A general equilibrium assessment of external and domestic shocks in Spain

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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.

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 also put a sudden end to credits Spain’s domestic and international savings, and financial markets to 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.

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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.
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 as 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. Ratto (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 long 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. 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). 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.

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, \( Y_t \), is a constant elasticity of substitution (CES) aggregate (Armington, 1969) of domestic products, \( Y_{di} \), and imports from the EU, \( Y_{ex} \), and the ROW, \( Y_{ri} \):

\[
Y_t = \phi_1 (\delta_{di} Y_{di}^{\rho_1} + \delta_{ex} Y_{ex}^{\rho_2} + \delta_{ri} Y_{ri}^{\rho_3})^{1/\rho_1}, \quad -\omega < \rho_1 < 1
\]  

where \( \delta_{di} \), \( \delta_{ex} \) and \( \delta_{ri} \) are the domestic and foreign distributive parameters, respectively, and \( \rho_1 \) is 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

\[
Y_{di} = \min \left( \frac{X_{ji}}{a_{di}}, \frac{X_{di}}{a_{di}}, \ldots, \frac{X_{30i}}{a_{30i}} \right)
\]

\[
V_i = \gamma_i K_i^{\beta_i} L_i^{\alpha_i}
\]

where \( \gamma_i \) is the scale parameter and \( \beta_i \) 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

\[
C_c = \min \left( \frac{Z_{1c}}{z_{1c}}, \frac{Z_{2c}}{z_{2c}}, \ldots, \frac{Z_{30c}}{z_{30c}} \right)
\]

where \( Z_i \) is the amount of commodity \( i \), which is the CES aggregate of domestic products and imports, used to produce \( c \), and \( z_i \) the unitary requirement. Consumption commodities are subject to value added. Consumer prices are calculated as:

\[
p_c = \left( \sum_{i=1}^{30} p_i z_i \right) \left( 1 + \tau^{VAT} \right)
\]

where \( p_i \) is the price of final production and \( \tau^{VAT} \) 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

\[
U(C_1, C_2, \ldots, C_{30}, S) = \prod_{c=1}^{30} c_s^{\alpha_e} S^{1-\alpha_e} \leq 1, \quad 0 < \sum_{c=1}^{30} \alpha_c < 1, \quad DI = \sum_{c=1}^{30} p_i C_c + p_s S
\]

where \( p_s \) is a price index of investment goods and \( DI \) is the disposable income. It is assumed that the household dedicates a fixed proportion of savings, \( \kappa \), for residential investment, \( RI \)

\[
p_s RI = \kappa p_s S
\]
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