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Per capita income, market access costs, and trade volumes

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ABSTRACT

There is strong empirical evidence that countries with lower per capita income tend to have smaller trade volumes even after controlling for aggregate income. Furthermore, poorer countries do not just trade less, but have a lower number of trading partners. In this paper, I construct and estimate a general equilibrium model of trade that captures both these features of the trade data. The key element of the model is an association between trade costs (both variable and fixed) and countries' development levels, which can account for the effect of per capita income on trade volumes and explain many zeros in bilateral trade flows. I find that market access costs play an important role in fitting the model to the data. In a counterfactual analysis, I find that removing the asymmetries in trade costs raises welfare in all countries with an average percentage change equal to 29% and larger gains for smaller and poorer countries. Real income inequality falls by 43%.

1. Introduction

There is strong empirical evidence suggesting that poorer countries (with lower per capita income) trade less even after controlling for aggregate income (see for example Hummels and Klenow (2002)). In addition, poorer countries do not just export or import smaller volumes, but have fewer trading partners. In 1995, for instance, 19% of all country pairs among the hundred largest countries in terms of *GDP* did not trade with each other in at least one direction (9% did not trade at all). However, there were no zero trade flows among the fifty richest countries in the sample. All the country pairs with trade zeros included at least one country belonging to the fifty poorest countries in the sample. This suggests that the country extensive margin (the number of trading partners) is relevant in explaining the relationship between per capita income and trade volumes.

There are several explanations for a positive relationship between trade volumes and per capita income (for instance, nonhomothetic preferences or differences in trade costs). The present paper focuses on an explanation based on cross-country variation in trade costs. To capture the above evidence, I construct and estimate a quantitative general equilibrium model of trade with many asymmetric countries. In the model, I introduce an association between trade costs (both variable and fixed) and exporter and importer development levels. A novel element here is a dependence of the costs of access to foreign markets on an *exporter* development level that I find plays an important role in explaining a number of zero trade flows and the correlation between trade and per capita income in the data. [1]

This association is motivated by indirect evidence suggesting that firms in poorer countries may face higher entry barriers to foreign markets. Indeed, exporting firms may be required to meet certain product standards, quality requirements, and technical regulations imposed by the destination country that are especially restrictive for developing and less developed countries. [2] For instance, studies conducted by the United Nations Conference on Trade and Development find that firms in some developing countries were unable to meet environmental standards and regulations imposed by developed countries, which in turn resulted in considerable export losses (see Chen et al. (2006)).[3] Poor infrastructure and bureaucracy also play a role of entry barriers to foreign markets for firms in less developed

[1] Exporter and importer specific variable trade costs are for instance allowed for in Eaton et al. (2011). Importer specific market access costs are considered in Arkolakis (2010) (see also Eaton et al. (2011)).

[2] See Hallak (2006) for how product quality affects the patterns of bilateral trade.

[3] Quality requirements are another entry barrier for firms from developing and less developed countries. The international management literature emphasizes that one of the key reasons for obtaining quality management certification (ISO 9000) is the requirements of international customers. For instance, Potoski and Prakash (2009) argue that ISO certification is a signal for the quality of a product, which is especially important for developing and less developed countries, as consumers often relate the quality of products to their countries of origin. Meanwhile, the process of certification is costly. It includes both the costs of development and implementation of new production processes satisfying the standards and the costs of certification itself (e.g. the costs of application and documentation review, registrar's visits, etc.). Mersha (1997) documents that achieving the quality management certification is especially complicated in less developed countries (he considers the countries of Sub-Saharan Africa in particular).

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countries. For example, because of a large number of long administrative procedures and poor logistics services, many firms in less developed countries cannot meet the reliability requirements of foreign partners and, thereby, cannot enter foreign markets (see Nordas et al. (2006)).[4]

I consider an environment based on Melitz (2003) and Chaney (2008) where each country is characterized by its population size and development level. Firms vary according to their productivity, which is defined as the product of a firm-specific productivity and a country development level. Exporting firms incur variable and fixed costs of trade. In the same manner as in Helpman et al. (2008), the model allows for zero exports from i to j: this happens when there are no firms in country i that are productive enough to find it profitable to export to country j. I assume that trade costs depend on development levels of the source and destination countries. Hence, if less developed countries have higher trade costs, then, all else equal, they tend to have smaller trade volumes in equilibrium and, moreover, a lower number of trading partners.

In the model, zero trade flows and the dependence of trade on per capita income can be explained by cross-country variation in variable as well as in fixed costs of trade. To understand the role of each type of trade cost, I estimate the key parameters of the model using 1995 data on bilateral trade flows of the 100 largest countries in terms of total income. The estimation procedure involves minimizing the sum of squared differences between the actual bilateral trade flows and those generated by the model subject to the constraint that the number of zero bilateral trade flows predicted by the model is the same as that in the data.[5] In other words, I estimate bilateral trade flows taking into account the country extensive margin of trade. The novelty of this estimation procedure is that it allows us to estimate both variable and fixed costs of trade. If we drop the constraint on the zeros, variable and fixed costs of trade are not separately identifiable from the bilateral trade data. Furthermore, in contrast to a reduced form approach (see for example Helpman et al. (2008)), the procedure accounts for the general equilibrium features of the model and enables us to examine how well Melitz-type models perform in explaining the trade data.

The estimated parameters reveal a strong negative correlation between *fixed* costs of trade predicted by the model and exporter and importer development levels. Entry barriers to foreign markets are higher for firms from less developed countries (the exporter effect) and, all else equal, it is more difficult to access markets in less developed countries (the importer effect). As a result, the model predicts that less developed countries tend to have smaller trade volumes and a lower number of trading partners. In contrast, the estimated correlation between *variable* trade costs and countries' development levels appears to be much weaker. These findings emphasize the importance of market entry costs in explaining trade volumes and trade zeros.

I find that the model performs well in matching the data. In the data, doubling a country's per capita income (controlling for the aggregate income) leads to a 19% increase in trade on average, while doubling a country's population increases trade by 85% on average. The model predicts an increase in trade of 13% and 75%, respectively. Given the estimated parameters, the model is able to explain 39% of trade zeros in the data. In other words, 39% of the zeros predicted by the model are zeros that are actually observed in the data (the rest is mismatch).[6] As a comparison, the exact same model but without exporter and importer specific trade costs correctly predicts only 11% of zeros. Hence, the relationship between trade costs and countries' development levels matters and helps to explain 28% of export zeros.

To explore further the role of market access costs, I estimate the model assuming away the dependence of variable trade costs on countries' development levels. In this case, the explanatory power of the model falls by only 0.4% and the quantitative predictions of the model do not considerably change compared to the benchmark model. Moreover, the estimated importer effect of fixed trade costs is quite weak compared to the exporter effect. This suggests that the exporter effect of fixed trade costs plays a dominant role in explaining trade zeros and the dependence of trade on per capita income. I also find that the model with the variation only in variable trade costs (fixed costs are assumed to be identical across the countries) performs worse in fitting the data. In particular, the model considerably overestimates the impact of per capita income on trade volumes (the explanatory power of the model falls by 2%). Doubling a country's per capita income (controlling for the aggregate income) results in a 44% increase in trade (compared to a 19% increase in trade in the data). Moreover, the percentage of correctly predicted zeros is 29% compared to 39% predicted by the benchmark model.

Finally, I examine what the welfare gains are if firms in poor countries incur the same trade costs as their counterparts in rich countries. To conduct this counterfactual, I set the fixed costs of trade of all countries equal to the estimated value of those in the U.S. and remove the asymmetries in variable costs of trade (the other parameters of the model are set equal to their estimated values). I find that in this case, welfare in all countries rises with the average percentage change equal to 29% and larger gains for smaller and poorer countries. In particular, the real income inequality (measured as the ratio of the average real income of the ten richest countries to that of the ten poorest countries) falls by 43%.

This paper is closely related to Waugh (2010), who considers a general equilibrium model of trade based on Eaton and Kortum (2002). He assumes that variable trade costs are a function of symmetric relationships (e.g., distance, etc.) and an exporter fixed effect. He finds a negative correlation between exporter per capita income and the fixed effect, implying that poor countries face higher variable trade costs than rich countries. The present paper also focuses on the relationship between trade costs and per capita income and its relevance to trade volumes. However, compared to Waugh (2010), it makes a step further in this direction. The model in the paper allows us to consider cross-country variation in both variable and fixed costs of trade and, thereby, to identify the role of each type of trade costs in explaining the data. In particular, I find that the presence of exporter specific market access costs considerably improves the fit of the model, which can be especially important for welfare implications.

A broad strand of the literature considers nonhomotheticity of consumer preferences as a main driving force of the dependence of trade on per capita income. A significant step in this direction is Fieler (2011), who extends the Ricardian model of trade in Eaton and Kortum (2002) by allowing for nonhomothetic preferences and cross-sector differences in production technologies.[7] The present paper provides another, possibly complementary, explanation of why poorer countries trade less, which is not based on nonhomotheticity of preferences.

The remainder of the paper is organized as follows. Section 2 introduces the basic concepts of the model and describes the equilibrium. Section 3 estimates the model and explores its quantitative

[4] According to the Doing Business (2006) report, there is a significant negative correlation between the number of documents required to be filled out before exporting and per capita income of an exporting country: the poorer a country is, the greater the number of documents exporters of that country have to fill out. Since the greater number of documents required to export would typically increase fixed costs of exporting, this evidence suggests that firms in richer countries find it relatively easier to start exporting compared to their counterparts in poorer countries.

[5] Notice that mismatch is possible. The model can predict some zeros that are not actually observed in the data and vice versa.

[6] Remember that the estimation procedure implies that the model predicts the same number of zeros as that in the data.

[7] See also Flam and Helpman (1987), Hunter (1991), Markusen (1986), Markusen (2010), Matsuyama (2000), Mitra and Trindade (2005), and Stokey (1991).