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Abstract

This paper estimates the extent of Pricing to Market (PTM) for Japanese automobiles exported to the US market over the 1987-2000 period. The price data used is the annual, model-specific, manufacturer's suggested retail price (MSRP) of identical cars (17 models in total), all made in Japan, but sold in both the US and Japan. These prices ratios (of foreign over domestic) are regressed on the real exchange rate, real wages and US and Japanese real GNI as in the seminal work of Marston (1989) which originally used industry level price data. As with Marston, I find a high degree of PTM behavior, indeed over 100% PTM, somewhat higher than Marston (1990). Moreover, it appears that this PTM behavior has fallen somewhat over time. This implies *increasing* exchange rate pass-through, contrary to Taylor's (2000) conjecture.

Keywords: Exchange-Rate Pass-through, Pricing-to-Market, Japanese autos, Retail data
JEL Categories: F31, F12, F32, F14

I Introduction

Thirty percent of all merchandise exports in 2008 from Japan to the US was "passenger cars" (UN Comtrade).[1] Thus, understanding the effect of exchange movements on US import prices in this dominant sector is important in explaining the effect of yen/dollar movements on the US-Japan trade balance. The measurement issue has been approached from both micro and macro levels in numerous papers (see Campa and Goldberg, 2002, *inter alia*). However, even in these micro-level studies, aggregation may mask the true pricing behavior in response to exchange rate changes for specific commodities. In this paper, I examine very detailed price data (firm and model-specific retail-level data) for exact matches of 17 models sold both in the US and Japanese markets. I conduct a Marston-style (1989, 1990) econometric analysis to definitely determine exchange pass-through in this industry from 1987-2000 and give concrete answers to questions typically only addressed at high levels of aggregation.

As a byproduct of the renewed interest in exchange-rate pass-through (ERPT) in recent years, many have observed a considerable decline in ERPT rates.[2] Often, earlier estimates on a fairly detailed industry level (see Knetter, 1993) found pass-through rates for major exporters of manufacturers like Japan, Germany to be around 50% for many goods. More recently, many authors have found declining pass-through, on a macro level (Taylor, 2000) and also at a more disaggregated industrial level. Marazzi and Sheets (2007), for example, find that ERPT rates in US imports prices fell from an average of

[1] For Japanese exports to the world, this figure is typically a little more than 10%.
[2] See Goldberg and Knetter (1997) for a review of the literature up until then, and Campa and Goldberg (2002) for one of the many papers which rekindled interest in the area and Taylor (2000) for an oft-cited paper on declining pass-through.

50% in the 1970s and 1980s to 20% or so in the late 1990s and early 2000s. However, at far a greater level of detail (9-digit-level trade data), Parsons and Sato (2008) found that ERPT rates for Japanese exports to the US have no clear trend, up or down, over time. Interestingly, they do find that the ERPT rates for Japanese autos to the US fell, which corroborates Marazzi and Sheets results for auto imports in the US.

In their summary of the previous 20 years of exchange-rate pass-through (ERPT) and pricing-to-market (PTM) literature, Goldberg and Knetter (1997) use the example of the 1994 Toyota Celica. While the yen appreciated approximately 34% in the course of the year, the retail price of the Celica only rose about 2% during that same time. This paper essentially conducts this exercise (albeit econometrically, and more rigorously) for 17 models and varieties ("trims" and "generations" of models) over the course of 14 years. But also, more importantly, I simultaneously look at the behavior of *Japanese prices* of the *identical* product.

Many pass-through and PTM papers, unfortunately, use only one set of (aggregate) price data. That is to say, when examining pass-through into US imports, they will use destination prices only. For example, a study may use US import prices, or the exporting country's export prices to the US to look at ERPT in the US. Very rarely do they use both. The seminal paper by Marston (1990) used both domestic and foreign price indices at a product level (e.g. "passenger cars", "light trucks", etc.). Using model-specific prices as done in the present paper allows for a far more accurate estimation of PTM and/or ERPT. Most of the PTM and pass-through models (Dornbusch, 1987; Krugman, 1987 *inter alia*) are based on firm-level models (either monopolistic,

oligopolistic, or monopolistically competitive), selling it two or more markets, so it makes sense to use data from more than one market, if possible.

The challenge, however, is finding prices for identical products in more than two markets. This is, of course, the same challenge which faces research into the Law of One Price. The strength of this study is that we do have virtually identical products produced in the same factory, yet shipped to two different markets. Again, this paper is not unique in the regard, but it is still rare. (See Pinelopi Goldberg and Frank Verboven's 2001 paper, for perhaps the only other example for autos.)

A valid question might be: why is it necessary to re-do the study of Marston (1990)? The merits of the current paper are three-fold. The first two merits are related. This paper improves upon the Marston paper, by using matched product data, whereas Marston only used aggregrate indices. At the same, other more detailed studies pass-through or PTM papers at the time only used a single country's (import or export prices only) data, thus could not benefit from the more complete Marston model of international price discrimination and his method of estimating PTM. As such, we can obtain truer estimates of Japanese pricing behavior in the 1980s which will help confirm or reject these often-cited estimates in seminal works. Third, as autos are almost a third of all Japanese merchandise exports to the US, understanding what the true exchange rate response is has important implications for 'global imbalances' and efforts to reduce them. As we will see, there still appears to be a great deal of PTM (implying little or no pass-through), so a dollar depreciation may do little to stem the (increasing) tide of Japanese imports, at least in autos.

II. Is pass-through really declining?

While many have argued (Marazzi and Sheets, 2007, *inter alia*) that ERPT has declined, most of those studies have used import data (typically trade data), i.e. not the final prices consumers pay. José Campa and Linda Goldberg (2006), however, argue that while import price ERPT may have indeed fallen, ERPT to consumer prices has risen, according to their results of price series at very aggregate levels (i.e. they look at price series for manufactured goods, energy, food, etc.). As we will see shortly, the finding here (the apparent *increase* in pass-through in cars) is consistent with Campa and Goldberg (2006), but in contrast to Taylor (2000), Marazzi and Sheets (2007) and others. Whether this is due to the use of very detailed retail price data, or a phenomenon specific to cars only is something which warrants more study.

III. Data description

Retail Price Data

The discussion and subsequent econometric analysis is done using retail price data obtained from various issues of Ward's Automotive Yearbook for the US prices and the *Jidousha Gaidobukku* (Japanese Motor Vehicles Guide Book) for the Japanese prices. The main prices used are the Manufacturer's Suggested Retail Prices (MSRP) for each make, model and "trim" for any given year. Initially, I gathered the earliest data in 1980 and the latest from 2006. However, as the US-Japan VER was in effect from 1981-1986 or so, I have chosen to start after that date, i.e. from 1987 onwards. Furthermore, due to the difficulty of matching identical models year to year, my initial data was further

truncated to 2000 in this study. This price data is only available once per year. Prices of models were considered for all of the major Japanese automobile producers, namely, Honda, Toyota, Mazda, etc. as well as their spin-off companies (Acura: Honda; Lexus: Toyota). Ultimately, only Honda models are examined in this paper. The reasons for the narrow scope are the following. Nissan was not included as I could find only a few Nissan models that did not change often over the time frame.[3] Mazda had a joint venture with Ford for much of the period, and thus may have had an unusual, and perhaps collusive pricing strategy to the US market. Honda and Toyota are both good candidate firms, having never merged and having a good number of particular models, relatively unchanged over time. Ultimately, due to the very tedious and labor-intensive nature of the matching process, however, the final data set only includes Honda/Acura models.

The data is very detailed in the sense that each price corresponds to a particular make (e.g. Honda), model (e.g. Accord) and trim (e.g. "2 door" as opposed to "4 door"). Indeed, the level of detail goes further than this, as I have delineated as distinct any model which had a substantial change in attributes or appearances over time. Thus, for example, the Honda Accord, one of the most popular cars, had various "generations", specifically: 1977-81, 1982-1985, 1986-1989, 1990-1993, 1994-1997, 1998-2002, 2003-2007. Thus, I consider an "Accord DX 4-dr sedan, fwd" in 1989 to be a different car (an entirely separate cross-section observation) than one with the same name in 1990.

In this way great detail is gained, and thus overcomes the major deficiency in any aggregate data set. Import and export data, which is typically used in ERPT and PTM studies such as Marston, use very highly disaggregated data. More recently, Parsons and

[3] This is in part due to Datsun/Nissan's own behavior in the 1980s as far as branding and re-inventing their popular models and also in part to the alliance with Renault in 1999.

Sato (2008), for example, use even more detailed 9-digit data for Japanese exports. Despite such detailed data, such categories are: 1) still heavily aggregated and 2) though the category name may not change, the actual product sold may have experienced substantial quality or other attribute changes. Even the very detailed 10 digit USITC data[4] , which distinguishes by country, includes data from all Japanese producers, and contains dozens or more models (e.g. Camry, Celica, Mazda GLC, etc.) and all the sub-categories or "trim" (2-dr or 4-dr, etc). Moreover, if any or all of these cars change over time (for example a bigger engine, or FWD rather than RWD, etc.) this would all be masked in the aggregation.

This large increase in detail does not come without costs, however. As models change frequently (on average, every few years), and there are often changes within a "generation" which may be significant enough to consider it a "break" in the data, the panel of data constructed here will be unbalanced, and with very short time series. The shortest change in price is over two years (i.e. the change from last year and this year), and longest continuous price series for a virtually unchanged "make/model/trim" is five years. All models chosen are made in Japan exclusively (and then either sold in Japan or shipped to the US).[5] This initial sample included over 400 data points across the three makers for the US price data, but ultimately, as mentioned above, only 35 models of Honda/Acura were perfectly matched with Japanese price data.

The use of retail price data, in pass-through studies, has become somewhat less rare. Bourdet (1996) used suggested retail prices for cars in a study of Swedish automobile pass-through. A handful of other studies have looked at detailed retail pass-

[4] http://dataweb.usitc.gov/scripts/query.asp.
[5] Honda and Toyota had started building some models in the US since the 1980s. Those models are not included in this sample.

through in the US, Hellerstein (2008) being one recent example. Goldberg and Verboven (2001) examine the Law of One Price (intimately related to ERPT, of course) using similar data in their study of the European retail car market just prior to currency unification. Feenstra and Levinsohn (1995) and Berry, Levinsohn and Pakes ("BLP") (1995) in seminal studies of hedonic demand regressions for the US automobile market also use retail automobile data, though they do not investigate pass-through issues.

Indeed, as the last paper (BLP) uses very similar data (MSRP data from "Automotive News Market Data Book", another trade magazine) to this paper, it shares the same shortcomings. While far more detailed than unit values or import price indices from trade data, the main concern is, of course, that the data is "suggested" retail price, rather than the actual price paid. While trade data is highly aggregated, at least in comparison to the data used here, it at least reflects an average of the actual contracted import price. Thus, the results and discussion here rest on the assumption that MSRP movements are actual prices paid by consumer are highly correlated.

While actual price paid for the various automobiles was not available, the "invoice" price is, at least for recent years (typically from 1997 onwards). While "invoice" data from the last 10 years or so is insufficient for our purpose here, namely to track the decline in pass-through over the past 25 years or so, its examination may shed some light on the "ERPT to import prices versus consumption prices" debate (Campa and Goldberg, 2006). Invoice prices are the prices dealers pay the maker for the car. Thus, in a sense it is a wholesale price. Invoice prices, like MSRP, suffers from the problem of a lack of a true observed contract price. The invoice price is set by the maker, but the actual price paid by the dealer varies, with the maker often giving rebates, and other financing,

thereby altering the actual price paid by the dealer. Nonetheless, I was interested to see the relationship between the two.

In the appendix, I have included the results of a simple regression of US dealer invoice prices and MSRP for each model. The correlation is strong, and nearly unity.[6] That is to say, MSRP and invoice prices move in an almost one-to-one correspondence in percentage terms. Thus, to the extent that we can rely on these prices as a reliable proxy for the actual price paid, our pass-through results should generally apply to invoice prices as well.[7]

However, to conduct Marston-style analysis, domestic (Japanese) prices for the same car are also needed. And to maintain the integrity of the experiment, I had to select only vehicles which were identical and sold in both the Japanese and US markets. This reduced the sample dramatically. While there are many reasons why the Japanese and US models differed and were dropped, one example would be engine size. For essentially the identical make and model (save for the steering wheel, which is always on the opposite side), the US model will sometimes have a larger engine. This is no doubt in large part due to Japan's motor vehicle tax which is based on engine size: the larger the engine, the higher the tax, which is several hundred dollars. As the engine size is an important criteria for willingness-to-pay for a car, as evidenced by hedonic studies by Feenstra (1989) and Berry, Levinsohn and Pakes (1995), this was deemed to be a "different car" and thus excluded from the sample. As such, for Honda (including Acura), the only

[6] I did not conduct a similar regression for Japanese MSRP data as the invoice data was not readily available.

[7] The degree in which invoice prices represent import prices is yet another important question. In general, as Toyota in Japan may set the invoice price to be paid by dealers in the US, this does represent an import price. Thus, there may be a decline or disappearance of ERPT in not only retail prices, as I seem to find here, but also in import prices. Relatedly, Bourdet (1996) (conveniently?) argues that MSRP prices better reflect firms' pricing behavior rather than actual transactions data (typically unavailable), as the MSRP as set by the firm's themselves. I believe there is some strength to this argument.

"true" matches that could be made thus far over the 1987-2006 period were 17 models (or "specs") and 35 observations.

Sample selection bias

Obviously, going from dozens of Honda models to only 17 raises serious sample-selection issues. It may very well be the case that the cars that do not change over time very much ("long-sellers"), i.e. those cars included in the present sample may have very different pricing behavior than those where the model is constantly changing, improving, etc. To this very real concern, I offer two replies. First, it is not clear *a priori* which way the bias might be. Perhaps popular long-sellers in the US have a lower elasticity of demand, which would imply, *ceteris paribus* (under Marston assumptions of demand, etc.) lower PTM. Or perhaps, it is the converse: that is, cars that do change very much are at the low-end, targeting the very elastic consumer, who just wants a car at the cheapest price regardless of the newest options. Poring over the data, which contains a variety of automobiles, both high and low-end suggested no obvious *a priori* one way or the other. Second, with the small sample size, some type of Heckit-style sample-selection correction is simply not possible.

As the data set is small, no sophisticated econometrics is done here. A simple pooled OLS estimation corrected for heteroskedasticity is conducted. There are no doubt time components, but the longest model, unchanged, is only five years, most much shorter. Moreover, the entire estimation is done in percentage changes, thus nullifying any potential non-stationarity issues. A larger message in this study is that the number and variety and quality of cars produced by any one maker, let along the industry overall, changes quite a bit from year to year. Moreover, new varieties are being developed every

few years or so. To extract any long-run properties on an individual product would be very dubious. This may be possible when examining, say, Coca-Cola or crude oil, but automobiles and many other products simply are not static in their nature.

Right-hand side variables

Following Marston, the real exchange rate is used, which is simply the nominal yen/dollar rate adjusted by US and Japanese CPI. Exchange rate data is from IMF's International Financial Statistics, and the CPI data are from the US BLS and Japanese Bank of Japan websites.[8]

Real wages are constructed in similar fashion as Marston, but at a greater level of detail. Whereas he used a nominal yen-based manufacturing index of yearly remuneration for all industries, I used the far narrower index for "Manufacturing of Transportation Equipment", which is of course, the most appropriate for the auto sector.[9] This data is available online at www.stat.go.jp. This nominal wage index was deflated by the Japanese "WPI", now called the "Corporate Goods Price Index" available from the BOJ's website.[10]

[8] In Marston (1990) he used effective exchange rates as he examined exports to a variety of destination markets. Here, we only look at the US market and thus the bilateral rate is appropriate. As we only use yearly data year, no complicated attempts at modeling exchange expectations were made. Likewise, more long-term pass-through effects through the use of lagged exchange rates were also not done. This is largely due to the very short series for each of the models. Having said that, a yearly average may be a reasonable proxy for Japanese makers' expectation for the exchange rate to be that year as new cars (used to) typically come out in the fall in the US.

[9] This series is pre-tax and incorporates bonuses as well.

[10] An important concern, at least if one is concerned with long-run pass-through, is the fact that the wholesale price index *declined* approximately 40% in autos since the 1980s as productivity has made continual, significant increases during this time. Marston (1991) argues that this may have offset the rising yen, thus reducing pass-through of the higher yen. Athukorala and Menon (1994) examined Japanese exports and used labor costs and a time-trend to capture production costs and the productivity increase during the period of their study (1980-1992) and obtained reasonable results for both cost and exchange rate pass-through. As this paper looks at very short run changes only, this is probably not a concern. But it

For the "real income" variables for Japan and the US, I used nominal Gross National Incomes obtained from the IMF IFS database, and deflated them by their respective CPIs.

Marston included a fifth right-hand side variable, the price of imported materials deflated by the Japanese WPI. However, as imported components have historically been, and continue to be miniscule in the auto sector, I have not included this variable.[11]

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IV. Methodology

As mentioned above, due to the small sample, and short time series properties, the regression is a pooled OLS corrected for heteroskedasticity. As such, no information particular to a specific model is used. It is simply a regression of all the percent changes in relative prices on the percent changes in the various right-hand side variables. As the variables are already in percentage changes, there is no need for a logarithmic transformation. As such, the estimated equation is as follows:

$$(1)\ \ \%\Delta X_i = c + \beta_1(\%\Delta RXR_t) + \beta_2(\%\Delta RWage)_i + \beta_3(\%\Delta RYJ_t) + \beta_4(RYUS_i) + e_i$$

where X, as in Marston, is the price in the foreign (i.e. US) market of the car converted into yen, divided by the Japanese price of the same car, in yen. *RXR* is the yearly average for the real dollar/yen exchange rate adjusted by the US and Japanese CPIs as mentioned above. The *RWage* is the nominal wage index in Transportation Equipment Manufacturing deflated by the Japanese "WPI" as described above. Finally *RYJ* and

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is certainly something to keep in mind, especially when comparing pass-through in the 1980s and today (with far less growth in productivity.)

[11] Import of parts as a percent of total automobile costs in Japan in 1994 was 0.7%. Compare this with the US (16.7%) and Germany (27.9%). In Japan, this is rising somewhat, but is still small (Diehl, 2001).

RYUS are the real National Incomes for Japan and the US as described in the previous data section. Here, an increase in RXR implies a weak yen, and thus should imply a value of zero if there is no PTM, i.e., complete exchange rate pass-through. In other words, the exchange rate changes but the price in yen *does not*, which implies that the price in US dollars *does*. At the same time (under reasonable, Marston-style assumptions) this means that a positive value of β_1 implies at least some PTM, with a value of 1 being perfect PTM and no pass-through.

The subscripts or *i* and *t* may be a bit confusing as this is a pooled regression. The time scripts *t* denotes the change that particular macro variable in the same year that the given price change occurred. The *i* refers to the each price (year on year) change for all of the (17) models, without any grouping among the same model. That is to say, there are no fixed effects. Thus, one observation might be the percent change in the Japan and US price ratios of an "Acura Integra RS 2dr from 1994-95", another observation would be for the same model, but for 1995-6, and yet a third observation would be for "Acura Integra GS-R 4dr, over the 1994-1995 period."

V. Results

Table 1 presents the results of the preferred estimation. Initially, all four right-hand side variables were included. In all regressions the real exchange rate parameter is significant at the 1% or greater level. Japanese income was always found to be insignificant as was the real wage. The US real income parameter had a *negative* and significant sign. That is, the stronger the US national income, the lower the price of relative price of autos sold in the US in yen-terms. *Ceteris paribus*, strong US income and demand should translate into higher US dollar prices and correspondingly higher yen

prices. To the extent that the strong US economy coincided with a strong yen through much of the 1990s, this may help to explain the perverse result. Interestingly, in Marston's study using data in the 1980s, he found the National Incomes to be irrelevant and dropped them from discussion.

Table 1: Estimates from Pooled OLS 1987-2000, 17 models
Dependent variable: % change in Price Ratio

	Coeff	s.e	p-value
Real XR	1.12	0.22	0.00
Const	0.04	0.016	0.015

Number of observations: 35
Adj. R-squared: 0.60
n.b. errors are White Heteroskedasticity Consistent

Thus, the main parameter of interest, the *RXR* parameter is found to have a value of 1.12. This implies *no* exchange rate pass-through or *complete Pricing-to-Market* over the 1987-2000 period. In other words, Honda was taking 100% of the exchange rate risk upon itself. Interestingly, with Marston's far more aggregate data, he found a PTM coefficient of 0.885. As 'more PTM means less exchange rate pass-through', one could argue that these findings suggest that pass-through has fallen somewhat in autos. This is also what Parsons and Sato (2008) find at a 9-digit level in Japanese autos. However, direct comparison with the results of Marston's is a challenge as he used aggregate data, and spanned the tumultuous early 1980s with an auto VER regime

Instead, using this unique micro-level data, I have run tentative regression on the tiny subsamples up to 1992 and from 1992 onwards. I find that from 1987-1992 the PTM is a staggering 1.9, whereas from 1992-2000 it falls to 0.60 (both coefficients still

significant at the 1% level). *Thus, ERPT in Japanese autos appears to be rising, not falling*. With the short subsamples, these results are suggestive but not definitive, however.

Currency Invoicing

The larger message is the relatively consistency with Marston's original work, i.e. high PTM in Japanese auto exports. This is, of course, consistent with PTM behavior as modeled in Marston, 1990. If so, this tells us a great deal about Japanese autos behavior in a micro-economic, industrial organization sense. However, there are at least two other reasons why perceived PTM may be so high. One possibility is that perhaps Japanese auto makers respond in lock-step with US auto makers prices. While US auto prices were not included in this study, a working paper (Parsons, 2008), did find the prices to have a tentative correlation. This is also consistent with pass-through papers which are modeled oligopolistically, such as Dornbusch (1987). A second real possibility is that currency invoicing matters. Though currency invoicing does not have to necessarily affect pass-through rates, under imperfect competition scenarios with a maker and dealer, it can (see Goldberg and Tille, 2006). In fact, Japanese automobile makers invoice almost entirely in US dollars when exporting to the US market (see Ito, Koibuchi, Sato, and Sasaki, 2010). If indeed, invoice matters, this may help explain the virtually 100% PTM and no pass-through. Of course, this dollar invoicing practice opens up new questions. For example, why is it that they (auto makers) choose to invoice in dollars, while some other firms do not? There is naturally some relationship between the market structure of the industry

itself, and the various benefits to choosing various invoicing strategy which needs to be explored more. This paper's unique combination of domestic and foreign prices is part of the answer to that puzzle.[12]

A final comment on the very nature of the price ratios themselves: the average of price ratios, for the whole sample, is very close to unity, with no clear trend one way or the other. This also does not appear to vary across time. That is to say, the cars cost about the same price, in yen terms, whether they are sold in the US or Japan. Maybe there is less international market segmentation than is commonly believed?

VI. Conclusions

While the possible explanations for PTM and incomplete pass-through are many, the data used and empirical results in this paper are somewhat straightforward. There seems to be 100% pricing to market (PTM) in Japanese (specifically Honda) auto exports to the US, at least over the 1987-2000 period. This is similar (but stronger PTM) to what Marston found in his study using earlier data at far more aggregate level. This PTM may be declining over time, but without a larger sample it is hard to tell.

With respect to the three goals of the paper, these results tentatively suggest the following. First, as Marston found PTM in autos in strong, but perhaps it was stronger than he thought. This also implies that pass-through is much smaller than the 50% or so, some others have found. This difference may be due to the highly detailed data as well as the higher accuracy gained by using Marston's price ratio methodology which utilizes both domestic and foreign prices. Second, though the sub-samples are short, it appears that PTM in autos may be declining. This suggests there has been an *increase* in pass-

[12] Ito, Koibuchi, Sato and Sasaki (2010) explore the possible determinants of invoicing in their highly illuminating paper.

through in the sector, something not typically found in aggregate data such as Taylor (2000) or Marazzi and Sheets (2007). Third and last, these results, if they hold for more recent data, imply that a weaker dollar will do little to reduce the largest component of the US-Japan trade deficit, passenger cars. Naturally, a next step in the research frontier is to conduct similar, detailed studies for other economically important sectors.

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Appendix:

As mentioned in the text, MSRP has been used before as a proxy for contract prices. Unfortunately, contract prices were not found on a systematic historical basis. However, invoice prices, or the price paid by dealers to the makers, is to some extent available on a historical basis and may better reflect movements in actual prices paid. Note, however, that invoice prices are also a proxy, as the dealer may ultimately pay a different price than the invoice price due. There are often dealer incentives and "holdbacks" offered by the maker that may increase the dealer's profit margin. (See Consumer Reports "car pricing" at www.consumerreports.org)

To see how well MSRP acts as a proxy for the presumably better invoice price, I regressed the former on the latter, i.e.

(A1) $\ln MSRP_{it} = \alpha_i + \beta Invoice_{it} + e_{it}$

MRSP should be a function of invoice plus some markup for the dealer. As with XRPT, this mark-up too could change from year to year, thus complicating the analysis.

Surprisingly perhaps, I found (for US data) that the two series are highly correlated, and nearly one-to-one, suggesting that dealer markups do not vary much year to year. This also implies that using MSRP (which is available for much longer periods) is a reasonable proxy to measure "retail" XRPT.

The invoice data is available at www.cargurus.com for many cars, but typically only goes back as far as 1997. This website also provides the MSRP for each make, which differ slightly from Ward's. So to be consistent for this test, only cargurus.com data was used. The longest series I was able to construct was 1997-2007, annually. With 17 foreign models, my number of observations for this regression was 50. In a simple fixed-effects regression I found the beta, or invoice parameter, in equation A1 above to be 0.92 and significant at beyond a 1% level of significance.

As such, while actual prices paid would be ideal, the use of MSRP appears no worse than invoice prices, which may indeed be close to actual prices paid. As MSRP prices from Ward's go back to the 1980s and further, these prices were used in the analysis in the text.