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# Trade barriers and the relative price of tradables☆

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ABSTRACT

In this paper I quantitatively address the role of trade barriers in explaining why prices of services relative to tradables are positively correlated with levels of development across countries. I argue that trade barriers play a crucial role in shaping the cross-country pattern of specialization across many tradable goods. I construct a multi-country, general equilibrium model of trade and derive tractable predictions that show how specialization affects relative prices. I calibrate the model to match the patterns of prices, levels of development, and bilateral trade across 103 countries. Through counterfactuals I find that removing trade barriers eliminates more than half of the gap in the relative price of services between rich and poor countries with only a minimal systematic effect on the absolute price of tradables.



## 1. Introduction

A striking feature of cross-country price data is that the price of services relative to tradable goods correlates positively with levels of development.[1] It is important to understand the fundamental sources of what causes differences in relative prices across countries for at least two reasons. First, relative prices lie at the heart of understanding real exchange rates (see for instance Burstein et al. (2005)). Second, relative prices play a crucial role in understanding income differences across countries; sectoral productivity differences across countries are often inferred from differences in relative prices (e.g., Restuccia and Urrutia, 2001; Hsieh and Klenow, 2007).

Modern globalization has resulted in tighter integration in goods markets across countries. The world trade-to-GDP ratio increased from 0.14 in 1990 to 0.25 in 2011.[2] However, there remain substantial barriers to international trade. In this paper I explore how trade barriers affect the distribution of the price of services relative to tradables across countries. I argue that trade barriers affect relative prices through their impact on productivity in the tradables sector. My main finding is that removing trade barriers eliminates more than half of the gap in the relative price of services between rich and poor countries with only a minimal systematic effect on the absolute price of tradables.

One of the first explanations for why relative prices co-vary positively with development is due to Balassa (1964) and Samuelson (1964). The Balassa–Samuelson hypothesis postulates that there are larger cross-country productivity differences in tradable goods than in nontradable goods.[3] There are four main components that drive the Balassa–Samuelson result: 1) large cross-country productivity differences in tradables, 2) small cross-country productivity differences in nontradables, 3) free trade, and 4) perfectly mobile labor within a country across tradables and nontradables. These four components imply that, in each country, the relative price of nontradables is equal to the

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[1] Further empirical documentation of relative prices can be found in Kravis and Lipsey (1988), and Heston et al. (1994). More recently, using detailed disaggregate price data from the 2005 World Bank's International Comparison Program, Marquez et al. (2012) show that prices of nontradable goods co-vary closely with levels of development while prices of tradable goods co-vary much less with development. They show that this observation remains robust even after removing goods and services that are "comparison resistant" across countries, for reasons that may stem from unobserved quality differences for instance.

[2] These data come from the 2012 World Bank's World Development Indicators. In the database, merchandise exports correspond to TX.VAL.MRCH.WL.CD and GDP corresponds to NY.GDP.MKTP.CD.

[3] Herrendorf and Valentinyi (2012) argue that the Balassa–Samuelson effect holds empirically in a large cross section of countries.

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inverse of its (exogenous) relative productivity. I build on the Balassa–Samuelson hypothesis by relaxing the first three assumptions. Instead, I infer the magnitude of productivity differences and the size of trade barriers by interacting a general equilibrium model of trade with data on prices, levels of development, and bilateral trade.

I build on the multi-country Ricardian model along the lines of Eaton and Kortum (2002), Alvarez and Lucas (2007) and Waugh (2010). I incorporate a full input–output structure in order to characterize the channels through which trade barriers affect prices in both tradable and nontradable sectors. In addition, I include a distribution margin in order to map the prices in my model to the retail prices in the data. In the model there is a continuum of tradable goods that are subject to bilateral trade barriers. Countries differ in their distribution of productivity across the continuum of tradable goods. A Ricardian motive for trade based on comparative advantage generates a selection mechanism that determines the set of goods that each country produces. Resultantly, each country's measured productivity in the tradables sector depends on the set of goods that it produces. There are also nontradable services for which productivity is taken exogenously.

Measured productivity in the tradables sector in each country is essentially the conditional average of productivity across the set of goods that the country produces. As barriers are removed, each country imports the goods for which it is comparatively inefficient at producing, thereby increasing measured productivity. This mechanism is discussed in detail in Finicelli et al. (2012) and used by Waugh (2010) to study how trade barriers affect the cross-country income gap.

I derive a tractable structural relationship that links trade to relative prices. As in the standard Balassa–Samuelson setup, in each country the equilibrium price of services relative to tradables is proportional to the inverse of that country's relative productivity between the two sectors (raised to an appropriate exponent to account for the input–output structure). The key to my model is that productivity in the tradables sector contains an endogenous component that captures the pattern of specialization. In this sense, the model encompasses the Balassa–Samuelson hypothesis by providing a mechanism through which some of the cross-country productivity differences in the tradables sector endogenously arise. A departure from the standard Balassa–Samuelson setup is that the model does not rely on the free trade. To the contrary, the model produces prices that are inline with the data in spite of, and more importantly as a result of, the fact that the inferred trade barriers are nontrivial.

I apply the model to a set of 103 countries for the year 2005. I calibrate the model using cross-country data on prices of services relative to retail goods, relative levels of development, and the pattern of bilateral trade. The mere presence of trade barriers implies that specialization is incomplete: all countries produce some goods for which they do not have a comparative advantage. Poor countries systematically face larger trade barriers than rich countries do, implying that they produce a larger share of goods for which they have a comparative disadvantage, making factors less productive on average in the tradables sector.

I decompose the variation in relative prices that stems from variation in trade barriers. Removing trade barriers has two effects. First, it results in exactly identical prices of tradables across countries (PPP holds). Since prices of tradables are only weakly related to levels of economic development to begin with, the elimination of trade barriers has a minimal systematic effect on the distribution of the price of tradables across countries. Second, free trade leads to all countries reallocating resources towards the production of goods for which they have a comparative advantage, thereby changing the pattern of specialization and increasing measured productivity in the tradables sector. The tradables-sector productivity gap between rich and poor countries falls for two reasons: i) poor countries face larger barriers than rich countries and ii) specialization in poor countries is more sensitive than that of rich countries to a given change in trade barriers. As a result, the gap in wages between rich and poor countries also falls, leading to a reduction in the gap in the price of services. I also show that if all countries faced the same barrier as the U.S. then the gap the relative price of services between rich and poor countries would fall by more than 15%.

My findings relate to the literature on cross-country differences in relative prices and relative productivity. Hsieh and Klenow (2007) use relative prices to infer relative productivity of tradable and nontradable investment and consumption goods. They show that the observed price of tradable investment goods exhibits little-to-no systematic correlation with income per worker across countries. This fact leads them to conclude that trade barriers are not an important component in delivering relative price differences. Instead, they argue that differences in relative prices reflect the fact that poor countries are inefficient at producing tradable investment goods and also inefficient at producing other goods that can be traded in exchange for investment goods. Their conclusion is inferred partly because their model has two tradable goods, and is not designed to address the pattern of bilateral trade across many countries. Relative to Hsieh and Klenow (2007) I exploit the data on the pattern of bilateral trade in order to infer trade barriers and productivity jointly. I find that cross-country differences in trade barriers are very important in order to explain the variation in prices of nontradable goods, while being consistent with the prices of tradable goods.

Recent studies have searched for mechanisms that give rise to the Balassa–Samuelson effect. For instance, Bergin et al. (2006) argue that the cross-country productivity gap is higher in tradables than in nontradables because more productive firms drive out less productive firms, and more productive firms tend to produce tradable goods. Buera et al. (2011) argue that financial frictions result in a misallocation of productive resources across sectors resulting in larger cross-country productivity differences in goods than in services.

A related strand of literature focuses exclusively on cross-country variation in the prices of retail goods. Giri (2012) shows that incorporating distribution margins into a Ricardian model of trade with trade barriers can help explain the cross-sectional pattern of prices of retail goods across countries. The distribution margin contributes to higher prices of retail goods in rich countries because distribution services have a higher price. Crucini and Yilmazkuday (2009) study retail price dispersion across international cities. They develop a two-sector, multi-city, general equilibrium model with a large number of goods and good-specific distribution margins. They use their model to estimate distribution margins for each good and quantify the importance of both trade costs and distribution costs on deviations from the law of one price.

Alessandria and Kaboski (2011) show that pricing-to-market accounts for a large share of deviations from absolute PPP across rich and poor countries, and that pricing-to-market may be even more important than distribution margins. Simonovska (forthcoming) documents a positive elasticity in the price of tradables (at the retail level) with respect to income per worker, using evidence from a particular online apparel exporter. She shows that price discrimination is quantitatively important for the systematic variation in the prices across destinations. In her model non-homothetic preferences result in higher price elasticities of demand for retail goods in rich countries, leading to higher markups and higher prices of retail goods.

My paper abstracts from price discrimination. Instead, prices in my model differ across countries because of terms-of-trade effects that stem from differences in productivity and trade barriers. I model a distribution margin to link the model's price of retail goods to the data. My quantitative results carry through for a wide range of plausible values for the distribution margin.

The results are robust to various modifications including non-homothetic preferences and unbalanced trade. The model with unbalanced trade fits the data on both the absolute price of services and the absolute price of retail goods (objects that are not direct targets in the calibration) better than the model with balanced trade. The counterfactual implications of removing trade barriers are similar in the models with and without balanced trade.