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A general equilibrium assessment of external and domestic shocks in Spain

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ABSTRACT

After many years of growth, the Spanish economy plunged into the most severe and prolonged recession recorded since reliable national accounts data have been available. The main goal of this paper is to quantify the effects of the external and domestic shocks that hit the Spanish economy in 2008–2009 by employing a disaggregated general equilibrium model calibrated to a 2000 SAM elaborated by the authors. External shocks are simulated by employing the neoclassical closure (private investment is determined by domestic and external savings) and the Keynesian closure (investment is exogenous). External and domestic shocks are also jointly simulated with the Keynesian closure. The results provide a good approximation to observed changes in key macroeconomic variables.

1. Introduction

The main goal of this article is to present the results of some simulations performed with a disaggregated computable general equilibrium (CGE) model to assess the impact of external and domestic shocks that struck the Spanish economy in 2008–2009. From 1996 to 2007, Spain had been a model of success of the EU with gross domestic product (GDP) growing at a 3.7% average rate. Almost 8 million new jobs were created and the unemployment rate fell from 23.5% in 1995 to 8.03% in the third quarter of 2007.[1] However, the economic situation changed suddenly in 2008. GDP grew just 0.9% that year and fell 3.7% in 2009, by far the largest drop recorded since the Statistics National Institute (INE) started publishing GDP estimates in the 50s. The number of unemployed grew at a disturbingly fast pace, and the unemployment rate hit 11.3% in the third quarter of 2008 and 17.9% a year later.

During the boom years, financial institutions, nonfinancial firms and households financed a growing share of domestic and international investments with credits from non-resident institutions. Although in 1996 there was a small current account surplus (0.2% of GDP), the difference between national savings and domestic investment as shares of GDP grew steadily in the following years (3.3% in 2000, 5.7% in 2004 and 10.0% in 2007). Gross external debt also rose at a fast pace in that period (341.1 thousand million euro in 1996, 784.5 in 2000, 1.29 billion in 2004 and 2.16 billion in 2007) and the net international investment position of Spain deteriorated without pause (−113.3 thousand million euros in 1996, −201.5 in 2000, −505.5 in 2004 and −822.8 in 2007). Any objective observer could easily foresee (Polo, 2005) that non-resident institutions would not be indefinitely willing to finance Spain's domestic[2] and international investments. Put another way: it was clear that any slowing of the inflow of external finances would surely stop Spain's growth.

During the second half of 2008, most advanced economies plunged into recession as financial instability spread out throughout the world. An immediate effect of the Great Recession was a sharp reduction in international trade. In the subsequent four-quarters, Spanish exports of traded goods and services fell 9.4% and non-resident consumption dropped 8.75%.[3] The closure of international financial markets to domestic financial institutions and nonfinancial firms also put a sudden end to the investment process, which fell 13.07%.

In this paper, we evaluate the impact of the decline in exports, non-resident consumption and private investment in the Spanish economy at the very beginning of the economic recession with a CGE model. These models have been widely used to assess the effects of changes in exogenous variables and parameters. Roberts and Zolkiewski (1996) used a static CGE model for Poland to estimate in 4% of GDP the effects of the drop in exports due to the end of the

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[1] Figures are not strictly comparable due to methodological changes introduced in the Active Population Survey (Encuesta Población Activa) since 1995.

[2] Domestic investment was highly concentrated in construction activities. Gross fixed capital formation amounted to 30.7% of GDP in 2007 and 58% of that was residential and non residential construction investment. In those years, more lodgings were constructed in Spain than in Germany, France and United Kingdom together, despite the fact that Spain has one of the lowest population growth rates in the EU.

[3] The average volume index from the third quarter of 2008 to the second quarter of 2009 has been divided by the average volume index in the four preceding quarters.

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CMEA. Polo and Valle (2008), also with a static CGE model but under alternative closure rules, estimate in 5% of GDP the negative effects of a 10% permanent fall in non-resident consumption in the Balearic Islands. Furthermore, there are other recent papers that use a CGE multi-sector model to assess the effects of very different economic policies such us tax rate cuts on labor and VAT (Boeters et al., 2010; Böhringer et al., 2005), or the impact of variations in the endowments of labor force (Learmonth et al., 2007), capital stock of multinationals (Latorre et al., 2009), etc. CGE models have been widely used since they can provide valuable quantitative insights into changes in the allocation of resources among sectors and major economic aggregates. However, the results drawn from the simulations are quite sensitive to the closure rule chosen, which determines the endogenous and exogenous variables in macroeconomic balances.[4] Rattso (1982), Dewatripont and Michel (1989) and Robinson (1991) described the main characteristic of the closure rules most commonly used in the literature and their effects on theoretical models and empirical results. The neoclassical closure rule assumes that the value of aggregate investment is determined by the value of domestic savings and the current account surplus of foreign sectors. In this setting, a negative external shock from the domestic viewpoint, such as a fall in exports, sets up an implausible investment boom in the economy. Under the Keynesian closure rule, aggregate investment is arbitrarily fixed as the sum of the value of private savings, the government deficit and the current account deficit that adjusts to equal the value of investment when there is an external negative shock. In this case, an investment boom is ruled out by hypothesis and the external shock raises the unemployment rate to reduce the value of private savings. Under these closure rules, if the exchange rate is fixed, foreign savings are flexible. The role of the exchange rate is a question that has received special attention in trade CGE models, Devarajan et al. (1993), as well as the effects of closure rules and the capital accumulation process, Francois et al. (1996), in dynamic CGE models.[5] In the case of Spain, the empirical effects of closure rules in CGE models have been recently evaluated (Polo and Valle, 2008; Polo and Viejo, 2009).[6] In our article, the simulations are performed using both neoclassical and Keynesian closure rules.

The paper is organized as follows. Section 2 depicts the main features of the model, and Section 3 presents the simulation scenarios and the results under the neoclassical closure. The results of the same simulations and two additional scenarios under the Keynesian closure are presented in Section 4. Finally, Section 5 gives some general conclusions.

2. The model

The model used in this study is a disaggregated static model. There are 30 producers, one representative consumer, the government and two foreign sectors, the EU and the ROW. Firms produce 30 domestic commodities that are combined with equivalent imports to obtain 30 production commodities. Labor and capital services are used to produce value added that firms mix with production commodities to obtain domestic products. Finally, total production is combined to produce consumption commodities. There are also six types of capital (non-consumed) goods.[7]

[4] The Government balance, the current account balance and the Savings–Investment balance.

[5] A detailed mathematical description of macro closure rules on CGE models and their implementation in the GAMS code can be found in Löfgren et al. (2002).

[6] Under the neoclassical closure, Polo and Valle (2008) results indicate that a 10% fall in non-residents' demand in the Balearic Islands causes an implausible investment boom. And Polo and Viejo (2009), in their attempt to replicate observed macroeconomic figures from 1991 to 1997 with a CGE model for Spain, suggest that although the neoclassical closure rule can give acceptable results in the medium run (1991–1997) it misses completely the economic recession of 1992–1993.

[7] The capital goods are agriculture products, machinery and mechanical products, transport equipment, residential dwellings, other construction and other products.

2.1. Production technology and firms' behavior

Technology is represented by a nested constant-returns-to-scale production function. At the first level, total production, Y_i, is a constant elasticity of substitution (CES) aggregate (Armington, 1969) of domestic products, Y_{di}, and imports from the EU, Y_{ei}, and the ROW, Y_{ri}:

$$Y_i = \phi_i\left(\delta_{di}Y_{di}^{\rho_i} + \delta_{ei}Y_{ei}^{\rho_i} + \delta_{ri}Y_{ri}^{\rho_i}\right)^{1/\rho_i}, -\infty < \rho_i < 1 \tag{1}$$

where δ_{di}, δ_{ei} and δ_{ri} are the domestic and foreign distributive parameters, respectively, and ρ_i the parameter that determines the degree of substitution between domestic products and imports and also between imports from the EU and the ROW. At the second level, domestic production combines intermediate inputs, X_{ji}, and value added, V_i, in fixed proportions

$$Y_{di} = \min\left(\frac{X_{1i}}{a_{1i}}, \frac{X_{2i}}{a_{2i}}, \ldots, \frac{X_{30i}}{a_{30i}}, \frac{V_i}{v_i}\right) \tag{2}$$

where a_{ji} and v_i are the corresponding technical coefficients and unitary requirement of value added. Finally, valued added is obtained as a Cobb–Douglas combination of labor (L_i) and capital(K_i)

$$V_i = \gamma_i L_i^{\beta_i} K_i^{(1-\beta_i)} \tag{3}$$

where γ_i is the scale parameter and β_i the distribution parameter.

Firms maximize profits. At each level of the nest, factor demands are derived by minimizing costs subject to the corresponding technology constraint and prices are set equal to average costs. Labor services are taxed with social security contributions on employers and employees and domestic production is subject to taxes (subsidies) on production and products. Imports are also subject to taxes.

Consumption commodities are elaborated with total production commodities using Leontief technology

$$C_c = \min\left(\frac{Z_{1c}}{z_{1c}}, \frac{Z_{2c}}{z_{2c}}, \ldots, \frac{Z_{30c}}{z_{30c}}\right) \tag{4}$$

where Z_{ic} is the amount of commodity i, which is the CES aggregate of domestic products and imports, used to produce c, and z_{ic} the unitary requirement. Consumption commodities are subject to value added. Consumer prices are calculated as:

$$p_c = \left(\sum_{i=1}^{30} p_i z_{ic}\right)\left(1 + \tau_c^{vat}\right) \tag{5}$$

where p_i is the price of final production and τ_c^{VAT} the corresponding VAT rate. Consumption commodities are demanded by households, non-resident consumers and the Government.

2.2. Households

The representative household derives utility from consumption C_c and savings S, which are endogenous, subject to the budget constraint

$$U(C_1, C_2, \ldots, C_{30}, S) = \prod_{c=1}^{30} C_c^{\alpha_c} S^{1-\sum_{c=1}^{30}\alpha_c},\ 0 < \sum_{c=1}^{30}\alpha_c < 1,\ DI = \sum_{c=1}^{30} p_c C_c + p_s S \tag{6}$$

p_s is a price index of investment goods and DI is the disposable income. It is assumed that the household dedicates a fix proportion of savings, ι_r, to purchase residential investment, RI

$$p_r RI = \iota_r p_s S \tag{7}$$