium:

$$r_t = r^* + \psi\left(\exp\left(\frac{\tilde{D}_{t+1}}{\Gamma_t} - \overline{d}\right) - 1\right) \tag{7}$$

[2] We assume that the financial markets are incomplete. The representative household is assumed to borrow and lend freely in international capital markets using a one-period non-contingent bond.