

Approaches to Gendered CGE Modeling: Review of the Literature and Applied Comparative Analysis

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1. Introduction

All over the world, policymakers face important challenges related to gender, including demands to absorb growing number of educated females into the labor force, and to eliminate inequalities in care work at home and wage discrimination in the market. (See, among others, World Bank 2023.) Moreover, achieving gender equality is one of the Sustainable Development Goals (SDGs) — SDG 5 calls for ending “all forms of discrimination against all women and girls everywhere”.

In recent years, a growing number of Computable General Equilibrium (CGE) models have been designed to bring the gender dimension into the analysis, not only in the labor market but also in care work at home and leisure. Given this, it is timely to take stock of the literature – model structures, data sources, and policy issues addressed – and to do a comparative applied assessment of some of the main approaches, exploring the tradeoffs that may be involved and extracting lessons from the work done to date.

Currently, some of the major and closely linked issues, both in the literature and in real-world economies, are related to (a) household decisions about the extent to which they should produce the household services they need themselves or purchase imperfect substitutes from the market (e.g., child and elderly care); (b) the mobility of and substitutability between male and female labor, both in the market and at home as well as between the two spheres, influencing the ability of economies to smoothly adapt to and benefit from a larger female

participation in the labor market; (c) the effects of wage discrimination; and (d) the effects of government policies designed to change outcomes

In this paper, we review the approaches to gender that have been used in the CGE literature (Section 2) and describe the challenges of building gendered CGE databases, including gendered Social Accounting Matrices (SAMs) (Section 3). In Section 4, we embark on the applied assessment, comparing the results for the same set of scenarios under different model structures that also differ in terms of data requirements. Our conclusions are drawn in Section 5.

2. Gendered CGE Models: Literature Review

The growing literature on gendered SAM-based CGE models has demonstrated the ability of the CGE approach to generate important insights about gender-differentiated effects of economic policies. This section surveys major contributions, taking note of their structure, data needs, and policy coverage.

Table 2.1 summarizes the features of key contributions to the literature. The gendered CGE models may be split into two groups. The first introduces a gender disaggregation of labor in the production sphere that, according to the System of National Accounts (SNA), is part of GDP. The second group goes beyond GDP by extending the model to cover household service production for own consumption, also in this sphere with a gender disaggregation of labor. The latter services include what often is referred to as care or social reproduction. Given that the second group of models views the time that is available to different household members more comprehensively, they also tend to cover leisure (or self-care activities). The coverage of the databases (most importantly the SAMs) that accompany the models in each of these two groups reflect whether they are limited to or go beyond the GDP sphere.

As shown in Table 2.1, Arndt and Tarp (2000), who analyze agricultural policies in Mozambique, is the pioneering paper in the first group. Their gender disaggregation of labor is limited to agriculture, a sector in which women play a major role. The disaggregation makes it possible to analyze the impacts of exogenous shocks (in their case affecting productivity and marketing

costs) on labor incomes by gender as well as standard non-gendered indicators. To make it possible to address gender aspects, the database for the Arndt-Tarp model juxtaposes the standard national accounts with additional detail on agriculture.

Table 2.1. Selected contributions to gendered CGE modeling

	Country	Time treatment	Household sectors*	GDP sectors**	Labor	Households	Policy issues
Arndt and Tarp (2000)***	Mozambique	Static	--	Explicit gender roles in agriculture	Gender disaggregation of labor factors within agriculture	Rural and urban	Changes in agricultural productivity and marketing costs
Fontana and Wood (2000)****	Bangladesh	Static	Reproduction and leisure	Explicit gender distinction in all sectors	Gender disaggregation of labor factors in all sectors	Aggregate household	Changes in food import prices, capital inflows, and manufacturing export incentives (with and without gender targeting)
Cicowiez and Lofgren***** (2023)	Korea	Dynamic	Reproduction, including child and elderly care sectors, and leisure	Explicit gender distinction in all sectors; explicit child and elderly care	Gender disaggregation of labor factors in all sectors	Household disaggregation to 3 groups linked to care needs	Support to child and elderly care via subsidies and public care; policies that reduce wage discrimination against women.

*Leisure and household service production for own consumption, which is not part of GDP

**Production that is part of GDP. (For goods, some of these sectors may be produced by households for own consumption.

***The models in the first group with gender disaggregation within the GDP sphere, also includes Thurlow (2006) on South Africa, Arndt et al. (2006) on Mozambique, Cockburn et al (2009) on multiple countries, and Arndt et al. (2011) on Mozambique.

**** Other models in the second group, which also disaggregate households, also include Fontana (2001) on Bangladesh, Fontana (2002) on Zambia, Fofana et al. (2005) on Nepal, Cockburn et al. (2007) on South Africa, Siddiqui (2009) on Pakistan, Ruggeri Laderchi et al. (2010) on Ethiopia, and Filipinski et al. (2011) on the Dominican Republic.

*****Using a similar model for Colombia, care-related policies are analyzed in Cicowiez et al. (2023).

In an application to trade policy for Bangladesh, Fontana and Wood (2000) were the first to go beyond GDP, extending a gendered CGE model to household service production for own consumption. As part of this extension, the model accounts for the decisions of working family members on how to allocate time between work at home, work in the market, and leisure. In their model, work at home is represented by a single sector labelled “reproduction,” an aggregate of time spent on tasks like care (of young and elderly family members), cooking, cleaning, washing, and shopping. Non-discretionary time, which is exogenous, is the time needed for personal maintenance, most importantly sleep and hygiene. Their extensions to non-GDP add to data requirements but have the important advantage of transcending the artificial boundary between time spent on GDP production and (often larger amounts of) time spent on household production of services for own consumption and leisure – it is rightly made explicit that all of these time uses matters to the well-being of the population.

Interestingly, the first wave of gendered CGE models focused on the impact of policies (e.g., trade policies) on female labor rather than the impact of policies to close gender gaps on a variety of economic indicators.

Compared to the study by Fontana and Wood, the study of South Korea by Cicowiez and Lofgren (2023) exemplifies how different innovations may help permit analysis of additional policy issues, in their case related to care and wage discrimination, both of which are linked to women's participation in the GDP labor market. A similar model is used to address the same set of issues for Colombia in Cicowiez et al. (2023). In the care area, the policies covered provide different types of support to the production of or demand for these services, including subsidies to households who purchase these services or transfers to households in support of their service provision at home. For wages, the model is able to analyze the effects of reducing wage discrimination; it does not explain the reasons for wage discrimination or for why it may change.

In the Cicowiez-Lofgren model and its database, the households are disaggregated on the basis of care needs into elderly, working households with children, and working households without children. The non-GDP sectors are disaggregated into child care, elderly care, and other services for own consumption. For each of these, the GDP sphere has a matching sector. In their demands and subject to their budget constraints, the households choose their preferred mix between GDP and non-GDP service options, which are treated as imperfect substitutes. The choice is captured via a two-level nested system of consumption demands with aggregated services at the top and the GDP and non-GDP alternatives at the bottom. For other goods and services, the demand system only has the top level. Wage discrimination against women is manifested in that employers pay women an exogenous fraction (less than or equal to 1) of their marginal value products (MVP), i.e., the product of the output price and the marginal product of female labor. This makes it possible to distinguish between wage differences that are due to productivity differences and discrimination.

The literature review will be expanded to consider other key contributions to the literature.

3. Databases for Gendered CGE Models

With a focus on the steps involved in SAM building, this section describes the differences in terms of data requirements between the approaches reviewed in Section 2. In addition, we

discuss how the GTAP dataset could be expanded to consider the production and consumption of household services.

4. Applied Comparative Analysis

In this section, we will run the same set of simulations using the key model structures reviewed in Section 2, applied to a dataset for a middle income country. Among other things, we will consider how the different approaches differ in terms of results from identical policy shocks (including welfare effects), data requirements, and the range of policies that each approach can assess.

Selected References

- World Bank. 2023. Gender Equality in Development: A Ten-Year Retrospective. Washington, DC: World Bank.
- Arndt, Channing, and Finn Tarp. 2000. Agricultural Technology, Risk, and Gender: A CGE Analysis of Mozambique. *World Development* Vol. 28, No. 7, pp. 1307-1326
- Cicowiez, Martín, and Hans Lofgren. 2023. Child and elderly care in South Korea: Policy analysis with a gendered, care-focused computable general equilibrium model. *The Philippine Review of Economics* 60(1):19-64. DOI:10.37907/3ERP3202J
- Cicowiez, Martín, Hans Lofgren, Ana Tribin, and Tatiana Mojica. 2023. Women's market work and childcare policies in Colombia: Policy simulations using a computable general equilibrium model. *The Philippine Review of Economics* 60(1):65-98. DOI:10.37907/2ERP3202J.
- Fontana, Marzia and Wood, Adrian (2000). Modeling the Effects of Trade on Women, at Work and at Home. *World Development* (28) 7: 1173–90.