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Rigid wage-setting and the effect of a supply shock, fiscal and monetary policies on Chinese economy by a CGE analysis

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ABSTRACT

The purpose of this paper is to present a computable general equilibrium (CGE) model of the Chinese economy which includes rigid wage-setting and integration of real and financial sectors, and to apply it to a quantitative evaluation of the oil price changes and the fiscal and monetary policies. The policy simulation shows whether the wage rate is flexible or rigid is crucial for the evaluation of various policy measures. Furthermore, the fields of application of the model are extended from the industry-related problems to the macroscopic ones such as inflation, stabilization policies and so on.

1. Introduction

There is a long tradition in economics of theorizing about markets for labor, goods and financial assets in general equilibrium. More recently, the use of numerically based computable general equilibrium models for research and policy simulation has grown rapidly. However, few numerical models explicitly include rigid wage-setting and financial market. In this paper we present an initial attempt at filling this gap, in the context of oil price changes and the fiscal and monetary policies formation for China.

The model attempts to explicitly introduce financial aspects into a multi-sector general equilibrium model and to capture interactions between real and monetary phenomena in a rigid wage-setting way under the general equilibrium setting.

In his previous paper (Li, 2006), the author has presented a CGE model of the Chinese economy focusing mainly on the real industrial sectors. The model covers markets for products, labor and foreign exchanges but not for financial assets (under an implicit assumption that financial markets are all cleared a priori in some way or others). As a result, only quantities, real values and relative prices are determined in the model, leaving absolute levels of values and prices undetermined. The model in this paper, on the other hand, attempts to explicitly introduce financial aspects into the multi-sector general equilibrium model and to capture interactions between real and monetary phenomena in a more rigorous way. The absolute price level is now determined endogenously in the model and the field of application of the model can be extended from the industry-related problems to the macroscopic ones such as inflation, stabilization policies and so on.

CGE models are now widely used, mainly by World Bank, for the analysis of development planning and policies in the developing countries. The CGE model of China in this paper owes its theoretical framework at the starting point to one of the World Bank studies: Dervis et al. (1982). The Chinese model here, however, includes a different approach to the labor market, an elaboration in the distribution and expenditure sides of GDP, and an extension[1] in the determination of exchange rate and price level, the last of which is closely related to

[1] See Dervis et al. (1982, pp. 150–152) for the importance of model's extension in this direction. Major changes in framework of the present model from the previous one are: (1) the model assumes the nominal wage (W) to be downward rigid, making it impossible for the wage to decline below a certain minimum level ($\overline{W}$); (2) addition of behavioral equations, identities and equilibrium conditions for the financial sector; (3) separation of banking and insurance from the industrial sectors;(4) separation of financial institutions from the institutional sectors; (5) revision in the specification of net property income, and (6) revision in the exchange rate determination.

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the endogenous treatment of the financial sector.[2] It should be emphasized that the Chinese model here fully utilizes the data and methodological framework of the SNA (System of National Accounts), which is a synthesis of the five major accounts or statistics for the national economy: input–output tables (2007), national income accounts, balance of payment accounts, flow of funds tables and national balance sheets.

There exist at least three econometric models of the multi-sector general equilibrium type for the developing economy: Tsujimura and Kuroda (1981), and Saito (1983), Bernanke et al. (1996), and Smets and Wouters (2003, 2008). The first one is the pioneering studies in this field made in the early seventies, while the second is an attempt to extend the 1973 version by allowing for monetary behaviors and the financial sector. The last two are attempt to build a DSGE model (Dynamic Stochastic General Equilibrium, DSGE) by introducing wage stickiness based on BGG model which already reflects both price stickiness and financial accelerate effect. They are all carefully made empirical studies. The model in this paper may be said to be an extensional version of these studies in the sense that empirical rigorousness is sacrificed for theoretical preciseness and operational simplicity (as is the case in most CGE studies).[3]

The CGE model of Chinese here depends exclusively on 2007 Input–output Tables (so far which is the latest version) for the data of industrial productions and expenditure allocations, so that 2007 is the bench mark year in the model for which the economy is assumed to be in equilibrium. The model disaggregates the economy into thirteen industrial sectors (see Table 1 in Appendix) according to the IO Tables with a special treatment for energy related industries and banking and insurance,[4] on the one hand, and five institutional sectors (see Table 2 in Appendix) which correspond exactly to the NAS classification, on the other.

The CGE model of Chinese assumes CES production functions for the 13 industries mentioned above. The model employs CET functions in aggregating imports and domestic products into composite goods for each of the 13 industries. The model assumes further a Cobb–Douglas utility function (in addition to a constant saving rate) for the households sector in deriving consumption demand disaggregated for each industry. In other words, elasticities of substitution are all set equal to one between production factors, between imported and domestically produced goods, and between consumption goods, resulting in the functional parameters to be estimated by appropriate shares in 2007. The model in this paper, therefore, describes the economy of China as the one with unitary elasticity of substitution, assuming it to be in equilibrium for the bench mark year 2007.

The structure and characteristics of the Chinese CGE model will be discussed in detail in Section 2. The performance of the model will be checked for the benchmark year in Section 3. In the same section, the model will be applied to a quantitative evaluation on the impacts of oil price changes, the fiscal and monetary policies, and the direct policy measures to reduce trade surpluses. In Section 4, concluding remarks will be given.

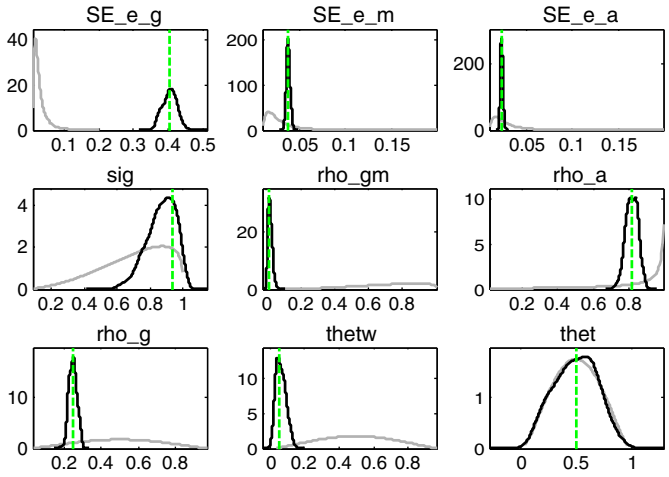

Fig. 1. The prior and posterior distribution of Bayesian estimation.

2. Structure of the model

The model is generally based on the neoclassical CGE model (Devarajan et al., 1982), but extends the statistic model to incorporate the rigid wage-setting and integration of real and financial sectors, and the accumulation of capital stock. Additionally, the model framework is also reference to Ezaki (2002) and Hertel (1997). The model includes the following blocks: production block, trade block, income distribution block, the consumer block, the balance of supply and demand of factors, and recursive dynamic block.

This paper constructs a financial CGE model in which data based on I-O tables (2007) and capital-flow related data, first of all to construct the financial SAM matrix in 2007 (Social Accounting Matrix, SAM). Its basic structure is shown in Table 3 (real SAM) and Table 4 (the financial SAM). In the Chinese CGE mode, while financial assets and liabilities accounts used in the model are illustrated in Table 4. Most of the parameters in the model, especially shares, ratios and constant terms, are estimated directly from IO42, NAS and other proper sources, but various elasticities in relation to demand and supply functions are derived from Bayesian estimation work (Fig. 1).[5]

The model is formulated precisely as a general equilibrium system, so that its essential part may best be summarized by the Law of Walras. It is supposed in the model that the domestic prices are determined by the equilibrium conditions in the product markets, the nominal wage constraint holds (i.e., $W = \overline{W}$ which will be explained in more detail later), the exchange rate (ER) by the equilibrium condition for the foreign exchanges market and the interest rates of securities and loans in the financial markets. The demand for and the supply of cash currency match automatically when the markets for products, labor, foreign exchanges, securities and loans are all cleared through adjustments in the corresponding prices and interest rates. In other words, the prices and interest rates determined endogenously for their absolute levels in the model are the ones that guarantee also the equilibrium in the money market.

The labor market in the present model is a deviation from the pure general equilibrium system. As the model assumes the nominal wage (W) to be downward rigid, making it impossible for the wage to decline below a certain minimum level ($\overline{W}$), this minimum wage level is set equal to the actual wage level in solving the system for 2007

[2] See Sanderson and Williamson (1984) for a survey and evaluation of the World Bank studies on CGE models. See Drud and Grais (2002), Amran and Grais (2009) and Gleb (2010) for models of Southeast Asia. General equilibrium models are widely used also in the developed countries by the name of applied general equilibrium (AGE) model for the analysis of taxation and trade policies. See Shoven and Whalley (1984) for a detailed survey of such AGE models.

[3] In the three econometric models, the aggregate budget constraint which leads to the Walras' Law is not explicitly shown, so that it is not clear which of the (possible) equilibrium conditions is redundant and therefore dropped from the system. Money is considered as the determinant of absolute price level in the second model above, but its supply is assumed to be identically equal to its demand. The wage rate based on the Philipps relations is the determinant of absolute price level in the first and third models above.

[4] Energy-related industries are separated out in some detail here for the model to be able to deal with energy problems at a minimum level. The disaggregation in energy-related industries here follows Ohio (1994). The separate treatment of banking and insurance is necessary to integrate the financial sector with the real parts of the model. This industry corresponds exactly to the sector of financial institutions.

[5] See Smets and Wouters (2003, 2007), Adolfson et al. (2007), Sala et al. (2008), Graeve (2008), Riggi and Tancioni (2010), Christiano et al. (2010), Justiniano et al. (2010).