Journal of International Economics 86 (2012) 82–100

Contents lists available at SciVerse ScienceDirect

Journal of International Economics

journal homepage: www.elsevier.com/locate/jie

Local costs of distribution, international trade costs and micro evidence on the law of one price☆

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ARTICLE INFO

Article history:
Received 20 December 2009
Received in revised form 18 August 2011
Accepted 19 August 2011
Available online 26 August 2011

JEL classification:
F11
F15

Keywords:
Trade
International trade costs
Distribution costs
Law of one price
Price dispersion

ABSTRACT

This paper connects trade flows to deviations from the law of one price (LOOP) in a structural model of trade and retailing. It accounts for the observed cross-country dispersion in prices of goods, based on retail price survey data, by focusing on two sources of goods market segmentation — (i) international trade costs, and (ii) non-traded input costs of distribution. I find that a multi-sector Ricardian trade model, *ala* Eaton–Kortum, augmented with a distribution sector, can account for the average price dispersion for a basket of goods fully and generates 70% of the variation in price dispersion across goods within the basket. While tradability of goods is important in explaining the average price dispersion for the basket of goods, distribution costs are important in explaining why, within the basket, some goods show more price dispersion than others.

1. Introduction

In frictionless markets, arms' length trade in goods will arbitrage away price differentials across countries, such that the absolute law of one price (LOOP) holds. As a result, two approaches have been used to measure market segmentation: One approach infers the degree of segmentation from the volume of bilateral trade flows,[1] the other deduces segmentation from the deviations from LOOP.[2] The two approaches developed largely independently, and both conclude that international goods markets are highly segmented.

This paper connects trade flows to deviations from LOOP in a structural model of trade and retailing. My objective is to account for the observed cross-country dispersion in prices of goods by focusing on two commonly cited sources of goods market segmentation — (i) international trade costs or barriers to trade and (ii) non-traded input costs of distributing and retailing goods within local markets.

Most empirical work focusing on measuring deviations from LOOP is limited by the use of price index data, or of prices of a very narrow set of individual goods. Much of the empirical evidence, therefore, concerns the volatility and persistence of changes in relative prices, although the first-order restrictions from theory are on absolute LOOP deviations. Crucini et al. (2005), however, compile local-currency retail prices on a large cross-section of goods across 13 European Union (EU) countries to study cross-country price dispersion.[3]

Using this same data set, I account for two moments of the distribution of cross-country dispersion in prices of goods: (i) average price dispersion across goods, which is about 28%, and (ii) the variation in price dispersion across goods, which ranges from a minimum of 2% to a maximum of 83%. The first moment provides a measure of market segmentation for a basket of a large variety of goods. The second moment tells us if, within the basket, markets are more segmented for some goods than others.

I develop a model of trade and retailing by incorporating local costs of distribution in the multi-country Ricardian model of trade

☆ I owe a debt of gratitude to Caroline Betts and Vincenzo Quadrini for their advice and support. Special thanks to the two anonymous referees, and Kei-Mu Yi. I have benefited from conversations with Mario Crucini, Chris Telmer, Ariel Burstein and Saralees Nadarajah. Comments from the participants at the seminars at Banco De Mexico and CIDE, SED Annual Meetings, Midwest Macro Meetings, the Dynamics Seminar at USC and the XII Workshop on Dynamic Macroeconomics have been very helpful. I am also thankful to Michael E. Waugh for sharing data. Lastly, I thank Asociación Mexicana de Cultura A.C. for providing financial support. All remaining errors are mine.
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[1] Krugman (1991), McCallum (1995), Eaton and Kortum (2002), and Waugh (2009).

[2] Knetter (1993), Campa and Wolf (1997), Burstein et al. (2003).

[3] Rogers (2001), Engel and Rogers (2004), Crucini and Shintani (2008), and Engel et al. (2005) also use broad cross-sectional dataset of retail prices, but these data are smaller in coverage of goods. Also, none of these studies look at absolute deviations from LOOP.

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doi:10.1016/j.jinteco.2011.08.011

due to Eaton and Kortum (2002) (henceforth EK).[4] Countries trade a continuum of goods, differentiated in costs (or productivity levels) subject to bilateral and asymmetric trade costs, that are estimated using data on bilateral trade flows. The retail good delivered to the consumer is a combination of the individual traded good and non-traded distribution services. The units of distribution services that are needed to deliver one unit of a retail good vary across goods and countries, and are calibrated to match data on distribution margins across countries.

Dispersion in retail prices of goods is driven by differences in the degree of tradability of goods and the differences in the use of distribution services, where tradability of goods depends on trade costs and the elasticity of substitution. For the benchmark value of the elasticity of substitution (or elasticity of trade),[5] which falls in the middle of the range of values estimated by EK, I find that the model can account for 96% of the average price dispersion and 32% of the variation in price dispersion across goods. To illustrate how tradability alone drives LOOP deviations, I present a version of the model that abstracts from distribution costs. Without distribution costs, the model generates 84% of average price dispersion but only 19% of the variation in price dispersion. Thus, incorporating differences in costs of distribution across countries in the EK model helps to match the average price dispersion for a basket of goods almost perfectly and improves the model's performance in generating the variation.

The inability of the model to match the variation in price dispersion results from insufficient heterogeneity in tradability and distributions costs across goods. To capture greater heterogeneity in the two sources of LOOP deviations, I extend the baseline model to a multi-sector framework. Now, countries trade goods across multiple sectors. This allows us to exploit the differences in trade volumes and distribution costs across sectors and countries, observed in the data. The sectoral model with distribution costs can account for 70% of the variation in price dispersion across goods, although it comes at the cost of a slight over prediction of the average price dispersion. Notably, it is the heterogeneity in distribution costs that drives this improvement; without distribution costs, the sectoral model can generate only 26% of the variation (and 95% of the average).

In sum, international trade costs and local distribution costs can account for the average price dispersion for a basket of goods fully and generate 70% of the differences in price dispersion across goods within the basket. While tradability of goods is important in explaining the average market segmentation for the entire basket of goods, distribution costs are important in explaining why, within the basket, some goods show more price dispersion than others.

The broad conclusion that tradability of goods and use of non-traded inputs is important in explaining differences in cross-country price dispersion across goods is consistent with the findings of Crucini et al. (2005). However, like most of the literature on LOOP deviations, they use a reduced form model to carry out their analysis. Anderson and Van Wincoop (2004) and Gorodnichenko and Tesar (2009) have emphasized the need for a structural approach to study relative price deviations. The reduced form specification in Crucini et al. (2005) does not allow them to assess which dimension of tradability — trade costs or elasticity of substitution, is more important in driving price dispersion. The structural approach used in this paper allows us to do so. I find that the elasticity of substitution is the key parameter driving the variation in price dispersion across goods in the one-sector EK model. The one-sector EK model, featuring trade costs as the only source of LOOP deviations, can generate average price dispersion broadly consistent with the data but not the variation. Changing the magnitude of trade costs, keeping the elasticity of substitution unchanged, cannot help to match the variation in price dispersion. On the other hand, elasticity of substitution can be chosen to match the moments of price dispersion. Choosing the elasticity of substitution to match the average price dispersion, exactly, results in a value of 5.5, which is at the lower end of the range of values estimated by EK. Additionally, the elasticity of substitution chosen to match the variation in price dispersion is significantly smaller than the lower bound of the range of values estimated by EK.

The lower estimates of the elasticity of substitution imply much larger gains from trade, and are supported by recent studies that use micro data on prices. Simonovska and Waugh (2010) show that the EK estimate is biased upward due to a small sample bias and that correcting for this bias results in an estimate as low as 2.5. Giri et al. (2011) estimate trade elasticity for 21 manufacturing sectors and find that it ranges from a minimum of 3.1 to a maximum of 9 with an average of 4.6. However, the multi-sector model with distribution costs, using the benchmark value of the elasticity of substitution which is close to the preferred EK estimate, does very well in accounting for both moments of good-by-good price dispersion. Therefore, micro data on retail prices certainly raise the question of what is the right estimate of the elasticity of substitution.

This paper contributes to the emerging literature on structural models of international relative prices. Although some recent work has used structural models to study the effect of bilateral trade costs on the time-series behavior of bilateral relative prices — Atkeson and Burstein (2008), Ghironi and Melitz (2005), and Betts and Kehoe (2001) for example — the ability of a model of geography to contribute to an account of cross-sectional price dispersion has not been formally investigated. Similarly, the literature has investigated the role of distribution costs in explaining the time series properties of relative prices – Crucini and Shintani (2008) and Burstein et al. (2003) – and not the cross-sectional properties.

The paper is closest in spirit to Crucini and Yilmazkuday (2009), who develop a model of international cities, with complete specialization, to account for intra as well inter-national behavior of LOOP deviations. Importantly, they do not use trade flows in their estimation methodology whereas I estimate trade costs and solve the model by matching the trade volumes observed in the data. This allows me to assess whether a model that is consistent with observed trade flows can account for observed dispersion in prices.

The next section discusses the micro price data. In Section 3, I start with the version of the model that abstracts from distribution costs and discuss its calibration. This is followed by results in Section 4. The role of elasticity of substitution and trade costs in driving price dispersion is discussed in Section 5. In Section 6, I present the model with distribution costs, discuss the calibration and the data on distribution costs. The results follow in the next section. Finally, the multi-sector framework is explained in Section 8. The last section concludes.

2. Measurement of LOOP deviations

The price data complied by Crucini et al. (2005) comes from four Eurostat surveys of retail prices in the capital cities of EU countries for each of the years 1975, 1980, 1985 and 1990.[6] Across the surveys, the goods maintain a high degree of comparability across both location and time. The retail price of a good in a given country is the average of surveyed prices across different sales points within the capital city of that country. Furthermore, the authors remove the effect of different value added tax (VAT) rates across countries from the retail prices. In total, there are 13 countries in the sample —Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg,

[4] The authors generalized the two country model of Dornbusch et al. (1977) to a multi-country model. Alvarez and Lucas (2007) showed the existence and uniqueness of equilibrium in the multi-country model.

[5] In the EK model the elasticity of substitution is governed by the parameter which governs the heterogeneity in idiosyncratic costs (or productivities).

[6] The data can be downloaded from http://www.aeaweb.org/articles.php?doi=10.1257/0002828054201332.