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The specification of price and income elasticities in computable general equilibrium models: An application of latent separability

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Abstract

This paper contributes to the ongoing debate about the specifications of price and income effects in Computable General Equilibrium models. We detail a procedure which allows to implement in such models any regular configuration of price and income effects. This procedure exploits the advantages of latent separability. By allowing some overlapping in the grouping of commodities, this separability concept offers much more flexibility than other separability structures since substitution between goods runs through many channels. This paper also provides an empirical illustration which demonstrates the applicability of our procedure and which highlights the substantial bearing of these specifications on CGE results.

JEL classification: D58; D12

Keywords: CGE models; Flexible Functional Forms; Latent separability

1. Introduction

Computable General Equilibrium (CGE) models are now widely used in order to examine a wide array of economic issues (trade reform, economic integration, environmental policy, etc.). The popularity of these economic tools can be partly

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attributed to their ability to fully take into account inter-sectoral effects of economic shocks. These inter-sectoral effects mainly occur through prices (of goods, primary factors of production, etc.) and income, reflecting competition for scarce resources, limited disposable income, etc. Accordingly, the specification of price and income effects is a crucial factor for the relevance of CGE models.

This specification of price and income effects is directly connected with the choice of functional forms used to represent production technologies of firms, preferences of households, etc. Several papers already highlight the substantial bearing of this choice upon CGE results. Let us mention four papers illustrating four different Flexible Functional Forms (FFF). The first paper by Hertel (1985) considers a CGE model of the New York State economy in order to examine the impact of a system of partial factor subsidies. In this framework, Hertel tests two specifications of production technologies. The first one is based on the Cobb–Douglas (CD) functional form, which can be easily introduced in the model but embodies restrictive hypotheses. The second uses the translog (TL) functional form, which is much less "convenient" but more flexible and adequate to capture patterns of substitution between production factors.[1] As expected, this analysis shows the huge impacts of these two specifications on results. Moreover, Hertel compares these results with those obtained using a flexible partial equilibrium model. The simulations' results indicate that the flexible partial equilibrium model dominates its CD, general equilibrium counterpart, yielding a more accurate approximation to the TL, general equilibrium "base-line" model. This latter result obviously depends on the particular problem under consideration but leads the author to conclude that general equilibrium analysis with restrictive specifications may be of little value for some policy analysis. The second paper by Despotakis and Fisher (1988) focuses on the energy sectors in the California economy. Again two specifications of production technologies are contemplated. The first one uses the Generalized Leontief (GL) functional form while the second relies on fixed coefficients. The authors then simulate the long-run impacts of a doubling of oil price under these two specifications. It comes as no surprise that this experiment leads to a much larger drop in oil use with the GL specification (34%) than is obtained with the fixed-coefficients version of the model (11%). More interesting are the differences on aggregate variables and, as a result, policy recommendations. This experiment leads to a strong decrease of gross domestic output with the GL specification (4%) and a small increase with the alternative one (0.2%). The third paper by Robinson et al. (1991) investigates the role of functional forms for the specification of import demand functions.[2] Using a three-country CGE model, they contrast the standard constant elasticity of substitution (CES) import-aggregation function with the almost ideal demand system (AIDS) formulation. Their analysis also demonstrates that, depending on simulation experiments, the choice of a particular specification has a strong impact on model results. Specifically, for experiments involving growth and tariff protection and thus generating significant income effects, the standard CES specification yields unrealistic

[1] Flexibility is defined here as the ability to represent production technologies (or consumers' preferences) without placing any prior restrictions on the full set of price (as well as income) elasticities at a base point.

[2] To our knowledge, this paper has never been published in an academic journal but is often quoted in subsequent papers using an AIDS specification (Robinson et al., 1993; Pogany, 1996; Weyerbrock, 1998).