Transfer Pricing by U.S.-Based Multinational Firms*

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Abstract

This paper examines how prices set by multinational firms vary across arm’s-length and related-party customers. We find that arm’s length prices are substantially and significantly higher than related party prices for U.S.-based multinational exporters. The price difference is large even when comparing the export of the same good by the same firm to the same destination country in the same month by the same mode of transport. The price wedge is smaller for commodities than for differentiated goods and is increasing in firm size and firm export share. The difference between arm’s length and related party prices is also significantly greater for goods sent to countries with lower taxes and higher tariffs. Changes in exchange rates have differential effects on arm’s length and related party prices; an appreciation of the dollar reduces the difference between the prices.

Keywords: related party trade, corporate taxes, intrafirm, arm’s length, tariffs, market structure, pricing-to-market

JEL classification: F23, F14, H25, H26, H32

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1. Introduction

This paper examines how prices set by multinational firms vary across arm’s length and related party customers. It takes advantage of a unique new dataset that tracks the population of U.S. export transactions during the 1990s. Consistent with a model of transfer pricing that we develop below, these data show that there is a large positive gap between firms arm’s length and related party prices, particularly for differentiated goods. The size of the price gap varies systematically with firms’ market power as well as destination-countries’ corporate tax rates, product tariffs and real exchange rates.

U.S. exports are highly concentrated among a relatively small number of firms. The top 1 percent of exporters represents just 0.03 percent of the total number of firms in the United States but accounts for more than 80 percent of the value of exports and employs more than 11 percent of all private sector workers. Among large exporters, U.S.-based multinationals, i.e., firms that are either U.S.-owned multinationals or local affiliates of foreign-owned multinationals, are dominant, controlling more than 90 percent of U.S. exports.\(^1\) A substantial fraction of these exports — one third — occur within the firm, i.e., between the U.S.-based multinational and a related party in a foreign country.\(^2\)

The prominence of multinationals in international trade has stimulated a large body of research attempting to explain their behavior in terms of the goods they produce, where they locate production and their response to policies set by individual governments. Their pricing behavior in particular has drawn wide attention from domestic tax authorities, customs bureaus and legislative bodies as well as from academics in economics, accounting and finance. Of specific interest is the potential difference between the prices multinational firms set for their arm’s length customers and the “transfer” prices they use to govern international trade within the boundaries of the firm.\(^3\) Given the large volume of U.S. and global trade that takes place inside multinational firms, the potential impact of this form of price discrimination is quite broad. Indeed, it has the ability to influence official trade statistics and national accounts aggregates as well as estimates of inflation and productivity growth via its effect on import and export price indexes.\(^4\)

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\(^1\) Exporting multinationals based in the U.S. account for 0.90 percent of all firms, 13 percent of exporting firms, and employ 27 percent of U.S. workers. See Bernard, Jensen and Schott (2005) for these and other facts about U.S. trading firms.

\(^2\) As discussed below, “related party” trade refers to trade between U.S. companies and their foreign subsidiaries as well as trade between U.S. subsidiaries of foreign companies and their foreign affiliates. For exports, firms are “related” if either party owns, directly or indirectly, 10 percent or more of the other party (see Section 30.7(v) of The Foreign Trade Statistics Regulations).

\(^3\) Transfer pricing concerns have traditionally been a cross-border issue; however recent court cases in the U.K. are threatening to impose the same restrictions on within-country intra-firm pricing as exist for cross-border transactions. See the Economist (2005).

\(^4\) U.S. import and export price indexes are currently constructed by the Bureau of Labor Statistics using prices
Multinational firms have both managerial and financial motives for setting different prices for arm’s length and related party transactions. Managerial motives include establishing the proper incentives for disparate divisions within a decentralized firm and avoiding “double marginalization” in the presence of market power. Financial motivations encompass the minimization of corporate tax and tariff payments as well as avoidance of foreign exchange controls, and quantitative restrictions on cross-border capital movements. Because obtaining direct evidence on the pricing behavior of multinationals has, until now, been extremely difficult, existing empirical studies generally have relied upon indirect evidence or responses in a very narrowly defined industry.

The dataset employed in this paper contains detailed information on every U.S. international export transaction that occurs between 1993 and 2000 inclusive. For each export shipment that leaves the United States, this dataset records the identity of the exporter, the Harmonized System product classification and date of the shipment, the value and quantity shipped, the destination country, the transport mode, and whether the transaction takes place at “arm’s length” or between “related parties”. This level of detail provides the first opportunity to consider the role that product characteristics, firm attributes and market structure play in the transfer pricing decisions of multinational firms. We use it here to answer the dominant question in the transfer pricing literature, whether and how much the gap between firms’ arm’s length and related party prices responds to tax and tariff rates in the destination country.

We find that export prices for intrafirm transactions are significantly lower than prices for the same good sent to an arm’s length customer. After matching related-party sales by a firm to arm’s length sales by the same firm for the same product to the same country in the same month using the same mode of transport, we find that the average arm’s length price is on average 47 percent higher than the related party price. Product characteristics are influential in the determination of this gap. We find that commodity products (i.e., undifferentiated goods) have an arm’s length price wedge of only 8.5 percent while the average wedge for differentiated products is 73.4 percent. Firm and market characteristics are also influential: the difference between arm’s length and related party prices are significantly higher for goods shipped by larger firms, firms with higher export shares, and firms in product-country markets served by fewer exporters.

With respect to the influence of tax rates on transfer pricing, we find that the gap between reported by firms in voluntary monthly surveys. To the extent that these prices reflect an unknown mixture of arm’s length and related party transactions, they may fail to capture true movements in the U.S. terms of trade. See, for example, Diewert et al. (2005) and Rangan and Lawrence (1993).

5 “Double marginalization” is a variant of the vertical externality where the downstream firm does not take the upstream firm’s profit into account when setting prices, see Tirole (1988).

6 For exceptions, see the discussion of Lall (1973), Swenson (2001) and Clausing (2003) in the next section.
arm’s length and related party prices is larger when the corporate tax rate in the destination country is lower. Indeed, for each one percentage point reduction in the foreign tax rate we find an increase in the price wedge of 0.54 to 0.71 percent. The difference between arm’s length and related party prices also varies with destination-country import tariffs. A one percentage point increase in the foreign customs duty increases the price wedge by 0.53 to 0.66 percent. These results show that multinational firms make substantial price adjustments to variation in country tax and tariff rates.

We also examine the role of exchange rates in multinational pricing. Though a large literature is devoted to analyzing the interaction of firm market power and exchange rate movements, it largely ignores issues of transfer pricing. Here, we find that the price gap between firms’ arm’s length and related party prices varies with movements in real exchange rates, with a one percent appreciation of the dollar against the destination currency reducing the price gap by 0.19 percent. This result suggests that multinationals adjust their arm’s length and related party prices quite differently in response to exchange rate shocks.

In addition to the literatures cited above, our results contribute to the large body of research on the performance attributes of multinational firms and their affiliates. Existing studies on multinationals find that they are larger, more innovative, exhibit higher productivity, pay higher wages and employ greater numbers of skilled or educated workers than domestic firms. Few, if any, of these studies contemplate the substantial price differences documented here. This omission is potentially significant in that affiliates’ ability to purchase lower-priced intermediate inputs from overseas parents may contribute to their observed positive performance, in particular their greater size, better productivity and higher wages.

The remainder of the paper proceeds as follows. We start by briefly surveying the large existing literature on transfer pricing. Next in Section 3, we develop a theoretical framework to highlight the product, firm, and country attributes that potentially influence the gap between firms’ arm’s length and related party prices. Section 4 describes the dataset and Section 5 outlines how we compare arm’s length and related party prices empirically. We present the main empirical results in Sections 6 and 7. In Section 8, we conclude and discuss the implications of the results for future research.

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7 See, for example, the survey by Goldberg and Knetter (1997).

8 Rangan and Lawrence (1993) argue that the U.S. export price index deviates insufficiently from the U.S. wholesale price index in the presence of exchange rate movements because it is biased towards sampling firms’ intrafirm prices. To the extent that exchange-rate driven changes in the arm’s length price wedge are due to relatively large adjustments in firms’ arm’s length prices, our results provide support for this argument.

9 Doms and Jensen (1998) report significantly higher productivity at plants owned by U.S. multinationals, a fact used by Helpman et al. (2004) to motivate a model of exporting and multinationals. Aitken et al. (1996) and many others report higher wages at foreign-owned plants. Lipsey and Sjöholm (2004) find higher wages, higher levels of education and more inputs per worker in foreign-owned plants in Indonesia. Criscuolo et al. (2005) report higher innovation activity at multinational firms in the U.K.
2. Existing Research on Transfer Pricing

There are large theoretical and empirical literatures on transfer pricing by multinational firms.\textsuperscript{10} Theoretical research considers two major topics: managerial and economic incentives in multivisional firms and tax minimization and compliance in cross-border transactions.

Eden (1998) develops a series of models to describe managerial as well as tax and tariff effects on intrafirm prices when the firm sets a single transfer price.\textsuperscript{11} Capithorne (1971), Horst (1971), Samuelson (1982), Halperin and Srinidhi (1987), and Harris and Sansing (1998) examine the effect of tax rate differences on production and pricing when a single agent is responsible for intra-company transactions. A set of recent papers decentralizes the decision-making process within the multinational firm. Hyde and Choe (2005) examine the effects of transfer pricing on economic incentives and tax compliance in a model where the domestic division sets two transfer prices: one for managerial decision-making and the other for tax compliance. Similarly, Baldenius et al. (2004) develop a model with two types of transfer prices and consider the effects of cost-based and market-based transfer pricing.\textsuperscript{12}

The empirical literature on transfer pricing focuses almost exclusively on the role taxes or tariffs in influencing over- or under-invoicing of intrafirm, cross-border transactions.\textsuperscript{13} Most of these studies address this question indirectly by examining whether firms in relatively low-tax jurisdictions are more profitable than firms in high tax jurisdictions\textsuperscript{14} or whether economic activity varies across locations.\textsuperscript{15} Hines (1997) provides a survey of this literature, which typically finds a negative correlation between tax rates and high profitability. He cautions, however, that the observed correlation may have other interpretations.

2.1. Price-based studies

In spite of the large amount of research on the issue of transfer pricing, there have only been a handful of empirical studies using actual price data. Lall (1973) investigates over-invoicing by a small sample of Colombian pharmaceutical firms with foreign affiliates in response to governmental restrictions on profit repatriation. Foreign exchange and capital controls gave multinational firms an incentive to raise their intrafirm prices above the arm’s-length level as a

\textsuperscript{10} A search on Econlit using the keywords "transfer pricing" and "multinational" yields 66 peer-reviewed journal articles and 10 books.

\textsuperscript{11} Eden (1998) also provides substantial coverage of non-academic evidence on the extent of transfer pricing and tax minimization by multinationals.

\textsuperscript{12} Halperin and Srinidhi (1991) and Narayanan and Smith (2000) also allow for decentralized decision-making in models with a single transfer price.

\textsuperscript{13} To our knowledge none of the empirical papers consider the role of product characteristics or firm market power in the transfer pricing decision.

\textsuperscript{14} See, for example, Jenkins and Wright (1975), Bernard and Weiner (1990), Harris et al. (1993), Klassen et al. (1993) and Collins et al. (1996).

\textsuperscript{15} See, for example, Bartelsman and Beetsma (2003) who look at income shifting among OECD countries.
means of transferring profits out of the country. Comparing intrafirm import prices to arm’s length prices for similar goods in local, regional and world markets during 1968 to 1970, he finds that related party prices ranged 33 to 300 percent higher than arm’s length prices.16

Two other studies, by Swenson (2001) and Clausing (2003), are more recent and cover a wider range of industries. Both have as their focus the relationship between country corporate tax (and tariff) rates and transfer prices. Swenson (2001) examines the response of aggregate unit values for country-product pairs to variations in U.S. import tariffs and foreign tax rates using annual U.S. import data for five countries during the 1980s. She finds evidence that changes in prices are consistent with incentives based on taxes and tariffs but that the economic magnitudes are small.17

Clausing (2003) uses product price data collected by the Bureau of Labor Statistics (BLS) from 1997 to 1999 to investigate the effect of taxes on related party prices. The BLS data separately identify intrafirm and arm’s length transactions. Clausing finds price responses in the expected directions, i.e., higher taxes abroad are associated with higher export prices and lower import prices for related party transactions. Her point estimates suggest that a 1 percent drop in taxes abroad reduces U.S. export prices between related parties by 0.94-1.8 percent.18

2.2. Taxes

Before introducing our theoretical framework and empirical analysis we provide a brief discussion of the international tax environment facing U.S. firms. In the United States, firms are taxed according to their worldwide income.19 As a result, U.S. firms must pay U.S. income tax on both their domestic profits as well as any foreign profits that are repatriated to the United States.20 The tax liability associated with foreign earnings, however, can be offset by income taxes the firm pays to other countries. If foreign profits are taxed more lightly (heavily) than domestic profits, the firm is said to have ‘deficit’ (‘excess’) foreign tax credits. If a firm has deficit foreign tax credits, its U.S. tax liability on foreign profits is the difference between what would be owed under the U.S. tax rate and what the firm actually paid to foreign government.

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16 A more extensive study by the Colombian government found prices to be an average of 155 percent higher. Lall (1973) notes that similar studies subsequently undertaken by neighboring Latin American countries reached similar conclusions.

17 Swenson’s (2001) data do not separately identify arm’s length and related party import transactions, nor do they allow one to control for firm-level differences in prices.

18 While Clausing (2003) uses individual transaction prices, her data is not without limitations: 42 percent of the prices are imputed and firm and product identifiers are unavailable. As a result, firm- or product-specific variation in prices cannot be examined.

19 This section draws on the discussion in Hines (1997).

20 According to Subpart F rules of the U.S. Internal Revenue service, foreign profits of certain majority-owned foreign affiliates are considered repatriated (i.e., “deemed distributed”) whether or not they are actually transferred back to the parent. The affected affiliates are generally characterized as “passive” operations in tax haven countries.
Excess foreign tax credits cannot be used to offset firm’s tax liabilities on domestic income in the year they are incurred, but they can be used to some extent to offset tax liabilities on foreign income in prior or subsequent years, subject to U.S. Internal Revenue Service guidelines.

During our sample period, U.S. firms had at least two alternatives for booking export profits. First, they could be attributed to a Foreign Sales Corporation (FSC) and U.S. tax liability would be imposed at a reduced rate and could be offset by foreign tax credits generated by other foreign income. Second, U.S. exporters could classify up to 50 percent of their export profits as foreign source income and U.S. tax liability could be wholly or partly offset by excess foreign tax credits from other activities. Both of these policies create a motive for firms to over- or under-invoice exports depending upon the tax rates of the destination countries. Firms booking profits to a FSC, for example, may have expected tax laws to change in their favor in the future. Indeed, the American Jobs Creation Act of 2004, a corporate tax bill enacted in 2004 largely in response to a World Trade Organization ruling against FSCs, allowed firms to repatriate their foreign profits at a highly advantageous tax rate.21 Allowing firms to book export profits as foreign income, on the other hand, essentially allowed firms with excess foreign tax credits to escape U.S. tax liability on those export profits.22

As a consequence of these components of the tax law, even though the United States relies upon a system of worldwide taxation, U.S. firms continue to face incentives to minimize their tax burden through transfer pricing. These incentives will exist whenever U.S. marginal tax rates differ from the combined burden of foreign marginal tax and tariff rates. In the next section we develop a framework that explicitly links foreign corporate taxes and transfer prices.

3. Theoretical Framework

The goal of our analysis is to understand the forces that shape multinationals’ arm’s length versus related party prices. It is likely that the same forces that play a role in pricing also influence multinationals’ more generally in terms of what they produce and where they locate.23 Here, however, we develop an explicitly partial equilibrium approach to the problem of transfer pricing in that we take the location of firm activity as given and examine the variation in the resulting prices.

In this section we consider the particular case of a firm exporting the same good both to a related party and to an arm’s length customer in the same destination country. Examination

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21 Estimates of profits that will be repatriated at these favorable corporate tax rates (5.25% instead of 35%) range from $320 billion (Wall Street Journal 2005) to as high as $520 billion (Business Week 2005).
22 Kemsley (1995) shows that firms with excess foreign tax credits are more likely to export from the United States than to produce in an establishment located abroad.
23 See Hines (1997) for a survey of the literature on the location of multinational activity.
of this case is useful for several reasons. First, it closely corresponds to the concept of arm’s length pricing used by U.S. and OECD tax authorities when evaluating transfer pricing for tax purposes. Second, limiting our analysis to the same good sent to the same country enables us to implicitly control for variation in both the nature of the product and in the cost structure of the exporting firm. Finally, this framework corresponds closely to the main strands of research in the existing theoretical literature.

While limited in scope, our focus is broader than most of the existing empirical literature on transfer pricing in that we consider the role of product attributes, firm characteristics and market structure in addition to that of taxes and tariffs in shaping related party prices. Given the high degree of concentration in U.S. exports, even this special case encompasses a large fraction of related party trade.

3.1. A model of transfer pricing

Our basic setup is straightforward and extends the framework developed in Hyde and Choe (2005).24 The multinational consists of two divisions: a home division and a foreign affiliate. The home division produces an intermediate good which is sold both at arm’s length (quantity $Q_{al}$) to a foreign firm and to the foreign affiliate (quantity $Q_f$). The good sold to both customers is identical, and we assume that both customers reside in the same destination country.25 For simplicity we also assume that there are no costs of transforming the intermediate good in the foreign country. Both the foreign arm’s length firm and the foreign affiliate costlessly transform the product and sell it to consumers in the foreign country.

The arm’s length customer for the multinational is a foreign firm who purchases quantity $Q_{al}$ for price $P_{al}$, payable in domestic currency units subject to an ad valorem tariff, $\tau$, and an exchange rate, $e$, measured in units of foreign currency per unit of home currency. The foreign firm in turn sells the goods for price $S_{al}$ in foreign currency. After-tax profit of the foreign arm’s-length firm is given by

\[ \pi_{al} = (1 - t_f) (S_{al} Q_{al} - (1 + \tau) e P_{al} Q_{al}) \]  
where $S_{al} = (1 + \tau) e P_{al}$.

The multinational firm (legally) keeps two sets of books, one used to set incentives within the firm, i.e., used by foreign managers to make quantity and price decisions and also to reward

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24 The extensions include the introduction of downstream firms, tariffs, and exchange rates.
25 By intermediate good we merely mean that the good is not directly consumed by the foreign importing firm, i.e. it is subject to further processing or handling by wholesale and/or retail establishments. We assume that there are no sales to the domestic market and we do not model any potential competition in the downstream market.

those same foreign managers, and the other reported to tax authorities in both countries and to customs authorities as the good crosses the border.

Pre-tax profits for the two divisions are given by

$\tilde{\pi}_h = P_{al} Q_{al} + P_{in} Q_f - c (Q_f + Q_{al})$

$\tilde{\pi}_f = S_f Q_f - c P_{in} Q_f - \tau c P_{tx} Q_f$

where $P_{in}$ is the internal incentive transfer price for the intermediate good paid by the foreign division, $P_{tx}$ is the transfer price of the intermediate good reported to the tax authorities, both income tax and customs or border, i.e., for tariff purposes, and $S_f$ is the price faced by the final customer of the foreign affiliate. The constant marginal cost of production is given by $c$ and the ad valorem tariff rate is given by $\tau$.

Taxable income for each division is given by

$I_h = P_{al} Q_{al} + P_{tx} Q_f - c (Q_f + Q_{al})$

$I_f = S_f Q_f - (1 + \tau) e P_{tx} Q_f$.

We assume the transfer price is bounded from below by the firm’s marginal cost and from above by an amount, $B$, that prevents the taxable income of the foreign affiliate from becoming negative, i.e., $c \leq P_{tx} \leq B$ where $I_f (B) = 0$, reflecting the likely objections of the tax authorities.

After-tax profit of the two divisions is given by

$\pi_h = \tilde{\pi}_h - t_h I_h = (1 - t_h) [P_{al} Q_{al} - c (Q_f + Q_{al})] + (P_{in} - t_h P_{tx}) Q_f$

$\pi_f = \tilde{\pi}_f - t_f I_f = (1 - t_f) [S_f Q_f] - (e P_{in} + (\tau - t_f (1 + \tau)) e P_{tx}) Q_f$

where $t_h$ and $t_f$ are home and foreign tax rates respectively.

The foreign arm’s length firm chooses the quantity to sell, $Q_{al}$, given the price it faces from the home affiliate of the multinational, the foreign tax rate, tariff, and exchange rate and the demand it faces in the foreign market, summarized by the elasticity, $\mu_{al}$, yielding a standard markup over cost,

$S_{al} = \frac{\mu_{al}}{\mu_{al} + 1} e (1 + \tau) P_{al}$.

The foreign affiliate of the multinational solves a similar problem. The price, $S_f$, and thus the quantity of intrafirm sales, depends on both transfer prices, $P_{in}$ and $P_{tx}$, foreign taxes, tariffs,
and the exchange rate. The foreign division chooses the quantity to sell given the foreign tax, incentive transfer prices, tariffs and the elasticity of demand it faces in the foreign market, $\mu_f$:

$$S_f = \left( \frac{\mu_f}{\mu_f + 1} \right) \left( \frac{c}{1 - t_f} \right) (P_m + (\tau - t_f - \tau t_f) P_{tx}). \quad (10)$$

After-tax profits for the parent firm are given by

$$\pi_p = (1 - t_h) [P_{al} Q_{al} - c (Q_f + Q_{al})] + (1 - t_f) \frac{1}{c} [S_f Q_f]$$

$$+ (t_f (1 + \tau) - (\tau + t_h)) P_{tx} Q_f. \quad (11)$$

The last term in equation 11 shows clearly that the profits of the parent are decreasing in the reported transfer price when the home tax rate is above the foreign tax rate. Without some restriction on behavior, the firm will choose the lowest possible tax transfer price. Similarly, a positive tariff rate will also induce the firm to minimize the reported tax transfer price.27

If the transfer price reported by the firm deviates too far from the tax authority’s expectation the firm may face a penalty, or at a minimum, an expensive audit. We augment the profit function with a penalty function that is a combination of the probability of being audited and the resulting penalty and is increasing in both the price difference between arm’s length and tax transfer prices and the quantity shipped to the foreign division. We consider the case where $t_h > t_f$ and a penalty function that is quadratic in the difference between total revenue from intrafirm sales using the arm’s length price and total revenue from intrafirm sales using the reported tax transfer price,

$$\frac{1}{2} \theta (P_{al} Q_f - P_{tx} Q_f)^2,$$

corresponding to the idea that the domestic tax authority is interested in taxable revenue from intrafirm sales. A more realistic setting might model the penalty function as the outcome of strategic choices by both the firm and the tax authority (see Graetz et al. (1986) and De Waegenaere et al. (2005)).

After-tax profits for the parent firm are now given by

$$\pi_p = (1 - t_h) [P_{al} Q_{al} - c (Q_f + Q_{al})] + (1 - t_f) \frac{1}{c} [S_f Q_f]$$

$$+ (t_f (1 + \tau) - (\tau + t_h)) P_{tx} Q_f - \frac{1}{2} \theta (P_{al} Q_f - P_{tx} Q_f)^2. \quad (12)$$

27If the foreign income tax rate is higher than domestic income tax rate, then the response of the after-tax profits of the parent to a higher tax/border transfer price depends on the level of the tariff, and the two income tax rates. If $t_f > t_h$ and $t_f - t_h < (1 - t_f) \tau$ then $\frac{\partial \pi_p}{\partial P_{tx}} < 0$. Normally high (relative) foreign income tax rates would induce the firm to raise the reported transfer price to shift profits into the low-tax home country. However, with small differences in income tax rates, high tariffs can induce the firm to once again reduce the reported transfer price to reduce tariff payments. See Swenson (2001) for a discussion.
The firm chooses \((P_{al}, P_{in}, P_{tx})\) yielding first-order conditions:

\[
P_{al} : P_{al} - \frac{\mu_{al}}{\mu_{al} + 1} c - \frac{\theta (P_{al} - P_{tx}) Q_f^2 P_{al}}{(1 - t_h) (\mu_{al} + 1) Q_{al}} = 0 \tag{13}
\]

\[
P_{in} : P_{in} - c (1 - t_h) - t_h P_{tx} - \theta Q_f (P_{al} - P_{tx})^2 = 0 \tag{14}
\]

\[
P_{tx} : \frac{\partial Q_f}{\partial P_{tx}} \left[ P_{in} - (1 - t_h) c - t_h P_{tx} - \theta Q_f (P_{al} - P_{tx})^2 \right] \\
+ [t_f (1 + \tau) - \tau - t_h] Q_f + \theta (P_{al} - P_{tx}) Q = 0 \tag{15}
\]

From the first-order conditions, we obtain three equilibrium relationships of interest. First, from equation 13, we generate the standard markup price for arm’s-length sales augmented by the effect of the penalty function,

\[
P_{al} = \frac{\mu_{al}}{\mu_{al} + 1} c + \frac{\theta (P_{al} - P_{tx}) Q_f^2 P_{al}}{(1 - t_h) (\mu_{al} + 1) Q_{al}}. \tag{16}
\]

The simple set-up for the arm’s length price is an important component of the framework as it explicitly introduces the market power of the firm in the pricing decision. Greater market power increases the price to the arm’s length customer.

Second, from equation 14, we see that the incentive transfer price consists of a weighted average of the marginal cost of production and the tax transfer price as well as a term from the penalty function

\[
P_{in} = (1 - t_h) c + t_h P_{tx} - \theta Q_f (P_{al} - P_{tx})^2. \tag{17}
\]

Finally, from equations 15 and 14, we obtain the following relationship between taxes, tariffs, and the transfer price reported to the tax authorities:

\[
(P_{al} - P_{tx}) \theta Q_f = t_h - t_f + \tau (1 - t_f). \tag{18}
\]

The left hand side of equation 18 gives the marginal cost to the firm of deviating from the arm’s length price while the right hand side represents the marginal benefit of deviating. In equilibrium the firm sets the transfer price reported to the tax and customs authorities to equalize the costs and benefits. The tax transfer price, \(P_{tx}\), equals the arm’s length price, \(P_{al}\), only when the tariff-adjusted difference in tax rates is zero. When \(t_h > t_f + \tau (1 - t_f)\), e.g. whenever the home tax rate is above the foreign rate or whenever tariffs are sufficiently large, the firm will choose to report a transfer price below the arm’s length price. Decreases in the foreign tax rate will increase the price difference as will increases in the tariff. The larger the quantity shipped to the foreign affiliate the greater the cost to the firm resulting in a smaller equilibrium price difference.

In spite of the relative simplicity of the framework it is not possible to derive closed-form solutions for the three prices even with simple forms for the demand functions in both markets,
e.g linear or CES. We can, however, solve the model numerically. Figure 1 displays the relationship between the price wedge and underlying parameters assuming linear demand where the price wedge is the log difference between the arm’s length and tax transfer prices. Appendix A describes the parameterization of the model.

As expected the price wedge is decreasing in the foreign tax rate and increasing the foreign tariff (panels A and B). In addition increases in the price elasticity of demand cause the price wedge to rise.\(^{28}\) Finally we see that the pricing wedge is increasing in the exchange rate. While multinational reduces all its prices as the exchange rate rises the tax transfer price falls faster than the arm’s length price.

The framework developed here provides a guide for our subsequent empirical work. As in the existing theoretical and empirical literature, tax and tariff differences across countries provide an incentive for firms to vary their transfer prices as well as their arm’s length prices and induce a wedge between arm’s length and intrafirm prices even for the same product destined for the same country.

We emphasize, in addition, that the optimal price wedge varies according to the market power of the firm in arm’s length market. Both the characteristics of the product and those of the firm will potentially influence the desire and ability of the firm to price discriminate between arm’s length and related purchasers. If the firm is selling an undifferentiated commodity, there will be little mark-up over marginal cost and thus a smaller wedge. Similarly, the firm’s ability to vary its transfer prices of undifferentiated commodities, or goods with easily visible reference prices, in response to differing tax rates may also be limited.

We note that this model does not include other relevant aspects of the pricing decision. For example any relationship-specific components of the arm’s length transaction have been assumed away. Firms that repeatedly deal with the same customers may offer price discounts. Also, firms may have to offer explicit or implicit guarantees for products sold at arm’s length which would tend raise the arm’s length price above the intrafirm price. Similarly, intrafirm sales may act like implicit long-term contracts and thus lower the price relative to arm’s length sales. More generally, unmeasured aspects of the transaction will tend to push the arm’s length price away from the related party price.

4. Data Description

At the heart of our empirical analysis is the Linked/Longitudinal Firm Trade Transaction Database (LFTTD) which links individual trade transactions to firms in the United States.\(^{29}\)\(^{28}\) In this case the elasticity is endogenous and is decreasing in the intercept of the linear demand equation.\(^{29}\) See Bernard et al. (2005) for a description of the LFTTD and its construction.
This dataset has two components. The first part, foreign trade data assembled by the U.S. Census Bureau and the U.S. Customs Bureau, captures all U.S. international trade transactions between 1993 and 2000 inclusive. For each flow of goods across a U.S. border, this dataset records the product classification, the value and quantity shipped, the date of the shipment, the destination (or source) country, the transport mode, and whether the transaction takes place at “arm’s length” or between “related parties”.30 “Related party”, or intrafirm, trade refers to shipments between U.S. companies and their foreign subsidiaries as well as trade between U.S. subsidiaries of foreign companies and their affiliates abroad. For export transactions, firms are “related” if either party owns, directly or indirectly, 10 percent or more of the other party (see Section 30.7(v) of the Foreign Trade Statistics Regulations). This definition of related party corresponds exactly to that used by the Bureau of Economic Analysis in their annual surveys of multinational activity.

The second component of the LFTTD is the Longitudinal Business Database (LBD) of the U.S. Census Bureau, which records annual employment and survival information for most U.S. establishments.31 Employment information for each establishment is collected in March of every year and we aggregate the establishment data up to the level of the firm. Matching the annual information in the LBD to the transaction-level trade data yields the LFTTD. Products in the LFTTD are tracked according to ten-digit Harmonized System (HS) categories, which break exported goods into 8572 products. These products are distributed across two-digit HS “industries” as noted in Table 1. Table 1 also records the share of exports in the industry that are intrafirm and the share of total U.S. exports accounted by the sector.

4.1. Exports Across Firms

The comprehensive nature of the trade transaction data allows us to develop an intimate picture of the firms that export from the United States. Figure 3 shows the distribution of total U.S. exports across exporting firms where the firms have been sorted by the value of their exports. Exports come from a remarkably small number of firms. Fewer than 4 percent of all U.S. firms export any amount at all. Among this select group of firms, the top one percent of U.S. exporters (1673 firms in 2000) control over 80 percent of total exports. The top ten percent of exporters are responsible for more than 95 percent of exports.

Our focus is on the behavior of multinational firms. Figure 4 shows that the concentration of U.S. exports is heavily influenced by the presence of multinational firms. In 2000, multinational

---

30 See Appendix A for a discussion and an example of the Shipper’s Export Declaration which form the basis for the export data in the LFTTD.
31 This dataset excludes the U.S. Postal Service and firms in agriculture, forestry and fishing, railroads, education, public administration and several smaller sectors. See Jarmin and Miranda (2002) for an extensive discussion of the LBD and its construction.
firms account for more than 93 percent of all U.S. exports. The figure also allows us to see the relative importance of intrafirm versus arm’s length activity in multinational firms. Related party exports make up slightly more than one third of all multinational export shipments.

These three facts, the concentration of U.S. exports among a small number of firms, the dominant role of multinationals in that select group, and the large role of intrafirm trade in multinational shipments, combine to emphasize the importance of understanding the cross-border pricing behavior of multinational firms.

4.2. The Transfer Pricing Dataset

For the purposes of this paper we focus only on export transactions in the LFTTD, corresponding to exports by U.S.-based firms (as distinct from firms with U.S. nationality). From the raw LFTTD data we make several adjustments to create our starting sample. First we eliminate firms with fewer than 10 transactions during 1993-2000 inclusive. Second we eliminate all transactions with missing, imputed or ‘converted’ quantities to ensure that all the observations in the data set for a product are measured in comparable units and are quantities recorded by the transacting firm, reducing the number of transactions by 12-20 percent depending on the year. For the remaining observations, we compute the export price as the unit value of the transaction, i.e., total value per unit quantity.

In order to understand the role of product and country characteristics in shaping related party prices we link several additional datasets to the LFTTD. Two datasets record time-series variation in international corporate tax rates. The first is the World Tax Database (WTD) compiled by the Office of Tax Policy Research at the University of Michigan. From the WTD, we use the maximum statutory corporate tax rate. Table 2 reports the maximum corporate tax rate for countries in the database for 2000. Across the 140 countries, the mean (median) tax rate is 30.8 (32) and the rates range from zero in the tax havens of Bermuda and the Bahamas to 54 percent in Iran. One hundred twelve countries (80 percent) have tax rates at or below that of the United States. Table 2 also reports estimates of countries effective tax rates estimated from Bureau of Economic Analysis (BEA) data, which record foreign revenues as well as the foreign taxes paid by foreign affiliates of U.S. firms. Following the literature, we estimate an effective corporate tax rate for country c in year t by dividing the foreign income taxes paid by total foreign revenue less cost of goods sold and selling and administrative costs.

The ideal rate as suggested by the model is a firm-specific marginal tax rate and, as such,
neither measure of country tax rates is entirely satisfactory. Firms, especially multinationals, may receive a variety of tax holidays or exemptions that reduce their own marginal tax rate relative to the published statutory maximum. The calculated effective rate represents an average, rather than a marginal, rate across firms in a destination country.

Two datasets provide product information: the first is from Rauch (1999) and is used to group products into differentiated and non-differentiated categories. The second is from the UNCTAD TRAINS database and provides tariff rates for six-digit HS (HS6) categories by country for 1993 to 1998.\textsuperscript{34} Table 1 reports the average differences in maximum and minimum tariff rates across products within two digit industries. The range of tariffs (highest minus lowest) across countries for the typical product is 64 percent. For example, the tariff rate on handheld computers (HS 847130) ranges from 0 (Canada and others) to 22 percent (Brazil), with a mean and median of 4 percent while the tariff rate on men’s dress shirts (HS 480990) ranges from 0 (Norway) to 80 percent (Mauritius).

Real exchange rates are constructed using monthly data on the end of period (line ae) nominal exchange rate and CPI from the IMF International Financial Statistics. Exchange rates are given in log units of foreign currency per U.S. dollar.

5. The “Arm’s Length Standard” and “Comparable Uncontrolled Prices”

In order to examine the transfer pricing behavior of multinational firms, we want to compare the price associated with each of a firm’s related party (i.e., “controlled”) transactions to some reference, or benchmark, price. As indicated in both the U.S. Treasury Regulations and OECD tax guidelines, the preferred benchmark for determining the appropriate transfer price is the “arm’s length standard”.\textsuperscript{35} The reported transfer price must be “consistent with the results that would have been realized if uncontrolled taxpayers had engaged in the same transaction under the same circumstances” (Treasury Regulations §1.482-1(b)(1)).

While there are several approved methods for satisfying the arm’s length standard, the most commonly used is the price associated with corresponding arm’s length (i.e., “uncontrolled”) transactions, the so-called “comparable uncontrolled price” (CUP).\textsuperscript{36} The U.S. tax code and OECD tax guidelines indicate the desirability of a tight match between the characteristics of the related party and CUP transactions. Here, we make full use of the unique level of detail

\textsuperscript{34}These data are available and described in greater detail on the web at http://r0.unctad.org/trains/

\textsuperscript{35}As stated in OECD (1995), “[When] conditions are made or imposed between ... two [associated] enterprises in their commercial or financial relations which differ from those which would be made between independent enterprises, then any profits which would, but for those conditions, have accrued to one of the enterprises, but, by reason of those conditions, have not so accrued, may be included in the profits of that enterprise and taxed accordingly.”

\textsuperscript{36}Ernst and Young (2003) report that CUP was the most common method used to create transfer prices for their tangible goods, used by 35 percent of surveyed multinationals.
available in the LFTTD dataset to define the CUPs used in our analysis very narrowly, i.e., to match the characteristics of the transactions as closely as possible.

Denote the related party price of product \(i\) from firm \(f\) to country \(c\) in month \(t\) by transport mode \(m\) as \(rp_{ficmt}\). We define the comparable uncontrolled price associated with this related party price to be the average of the firm’s \(N\) comparable arm’s length prices made in the same month,

\[
cup_{ficmt} = \frac{1}{N} \sum_{n} al_{ficmt}^{n}, \tag{19}
\]

where \(al_{ficmt}^{n}\) is one of the firm’s \(N\) arm’s length export prices of product \(i\) to country \(c\) in month \(t\) by transport mode \(m\). Note that if \(N = 0\), i.e., if the firm does not export to an arm’s length party within the product-country-mode-month bin, the CUP for a related party transaction does not exist. Of the more than 15 million related party export transactions in the LFTTD, 3.3 million can be associated with our definition of a CUP. These matched transactions account for roughly one fifth of the total value of related party exports in 2000.

For each related party export transaction that can be matched to a comparable uncontrolled price, we define the arm’s length-related party (ALRP) price wedge to be the difference between the log CUP and the log related party price,

\[
wedge_{ficmt} = \ln cup_{ficmt} - \ln rp_{ficmt}. \tag{20}
\]

As noted in the theoretical discussion in Section 3, \(wedge_{ficmt}\) is expected to be greater than zero. The wedge will be positive when the arm’s length price is marked up over marginal cost and when the U.S. tax rate is greater than the tariff-adjusted foreign tax rate.

In addition to adhering to U.S. and OECD guidelines, the narrowness of the CUPs we define afford several advantages vis-a-vis the data used in previous examinations of multinational transfer pricing behavior. In particular, within-firm comparisons of export prices to both arm’s length and related parties allows us to control for time-varying firm-specific marginal costs. Unlike previous empirical studies, we are able to both more closely match the theory and the definitions of arm’s length prices preferred by most national tax authorities. In addition, our comparison of prices within firms, months, products, destination countries and modes of transport minimizes the likelihood that the ALRP price wedge captures price variation due to product heterogeneity or varying market conditions. Transport mode, for example, has been linked to variation in product quality, time sensitivity and other factors that might affect price (Harrigan 2005; Hummels and Skiba 2004).\textsuperscript{38}

\textsuperscript{37}Transport mode refers to whether the product is sent by air, ship or some other method.

\textsuperscript{38}We caution that even within a relatively narrow product category, it is possible that a firm may be shipping products with very different attributes.
Even though we are able to determine firm, country, time, transport and product effects, there remain unobservable attributes of the transactions that may vary across arm’s length and related party customers. While the data provide detailed product classification information, we do not have information on product characteristics or ancillary services (packaging, marketing, etc) provided by U.S.-based firms that might explain the price differential between related party and arm’s length prices. In addition, transactions inside the firm may act like implicit long-term contracts and as a result be price below similar arm’s length trades. We caution that the levels of the price wedge must be interpreted in light of these unobservables, i.e., the mere existence of a positive price wedge does not imply inappropriate behavior by the firm.

5.1. The ALRP Wedge

We report the price wedge for several definitions of the CUP in Table 3. In each case, we find that exporters based in the United States charge arm’s length customers higher prices for their products than related party (RP) customers.

The final row of the table reports the mean wedge for the CUP defined in equation 20. As indicated in the table, the wedge averages 0.478 log points within firm, product, month, transport mode, and destination country groups. The other rows of the table relax the definition of the groups defining the CUP. The penultimate row of the table, for example, indicates the price wedge for a CUP defined over the arm’s length transactions of all firms within a product, month, transport mode, and destination country group. Within this broader group of comparable arm’s length prices, the price wedge almost triples in size to 1.28 log points. Further relaxing the definition of comparable transactions continues to increase the size of the arm’s length price wedge.

Our theoretical framework includes an important role for product characteristics in determining the wedge between arm’s length and related party prices. If the exporting firm has no market power in the product then in the absence of tax or tariff incentives the arm’s length and related party prices should coincide. Even with differences in taxes and tariffs across countries, if the product in question is an undifferentiated commodity the exporting firm will have little opportunity to shift profits between affiliates without risking offending one of the relevant tax authorities. As a result we expect that there will be substantial differences in the price wedge for differentiated and commodity products.

Table 4 documents that the price wedge is substantially larger for differentiated products than for commodities. We make this comparison using three different classifications of product differentiation. The first classification is based upon a “naive” inspection of the HS industry identifiers reported in Table 4: products in two-digit HS industries 01 to 21 and 25-29
are designated ‘commodities’, products in industries 84 to 97 are denominated ‘differentiated’. The second and third classifications are due to Rauch (1999), who provides conservative and liberal identifications of commodities according to whether goods are quoted on an organized exchange.\footnote{The Rauch (1999) classifications are for four-digit SITC industries. To make use of it here, we concord ten-digit HS products to these industries using the concordances available in Feenstra et al. (2002).} The Rauch classification separates products into three categories: ‘commodities’, which are traded on an exchange, ‘reference-priced’, which are not traded on an exchange but whose prices can be found in catalogs, and ‘differentiated’, whose prices cannot be looked up. We combine the commodity and reference-priced categories into a single group.

All three classification schemes offer similar results. Wedges are positive for both commodities and differentiated goods, but they are substantially larger for differentiated goods. The average price wedge for commodity products ranges from 8.5 percent using the HS-based classification to 18.6 percent using the conservative Rauch system. The price wedge for differentiated goods, by contrast, is 73.4 percent according to the HS-based system and 58.2 percent according to the Rauch definition. In line with the model introduced above, the gap between commodity and differentiated-good wedges indicates that commodity product markets are less likely to show evidence of differential pricing behavior. For the remainder of the paper, we focus on differentiated goods by dropping all transactions designated as ‘commodity’ in the HS-based classification system.

Though the evidence presented in this section demonstrates that ALRP wedges are sizeable, it does not pin down the source of the price differences. If we make the strong assumption that firms’ related party prices are an accurate estimate of their marginal costs, and ignore all other potential sources of price variation, it implies an average markup in the sample of 47.8 percent. However, we suspect that omitted characteristics of the transaction are responsible for a substantial amount of the ALRP price wedge. In the next section we examine the relationship between the price wedge and product, firm and country attributes.

6. Main Results

The theoretical model in the Section 3 shows that the difference between arm’s length and related party prices depends on firm, product and country characteristics. In this section we examine the variation in arm’s length and related party prices by U.S. exporters from 1993 to 2000. The basic empirical specification regresses firms’ ALRP price wedges on proxies of product differentiation and firm market power, destination-country tax rates and destination-country product-level import tariff rates as well as product fixed effects.
6.1. Firms and the Price Wedge

Table 5 examines the relationship between the ALRP price wedge and firm and market characteristics. Firms with greater market power and those selling to less competitive product markets are expected to have larger price wedges. Lacking direct measures of market power or product-market competitiveness, we use three proxies: firm size as measured by log total employment, the firm’s share of U.S. exports in the product across all countries, and the number of firms exporting the product from the U.S. to a particular destination country in a calendar year. If the price wedge is increasing in the market power of the firm, and if our measures capture aspects of firm pricing power and market structure, then we would expect to see a positive correlation between firm size and the wedge. Similarly, the wedge would be increasing in the export share of the firm and decreasing in the number of exporters in the product-destination country.

The results in Table 5 support the hypothesis that firms with greater market power have larger ALRP price wedges. The OLS estimate of the price wedge on log employment is positive and statistically significant at the 10 percent level. Including product fixed effects, the coefficient remains positive and is significant at the 1 percent level, although the magnitude falls.

Columns four and five report the estimates using firm export share. The coefficients are again positive, as expected if market power increases the price gap. Export share is only statistically significant once product fixed effects are included.

The final two columns in Table 5 examine relationship between the ALRP price wedge and the number of firms exporting the product to each destination country in each calendar year. Here, too, we find the expected relationship: thicker markets are associated with lower differences between firms’ arm’s length and related party prices. The simple OLS specification is negative and statistically significant at the 10 percent level, while the regression with product fixed effects yields a larger coefficient and is significant at the 1 percent level.

To our knowledge, the results in Table 5 provide the first evidence that firm characteristics and market structure influence transfer pricing by multinationals. Greater market power is associated with larger wedges between arm’s length and intrafirm prices.

6.2. Taxes, Tariffs and the Price Wedge

The role of taxes on transfer pricing has dominated the existing theoretical and empirical literature. In this section we investigate the relationship between countries’ corporate tax rates and their product-level import tariffs on transfer pricing. As discussed in Sections 2 and 3, the expected relationship between the foreign tax rate and the ALRP price wedge is negative. Low (high) destination-country tax rates provide firms with an incentive to report relatively
low (high) related party prices. Firms are also expected to change their related party prices in response to tariffs. As noted in the theoretical framework, firms have an incentive to lower their related party prices when exporting to countries with high import tariffs.

The ideal dataset for examining the influence of tax rates on multinational firms’ pricing behavior would track the nationality of ownership of each firm, the relevant (preferably firm-specific) corporate tax rates in the countries to which they export, and, for U.S. firms, their worldwide tax exposure. While we have substantial detail on individual transactions, we do not have any detail on either firms’ corporate structure or their foreign earnings. As a result we estimate a simple regression of the ALRP price wedge on the destination country tax rate.

The second and third columns of Table 6 report the results using statutory maximum tax rates from the Michigan World Tax Database. As predicted by the model, we find large, statistically significant and negative coefficients for both specifications. A decrease of one percentage point in the tax rate is associated with an increase of the price wedge of 1.88 to 3.95 percent.

Using effective tax rates calculated from BEA data in columns four and five, we again find the expected negative relationship. The point estimates are smaller, 0.51 to 0.63, and are significant at the 1 percent level with the inclusion of product fixed effects.

The final two columns of Table 6 examine the role of tariffs on price differentials. High tariffs work like low corporate income taxes as they give firms the incentive to lower related party prices. The availability of the tariff data is more limited, cutting the sample size substantially. Pooling all products and countries in an OLS specification, we find a negative relationship between tariffs and the ALRP price wedge. However, once we look within a product, or within a firm-product pair, we find the expected positive relationship. \(^{40}\) A one percentage point increase in the tariff increases the price wedge by 0.55 to 0.57 percentage points.

The results presented in this section provide evidence that taxes and tariffs matter for transfer pricing by multinationals. Even for products with a narrowly defined CUP available within the firm, we find that lower taxes and higher tariffs increase the gap between arm’s length and related party prices.

6.3. Multivariate results

In this section we present multivariate specifications that incorporate combinations of firm, product and country characteristics. Results are reported in Table 7. Columns two to four present OLS regressions including Michigan WTD tax rates and product fixed effects with each of the three market structure variables, firm size, firm export share and firms per product-

\(^{40}\) These results suggest that, within a country, high tariff products are those with low wedges – possibly because of low market power.
country respectively. In each case the measure of market structure has the expected sign and is statistically significant at the 1 percent level. Firm size and firm export share are positively correlated with the price wedge while the count of firms per product-destination country is negative. In every specification, destination-country tax rates are negatively associated with the arms’ length price wedge; coefficients are large in magnitude and are statistically significant at the 1 percent level.

In columns five to seven we add the tariff measure to the base OLS specification including product fixed effects. As before the sample size is substantially reduced when tariffs are added. However, our findings on market structure and taxes are unchanged. Firm size, export share and the number of exporters continue to be significantly correlated with the price wedge and in the cases of firm size and the number of exporters the magnitude of the coefficient is substantially larger. We continue to find that the price wedge is negatively and significantly associated with the tax rate. Tariffs enter with the expected positive sign. The coefficients on tax rates and tariffs are of a comparable order of magnitude as predicted by the theoretical framework; a decrease in the corporate tax rate or an increase in the tariff rate of one percentage point increases the gap between arm’s length and related party prices by 0.55 to 0.78 percent.

The coefficients reported here correspond to substantial price differences across firms and countries. A one standard deviation increase in log employment corresponds to an increase of the price wedge by 2.4 percent. A one standard deviation increase in firm export share is associated with a 4.6 percent rise in the price wedge, while increasing the number of firms exporting in a product to a country by a standard deviation decreases the price wedge by 11.1 percent. The difference in maximum corporate tax rates between Mexico (35%) and Chile (15%) corresponds to a 12.1 percent increase in the price wedge (column 4). For handheld computers (HS 847130), the difference in import tariffs between Canada (no tariff) and Brazil (22 percent) corresponds to a 12.2 percent increase in the price wedge (column 4).

6.4. Exchange Rates and the Price Wedge

This section examines how exchange rates affect prices set by multinational firms to their arm’s length and related party customers. There is a large body of research on pricing-to-market by exporters, see Knetter (1989, 1993) and the survey in Goldberg and Knetter (1997). This literature has focused on the interaction of firm pricing (i.e., market) power and changes in the real exchange and generally concludes that firms ‘price-to-market’, i.e. their prices partially offset exchange rate movements.41 For the most part the pricing-to-market literature has been silent on whether the international structure of the firm shapes price responses to exchange

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41 Goldberg and Knetter (1997) find that the typical response is on the order of 50 percent, i.e. half of the exchange rate change shows up in the destination market price.
rates. An exception is Rangan and Lawrence (1993) who argue that the presence of intrafirm exports by U.S. multinationals and their low price responsiveness explains low U.S. aggregate export price responsiveness during the dollar decline in the late 1980s. 42 We use the matched transactions and the ALRP price wedge to test whether U.S.-based multinationals change their prices differently for arm’s length and related party customers.

The basic framework in the pricing-to-market literature can be directly applied to the effect of exchange rates on arm’s length prices in our theoretical framework. In response to a dollar (home currency) appreciation, the home affiliate will lower dollar-based prices to the arm’s length customer. The degree of the price reduction depends on the demand elasticity in the foreign market. In contrast, the internal transfer price set by the firm is much less sensitive to the appreciation, as is seen in Figure 1; the foreign affiliate sees an increase in its marginal cost (the foreign currency price of the intermediate rises) and responds by raising its final good price thus lowering quantity demanded. In the absence of tax differences or tariffs, the ALRP wedge will fall by the amount of the change in the arm’s length price. If there are tax differences between the countries or in the presence of a tariff, the firm will have an incentive to adjust its tax transfer price. In the case of linear final good demand, we see that the adjustment of the tax transfer price is greater than the arm’s length price leading to a positive expected sign of the relationship between the exchange rate and the price wedge.

6.5. Empirical Evidence

Table 8 adds the log of real exchange rate to the specification with tax, tariff, and number of exporters in column 6 of Table 7. The real exchange rate is defined in units of foreign currency per US dollar and the value for month \( m \), \( \ln RER_m \), is the rate on the last day of the month before the trade transaction. Column two uses the WTD marginal rate as the tax variable while column three uses the BEA average tax rate.

In both cases we see a significant response of the price wedge to the real exchange rate. A one percent appreciation of the dollar results in a 0.19 percent reduction in the price wedge. These results provide the first evidence that multinationals differentially adjust their prices inside and outside the firm in response to exchange rate movements. Changes in the exchange rate result in relatively larger movements of arm’s-length prices than of intra-firm prices suggesting that intra-firm trade may provide multinationals with a means to insulate themselves from exchange rate shocks.

\(^{42}\)Clausing (2003) reports the opposite result, i.e., that prices for intrafirm exports respond much more strongly to an exchange rate change (no pass-through of the exchange rate change to the price in the foreign currency) than do prices of arm’s length transactions (65 percent pass-through). Adding controls for GDP and GDP per capita, Clausing (2003) finds an unexpected significantly positive response of arm’s length export prices to a dollar appreciation.
7. Conclusions

Multinational firms based in the U.S. report large differences in prices for arm’s length and related party exports. These differences exist even for the same product produced by the same firm shipped to the same country in the same month by the same mode of transport. Following the development of a simple theoretical framework we find that the price wedge between arm’s length and intrafirm prices responds to differences in market structure, taxes, and tariffs.

Commodity products show much smaller price wedges while those for differentiated products are large, averaging over 73 percent. Similarly, firms with characteristics indicating greater market power, i.e., larger firms and firms with bigger export shares, have larger price differences. Looking across countries, we find the price wedge is larger when the number of exporting firms is smaller.

Much of the interest in transfer pricing centers on the behavior of firms in response to taxes and tariffs. We find significant differences in price wedges for the same product in countries with different tax and tariff rates. Lower corporate taxes and higher tariffs are associated with larger gaps between the arm’s length and related party prices.

Our results suggest that transfer pricing may be playing an important role in aggregate national accounting, potentially reducing the reported value of exports and the current account (and thus GDP). The response of the price wedge to tax rates indicates that tax minimization may be an important part of transfer pricing decisions with consequences for the level of corporate tax revenue and strategic responses to changes in the tax code.

This paper also provides some of the first evidence on the effect of exchange rates on pricing decisions inside and outside the firm. The price wedge responds to movements in the real exchange rate: an appreciation of the dollar is associated with a substantial narrowing of the wedge. This result supports the hypothesis that intrafirm trade plays a role in the determination of aggregate export price indices. More importantly, this suggests that intrafirm trade may play a role in insulating multinationals from exchange rate movements.

Our findings also are important for future research on the role of the multinational corporation in both advanced and developing economies. The sizable gap in prices may be playing an unobserved role in the perceived performance advantage of multinational firms both at home and abroad.
References


Business Week. 2005. Profits Head Homeward, But where are the Jobs?. Michael Arndt, August 1, p.34.


A Appendix - Parameters for the Numerical Model

Parameters for the baseline model are:

- \( Q_{al} = 1000 - 5S_{al} \)
- \( Q_f = 1000 - 5S_f \)
- \( \tau = 0.05 \)
- \( t_h = 0.35 \)
- \( t_f = 0.20 \)
- \( c = 50 \)
- \( e = 1 \)
- \( \theta = 0.0005 \)

B Appendix - The Export Customs Form

Figure 2 displays the Shipper’s Export Declaration (SED) form that accompanies each export transaction in the United States. As noted in the guidelines for filling out this form posted on the web\(^43\):

- A separate SED is required for each shipment per U.S. Principal Party of Interest (USPPI), including each rail car, truck, ocean vessel, airplane, or other vehicle.

- A shipment is defined as all merchandise sent from one USPPI to one foreign consignee, to a single foreign country of ultimate destination, on a single carrier, on the same day.

- Where two or more items are classified under the same Harmonized System product code, the product code appears only once on the SED with a single quantity, shipping weight, and value, unless a validated license requires otherwise or the shipment consists of a combination of foreign and domestic merchandise classified under the same product code.

- Shipments involving multiple invoices or packages must be reported on the same SED.

\(^{43}\)See http://www.census.gov/foreign-trade/regulations/forms/correct-way-to-complete-the-sed.pdf.
## Table 1: Exports and Related-Party Exports by Two-Digit HS Category

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</tr>
</thead>
<tbody>
<tr>
<td>01-05 Animal &amp; Animal Products</td>
<td>340</td>
<td>0.121</td>
<td>0.087</td>
<td>0.017</td>
<td>0.013</td>
<td>87</td>
</tr>
<tr>
<td>06-15 Vegetable Products</td>
<td>495</td>
<td>0.152</td>
<td>0.167</td>
<td>0.055</td>
<td>0.032</td>
<td>56</td>
</tr>
<tr>
<td>16-24 Foodstuffs</td>
<td>402</td>
<td>0.312</td>
<td>0.226</td>
<td>0.038</td>
<td>0.030</td>
<td>134</td>
</tr>
<tr>
<td>25-27 Mineral Products</td>
<td>211</td>
<td>0.140</td>
<td>0.157</td>
<td>0.028</td>
<td>0.016</td>
<td>51</td>
</tr>
<tr>
<td>28-38 Chemicals &amp; Allied Industries</td>
<td>1,079</td>
<td>0.427</td>
<td>0.444</td>
<td>0.090</td>
<td>0.110</td>
<td>45</td>
</tr>
<tr>
<td>39-40 Plastics / Rubbers</td>
<td>281</td>
<td>0.461</td>
<td>0.385</td>
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Notes: First column reports the number of ten-digit Harmonized System (HS) exports products in 2000 by two-digit prefixes; they total to 8,572. Second and third columns report the share of related-party activity by two-digit categories and the the share of that product category in total U.S. exports, by year. Fourth column reports the mean high minus low tariff rate in percentage points across products in the noted two-digit HS categories.
Table 2: Country Tax Rates

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<th>BEA</th>
<th>Country</th>
<th>WTD</th>
<th>BEA</th>
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<th>WTD</th>
<th>BEA</th>
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Table reports maximum statutory corporate tax rate (WTD) from the Michigan World Tax Database and the effective tax rate (BEA) from the Bureau of Economic Analysis for each country in 2000.
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<th>Bins Within Which Arm's Length Prices Are Averaged</th>
<th>Mean</th>
<th>Std Dev</th>
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<tr>
<td>Within product, month</td>
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<td>2.51</td>
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<tr>
<td>Within product, month, country</td>
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<td>2.39</td>
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<tr>
<td>Within product, month, country, transport mode</td>
<td>1.28</td>
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<td>Within product, month, country, transport mode, firm</td>
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Notes: Table displays mean and standard deviation of log difference of firms arm’s length and related party unit values. Each row reports statistics for successively more refined bins for comparing arm’s length and related party prices. The set of observations related party observations used in each row (3,360,281) is held constant.

Table 3: Mean Log Difference (i.e., Wedge) Between Arm’s Length and Related Party Prices
Table 4: Product Characteristics and the Price Wedge

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<th>Method for Assessing Product Differentiation</th>
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<th>Rauch Liberal</th>
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<td>Differentiated</td>
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<tr>
<td>Other</td>
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Notes: Table reports OLS regression results of the log difference in firms’ arm’s length and related party prices on a constant and a dummy for differentiated products. The first column divided products into three categories: commodity (two-digit HS categories 01-21, 25-29), differentiated (two-digit HS categories 84-97) and other (all remaining two-digit HS categories). For the second and third columns commodity and reference price groups given by Rauch (1999) are combined. Standard errors are adjusted for clustering at the product level (6767 clusters).
Table 5: Firm and Market Characteristics and the Price Wedge

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</tbody>
</table>

Notes: Table reports OLS regression results of the log difference in firms’ arm’s length and related party prices on noted covariates. Standard errors are robust to clustering (firm-year in columns two and three, firm-product-year in all other columns). Constant is suppressed. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively. *Coefficients and standard errors for exporters per product-country have been multiplied by 100 to increase readability.
### Table 6: Country Characteristics and the Price Wedge

<table>
<thead>
<tr>
<th>Variable</th>
<th>Price Wedge</th>
<th>Price Wedge</th>
<th>Price Wedge</th>
<th>Price Wedge</th>
<th>Price Wedge</th>
<th>Price Wedge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax Rate (WTD)</td>
<td>-3.951 ***</td>
<td>-1.882 ***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.703</td>
<td>0.514</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax Rate (BEA)</td>
<td></td>
<td></td>
<td>-0.509</td>
<td>-0.630 ***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.345</td>
<td>0.225</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tariff Rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.549 **</td>
<td>0.573 ***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.236</td>
<td>0.190</td>
</tr>
<tr>
<td>Fixed Effects</td>
<td>No</td>
<td>Product</td>
<td>No</td>
<td>Product</td>
<td>No</td>
<td>Product</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.01</td>
<td>0.13</td>
<td>0.00</td>
<td>0.15</td>
<td>0.00</td>
<td>0.11</td>
</tr>
<tr>
<td>Observations</td>
<td>2,982,223</td>
<td>2,982,223</td>
<td>2,244,318</td>
<td>2,244,318</td>
<td>1,397,880</td>
<td>1,397,880</td>
</tr>
</tbody>
</table>

Note: Table reports OLS regression results of the log difference in firms' arm's length and related party prices on noted covariates. Standard errors are robust to clustering (country-year for both types of tax rates, product-country-year in for tariff rates). Constant is suppressed. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.
### Table 7: Firms, Countries and the Price Wedge

<table>
<thead>
<tr>
<th>Covariate</th>
<th>Price Wedge 1</th>
<th>Price Wedge 2</th>
<th>Price Wedge 3</th>
<th>Price Wedge 4</th>
<th>Price Wedge 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln Employment</td>
<td>0.018 ***</td>
<td>0.001</td>
<td>0.014 ***</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Firm Export Share</td>
<td>0.0030 ***</td>
<td>0.0001</td>
<td>0.0021 ***</td>
<td>0.0001</td>
<td></td>
</tr>
<tr>
<td>Exporters per Product-Country&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.0067 ***</td>
<td>0.0003</td>
<td>-0.0137 ***</td>
<td>0.0005</td>
<td></td>
</tr>
<tr>
<td>Tax Rate (WTD)</td>
<td>-2.093 ***</td>
<td>-1.983 ***</td>
<td>-1.990 ***</td>
<td>-0.782 ***</td>
<td>-0.739 ***</td>
</tr>
<tr>
<td>Tariff</td>
<td>0.031</td>
<td>0.031</td>
<td>0.032</td>
<td>0.048</td>
<td>0.048</td>
</tr>
<tr>
<td>Fixed Effects</td>
<td>Product</td>
<td>Product</td>
<td>Product</td>
<td>Product</td>
<td>Product</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.18</td>
<td>0.19</td>
<td>0.18</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>Observations</td>
<td>2,201,861</td>
<td>2,201,861</td>
<td>2,201,861</td>
<td>1,283,550</td>
<td>1,283,550</td>
</tr>
</tbody>
</table>

Notes: Table reports OLS regression results of log difference in firms’ arm’s length and related party prices on noted covariates. Tax rate is the statutory maximum rate from the Michigan World Tax Database. Robust standard errors noted below each coefficient. Coefficients for product fixed effects are suppressed. ***, **, and * represent statistical significance at the 1%, 5% and 10% levels, respectively. *Coefficients and standard errors for exporters per product-country have been multiplied by 100 to increase readability.
## Table 8: Exchange Rates and the Price Wedge

<table>
<thead>
<tr>
<th></th>
<th>Price Wedge</th>
<th>Price Wedge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exporters per Product-Country&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.014 ***</td>
<td>-0.014 ***</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Tax Rate (WTD)</td>
<td>-0.582 ***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.049</td>
<td></td>
</tr>
<tr>
<td>Tax Rate (BEA)</td>
<td></td>
<td>-0.354 ***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.024</td>
</tr>
<tr>
<td>Tariff Rate</td>
<td>0.568 ***</td>
<td>0.496 ***</td>
</tr>
<tr>
<td></td>
<td>0.021</td>
<td>0.021</td>
</tr>
<tr>
<td>Log Real Exchange Rate</td>
<td>-0.191 ***</td>
<td>-0.187 ***</td>
</tr>
<tr>
<td></td>
<td>0.022</td>
<td>0.022</td>
</tr>
</tbody>
</table>

Notes: Table reports OLS regression results of log difference in firms' arm's length and related party prices on noted covariates. First tax rate is the statutory maximum rate from the Michigan World Tax Database. Second tax rates is the effective tax rate according to BEA data. Robust standard errors noted below each coefficient. Coefficients for product fixed effects as well as regression constant are suppressed. ***, **, and * represent statistical significance at the 1%, 5% and 10% levels, respectively. <sup>a</sup>Coefficients and standard errors for first covariate have been multiplied by 100 to increase readability.
Figure 1: Taxes, Tariffs, Exchange Rates, Demand Elasticities and the Price Wedge - Numerical Solutions with Linear Demand
**Figure 2: Shipper’s Export Declaration Form**
Figure 3: Distribution of U.S. Exports Across Firms in 2000

Figure 4: U.S. Exports by Multinationals and Arms-Length Exporters in 2000