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Darwinian pools? The evolution of factor market modelling in global CGE models.

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Summary

Background

The construction and subsequent releases of the global database of international trade and domestic transactions (GTAP database) together with advances in computing, has made global CGE modelling possible over the last twenty years. Applications of global CGE models based on the GTAP databases range from trade liberalisation to climate change and now many of the key international institutes use and develop some form of global CGE model. Apart from the way of modelling intermediate demand in the different sectors, modelling of factor demand and supply is one of the most crucial assumptions in the 'general set-up' of the CGE model. The presentation of factor demand describes the ability of different sectors to react to changes in relative output prices and in longer-terms the economic structure of the economy.

This paper brings together the work done in these many institutes into one paper with a focus on the various ways that factor markets are captured with global CGE models. A range of global CGE models are identified and through literature searches and contacts with the developers, the current state of the art in factor market modelling in global CGE models is identified. Extensions that have particular relevance for agriculture and/or other sectors are given special mention. Commonalities between models will be drawn as will differences that may explain variations in models results. We explore whether 'Darwinian pools' exist in which the separate development of models starting from a common base has led to significantly different ways of modelling factor markets. In addition, we complement the review of global modelling with a summary of innovations in factor market modelling in single country CGE models.

The paper forms the starting point for the global modelling component of the EU FP7 project 'Comparative Analysis of Factor Markets across the Member States' as well as providing a resource to the GTAP community on the current state of factor market modelling in global CGE models.

Introduction

The term 'factor market' refers to the demand and supply of the factors of production: land, labour and capital. Many global CGE models have been developed (see appendix for an extensive list). The review of factor market modelling is however restricted to six key global models: GTAP (Hertel, 1997) and its variants: GTAP-AGR (Keeney & Hertel, 2005), GTAP-E (Burniaux & Truong, 2002), GTAP-DYN (Ianchovichina & McDougall, 2000) and G-MIG (Walmsley et al., 2007), GLOBE (McDonald et al., 2007), the LINKAGE model at the World Bank (van der Mensbrugghe, 2005), MIRAGE (Hedi Bchir et al., 2002), MAGNET (formerly LEITAP, Woltjer, 2010) and WORLDSCAN (Lejour et al., 2006). The models are chosen because they are computable general equilibrium models with a global coverage that are well-known and widely referenced in the CGE literature. Moreover, the characteristics of the models can be corroborated through available documentation and contact with the models' developers. Given the heavy data requirements needed for a global model, most of the models described here use a common core database: GTAP. In addition, most models are descendants of the GTAP global CGE model.

The paper is structured as follows; the first part of the paper is devoted to comparing the ways in which factor markets are modelled in the six selected global CGE models. Each market is addressed in turn (labour, capital and land) and summary tables are provided to give an overview of the characteristics of each model. The review of global modelling concludes with a synthesis of the similarities and differences between the models that addresses the question of whether the development of factor market modelling in global CGE models has developed in a convergent or divergent manner. The second part of the paper focuses on innovations in factor market modelling in single country CGE models. The final section concludes and offers suggestions for further developments in factor market modelling offered by the developments in single country modelling.

Factor market modelling in global CGE models

The review of factor market modelling in global CGE models is structured by market: labour, capital and land. For each market, the standard GTAP formulation of the market is described followed by a review of other market features captured in the six models.

Labour markets

Labour is classified as a mobile factor in the standard GTAP model. As such, labour is free to move between sectors in a country or region in response to changes in relative prices; which leads to the an equalisation of the increase or decrease in the wage rate across all sectors. Two types of labour are included in the standard GTAP model; skilled labour and unskilled labour. Each type of labour has its own wage rate determined by the interaction of the supply of labour (usually exogenous) and the demand for labour as a factor of production. Skilled and unskilled labour are substitutable both for the other type of labour and the other factors of production in the formation of the value added composite which in turn is substitutable with composite (domestic and imported) intermediate goods in the production of the output of each sector.

Labour Movements

Price Determination

Market Interventions

Table 1 Labour market features in global CGE models

	GTAP	GTAP-AG	GTAP-E	GTAP-DYN	G-MIG	MIRAGE	LINKAGE	MAGNET	GLOBE	WORLDSCAN
Minimum wage						X	X			
Segmented markets						X	X	X		
International migration					X	X			X	
Unemployment							X			
Institutional design							X			
Wage bargaining							X			
Integrated markets (zone)						X				
Labour biased technical change							X			
Union power							X			
Efficiency wages							X			

Capital markets

Capital Accumulation

Capital Movements

Table 2 Capital market features in global CGE models

	GTAP	GTAP-AG	GTAP-E	GTAP-DYN	G-MIG	MIRAGE	LINKAGE	MAGNET	GLOBE	WORLDSCAN
Putty-clay						X				
Putty-semi-putty							X			
Multiple vintages							X			
Partial mobility							X			
Sectorally fixed							X			

Land markets

Land Supply

Allocation across Sectors

Other

Table 3 Land market features in global CGE models

	GTAP	GTAP-AG	GTAP-E	GTAP-DYN	G-MIG	MIRAGE	LINKAGE	MAGNET	GLOBE	WORLDSCAN
Land supply function								X		
Set-aside						X				
CET allocation		X						X	X	
Logistic function							X			

Synthesis: Commonalities and Differences

Innovations from single country modelling

Conclusions

We expect to find that although the models may share a common database, and in many cases a common starting place in the GTAP model, that the modelling of factor markets differs significantly across models. By bringing together the developments in one place, the current state of the art in factor market modelling will be reviewed to provide a resource for CGE-modellers wishing to extend the presentation of factor markets within their models.

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Appendix: Global CGE Models