

GTAP-HET Reloaded: An Integration of Firm Heterogeneity into GTAP Version 7 Model

Abstract

Firm heterogeneity, i.e. the substantial diversity existing among firms within the same industry, constitutes a notable empirical phenomenon. Melitz (2003) introduces the concept of firm self-selection into trade, where only the most productive firms can participate profitably in the export market. This mechanism leads to increased competition and notable compositional changes in the domestic and export markets. Trade liberalization, according to this theory, alters the market composition through firm entry and exit, contributing to an increase in aggregate productivity—a facet not encompassed in traditional trade models. This paradigm shift has significant implications for understanding international trade and formulating effective economic policies.

CGE models, with their ability to bridge macroeconomic and microeconomic variables, offer a powerful tool for assessing the impacts of trade policies comprehensively. Integrating the Melitz model into CGE models presents several advantages, capturing empirical facts in real markets and providing micro-level insights into how individual firms respond to trade shocks. Additionally, such models are better equipped to evaluate the distributional consequences of trade policies, discerning which firms benefit and which suffer under different scenarios.

There have been important efforts to bring firm heterogeneity into CGE modeling (Zhai, 2008; Balistreri and Rutherford, 2011; Balistreri and Tarr, 2022) and into GTAP (Akgul et al., 2016, Dixon et al., 2018, Bekkers and Francois, 2018). While firm heterogeneity has been applied to the classic GTAP Model (Version 6.2), it has not yet been implemented in the new GTAP model Version 7 (Corong et al., 2017) (henceforth GTAP V7), which is the most up-to-date standard model. GTAP V7 introduces new features compared to the classic version, offering improvements in modeling commodities, activities, and updated treatments of non-homotheticity. Specifically, in GTAP V7, commodities and activities are separated which allows for multi-product sectors as well as multiple sectors producing the same commodity. In addition, modelling of production and consumption behavior is also updated to introduce additional flexibilities. Furthermore, the nomenclature and valuation of the model have been updated. Finally, the treatment of non-homotheticity in final demand, welfare decomposition and multi-modal international transportation have been revised.

In this paper, our objective is to integrate the GTAP Firm Heterogeneity (GTAP-HET) Model (Akgul et al., 2016) into the GTAP V7 model in a flexible way by allowing users to specify sectors with firm heterogeneity specifications, thereby not only enhancing GTAP-HET with the latest features of the standard model but also augmenting its capability to analyze policy impacts comprehensively. Our methodology in implementing firm heterogeneity will draw from Akgul et al. (2016) and Dixon et al. (2018). This entails introducing monopolistic competition and endogenous productivity effects.

GTAP-HET extends the classic GTAP model, GTAP V6.2, with firm heterogeneity features. In particular, GTAP-HET (i) traces out self-selection of firms into domestic and export markets based on productivity differences across firms, (ii) allows for firm entry/exit into the industry capturing trade growth along the extensive margin, (iii) relaxes the Armington assumption and incorporates consumer

love-of-variety, and (iv) accounts for fixed costs in domestic and export markets, which is an important aspect of non-tariff barriers addressed in new trade agreements. These mechanisms create new sources of welfare changes via productivity, scale, and variety effects, in addition to the traditional allocative efficiency and terms of trade effects prevalent in Armington-based models. We will follow the demand and supply side treatment in Akgul et al. (2016) in incorporating firm heterogeneity into GTAP V7.

We will also incorporate insights from the GTAP-Melitz model documented in Dixon et al. (2018). Our focus will be on refining the firm mark-up pricing equation, transitioning from its exporter-neutral nature in the current GTAP-HET model to a more exporter-specific formulation in the updated version. We will then illustrate the new mechanisms at play by calibrating the model to GTAP Data Base Version 11 (Aguiar et al., 2023) and investigating the effects of trade policies using a stylized trade policy scenario and comparing the results from the standard model to the firm heterogeneity extension.

The enhanced GTAP-HET model by including the latest features of the standard GTAP model will provide researchers and policymakers with an advanced tool for detailed analyses, using insights from firm heterogeneity in international trade.

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