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Exaggerated death of distance: Revisiting distance effects on regional price dispersions ☆

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ABSTRACT

This paper empirically establishes the significant roles of transport costs in price dispersions across regions. We identify and estimate the iceberg-type distance-elastic transport costs as a parameter of a structural model of cross-regional price differentials featuring product delivery decisions. Utilizing a data set of wholesale prices and product delivery patterns of agricultural products in Japan, our structural estimation approach finds large distance elasticities of the transport costs. The result confirms that geographical barriers are an economically significant contributor to the failures of the law of one price.

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1. Introduction

The recent years have witnessed the increased roles of trade costs in international macroeconomics. Highlighting the microfoundations of international trade patterns and geographical market segmentations with trade costs, careful calibration studies deepen our understanding of puzzling data characteristics in international macroeconomics.[3]

This paper empirically establishes the significant roles of transport costs, which are the major component of trade costs, in price dispersions across regions. Utilizing a data set of price differentials and product delivery patterns across regions, we identify and estimate the distance-elastic transport costs as a parameter of a structural model. The previous reduced-form regression studies treat the data associations between price differential and distance as a proxy of transport

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[3] Obstfeld and Rogoff (2001) point out trade costs as a central factor to explain six major puzzles in open-economy macroeconomics. Utilizing trade costs to motivate entry and exit behavior of heterogenous firms in export markets, Ghironi and Melitz (2005) provide a microfounded explanation for the Harrod–Balassa–Samuelson effect. Allowing for the distribution of trade costs over goods, Bergin and Glick (2009) endogenously determine the tradedness of goods in a small open-economy model. The resulting endogenous share of non-traded goods in the consumer price index accounts for the empirically observed low volatility in the relative price of non-traded goods. Atkeson and Burstein (2008) show that trade costs are essential to pricing-to-market behaviors of firms with variable markups in an open-economy model of imperfect competitive markets.

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costs liberally, as in Rogers and Jenkins (1995), Engel and Rogers (1996), Engel and Rogers (2001), and Crucini et al. (2010). To the contrary, our structural estimation approach econometrically extracts the unobservable size of the transport costs from the reduced-form data associations in our data set.[4] The resulting structural estimate of the distance elasticity of transport costs evaluates an implicit price of the geographical barrier between the segmented markets. Our estimation of a "price of distance," indeed, is the first attempt to parse out structurally different potential contributors to the cross-regional price dispersions.

According to Anderson and van Wincoop (2004), trade costs in general consist of two categories: costs imposed by policies (e.g., tariffs, quotas, and the like) and costs imposed by the environment (e.g., transportation, insurance against various hazards, and time costs). Except for the extensive work by Hummels (1999), the direct measures of both categories are scarce and inaccurate. The empirical task of probing trade costs, therefore, largely relies on indirect econometric inferences from the measurements of equilibrium prices and quantities. Particularly in the field of international macroeconomics, the most common method of inferring trade costs exploits the hypothesis of the law of one price (LOP) because trade costs are recognized to be the main obstacles to the perfect arbitrage of goods across regions. To approach the hypothesis, previous studies scrutinize disaggregate consumer prices, which are surveyed internationally as well as domestically across retail stores. In addition to the well-known violations of the LOP, one of the most robust findings across the previous reduced-form regression exercises is the statistically significant effects of geographical distance on the absolute levels or the time-series variances of the cross-regional price differentials.[5] Because distance is used as a liberal proxy for the transport costs, the empirically significant distance effects in the price differentials are suggestive, but still indecisive, evidence for transport costs as a major contributor to the LOP violations. There are at least three concerns.

The first concern relates to the measurement of transport costs. As argued by Engel and Rogers (1996) and Engel et al. (2005), the dependence of consumer price differentials on the distance observed in the reduced-form regressions is a mixture of several mutually exclusive effects: it reflects not only the transport costs but also other factors such as the geographical differences in the local distributional costs and the heterogeneous markups due to a home bias in preferences. The second concern regards the economic significance of the transport costs in the price differentials. Many of the past studies estimate that the elasticity of the price differential with respect to distance is less than 3%.[6] This small estimate for the distance elasticity of the price differential requires an unrealistically large degree of geographical scattering of sampling points (i.e., retail stores in cities) to explain the observed degree of price dispersions alone.[7] This observation naturally casts doubt on defining the transport costs as a main economic source for the cross-regional price dispersions: distance is empirically "dead" as a prime suspect for the commonly observed violations of the LOP.

Lastly, this economically subtle distance effect on the price differentials appears to be sharply inconsistent with the indirect econometric inferences from equilibrium trade volumes. Past empirical studies in international trade unambiguously recognize that distance plays an economically crucial role in determining bilateral trade volumes. Anderson and van Wincoop (2003) estimate a gravity model of bilateral trade volumes and infer that the distance elasticity of transport costs is approximately 20% conditional on a conventional calibration of the elasticity of substitution. Helpman et al. (2008) find that the distance elasticity of bilateral export volumes is approximately 80%, taking account of firms' selections into bilateral export markets with firm heterogeneity in productivity.[8] Importantly, their estimate suggests a 20% distance elasticity of transport costs under the same calibration of the elasticity of substitution as that used in Anderson and van Wincoop (2003). Why is our inference of the distance elasticity of transport costs widely diverse, at between approximately 3% and 20% when using data of equilibrium prices and quantities, respectively? This question is a serious challenge for the students of international economics who admit the importance of trade costs.

We incorporate the above concerns into our inferences on the effects of transport costs on price dispersions. In so doing, we investigate a unique daily data set of wholesale prices of agricultural products in Japan.[9] Following the spirit of Parsley and Wei (1996), we use disaggregate price data within a country to avoid any potential effects of cross-country differences in tax, tariff, quota, and currency on our inference on transport costs. Scrutinizing the information of wholesale prices helps us overcome the first concern: we make our estimate of transport costs immune to the influences of local distributional costs as well as to the local retailers' pricing strategies.[10]

More importantly, there are two outstanding characteristics of our data set. First, we can identify the wholesale prices of an identical product at both the producing and the consuming regions. The first characteristic is essential for identifying the transport costs because, as discussed by Anderson and van Wincoop (2004), only when the source region of a product is identified, can the correct information for the transport costs be extracted from the relative prices at the consuming regions to the corresponding source region. The main difficulty that past studies face is the fact that a retail price survey at retail stores rarely provides information on the source regions of a product and the market prices prevailed in these regions. Our data set, on the other hand, shows us not only in which regions in Japan a variety of fruits and vegetables are produced but also at what wholesale prices these products are sold in their originated regions.[11]

[4] Our structural estimate is a cousin of those identified in recent works by Crozet and Koenig (2010) and Balistreri et al. (2011) who use structural gravity models of international trade. Our approach, however, is quite different from theirs.

[5] A not-exhaustive list of studies that conduct gravity-type regressions contains Engel and Rogers (1996), Parsley and Wei (1996), Broda and Weinstein (2008), Engel et al. (2005), Ceglowski (2003), Crucini et al. (2010), and Baba (2007).

[6] Among a series of past studies, for example, Broda and Weinstein (2008) observe the 1.2% distance elasticity of the absolute log price differentials within the barcode-level scanner data of retail prices across Canadian and U.S. cities. Engel et al. (2005) find the distance elasticity of 0.32% with pooled annual panel data distributed by the Economic Intelligence Unit (EIU) that covers retail prices of 100 consumer goods surveyed in 17 Canadian and U.S. cities. Ceglowski (2003) reports 1.6–2.0% estimates for the distance elasticities of 45 different products across 25 Canadian cities. Baba (2007) scrutinizes Japanese and Korean retail price survey data and estimates less than approximately 3% of the distance elasticity after taking into account a border dummy between the two countries.

[7] Because the standard deviation of the absolute value of the log price differential is typically reported at approximately 20% in this literature, we need a standard deviation of the log of distance of 6.66 to explain the observed degree of regional price dispersions only by geographical distance. The required standard deviation of the log of distance, however, is too large to be consistent with the actual degree for the geographical scattering of cities. For instance, the standard deviation of the log of distance between two prefectural capital cities in Japan is 0.803 over all of the 1081 city-pairs from 47 prefectures.

[8] Indeed, this size for the distance effects on export volumes is common in the literature of empirical trade. For example, in their meta analysis based on 1051 past estimates of distance effects, Disdier and Head (2008) report the average of 0.893.

[9] This is not the first paper that intensively scrutinizes price data of agricultural products in the literature of the LOP and PPP. Midrigan (2007) employs the prices of agricultural products sold in open-air markets in European countries to test the theoretical implications of his state-dependent pricing model with trade costs.

[10] As pointed out by the editor Charles Engel, our inferences from the wholesale prices are still not immune to the influence of the cross-regional heterogeneity of markups. We empirically control for these effects by regional fixed effects in our estimation exercise.

[11] In a recent paper, Inanc and Zachariadis (2012) identify the source regions of products reported in the Eurostat survey in several indirect ways and find approximately 10% distance elasticity of price differentials in the 1990 survey. This finding could be indirect evidence that the identification of the origin of a product is essential for the inference of transportation costs. A more direct identification of source regions is taken by Donaldson (2010) who scrutinizes the cross-regional data for prices of salt in North India during the British colonial period. In his paper, the source regions of salt are identified because salt was produced only in several licensed districts in India. He observes approximately 24% distance elasticity of the price differentials of salts.

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