Economics Letters 140 (2016) 64–67

Contents lists available at ScienceDirect

Economics Letters

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

Price dispersion across countries and the heterogeneous impacts of income differences

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HIGHLIGHTS

- I use online prices across countries to analyze the deviations from Law of One Price (LOP).
- The deviations from LOP are relatively smaller for higher-priced products.
- Income difference across countries is one reason for the price dispersions.
- The impacts of income difference on price dispersions are smaller for higher-priced products.

ARTICLE INFO

Article history:
Received 27 October 2015
Received in revised form
14 January 2016
Accepted 20 January 2016
Available online 29 January 2016

JEL classification:
E3
F1
F3

Keywords:
Law of one price
Income difference
Online price

ABSTRACT

Using price information about thousands of identical products sold across over 70 countries, I show that the deviations from Law of One Price (LOP) are substantial, and relatively smaller for higher-priced products. In addition, I find that income difference across countries is one reason for the price dispersions, and its impact is smaller for higher-priced products.

1. Introduction

The Law of One Price (LOP) is an important building block in many open-economy models. However, prices of tradable goods tend to be different across countries. Massive micro-level price data are now available for detailed analysis of the failure of Law of One Price. Cavallo et al. (2014) collected price information of tens of thousands of identical products sold across countries by four large global companies.[1] They found that the deviations from LOP are significant, although LOP holds very well for the countries within the same currency union. Since their analysis is based on prices of identical tradable goods, the price dispersions across countries imply different markups across countries, rather than quality differences.[2]

In this paper, I take a step further to investigate the relationship between price dispersions and price levels.[3] Although there are many papers addressing this issue within one country, relatively little work has dealt with it in a multi-country environment. Using prices of thousands of identical products from Zara[4], a global clothing company, I find that the deviations from Law of One Price (LOP) are smaller for higher-priced products.

I show that trade and distribution costs could not fully explain the negative relationship between price dispersions and price levels. To better understand this relationship, I propose that income difference across countries is one potential reason. Specifically, greater income differences indicate higher deviations from LOP.[5] In addition, the impacts of income differences are

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1 The four companies are Apple, IKEA, H&M, and Zara.

2 Prices may also differ because of non-tradable factors associated with the product (Crucini and Yilmazkuday, 2014), or quality differences (Manova and Zhang, 2012).

3 The two terms, price dispersion and deviation from LOP, are interchangeable in this paper.

4 The data are from Cavallo et al. (2014, 2015). I appreciate it a lot that they make the data publicly available.

5 This is consistent with the results in Simonovska (2015).

http://dx.doi.org/10.1016/j.econlet.2016.01.012
0165-1765/

smaller for higher-priced products. If the prices reflect product quality (e.g. Manova and Zhang, 2012), it implies that the price elasticity with respect to income is larger for high-quality products. The results could not be easily generated in simple trade models with non-homothetic preferences, and thus this paper provides new insights on theoretical models.[6]

The data and estimation specifications are outlined in Section 2. I discuss the basic results between price dispersion and price level in Section 3. In Section 4, I illustrate the heterogeneous effects of income differences and the theoretical implications. Section 5 concludes the paper.

2. Data and estimation specification

The main data used in this paper are from Cavallo et al. (2014, 2015). They scraped price data from the webpages of several large global companies. Since the online prices across countries are for identical tradable goods, it is an ideal dataset for the analysis of product-level LOP. Specifically, I use price information about products from Zara, a large global clothing retailer. The main reason to choose Zara is that it operates in over 70 countries, much more than other companies.[7] There is a unique ID for each product, which can be used to identify the price of the same product in each country. The dataset used in this paper includes the price information for 3183 products in 63 categories sold across 74 countries in week 32, 2013.[8]

Following Cavallo et al. (2014), I define the good-level Real exchange rate $q_{ij}(z)$ between any two countries as

$$q_{ij}(z) = \ln \frac{p_i(z)}{p_j(z)e_{ij}}, \tag{1}$$

where z denotes a product. $p_i(z)$, and $p_j(z)$ are the prices of product z in country i and j, respectively. e_{ij} is the value of one unit of country j's currency in terms of country i's currency. If LOP holds, $q_{ij}(z)$ is expected to be 0.

The statistics for the main variables are listed in Panel A of Table 1, where $q_{ij}\_abs(z)$ is the absolute value of $q_{ij}(z)$. The mean of $q_{ij}\_abs(z)$ over all observations is about 0.2, implying substantial deviations from LOP. $\ln(price(z))$ is the log of price level for product z, and GDP_{ij} is the absolute value of the log of relative GDP per capita between country i and j.[9] Although the prices for the same product differ across countries, the order of the prices of the products is the same for all the countries. That is, if $p_i(z) \geq p_i(z')$ in country i, then $p_j(z) \geq p_j(z')$. Since the headquarter and most of Zara's plants are located in Spain, I choose the prices there as the measure of price level for each product.

Panel B of Table 1 briefly illustrates the relationship between price dispersion and price level. For products with log prices between 1 and 2, the average price dispersion is 0.259. The deviations from LOP get smaller as the price level increases, and go down to 0.146 for products with log prices greater than 4.

Table 1
Summary statistics.

Variable	Mean	Std. Dev.	Min.	Max.	No. of obs.
Panel A: Variables					
$q_{ij}\_abs(z)$	0.204	0.169	0	0.750	3 582 188
$\ln(price(z))$	3.034	0.705	0.688	5.004	3 582 188
GDP_{ij}	1.206	0.863	0.001	4.331	3 582 188
Panel B: Price dispersion ($q_{ij}\_abs(z)$) by groups					
$1 < \ln(price(z)) < 2$	0.259	0.189	0	0.750	312 914
$2 < \ln(price(z)) < 3$	0.241	0.185	0	0.750	1 560 892
$3 < \ln(price(z)) < 5$	0.160	0.135	0	0.750	1 386 135
$4 < \ln(price(z))$	0.146	0.124	0	0.750	287 976

Notes: $qij\_abs(z)$ is the absolute value of $q_{ij}(z)$. $\ln(price(z))$ is the price level for all the products in the form of logarithm. GDP_{ij} is the absolute value of the logarithm of relative GDP per capita between country i and j.

To get more robust results about the relation between price dispersion and price level, I run the following regression:

$$qij\_abs(z) = \beta_0 + \beta_1 \ln(price(z)) + \beta_2 GDP_{ij} + \beta_3 \ln(price(z)) \times GDP_{ij} + FE + e$$

where FE is either product category fixed effect, or country-pair fixed effect.

3. Results

The regression results are in Table 2. The first three columns show the correlation between price dispersion and price level. The last two columns address the role of income differences across countries on this relationship.

In column (1), the result suggests a clear negative coefficient between the deviations from LOP and price levels, controlling for product-category fixed effects. To control for possible factors that are specific to each country pair, column (2) includes country-pair fixed effects. The basic result is robust, and the magnitude of the coefficient gets even stronger.

One explanation for this negative relationship is that the arbitrage opportunities are taken more for higher-priced products, or there is return to search. Although this explanation may work well for products within a relatively integrated economy, it would play a much smaller role for price dispersions across countries.[10] In fact, consumers in one country could not purchase Zara products from other countries through online orders, and the probability is relatively low for large number of consumers to travel frequently across boarders.

Another explanation is that trade and distribution costs have different impacts on the products of different prices. There could be both additive and multiplicative costs associated with each product. For additive cost, it would have larger impact on low-price products, as in Crucini and Yilmazkuday (2014). However, for multiplicative cost, such as import value-added tax (VAT), the impact on prices should be uniform across product.

To verify the second explanation, I use an indirect way by examining whether import VAT has uniform effects on prices. The results are listed in column (3). The coefficient of the interaction term of relative VAT rates between two countries and price levels is significantly negative, indicating that VAT has heterogeneous effects on prices across products. It suggests that firms are pricing to market, and the pricing rule differs across products.

[6] In Melitz and Ottaviano (2008), there are no income effects. Models in Markusen (2013), Simonovska (2015) and Yilmazkuday (2014, 2015) could generate variable markups and different demand elasticities across products. However, they are not quite consistent with the heterogeneous effects income differences across products. I will discuss it in Section 4.

[7] Although other companies, like Apple, and IKEA, also operate in many countries, they only list online prices in a small fraction of the countries.

[8] I can only observe information about the product ID, category ID, and the price for each product in each country in the dataset. I could not tell anything about the characteristics of the products, even the name of the product.

[9] As in Cavallo et al. (2014), I exclude the outliers with $q_{ij}\_abs(z) > 0.75$. The information on GDP per capita is from World Development Indicator.

[10] This explanation may still hold for countries between US and Canada, or among EU countries (see Gorodnichenko and Talavera, 2014). However, there are more than 70 countries across the world in the current analysis.