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International Price Dispersion and Market Segmentation in Japan and the United States: Theory and Empirics

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Abstract

This paper focuses on the pricing behavior of Japanese and United States firms selling their identical products in New York City, Chicago, Osaka, and Tokyo. The authors utilize some simple models of international price dispersion and market segmentation that generate predictions about testable prices. The dataset, which consists of prices of identical products in the Japanese and American cities, was collected and accepted by both governments. Using this data, versions of international price dispersion theories are tested and some empirical evidence to support the view that simple international price dispersion models can partly explain the observed prices is found.

JEL Classification: F12, F14, L11, L13

Contents

1. INTRODUCTION

There have been many theoretical models yielding observations of differing prices for identical products. In this paper we focus on two related strands of literature: international price dispersion and market segmentation.[1] Many of the international market segmentation papers incorporate theories that feature firms with market powers operating in different international markets (see e.g., Bagwell and Staiger 2009; Aminian, Fung, Garcia-Herrero, and Lin 2012; Helpman and Krugman 1985, 1989; Bernhofen 1999; Christos, Clerides, Ioannou, and Senft 2007; etc.). These papers tend to use international oligopolistic models to analyze international trade patterns and the effects of trade policies. Some of these papers exhibit features associated with international price differences. In contrast, in the literature of price dispersion, Belleflamme and Peitz (2010) provides us with a clear and recent discussion on the phenomenon of price dispersion, a notion related to whether the law of one price holds. In Engel and Rogers (2004), a dataset of prices of consumer goods across European cities from 1990 to 2003 is collected and the paper tests if the introduction of the euro increases the integration of European markets. The authors conclude that there is no evidence of price convergence. In Bayes et al. (2006), firm and pricing information are collected from online sites in seven countries (four in the eurozone and three outside). The paper concludes that the introduction of the euro raises eurozone prices by at least 3%, and that with a currency union, online pricing seems to act like a clearinghouse. In Goldberg and Verboven (2005), detailed automobile prices are collected in five European countries from 1970 to 2000, a period during which the policies associated with the European Single Market were intensifying. The paper examines versions of the law of one price and concludes that contrary to the existing literature, there is surprising evidence indicating the convergence of prices. Finally, in Maier (2009), prices of homogenous goods auctioned on eBay across euro countries and the United Kingdom are collected; the paper finds that in countries with the same currency, price variations are smaller.

The models we will use here do exhibit features of price dispersion and market segmentation. But our paper differs in focus from these two strands of literature. As previously mentioned, in the international market segmentation literature, the models are utilized mainly to study the trade pattern and the impact of trade policies in imperfectly competitive markets. For our focus, we adopt versions of a simple, stylized oligopolistic model of international market segmentation to see if they can explain the observed prices across markets for almost identical products. In the price dispersion literature, the main interest seems to be on examining the law of one price and the rate at which prices tend to converge. Another major concern of this literature is how policies such as the creation of a currency union (introduction of the euro) or a Single Market Program can affect the convergence of prices. In this paper, our focus is not the law of one price. We simply want to ask if the observed prices are consistent with the predictions of a popular, stylized model of international oligopoly that sells across different markets. One further potential contribution of our work is that our data are neither from different countries within the European Union (even though European markets clearly provide a natural experiment to study market integration and the law of one price), nor from different states within an integrated United States (US). Instead, our data consists of prices from four cities in two different major Pacific economies: Japan and the US. Furthermore, these surveyed price data are jointly collected and publicly accepted as valid by both governments.

One difficulty of empirically examining price variations across different countries such as Japan and the US is that the usual observations are often associated with highly

[1] We are indebted to a referee for pointing out the relationship of our paper to the price dispersion literature and for suggesting a better review of the price dispersion literature.

differentiated products. Even for products that have very similar characteristics, one is unsure if the data of prices collected are from expensive department stores (stores that inflate prices due to the brands of the department stores, location, etc.), from discount stores or other outlets. In other words, the researchers cannot be sure if the observed outcomes are due to international pricing behavior by oligopolistic firms or to products having different attributes (including different locational or geographic characteristics).

In this paper, the dataset we will use provides us with prices of products that are as close to being identical as possible, and sold in different cities and different markets in Japan and in the US. These surveyed prices are for goods of the same brands, and for the same volumes and sizes. Retail prices were also collected according to the types of stores at which they were sold (supermarkets, discount stores, specialty stores). These data are highly suitable to test price dispersion and international market segmentation models.[2]

In the next section, we will present a stylized model of international price dispersion and derive a testable hypothesis associated with the model. Econometric tests will then be conducted to see if the predictions of the models can be rejected. From the data, we observe price differences of identical products in different international markets. Initially, it appears that there are no particular reasons why these different prices in Japan and in the US should be compatible with some simple stylized price dispersion models. However, there does indeed seem to be some empirical support. In section 3, we will present our empirical results. In the last section, we conclude.

2. A SIMPLE STYLIZED MODEL OF INTERNATIONAL PRICE DISPERSION AND MARKET SEGMENTATION

We first assume there are two international firms, one in Japan and one in the US[3], each selling an identical product at home and abroad. They compete as *duopolistic* quantity-setting firms. They have identical constant marginal cost c_i. The retail price of good i in the domestic market is p_i, and the price of the same good in the foreign market is p^*_i. For prices generated by US producers, p_i is the price observed in the US market, while p^*_i is the price in Japan. Conversely, for prices generated by Japanese manufacturers, p_i is the price observed in Japan, while the foreign price p^*_i is the price in the US. To get good i from the domestic factory to the retail store in the domestic market, an ad valorem distribution cost of d_i must be incurred. To get good i from the factory of the domestic market to the foreign retail store, an ad valorem international transport cost of tr^*_i must first be paid.[4] When it

[2] However, we do not have data on individual firms. We simply know that US firms were selling their almost identical goods across markets and cities, and Japanese firms were selling their almost identical products across Japan and the US. We are grateful to a referee for suggesting the use of a matched-group econometric technique. In future work, we will attempt to collect firm-level data as well as price data, and adopt the more appropriate econometrics techniques.

[3] We will extend the assumption of having only two international firms to multiple firms in Section 3.

[4] As pointed out by a referee, we are making an assumption that transport costs are ad valorem instead of being specific. This has the implication that as the price of the product increases, the absolute amount of the transport cost rises. This can partly be explained by the observation that as the product becomes more expensive, producers may want to purchase more insurance, raising the effective transport cost (or cost, insurance and freight, c.i.f.). In addition, some more expensive items such as high quality computer chips may be better transported via air transport, which would also increase transportation costs.

arrives at the foreign shore, the good faces an ad valorem tariff rate of t^*_i. Then, before the good ends up on the shelf of the foreign retail store, a foreign ad valorem distribution cost of d^*_i is incurred. We can similarly trace how a good originating in the foreign country ends up on the shelves of the foreign retail store (a foreign distribution cost of d^*_i has to be paid) and in the domestic retail stores (international transport cost tr_i, tariff rate t_i and domestic distribution cost of d_i must be incurred). With these various costs in mind, we can define the profit functions of the two international firms, one Japanese and one American, as:

$$H_i = x_i p_i /(1 + d_i) – c_i(x_i + x^*_i) + x^*_i p^*_i /(1 + d^*_i)(1 + t^*_i)(1 + tr^*_i) \quad (1)$$

$$H^*_i = y_i p_i /(1 + tr_i)(1 + t_i)(1 + d_i) + y^*_i p^*_i /(1 + d^*_i) – c_i(y_i + y^*_i) \quad (2)$$

where x_i is the output of the domestic firm for the domestic market, x^*_i is the output of the domestic firm for the foreign market, y_i is the output of the foreign firm in the domestic market, and y^*_i is the output of the foreign firm in the foreign market. Market segmentation and price dispersion imply that each firm chooses its output in each market separately. From the profit maximization first order conditions, the retail price of product i in the domestic market is:

$$p_i = [e_i /(2e_i – 1)]c_i(1 + d_i)[(1 + tr_i)(1 + t_i) + 1] \quad (3)$$

where e_i is the domestic elasticity of demand and c_i is the marginal cost of production. Note that to determine the domestic retail price of a product manufactured domestically, the domestic tariff rates imposed by the domestic country t_i and the international transport costs to the domestic country tr_i enter in the expression for p_i. This reflects the *interdependence* between the Japanese and US firms, with x_i and y_i (which has to incur t_i and tr_i in order to sell in the domestic market) competing in the domestic market. Similarly, the firms maximize profits in the foreign market, generating an expression for p^*_i:

$$p^*_i = [e^*_i/(2e^*_i – 1)]c_i(1 + d^*_i)[1 + (1 + t^*_i)(1 + tr^*_i)] \quad (4)$$

with e^*_i being the foreign demand elasticity. Using the retail prices of the same good sold in Japan and the US, we have:

$$p^*_i /p_i = \{[e^*_i /(2e^*_i – 1)](1 + d^*_i)[1 + (1 + t^*_i)(1 + tr^*_i)]\}/ \{[e_i /(2e_i – 1)](1 + d_i)[1 + (1 + t_i)(1 + tr_i)]\} \quad (5)$$

Note that the retail price ratio depends on both countries' distribution costs, both countries' elasticities of demand, tariff rates imposed by both countries, and international transport costs to and from the domestic or foreign country. Recall that the domestic price is the domestic retail price of the product manufactured in the domestic country, and the foreign price is the retail price of the domestically manufactured good. Intuitively, the price ratio should include domestic distribution costs, tariffs imposed by the foreign country and international transport costs from the domestic country to the foreign country. However, the fact that the price ratio is also determined by the tariffs imposed by the domestic country and the international transport costs to the domestic country is a *special* feature of this stylized international oligopolistic price dispersion and market segmentation model. Taking logs on both sides, the regression equation is given by:

$$\ln (p^*_i /p_i) = a + b_1 \ln [(1 + d^*_i)/(1 + d_i)] + b_2 \ln \{[1 + (1 + t^*_i)(1 + tr^*_i)]/[1 + (1 + t_i)(1 + tr_i)]\} + b_3 \ln \{[(2 – 1/e_i)/(2 – 1/e^*_i)]\} + u_i \quad (6)$$

where u_i is the disturbance term. To test the international price dispersion and market segmentation model, we subsume the positive markup ratio (the term involving the price elasticities) in the intercept. Then, to test for the international price dispersion model is to test:

$a>0$, $b_1 = 1$ and $b_2 = 1$
(7)

In addition, we can conduct a joint F-test for the model.[5] Alternatively, we can also divide the products into product groups, with category-specific intercepts D_1, D_2, D_3 and D_4 and allow the markup ratios of different product groups to differ, in which case, we are testing: $D_1>0$, $D_2>0$, $D_3>0$, $D_4>0$, $b_1=1$, $b_2=1$. The regression equation can be written as:

$$\ln (p^*_i / p_i) = D_i + b_1 \ln [(1 + d^*_i)/(1 + d_i)] +$$

$$b_2 \ln \{[1 + (1 + t^*_i)(1 + tr^*_i)]/[1 + (1 + t_i)(1 + tr_i)]\} + u_i \quad (8)$$

where the markups have been subsumed into D_i ($i = 1, 2, 3,4$), corresponding to the four different product groups.

We next turn to the data, which includes two price surveys jointly conducted by the staff of the International Trade Administration of the US Department of Commerce (DOC) and the staff of the former Ministry of Trade and Industry (MITI, now METI) of Japan. The surveys also received some help from other Japanese ministries such as the Ministry of Agriculture. The objective of the surveys is to observe how identical goods (or goods that are as close to identical as possible) are priced in Japan and in the US. The surveys cover a wide range of goods, including consumer goods, capital goods, and services. There are, however, only two years of data: The first survey was conducted in October 1989 and the second survey in April 1991. A set of prices were identified as generated by US manufacturers, while other prices were generated by Japanese producers. The results of the surveys were publicly accepted as valid by both governments. Although these data are not new, they have not yet been used to test models of price dispersion and market segmentation. Furthermore, our theories of international price dispersion are abstract, timeless models that should apply to useful data surveyed from a different decade.

For the 1989 survey, 121 products (both consumer and capital goods) and 18 services were examined; for the 1991 survey, the corresponding figures were 112 products and 14 services. In this paper, we ignore the observations about the services, as they tend to be non-tradables in the 1990s and may not be suitable for testing our international price dispersion models. The surveys were conducted in four cities: Tokyo, Osaka, Chicago, and New York City. The retail prices of identical goods (controlling for brand names, volume, and/or size) in a variety of outlets (including supermarkets, discount stores, and specialty stores) were surveyed. Each survey was conducted over a two-week period. Prices of the products observed in Japan were given in yen, while prices of products observed in the US were given in US dollars. The averages of the prevailing exchange rates during the survey periods were used to convert the prices from yen to US dollars. For both consumer and capital goods, the objective was to obtain actual prices to the end-users. For consumer and electronic goods, the prices observed in the stores were used. For autos, interviews were conducted to ascertain the actual selling prices. For capital goods, distributors and manufacturers' sales representatives were interviewed to determine the discounted prices. The surveys also indicate and differentiate prices generated by US manufacturers versus those generated by Japanese manufacturers. To implement the tests of the model, we also collected data on ad valorem distribution costs, ad valorem international transport costs, and ad valorem tariff rates. Different surveyed prices are also identified as belonging to different sectors or subsectors (e.g., as auto parts or perfume or tobacco). We identify similar subsectors using trade data, tariff lines, and input-output tables. These costs are then matched up with the different product prices. It should be noted that the distribution costs are taken from the US and Japan input-output tables, which are classified by fairly aggregate

[5] We are indebted to a referee for suggesting the additional joint F-test to test the model.

sectors and are not in sufficient details to match the product prices. Because of this, the distribution costs may be less accurate than other data used in this paper. The definitions and the sources of all the relevant data are listed in the appendix. The following tables provide some summary statistics.

Table 1 highlights summary statistics concerning retail prices in the domestic market relative to those in the foreign market. Recall that the domestic retail price p_i is the retail price of good is observed in the same country where it is manufactured, and the foreign retail price p^*_i is the retail price of good i observed in a country different from where it is manufactured. For example, the retail price of a made-in-Japan good in Japan is an observation p_i, while the retail price of the same good sold in the US is an observation p_{*i}. The (p_i /p^*_i) ratios vary by product groups and by whether Japan or the US is the domestic market. Table 2 and 3 provide summary statistics for the independent explanatory variables, including ad valorem domestic distribution costs, ad valorem international transport costs, and ad valorem tariff rates. Table 4 shows the results of our regressions in testing the international price dispersion and market segmentation model.

Table 1: Summary Statistics of the Dependent Variable: Ratios of Domestic Retail Prices to Foreign Retail Prices

Average Domestic Price/Foreign Price (p_i/p^*_i) by Product Groups	Ratio of Prices with Products Made in the US as Domestic Prices p_i (1989)	Ratio of Prices with Products Made in Japan as Domestic Prices p_i (1989)	Ratio of Prices with Products Made in the US as Domestic Prices p_i (1991)	Ratio of Prices with Products Made in Japan as Domestic Prices p_i (1991)
Auto Parts	0.6198	1.5715	0.4641	1.2947
Autos	0.6793	0.9977	0.7364	0.8595
Capital Goods	0.6930	1.0282	0.6409	0.9646
Electronic and Optical Goods	0.7284	0.9611	0.8961	0.9222
Food Products	0.6082	0.4480	0.5876	0.4050
Liquor	0.3574	0.5415	0.6826	1.4545
Other Consumption Goods	0.6305	0.5414	0.7804	0.9655

Source: Authors' calculations and estimations.

Table 2: Summary Statistics for Independent Variables for the Japanese Market

	Ad valorem Distribution Cost	Ad valorem Transport Cost	Ad valorem Tariff
Mean	0.2180	0.0569	0.0305
Standard Deviation	0.1066	0.0380	0.0584
Maximum	0.6790	0.2100	0.2672
Minimum	0.0496	0.0000	0.0002

Source: Authors' calculations and estimations.

Table 3: Summary Statistics for Independent Variables for the US Market

	Ad valorem Distribution Cost	Ad valorem Transport Cost	Ad valorem Tariff
Mean	0.00698	0.0904	0.0841
Standard Deviation	0.00711	0.1076	0.1117
Maximum	0.03496	0.6309	0.9600
Minimum	0.00003	0.0000	0.0078

Source: Authors' calculations and estimations.

Table 4: Testing the Basic International Price Dispersion and Market Segmentation Model

	All Products, Both Years	Japanese Products Only	US Products Only	All Products, 1989	All Products, 1991
a	0.209 (7.688)	-0.154 (-1.987)	0.330 (3.787)	0.213 (5.449)	0.207 (5.360)
Reject a>0?	No	Yes	No	No	No
b_1	0.669 (-3.101)	-1.065 (-5.696)	0.371 (-2.087)	0.770 (-1.388)	0.592 (-2.844)
Reject b_1=1?	Yes	Yes	Yes	No	Yes
b_2	1.593 (0.681)	1.202 (0.146)	2.329 (1.285)	1.332 (0.258)	1.676 (0.554)
Reject b_2=1	No	No	No	No	No
Joint F-Statistics	5.303	16.382	3.075	0.982	4.846
Reject F-Test?	Yes	Yes	No	No	Yes
Adjusted R Squared	0.188	0.074	0.050	0.201	0.156
Number of Observations	168	87	81	85	83

Note: The numbers in parentheses are t-statistics. For b_1 and b_2, the t-statistics are for the hypothesis b_1 =1 and b_2 = 1

Source: Authors' calculations and estimations.

Table 4 shows that at least for some cases, our empirical tests cannot reject the predictions of our stylized international price dispersion and market segmentation model. For the intercept term, almost all the hypothesis testing (except for the one using data with Japanese products only) conforms to the model. Tests involving the coefficient on the distribution margins (b_1) are less successful. All, except the one involving data from 1989 only, reject the price dispersion model. However, for the coefficient involving tariffs and transport costs (b_2), the price dispersion model does very well. None of the tests can reject the prediction of the model. As discussed earlier, the term b_2 is a special feature of the stylized oligopoly model and it is noteworthy that b_2 =1 is statistically significant in all tests. The results of the joint F-test are mixed, with two out of five tests not able to reject the model. The adjusted R squared is also low. Yet overall there is some evidence supportive of the international price dispersion model. The model is strongest for two cases: data with US products only (column 4) and data for 1989 only (column 5). In the former case, all but one of the predictions are consistent with the tests, while in the latter, none of our tests can reject any prediction of the basic international price dispersion and market segmentation model. We interpret results from the above table to mean that there is at least mild evidence in support of the international price dispersion and market segmentation model.

In tests so far, we have imposed the restriction that all products have the same constant intercept. We next want to relax this assumption. To do so, we divide the products into four groups: consumer and household electronics (group 1); automotive and machinery (group 2); consumer goods and miscellaneous (group 3); and food, liquor, and tobacco (group 4). The next table shows the results of our tests.

By examining Table 5, we see that very few tests can reject the predictions that the intercept terms of different product groups are positive (D_1>0, D_2>0, D_3>0, D_4>0). For the coefficient on the term with the distribution margins (b_1), however, the prediction of the basic international price dispersion model is uniformly rejected. On the other hand, the prediction that b_2 =1 is almost uniformly consistent. Again, the fact that the term involving b_2 =1 cannot

be rejected provides an important piece of evidence in favor of the model. In general, there is at least some evidence in favor of the basic model with different product group intercepts. This is true for the D's and for b_2. Indeed, for the case of "US products only," all the predictions except one cannot be rejected by the empirical tests. Furthermore, the F-test cannot reject the joint test of the model. We interpret the tests for the case with different product groups to indicate that while the results are certainly mixed, there is nonetheless some evidence in favor of the basic model.

Table 5: Testing the Basic International Price Dispersion and Market Segmentation Model with Different Product Groups

	All Products, Both Years	Japanese Products Only	US Products Only	All Products 1989	All Products 1991
D_1	0.151 (3.251)	-0.060 (-0.745)	0.275 (0.139)	0.124 (1.843)	0.176 (2.689)
Reject $D_1>0$	No	Yes	No	No	No
D_2	0.130 (2.849)	-0.186 (-1.969)	0.299 (2.813)	0.104 (1.405)	0.152 (2.273)
Reject $D_2>0$	No	Yes	No	Yes	No
D_3	0.338 (4.738)	0.247 (1.088)	0.368 (2.673)	0.340 (3.368)	0.340 (3.273)
Reject $D_3>0$?	No	Yes	No	No	No
D_4	0.350 (5.456)	-0.209 (-1.368)	0.450 (3.423)	0.415 (4.719)	0.273 (2.718)
Reject $D_4>0$?	No	Yes	No	No	No
b_1	0.488 (-4.159)	-0.870 (-4.662)	0.243 (-2.159)	0.480 (-2.620)	0.452 (-3.139)
Reject $b_1=1$?	Yes	Yes	Yes	Yes	Yes
b_2	1.427 (0.482)	-0.253 (-2.781)	1.207 (0.139)	1.659 (0.516)	1.469 (0.347)
Reject $b_2=1$?	No	Yes	No	No	No
Joint F-statistics	8.976	14.464	2.388	3.443	5.434
Reject F-Test?	Yes	Yes	No	Yes	Yes
Adjusted R Squared	0.224	0.122	0.033	0.254	0.153
Number of Observations	168	87	81	85	83

Note: The numbers in parentheses are t-statistics. For b_1 and b_2, the t-statistics are for the null hypothesis of $b_1=1$, $b_2=1$, respectively.

Source: Authors' calculations and estimations.

3. AN EXPANDED MODEL OF INTERNATIONAL PRICE DISPERSION AND MARKET SEGMENTATION

In Section 2, we use a simple, stylized model of international price dispersion and test its predictions. The basic model assumes that we have two international quantity-setting firms, one Japanese and one American. In this section, we adopt a more expanded model and examine the case with n identical firms in one country and n* identical firms in the other country. All firms produce an identical product using the same constant marginal costs, [6] and

each firm sells both at home and abroad. Domestic firm i produces x_i for the domestic market and x^*_i for the foreign market, while foreign firm i produces y_i for the domestic market and y^*_i for the foreign market. Following the same derivations as before, the ratio of the retail prices of identical products at home and abroad is given by:

$$p^*_i / p_i = \{[e^*_i/((n + n^*)e^*_i - 1)](1 + d^*_i)[n^* + n(1 + t^*_i)(1 + tr^*_i)]\}/$$

$$\{[e_i/((n + n^*)e_i - 1)](1 + d_i)[n + n^*(1 + t_i)(1 + tr_i)]\} \quad (9)$$

Note again that the domestic tariff rates and the international transport costs to the domestic market are included in the expression for p_i. But compared to the similar expression for the basic international price dispersion and market segmentation model, the term involving t_i and tr_i also involves n and n*. Incorporating the number of firms and testing the coefficient on this term is potentially a way to distinguish between the basic and the expanded version of the model. Thus the regression to be run is:

$$\ln (p^*_i / p_i) = a + b_1 \ln [(1 + d^*_i)/(1 + d_i)] +$$

$$b_2 \ln \{[n^* + n(1 + t^*_i)(1 + tr^*_i)]/[n + n^*(1 + t_i)(1 + tr_i)]\} + u_i \quad (10)$$

where we again subsume our positive markups into the intercept term. To test the expanded version of international market segmentation, we test the hypothesis that $a>0$, $b_1=1$ and $b_2=1$. The table below shows the results.

Our testing of the expanded version of the international market segmentation model exhibits results that are consistent with those from testing the basic model. The prediction for $a>0$ is almost always supported (row 1). Results for testing $b_1=1$ and $b_2=1$ are more mixed. Since the coefficient associated with the term containing tariff rates and transport costs (b_2) is what distinguishes the basic model from the expanded one, we can loosely interpret the results from Table 4 and Table 6 to mean that the basic model performs better. In the basic price dispersion model, we cannot reject $b_2=1$ in all cases, whereas in the expanded model, b_2 conforms to the prediction in two out of five cases. Nonetheless, in two cases, "US products only" and "All products, 1989" (columns 4 and 5, respectively), we cannot reject the F-test or the two separate tests $b_1=1$ and $b_2=1$. In fact, even though the R^2 tends to be low, for these cases, none of the predictions of the expanded international market segmentation can be rejected.

In both the basic and expanded versions of the model, tests using the subsample "US products only" yield a greater degree of support of the international price dispersion model than tests using "Japanese products only." This may be due to the different *perceptions* of market segmentation by Japanese and US producers in the 1990s. Perceptions of market segmentation form an integral part of the international price dispersion models (Helpman 1984, Fung 1991a). For instance, it is often perceived that Japanese firms have stable, exclusive and long-term relationships with their distributors (Fung 1991b, Fung 2002), and in the past, US producers often had the impression that they could not easily find suitable Japanese distributors to carry their products in Japan. If US firms felt that the Japanese market was difficult to penetrate for institutional or structural reasons, they might regard the Japanese market and the US market as segmented. If Japanese firms felt that they had access to both group-affiliated distributors in Japan and the arms-length, competitive distributors in the US, they would be less likely to consider the two markets segmented. Thus, the different perceptions about market segmentations may explain why the international price dispersion model works better if we use the subsample "US products only."

Next, we turn to testing the expanded model by allowing for different product groups.

Tables 6 and 7 show that in a majority of cases, we cannot reject $D_1>0$, $D_2>0$, $D_3>0$, or $D_4>0$. For tests involving "All products, both years," "US Products Only," and "All Products, 1991," all the product groups have positive intercepts. With "All Products, 1989," we can only

reject the hypothesis that $D_i > 0$ for product group 2 (D_2). Results involving b_1 and b_2 are more mixed. For the case of "US products only," all the predictions of the model conform to the tests. For the case of "All products, 1989," we cannot reject the hypothesis $b_2 = 1$. Support for the expanded version of the international price dispersion model seems weaker, but again, when we use data for US product prices only, none of the predictions of the model can be rejected.

Table 6: Testing the Expanded International Price Dispersion and Market Segmentation Model

	All Products, Both Years	Japanese Products Only	US Products Only	All Products, 1989	All Products, 1991
a	0.208 (7.371)	-0.132 (-1.716)	0.313 (3.174)	0.204 (5.024)	0.214 (5.362)
Reject a>0?	No	Yes	No	No	No
b_1	0.638 (-3.064)	-1.025 (-5.599)	0.457 (-1.638)	0.783 (-1.188)	0.522 (-3.072)
Reject b_1=1?	Yes	Yes	No	No	Yes
b_2	0.110 (-3.228)	-0.130 (-2.463)	0.391 (-1.787)	0.252 (-1.696)	-0.018 (-2.600)
Reject b_2 =1?	Yes	Yes	No	No	Yes
Joint F-statistics	7.587	19.134	2.730	1.983	6.292
Reject F-Test?	Yes	Yes	No	No	Yes
Adjusted R Squared	0.156	0.087	0.014	0.176	0.120
Number of Observations	157	87	70	80	77

Note: numbers in parenthesis are t-statistics. Those for b_1 and b_2 are t-statistics for b_1=1 and b_2=1.

Source: Authors' calculations and estimations.

Table 7: Testing the Expanded International Price Dispersion and Market Segmentation Model with Different Product Groups

	All Products, Both Years	Japanese Products Only	US Products Only	All Products, 1989	All Products, 1991
D_1	0.151 (3.420)	-0.060 (-0.745)	0.274 (1.972)	0.134 (1.986)	0.191 (2.818)
Reject $d_1>0$?	No	Yes	No	No	No
D_2	0.108 (2.078)	-0.186 (-1.969)	0.243 (2.157)	0.079 (1.018)	0.136 (1.572)
Reject $d_2>0$?	No	Yes	No	Yes	No
D_3	0.333 (4.561)	0.247 (1.088)	0.352 (2.400)	0.325 (3.196)	0.344 (3.163)
Reject $d_3>0$?	No	Yes	No	No	No
D_4	0.377 (5.238)	-0.209 (-1.388)	0.528 (3.936)	0.437 (4.406)	0.301 (2.783)
Reject $d_4>0$?	No	Yes	No	No	No
b_1	0.450 (-3.999)	-0.870 (-4.662)	0.287 (-1.894)	0.529 (-2.245)	0.383 (-3.291)
Reject $b_1=1$?	Yes	Yes	No	Yes	Yes
b_2	0.132 (-3.220)	-0.253 (-2.781)	0.354 (-1.927)	0.269 (-1.925)	-0.017 (-2.573)
Reject $b_2=1$?	Yes	Yes	No	No	Yes
Joint F-statistics	10.635	14.484	3.294	3.488	7.136
Reject F-Test?	Yes	Yes	Yes	Yes	Yes
Adjusted R Squared	0.200	0.120	0.052	0.237	0.121
Number of Observations	157	87	70	80	77

Note: numbers in parenthesis are t-statistics. Those for b_1 and b_2 are t-statistics for $b_1=1$ and $b_2=1$.

Source: Authors' calculations and estimations.

4. CONCLUSION

In this paper we examine different stylized versions of international price dispersion and market segmentation models, and we derive specific testable predictions of these models. To test the models, we utilize a dataset collected and publicly accepted by both the Japanese and US governments. The dataset consists of surveyed prices of individual, identical products in both Japanese and US cities. The retail prices of the goods were obtained by controlling for brand names, volumes, and sizes, as well as the types of stores in which they were sold. Thus we have observations of retail prices of products across markets that can be viewed as identical. For both goods manufactured by US producers and goods manufactured by Japanese producers, we are using prices of products that are as close to being identical as possible to test the predictions of models of international oligopolistic market segmentation and price dispersion.

Our tests found evidence for both the basic international price dispersion model as well as the expanded model. The theories seem to have very strong support when we focus on the use of prices of US products. There also seems to be stronger support for the basic model

as compared with the expanded model. Thus a more stylized, simple and parsimonious model of international oligopolistic price dispersion may also is of greater empirical relevance. We believe that our study is important as it is done by using consistent micro data surveyed by both the Japanese and the US governments.

There are several broad policy implications from our analysis. While Japan is indeed a technologically advanced high-income country, the last two decades demonstrate clearly that Japan will need more revitalizations and more liberalizations, particularly in its distribution and service sectors. As such, the international price dispersion highlighted in this paper is just a symptom of the much larger underlying problem facing Japan. How can Japan become even more competitive and generate more growth? Opening up to more international competition (particularly in services) and embracing globalization, including inviting more foreign direct investment and sending more students abroad to study, will seem a logical way for Japan to plot a path to reclaim some of the lost advantages that Japan used to have in the 1980s and in the early 1990s. International price differences seem to be a symptom associated with a traditional, stagnating Japan. Instead we believe that the world and in particular Asia need a stronger, more vibrant, more open and more competitive Japanese economy. Linking the economy of Japan with that of the US and other Pacific countries more closely will generate higher productivities. Joining in free trade arrangements like the Trans-Pacific Partnership (TPP) can thus be a useful way to improve the competitiveness and growth of Japan, the US, and other Asian economies.

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APPENDIX

p_i/p^*_i	Ratio of retail price of product i in the domestic market to the retail price of the same product in the foreign market Source: Japanese and US Governments, "Joint Price Surveys"
d_i (d^*_i)	ad valorem distribution costs (the sum of retail and wholesale costs divided by the producer's price) in the domestic (foreign) market Source: US Bureau of Economic Analysis, "Input-Output Tables," Department of Commerce; Japan Administrative Management Agency, "Input-Output Tables"
tr_i (tr^*_i)	ad valorem international transport costs from the domestic (foreign) market to the foreign (domestic) market Source: US international transport costs come from data supplied by the Trade Policy Division, World Bank, constructed from import data of the US Bureau of the Census; Japanese international transport costs come from data supplied by Japan Economic Planning Agency
n (n*)	number of domestic (foreign) firms Source: US Department of Commerce, Census of Manufactures; Japan Census of Manufactures
t_i (t^*_i)	ad valorem domestic (foreign) tariff rates for product i Source: GATT tariff data