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Exploring the sources of Spanish macroeconomic fluctuations: An estimation of a small open economy DSGE model

José M. Martín-Moreno [a,*], Rafaela Pérez [b], Jesús Ruiz [c]

[a] Universidad de Vigo and rede, Spain
[b] Departamento de Fundamentos del Análisis Económico I and ICAE, Universidad Complutense de Madrid, Spain
[c] Departamento de Fundamentos del Análisis Económico II and ICAE, Universidad Complutense de Madrid, Spain

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ABSTRACT

This paper analyzes the role of a variety of shocks as determinants of Spanish macroeconomic fluctuations before the international financial and economic crisis (1970–2008). To do this we estimate a small open economy stochastic model using Kalman Filter techniques. The set of estimated parameters allows the replication with remarkable accuracy of the time path for the major macroeconomic aggregates. In particular, the model reproduces the so-called dual inflation phenomenon which burdens the competitiveness of the Spanish economy.

1. Introduction

A combination of cyclical and structural factors has made prices evolve differently in the Spanish economy as compared to the rest of the Euro zone. This evolution of prices hampers Spanish competitiveness, hinders real convergence with Europe and burdens economic activity.

Countries that belong to a monetary union may experience temporary, though persistent, differences in inflation rates. These differences may be associated to real convergence processes. In this context, countries with higher productivity growth tend to have higher inflations rates. Additionally, these higher inflation rates could be caused by asymmetrical shocks. These asymmetrical shocks force an adjustment in relative prices among the countries of the monetary union. Finally, these inflation differentials can be generated by the structure of each country and the way common economic shocks spread over the economy.

In this sense, despite being part of the European Monetary Union (EMU), the Spanish economy has experienced positive inflation differentials with the Euro area over the last years along with a remarkable increase in the prices of non-tradable goods (relative to the prices of tradable goods) throughout three decades. This is the so-called dual inflation phenomenon which has had serious implications on Spain's competitiveness. On the other hand, private consumption is remarkably more volatile in Spain

* Corresponding author at: Departamento de Fundamentos del Análisis Económico, Facultad de CC.EE.EE, Universidad de Vigo, Spain.
E-mail addresses: jmartin@uvigo.es (J.M. Martín-Moreno), rmperezs@ccee.ucm.es (R. Pérez), jruizand@ccee.ucm.es (J. Ruiz).

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than it is in any of its neighboring economies (Dolado et al. puzzle). Some researchers have mentioned several possible reasons behind Spanish distinct behavior: its different cyclical position, different economic structures in several markets and the different shocks hitting the economy.

In this paper, we use a Dynamic Stochastic General Equilibrium (DSGE) Model corresponding to a small open economy framework, in which the tradable or non-tradable nature of produced goods is taken into account. Using this paradigm, we estimate using the Kalman Filter approach a number of parameters, in order to explore the different sources driving the Spanish Business Cycle. In order to set aside the distortions produced by the financial crisis, we restrict the analysis to the period 1970–2008.

Some versions of the model have been previously used by Turnosvsky (1997), who presents several versions of the so-called 'dependent economy'. Rebelo and Vegh (1995) also use these types of models to analyze the different exchange rate regimes, Fernández de Córdoba and Kehoe (2000) use a deterministic model to explain the fluctuations of the real exchange rate since Spain entered the European Economic Community, Andrés, Hurtado, Ortega, and Thomas (2010) try to explain Spain's growth and inflation differentials with respect to the rest of the European Monetary Union and Martín-Moreno, Pérez, and Ruiz (2014a, 2014b) use this type of model to try to reproduce the second moments of the Spanish business cycle.

As Martín-Moreno et al. (2014a, 2014b) pointed, one major contribution of the model we use here is to consider separately tradable and non-tradable goods. This is important in the Spanish case, characterized by a larger than average non-tradable sector share (around 70% out of total GDP). Furthermore, it allows us to characterize the odd behavior observed in Spain for the prices of tradable goods relative to the prices of non-tradable goods, a stylized fact called dual inflation in the literature. Finally, disaggregation also allows us to analyze the Spanish economy at the sectorial level. Then we estimate the parameter values of the model to analyze the contributions of the several shocks considered to the fluctuations observed for the main economic variables. Additionally, we simulated the model to obtain: a) the model fit under the time paths observed for the five shocks considered (productivity, public spending, real interest rate and preferences), b) the variance decompositions of the main variables, and c) the impulse responses to the different types of shocks.

We show that the simulated paths for major aggregates replicate with a remarkable accuracy the corresponding observed time paths during the analyzed period, suggesting a good fit of the model. On the other hand, the variance decomposition analysis points to the preferences shock as the major source of private consumption volatility, while both the international interest rate and the tradable sector specific productivity shock are necessary to explain tradable output volatility, and finally, the non-tradable productivity shock is the main driving force to explain non-tradable output volatility. Moreover, a variety of cyclical properties of the data are also reproduced with a reasonable degree of accuracy.

The rest of the paper is organized as follows. Section 2 describes the theoretical model and derives the conditions of the equilibrium. Section 3 discusses the estimation of the model parameters. Section 4 presents the numerical simulation of the model and the results. Finally, Section 5 concludes.

2. The model

We start by describing the model. We will discuss each one of the four types of agents (households, tradable and non-tradable goods sectors and government) and their decision-making behavior. The model is a version of the one proposed by Martín-Moreno et al. (2014a, 2014b). The basic structure includes a representative consumer that works, consumes and saves. Two representative firms, tradable and non-tradable sector and a government are modeled. The theoretical framework assumes rational expectations under a small open economy DSGE model[1].

2.1. The household

The representative household maximizes the expected utility defined over the stochastic sequences of consumption (C_T, C_N) and labor (N_T, N_N) subject to the budget constraint:

$$\begin{aligned} &\max\left\{C_{T_t}, C_{N_t}, N_{T_t}, N_{N_t}, K_{T_t}, K_{T_t}, D_t\right\} E_0\left\{\sum_{t=0}^{\infty}, \beta^t, \frac{1}{1-\sigma}, \left[\left[\left(C_{T_t}\right)^{\phi}\left(C_{N_t}\right)^{1-\phi} - \frac{1}{\Psi}\left(N_{T_t}+N_{N_t},\right)^{\Psi}\right]^{1-\sigma} - 1\right], a_t\right\} \\ &s.t: \quad w_{T_t}N_{T_t} + w_{N_t}N_{N_t} + r_{T_t}K_{T_t} + r_{N_t}K_{N_t} + r_{t-1}D_{t-1} = \\ &\qquad = \tau_t + P_{T_t}C_{T_t} + P_{N_t}C_{N_t} + P_{T_t}I_{T_t} + P_{N_t}I_{N_t} + D_t - D_{t-1} \end{aligned} \tag{1}$$

E_0 denotes the expectation based upon the informational set available in the initial period, C_T is the consumption of tradable goods, C_N is the consumption of non-tradable goods, N_T and N_N are, respectively, the time devoted to work in the tradable sector and the non-tradable sector, a_t is a shock in preferences, $\beta > 0$ is the intertemporal subjective discount rate, $\sigma > 0$ is the risk aversion parameter, and $1/(\psi - 1)$, with $\psi > 1$, measures the elasticity of labor supply with respect to the real wage[2]. The household total income consists

[1] As aforementioned, following Chari, Kehoe and McGrattan (2008) and Aguiar and Gopinath (2007), we have chosen a model without any rigidities as a first approach to characterize the determinants of Spain's macroeconomic fluctuations.

[2] A well-known fact in the real business cycle literature for small open economies is that under Cobb-Douglas preferences in consumption and leisure, the consumption path is too smooth compared to the data. Correia, Neves, and Rebelo (1995) show that under the preferences that we are using, this problem does not arise due to the absence of income effects on labor.