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The composition of trade flows and the aggregate effects of trade barriers☆

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ABSTRACT

A widely used class of quantitative trade models implicitly assumes that patterns of comparative advantage take a specific form such that they have no influence over the effect of trade barriers on aggregate trade flows and welfare. In this paper, I relax this assumption, developing a framework in which to analyze the role of interactions among countries' patterns of comparative advantage in determining the aggregate effects of trade barriers. My model preserves much of the tractability of standard aggregate quantitative trade models while allowing for the effects of any pattern of comparative advantage, across many products and countries, to be taken into account. After fitting my model to product-level trade data, I find that the composition of trade flows is quantitatively important in determining the welfare gains from trade and the aggregate effects of trade barriers. A key finding is that the welfare gains from trade tend to be larger and more skewed in favor of low-income countries than an aggregate model would suggest.

1. Introduction

The workhorse quantitative models of international trade imply that the aggregate effects of trade barriers and the welfare gains from trade can be inferred from data on aggregate bilateral trade flows. Some of these models feature rich micro-level market structures, and all of them have the desirable feature that the amount of data required to make predictions regarding aggregate variables – such as income, welfare, and trade flows – is quite low. As Arkolakis et al. (2012) have shown, for a large class of such models, the welfare gains from trade are a function of only the share of domestic goods in aggregate expenditure and the elasticity of bilateral trade flows with respect to variable trade costs, regardless of the underlying micro-level structure of the model.[1] However, the restrictions of these models which make them so analytically tractable and conducive to quantitative analysis require the implicit assumption either that there is no trade arising from comparative advantage across products or that countries' patterns of comparative advantage take a very special form, both of which imply that the effect of trade barriers on aggregate trade flows is independent of the composition of those trade flows.

In this paper, I relax these restrictions, developing a model with the flexibility to allow for arbitrary patterns of comparative advantage across products for every country, while maintaining much of the analytical tractability of aggregate models. I show that these patterns of

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[1] These models include the model of monopolistic competition and increasing returns to scale of Krugman (1980), the Armington model of Anderson and van Wincoop (2003), the Ricardian trade model of Eaton and Kortum (2002), and models of heterogeneous firms á la Melitz (2003), such as Chaney (2008). For the sake of brevity, in the remainder of the paper, I refer to this class of models as "aggregate trade models".

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product-level comparative advantage can interact in non-trivial ways to influence the effects of trade barriers on aggregate bilateral trade flows and welfare. Using data on product-level bilateral trade flows, I find countries' patterns of comparative advantage are quantitatively important in determining aggregate bilateral trade flows and the welfare gains from trade.[2] For example, I find that one quarter of the variation in aggregate bilateral trade flows and two thirds of the average country's welfare gains from trade relative to autarky are related to countries' patterns of comparative advantage. In addition, I find that, after taking these patterns into account, the welfare gains from trade are significantly larger and more skewed in favor of developing countries than an aggregate model would conclude, with the welfare gains being more than twice that of an aggregate model for the average non-OECD country.

The model I employ is an extension of the Ricardian trade model of Eaton and Kortum (2002) — henceforth EK. As in the EK model, there is a continuum of product varieties, and international trade occurs due to countries' idiosyncratic differences in productivity across varieties. However, I allow countries' expected productivity to differ across product categories into which varieties are grouped, in contrast with the EK model, for which every variety is ex-ante identical. This setup maintains much of the analytical tractability of the EK model, while also allowing for any pattern of product-level comparative advantage to be incorporated into the model.

My model provides a succinct way to summarize and quantify the strength of a basic Ricardian force that is absent from standard aggregate quantitative trade models. Specifically, country i will export relatively more to country n if country i is relatively productive for goods that country n cannot purchase cheaply from other sources (including domestic producers in n). Except in some very special cases in which my model collapses to an aggregate model, aggregate trade flows from i to n depend on the strength of i's product-level comparative advantage in n, vis-à-vis the rest of the world. By contrast, the aggregate models delineated by Arkolakis et al. (2012) all assume that there is either no scope for comparative advantage across products or that each country completely specializes in a unique set of products. Under such restrictions, trade barriers have no effect on the relative prices of an exporter's products in any market, so the elasticity of aggregate trade flows with respect to trade costs is constant and identical for every bilateral country pair.

In the presence of non-trivial patterns of comparative advantage, the welfare effects of trade barriers are also non-homogeneous. The trade cost elasticity differs across country pairs and depends on countries' patterns of product-level comparative advantage, which implies that the welfare effects of trade barriers also depend on these patterns. In my model, the magnitude of this effect is fully summarized by an endogenous, country-specific term which measures the effect of a country's comparative advantage on its domestic trade share. This captures the insight that, if the products that a country can purchase relatively cheaply from abroad are those for which it is relatively unproductive, then for a given level of international trade flows, this country benefits relatively more from specialization according to comparative advantage. Further, as external trade barriers fall, a country's domestic trade share will fall relatively slowly if its product-level comparative advantage is relatively strong, despite the fact that it benefits relatively more from specializing in its comparative advantage products. Thus, the tight link between the domestic trade share and welfare of aggregate models is broken.

I use data on product-level trade flows to infer countries' patterns of product-level comparative advantage and consider how they influence the welfare effects of trade barriers under several counterfactual scenarios. As trade barriers fall, the model predicts that countries with relatively strong patterns of comparative advantage will specialize more fully in the production of their comparative advantage products. In the case of the welfare gains from trade relative to autarky, this implies that countries whose domestic trade flows are concentrated in relatively few products experience greater gains from trade. It turns out that this tends to be the case for low-income countries.

I also consider the welfare effects of the growth of Chinese exports and find that the gains from trade are highly dependent on the similarities of countries' patterns of comparative advantage with China's in foreign markets. By contrast, an aggregate model predicts that the gains from China's growth are driven by countries' geographical proximity to China because, if the relative prices of countries' exports are assumed to be affected uniformly, countries benefit from the lower prices of Chinese exports in proportion to the share of their expenditure devoted to Chinese goods.

This paper builds on the previous literature which uses quantitative trade models to determine the effects of trade barriers on aggregate bilateral trade flows, income, and welfare – including Eaton and Kortum (2002), Anderson and van Wincoop (2003), Alvarez and Lucas (2007), and Helpman et al. (2008) – and more recent papers that address discrepancies between more traditional quantitative trade models and the data.[3] The main contribution of my paper to this literature is that it demonstrates how the workhorse class of quantitative trade models can be generalized to account for the aggregate effects of non-trivial patterns of product-level comparative advantage. It does so in a way that maintains, to a large extent, the tractability and parsimony of this class of models while utilizing the wealth of information contained in product-level trade data, which is available for most of the world's countries. It also provides succinct and intuitive expressions relating the gains from trade to countries' patterns of product-level comparative advantage, allowing for a straightforward decomposition of the gains from trade into across-product and within-product components.

This paper is also related to (Arkolakis et al., 2012) in that both papers address important features shared among the literature's workhorse class of quantitative trade models, but we make very distinct points. (Arkolakis et al., 2012) demonstrate that, in this class of models, the welfare gains from trade depend only on two aggregate variables. My paper demonstrates that welfare in these models depends only on aggregate variables because of particular assumptions that imply no role for patterns of comparative advantage across products in influencing the welfare effects of trade barriers. I also show that, when the patterns that exist in the data are taken into account using a more general framework, the role of such patterns is quantitatively important.

A recent branch of the literature, to which my paper is highly complementary, is focused on the effects of trade barriers in multi-sector models. Most closely related are (Caliendo and Parro, 2015) and (Levchenko and Zhang, 2014), which take into account sectoral heterogeneity at the industry level in measuring the gains from trade.[4] Although my model shares many features with the models in these papers, my paper is distinct in two important ways. First, because I focus on the effects of patterns of comparative advantage at a level

[2] In particular, I use data from the UN Comtrade database at 6-digit level of Harmonized System, which includes bilateral trade flows within more than 4500 manufactured product categories.

[3] Examples of the latter include Waugh (2010), Fieler (2011), and Caron et al. (2014). Anderson and van Wincoop (2004) provide a survey of older papers that have extended theoretically-founded gravity models, such as Anderson (1979) and Krugman (1980), in a number of dimensions. Costinot and Rodrguez-Clare (2014) review recent advances in this literature in measuring the welfare gains from international trade relative to autarky.

[4] Arkolakis et al. (2012) also derive an expression for welfare in a multi-sector extension to their aggregate framework. Other notable recent papers that consider the effects of trade barriers in multi-sector models include Anderson and Yotov (2011), Costinot et al. (2012), and Chen and Novy (2011).

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