

# TRANSFER PRICING BY U.S.-BASED MULTINATIONAL FIRMS\*

Andrew B. Bernard<sup>†</sup>

*Tuck School of Business at Dartmouth & NBER*

J. Bradford Jensen<sup>‡</sup>

*Institute for International Economics*

Peter K. Schott<sup>§</sup>

*Yale School of Management & NBER*

---

August, 2006

---

## Abstract

This paper examines how prices set by multinational firms vary across arm's-length and related-party customers. Comparing prices within firms, products, destination countries, modes of transport and month, we find that the prices U.S. exporters set for their arm's-length customers are substantially larger than the prices recorded for related-parties. This price wedge is smaller for commodities than for differentiated goods, is increasing in firm size and firm export share, and is greater for goods sent to countries with lower corporate tax rates and higher tariffs. We also find that 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 trade, Arm's-length sales, Tariffs, Market structure, Pricing-to-market

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

---

---

\*The authors would like to thank Gary Hufbauer and Richard Sansing for helpful comments as well as seminar participants at IIE, FIEF, NBER, Princeton, Toronto, Wisconsin and Yale. Special thanks to Jim Davis for timely help when it counted and to Evan Gill for research assistance. Bernard and Schott (SES-0241474) and Jensen (SES-0552029) thank the National Science Foundation for research support. The research in this paper was conducted while the authors were Special Sworn Status researchers of the U.S. Census Bureau at the Boston Census Research Data Center and the Center for Economic Studies. Results and conclusions expressed are those of the authors and do not necessarily reflect the views of the Census Bureau or the NBER. This paper has been screened to insure that no confidential data are revealed.

<sup>†</sup>100 Tuck Hall, Hanover, NH 03755, USA, *tel:* (603) 646-0302, *fax:* (603) 646-0995, *email:* andrew.b.bernard@dartmouth.edu

<sup>‡</sup>1750 Massachusetts Avenue, Washington, DC, 20036-1903, *tel:* (202) 328-9000, *email:* jbjensen@iie.com

<sup>§</sup>135 Prospect Street, New Haven, CT 06520, USA, *tel:* (203) 436-4260, *fax:* (203) 432-6974, *email:* peter.schott@yale.edu

## 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 developed below, these data show that there is a large positive gap between firms’ internal and external prices. The size of this price wedge varies systematically with product differentiation, firms’ market power and destination-countries’ corporate tax rates and import tariffs.

U.S. exports are highly concentrated among a relatively small number of firms. The top 1 percent of exporters represent 0.03 percent of the total number of firms in the United States but account for more than 80 percent of the value of exports and employ more than 11 percent of all private-sector workers. Among large exporters, U.S.-based multinationals, i.e., U.S.-owned multinationals or local affiliates of foreign-owned multinationals, are dominant, controlling more than 90 percent of total U.S. exports.<sup>1</sup> 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.<sup>2</sup>

The prominence of multinational firms in international trade has stimulated a large body of research attempting to explain what goods they produce, where they locate production and how they respond to incentives and policies enacted by national and sub-national governments. Their potential use of “transfer” pricing for related-party transactions has, in particular, drawn widespread attention from practitioners as well as academics.<sup>3</sup> Given the large volume of U.S. and global trade that takes place within multinationals, the potential impact of transfer pricing is substantial, having the ability to influence official trade statistics, national accounts aggregates and estimates of inflation and productivity growth via its effect on import and export price indexes.<sup>4</sup>

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.<sup>5</sup> Financial motivations encompass the minimization of corporate tax and tariff payments as well as the avoidance of foreign exchange controls or other restrictions on cross-border capital movements. Because obtaining direct evidence on the pricing behavior of multinationals is extremely difficult, existing empirical studies generally rely

---

<sup>1</sup>U.S.-based multinationals that export 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.

<sup>2</sup>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).

<sup>3</sup>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).

<sup>4</sup>U.S. import and export price indexes are currently constructed by the Bureau of Labor Statistics using prices 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).

<sup>5</sup>“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).

upon indirect evidence or responses in a narrowly defined industry.<sup>6</sup>

The data employed in this paper are derived from point-of-export customs documents tracking every U.S. international export transaction occurring between 1993 and 2000 inclusive. For each export shipment that leaves the United States, these documents record the identity of the exporter, the Harmonized System product classification and date of 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”. These data provide researchers the first opportunity to observe key features of multinational-firm activity. Our focus in this paper is on the wedge between multinational firms’ arm’s-length and related-party prices (i.e., unit values) and the extent to which this wedge varies with product and firm characteristics, market structure and government policy.

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 43 percent higher than the related-party price. Product characteristics are influential in determining this gap. While the wedge for commodities (i.e., undifferentiated goods) averages 8.8 percent, the gap for differentiated goods is 66.7 percent. Firm and market attributes are also influential: the difference between arm’s-length and related-party prices are higher for goods shipped by larger firms, by firms with higher export shares, and by firms in product-country markets served by fewer exporters.

Consistent with incentives to minimize taxation and import duties, we find that the wedge between arm’s-length and related-party prices is negatively associated with destination-country corporate tax rates and positively associated with destination-country import tariffs. For each one percentage point reduction in the foreign tax rate we find an increase in the price wedge of 0.56 to 0.66 percent. A one percentage point increase in the foreign customs duty increases the price wedge by 0.56 to 0.60 percent. These results show that multinational firms make substantial price adjustments to variation in country tax and tariff rates. Back-of-the-envelope calculations suggest that pricing responses to tax rate differences across countries led to \$5.5 billion in lower U.S. corporate tax revenues and a \$15 billion increase in the merchandise trade deficit in 2004.

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.<sup>7</sup> Here, we find that the price gap between firms’ arm’s-length and related-party prices varies negatively with countries’ real exchange rates, suggesting that multinationals adjust their arm’s-length and related-party prices asymmetrically in response to exchange rate shocks.<sup>8</sup> Coefficient estimates imply that a ten percent appreciation of the dollar against the destination currency reduces the price gap by approximately 2 percent.

The relatively large wedge we find between firms arm’s-length and related-party prices has intriguing implications for how multinational performance should be evaluated. Existing comparison of multinationals with purely domestic firms generally find that they are larger, more

<sup>6</sup>For exceptions, see the discussion of Lall (1973), Swenson (2001) and Clausing (2003) in the next section.

<sup>7</sup>See, for example, the survey by Goldberg and Knetter (1997).

<sup>8</sup>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.

innovative, exhibit higher productivity, pay higher wages and employ greater numbers of skilled or educated workers.<sup>9</sup> Few, if any, of these studies, however, contemplate the influence of transfer pricing, a potentially important omission given that affiliates' ability to purchase lower-priced intermediate inputs from overseas parents may influence all of these measures of performance.

The remainder of the paper proceeds as follows. We start by briefly surveying the large existing literature on transfer pricing. 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, 7 and 8. Section 9 concludes.

## 2. Existing Research on Transfer Pricing

There are large theoretical and empirical literatures on transfer pricing by multinational firms.<sup>10</sup> Theoretical research considers two major topics: managerial and economic incentives in multidivisional 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.<sup>11</sup> 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 more recent papers analyzes decentralization of 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.<sup>12</sup> The model we develop below is a generalization of this two-price approach.

The empirical literature on transfer pricing focuses almost exclusively on the relationship between corporate tax and import tariff rates and multinational firms' over- or under-invoicing in international trade. 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<sup>13</sup> or whether economic activity varies across locations<sup>14</sup>. Hines (1997) provides a survey of this literature, which typically finds a negative correlation between tax rates and firm profitability. To our knowledge none of the empirical papers consider the role of product characteristics or firm market power in the transfer pricing decision.

---

<sup>9</sup>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 United Kingdom.

<sup>10</sup>A search on Econlit using the keywords "transfer pricing" and "multinational" yields 66 peer-reviewed journal articles and 10 books.

<sup>11</sup>Eden (1998) also provides substantial coverage of non-academic evidence on the extent of transfer pricing and tax minimization by multinationals.

<sup>12</sup>Halperin and Srinidhi (1991) and Narayanan and Smith (2000) also allow for decentralized decision-making in models with a single transfer price.

<sup>13</sup>See, for example, Jenkins and Wright (1975), Bernard and Weiner (1990), Harris et al. (1993), Klassen et al. (1993) and Collins et al. (1996).

<sup>14</sup>See, for example, Bartelsman and Beetsma (2003), who look at income shifting among OECD countries.

### 2.1. *Price-based studies*

Very few studies of transfer pricing use 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 in Colombia during the 1960s gave multinational firms an incentive to raise their intrafirm prices above the arm's-length level as a 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, Lall finds that related-party prices ranged 33 to 300 percent higher than arm's-length prices.<sup>15</sup>

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), using annual U.S. import data for five countries during the 1980s, analyzes the response of average unit values across all (unobserved) transactions within country-product pairs to variations in U.S. import tariffs and foreign tax rates. She finds evidence that changes in prices are consistent with incentives based on taxes and tariffs but that the economic magnitudes are small.<sup>16</sup>

Clausing (2003) uses data on import and export product prices collected by the Bureau of Labor Statistics (BLS) from 1997 to 1999 to investigate the effect of country corporate tax rates 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 0.9 to 1.8 percent.<sup>17</sup>

### 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.<sup>18</sup> 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.<sup>19</sup> 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. Excess foreign tax credits cannot be used to offset firm's tax liabilities on domestic income in

---

<sup>15</sup>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.

<sup>16</sup>These results may be influenced by the fact that 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.

<sup>17</sup>Prices are imputed for 42 percent of Clausing's (2003) transactions, and firm and product identifiers are unavailable. As a result, firm- or product-specific variation in prices cannot be examined.

<sup>18</sup>This section draws on the discussion in Hines (1997).

<sup>19</sup>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.

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.<sup>20</sup> 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.<sup>21</sup>

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.<sup>22</sup> 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 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, exchange rates 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.

---

<sup>20</sup> Estimates of profits to 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).

<sup>21</sup> 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.

<sup>22</sup> See Hines (1997) for a survey of the literature on the location of multinational activity.

### 3.1. A model of transfer pricing

Our basic setup is straightforward and extends the framework developed in Hyde and Choe (2005). The extensions include the introduction of downstream firms, tariffs, and exchange rates, as well as a penalty function for tax minimization that depends upon the difference between firms' arm's-length and related-party prices.<sup>23</sup>

We consider a multinational with two divisions: a home ( $h$ ) office and a foreign ( $f$ ) affiliate. The home division produces an intermediate good which is sold at arm's-length (quantity  $Q_{al}$ ) to an unrelated 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.<sup>24</sup> 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 purchase of quantity  $Q_{al}$  for price  $P_{al}$  by the arm's-length foreign firm is 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 arm's-length foreign firm in turn sells the goods for price  $S_{al}$  in the foreign market in foreign currency. After-tax profit of the foreign arm's-length firm is given by

$$\pi_{al} = (1 - t_f)(S_{al}Q_{al} - (1 + \tau)eP_{al}Q_{al}) \quad (1)$$

$$\text{where } S_{al} = (1 + \tau)eP_{al}. \quad (2)$$

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

Pre-tax profits for the two divisions of the multinational are given by

$$\tilde{\pi}_h = P_{al}Q_{al} + P_{in}Q_f - c(Q_f + Q_{al}) \quad (3)$$

$$\tilde{\pi}_f = S_fQ_f - eP_{in}Q_f - \tau eP_{tx}Q_f \quad (4)$$

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 and customs authorities, and  $S_f$  is the price faced by the final customer of the foreign affiliate. The constant marginal cost of production is given by  $c$ .<sup>25</sup>

Taxable income for each division of the multinational is given by

$$I_h = P_{al}Q_{al} + P_{tx}Q_f - c(Q_f + Q_{al}) \quad (5)$$

$$I_f = S_fQ_f - (1 + \tau)eP_{tx}Q_f. \quad (6)$$

<sup>23</sup>In Hyde and Choe (2005), the government compares firm's arm's-length prices to an exogenous benchmark.

<sup>24</sup>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.

<sup>25</sup>The appropriate marginal cost for tax purposes would include non-production components such as interest and depreciation changes. For sales to the arm's-length customer we assume that the importing firm pays the tariff. Ernst and Young (2003) report that 75 percent of U.S. multinationals consider the customs and VAT implications of their transfer pricing policies.

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

$$\pi_h = \tilde{\pi}_h - t_h I_h = (1 - t_h) [P_{al} Q_{al} - c(Q_f + Q_{al})] + (P_{in} - t_h P_{tx}) Q_f \quad (7)$$

$$\pi_f = \tilde{\pi}_f - t_f I_f = (1 - t_f) [S_f Q_f] - (e P_{in} + (\tau - t_f (1 + \tau)) e P_{tx}) Q_f \quad (8)$$

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

The arm's-length foreign 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 as well as the demand it faces in the foreign market, summarized by the elasticity,  $\mu_{al}$ , yielding a standard markup over cost,

$$S_{al} = \frac{\mu_{al}}{\mu_{al} + 1} e (1 + \tau) P_{al}. \quad (9)$$

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 affiliate chooses the quantity to sell given the foreign tax, incentive transfer prices, tariffs and the elasticity of demand it faces in the foreign market,  $\mu_f$ :

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

After-tax profits for the parent firm are given by

$$\begin{aligned} \pi_p = & (1 - t_h) [P_{al} Q_{al} - c(Q_f + Q_{al})] + (1 - t_f) \frac{1}{e} [S_f Q_f] \\ & + (t_f (1 + \tau) - (\tau + t_h)) P_{tx} Q_f. \end{aligned} \quad (11)$$

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 transfer price. Similarly, a positive tariff rate will also induce the firm to minimize the reported transfer price.<sup>26</sup>

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 consider the case where  $t_h > t_f$  and augment the profit function with a penalty function,

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

that is increasing in the price difference between arm's-length and tax-transfer prices and the quantity shipped intrafirm. The exogenous parameter,  $\theta \in (0, 1)$ , indicates that the firm does

<sup>26</sup>If 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.



not expect to repay the entire difference in the revenue streams. This penalty function captures the idea that the domestic tax authority focuses on the foregone tax revenue from intrafirm sales.<sup>27</sup>

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

$$\begin{aligned} \pi_p = & (1 - t_h) [P_{al}Q_{al} - c(Q_f + Q_{al})] + (1 - t_f) \frac{1}{e} [S_f Q_f] \\ & + (t_f(1 + \tau) - (\tau + t_h)) P_{tx} Q_f - \frac{1}{2} \theta (P_{al} Q_f - P_{tx} Q_f)^2. \end{aligned} \quad (12)$$

The firm chooses  $(P_{al}, P_{in}, P_{tx})$  yielding first-order conditions:

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

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

$$\begin{aligned} P_{tx} : & \frac{\partial Q_f}{\partial P_{tx}} [P_{in} - (1 - t_h) c - t_h P_{tx} - \theta Q_f (P_{al} - P_{tx})^2] \\ & + [t_f(1 + \tau) - \tau - t_h] Q_f + \theta (P_{al} - P_{tx}) Q = 0 \end{aligned} \quad (15)$$

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

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

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,

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

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

$$(P_{al} - P_{tx}) \theta Q_f = t_h - t_f + \tau (1 - t_f). \quad (18)$$

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 increase the price difference as do increases in the tariff. The larger the quantity

<sup>27</sup> Alternatively, the penalty function could be modeled as the outcome of strategic choices by both the firm and the tax authority. See Graetz et al. 1986 and De Waegenare et al. 2005.

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 does not yield closed-form solutions for either linear or constant-elasticity of substitution demand. As a result, we solve the model numerically.<sup>28</sup> Figure 3 displays the relationship between the price wedge and underlying parameters assuming linear demand. In the Figure, the price wedge is defined as the log difference between the arm’s-length and related-party prices, e.g.,  $\ln(P_{al}) - \ln(P_{tx})$ . Appendix A describes the parameterization of the model.

As indicated in the first two panels, the price wedge is decreasing in the foreign tax rate and increasing in the foreign tariff. The final panel reveals a positive relationship between the price wedge and movements in the foreign exchange rate. While the multinational reduces all three of its prices as the exchange rate increases, the transfer price falls faster than the arm’s-length price. The difference between the arm’s-length price and the incentive price narrows dramatically as the exchange rate rises.

We use the framework developed in this section as a guide for empirical analysis. 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 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, for example, 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.<sup>29</sup> This dataset has two components. The first, 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”.<sup>30</sup> “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

---

<sup>28</sup>Numerical solutions are obtained via Mathematica. The code for obtaining solutions is available from the authors upon request.

<sup>29</sup>See Bernard et al. (2005) for a description of the LFTTD and its construction.

<sup>30</sup>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.

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.<sup>31</sup> 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 1 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 2 shows that the concentration of U.S. exports is heavily influenced by the presence of multinational firms. In 2000, multinational 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

In this paper we use the LFTTD to focus on the export transactions of U.S.-based firms (as distinct from firms with U.S. nationality).<sup>32</sup> From the raw LFTTD we make two adjustments to create our estimation sample. First we eliminate firms with fewer than 10 transactions during 1993 to 2000 inclusive. Second we eliminate all transactions with missing, imputed or “converted” quantities to ensure that all the observations for a particular product are measured in comparable units and are actually recorded by the transacting firm. Depending on the year, these screens reduce the number of transactions in our sample by 12 to 20 percent relative to the raw data. For the remaining observations, we compute the export price as the unit value of the transaction, i.e., total value per unit quantity.<sup>33</sup>

---

<sup>31</sup>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.

<sup>32</sup>As discussed further below, the export data allow us to control for the identity of the exporting firm.

<sup>33</sup>Units vary by HS product, e.g. dozens of shirts or pairs of shoes.

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.<sup>34</sup> 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.<sup>35</sup> 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.<sup>36</sup> 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 (line 64) 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”.<sup>37</sup> The reported transfer price must be “consistent with the results

<sup>34</sup>See <http://www.bus.umich.edu/OTPR/otpr/introduction.htm> to view the dataset or a more detailed description of it.

<sup>35</sup>See [http://www.bea.doc.gov/bea/uguide.htm#\\_1\\_24](http://www.bea.doc.gov/bea/uguide.htm#_1_24) to view the dataset or a more detailed description of it.

<sup>36</sup>These data are available and described in greater detail on the web at <http://r0.unctad.org/trains/>

<sup>37</sup>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.”

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).<sup>38</sup> 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 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  $rp_{ficmt}$ .<sup>39</sup> 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,

$$cup_{ficmt} = \frac{1}{N} \sum_n al_{ficmt}^n, \quad (19)$$

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, roughly 4 million can be associated with our definition of a CUP. These matched transactions account for roughly one third 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,

$$wedge_{ficmt} = \ln cup_{ficmt} - \ln rp_{ficmt}. \quad (20)$$

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. Firms’ chosen mode of transport, for example, has been associated with variation in product quality, time sensitivity and other factors that might affect price (Harrigan 2005; Hummels and Skiba 2004).<sup>40</sup>

<sup>38</sup>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.

<sup>39</sup>Transport mode refers to whether the product is sent by air, ship or some other method.

<sup>40</sup>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 difference out product, time, country, mode-of-transport and firm effects, there remain unobservable attributes of the transactions that may vary across arm’s-length and related-party customers. While the HS classification is highly disaggregate, we do not have information on very detailed product characteristics or ancillary services (packaging, marketing, etc.) embedded in products or provided by exporters 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 priced 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 successively stringent dimensions of the data in Table 3. In each case, we find that U.S.-based exporters charge arm’s-length customers higher prices for their products than related-party customers.

As indicated in the final row of the table, the mean ALRP wedge for CUPs within products, months, countries, modes of transport and firm as defined in equation 20, is 0.43 log points. The mean wedge in the penultimate row of the table, which pools across firms within products, months, countries and modes of transport to define the CUP, is nearly three times larger, at 1.13 log points. For CUPs defined “just” within products, months and countries, the mean wedge is 1.92 log points, or almost five times larger.

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 may have little opportunity to shift profits between affiliates without risking offending one of the relevant tax authorities.<sup>41</sup> 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 to 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.<sup>42</sup> 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

---

<sup>41</sup> Similarly, it is plausible that firms find it easier to justify differences between arm’s-length and related-party prices for custom-tailored, i.e., differentiated, goods than commodities.

<sup>42</sup> 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).

price wedge for commodity products ranges from 8.8 log points using the HS-based classification to 17.6 log points using the conservative Rauch system. The price wedge for differentiated goods, by contrast, is 66.7 log points according to the HS-based system and 52.8 log points 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 43 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 destination-country tax rates and destination-country product-level import tariff rates as well as proxies of product differentiation and firm market power.

### 6.1. 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 first and second columns of Table 5 report the results using statutory maximum tax rates from the Michigan World Tax Database. Column one reports results with no fixed effects while column two includes products fixed effects. In both cases, as predicted by the model, we find large, statistically significant and negative coefficients for both specifications. Across the two specifications, a decrease of one percentage point in the tax rate is associated with an increase of the price wedge of 1.6 to 4.2 percent.

Using effective tax rates calculated from BEA data in columns three and four, we again find the expected negative relationship. The point estimates are smaller, 0.5 to 1.7, and are significant at the 1 and 5 percent levels, respectively.

The final two columns of Table 5 examine the role of tariffs on price differentials. In the model, 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.<sup>43</sup> A one percentage point increase in the tariff increases the price wedge by 0.60 to 0.63 percentage points.

The results presented in this section provide evidence that taxes and tariffs matter for transfer pricing by multinationals. Even for products with transactions matched very narrowly to a CUP, we find that lower taxes and higher tariffs increase the gap between arm's-length and related-party prices.

## 6.2. Market Structure, Taxes and Tariffs

In this section we examine the association between the ALRP wedge and market structure controlling for cross-country differences in corporate tax and tariff rates.

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; firm's share of U.S. exports in the product across all countries; and the number of U.S.-based firms exporting the product to a particular destination country during each 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.

Results are reported in Table 6. Columns one to three present OLS regressions including our proxies for market structure along with Michigan WTD tax rates and product fixed effects.<sup>44</sup> 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. 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 0.56 to 0.66 percent.

The coefficients reported here correspond to substantial price differences across firms and countries. Using the estimated coefficients, we find that a one standard deviation increase in log employment or firm export share corresponds to an increase of the price wedge by 2 percent, while increasing the number of firms exporting in a product to a country by a standard deviation decreases the price wedge by 0.1 percent. The difference in maximum corporate

<sup>43</sup>These results suggest that, within a country, high-tariff products are those with low wedges – possibly because of low market power.

<sup>44</sup>Results using the BEA effective tax rate are analogous and available from the authors upon request.



tax rates between Mexico (35%) and Chile (15%) corresponds to a 11.2 percent increase in the price wedge (column 1). 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 1).

To our knowledge, the results in Table 6 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.

### 6.3. 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 (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.<sup>45</sup> 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 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.<sup>46</sup> 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 lowers 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 3; 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 falls 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 has an incentive to adjust its tax transfer price. In the case of linear final good demand, 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.

Table 7 adds the log of real exchange rate to the specification with tax, tariff, and number of exporters in column four of Table 6. 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.

<sup>45</sup>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.

<sup>46</sup>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.

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, in contrast to the theoretical prediction of the model. The narrowing of the price wedge in response to a home currency appreciation suggests that incentive prices may be playing a stronger role than suggested in the theoretical framework.

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 intrafirm prices suggesting that intrafirm trade may provide multinationals with a means to insulate themselves from exchange rate shocks.

#### 6.4. *Robustness*

In this section we analyze the robustness of our results by allowing for two alternative formulations of the ALRP price wedge and including an additional country characteristic, per capita GDP. Results are reported in Table 8.

The first four columns of Table 8 examine the robustness of our results to two alternate definitions of comparable uncontrolled prices. As noted above, tax guidelines do not specify exactly how an arm’s-length based CUP is to be computed. Here, we consider price wedges relying upon a value weighted average of arm’s-length prices (columns one and two) and the median arm’s-length price (columns three and four), in both cases computing these CUPs within firms, products, countries, modes of transport and month. As noted in the table, the qualitative implications of our baseline results are supported. Both the weighted average price wedge and the median price wedge increase with our proxy for firms’ market power, and both are greater for goods sent to countries with lower corporate tax rates and higher tariffs.

Both tax rates and tariffs may be correlated with other country characteristics, in particular GDP per capita. The final two columns of Table 8 reveal that using our preferred measure of the ALRP price wedge, controlling for per capita GDP does not alter coefficient estimates on our variables of interest in any substantial way. The coefficient on per capita GDP itself varies from positive and statistically insignificant in the first column to negative and statistically significant in the second column.

## 7. **Implications**

The previous section documents substantial pricing responses by U.S.-based multinationals to both tax and tariff differences across countries. Here we calculate “back-of-the-envelope” estimates of the lost tax revenue for the U.S. Treasury and compute “transfer-price” adjustments to the reported value of U.S. merchandise exports and imports.

To estimate the magnitudes of these aggregate effects we ask how much larger U.S. exports would be and how much smaller U.S. imports would be if every trading partner had the same top marginal tax rate as the United States. We note that analysis requires a number of strong assumptions, in particular that firms would not adjust either destinations or quantities if countries altered their tax rates, and that import and export prices would respond symmetrically to these changes. We caution that our estimates are crude and should be taken as suggestive rather than definitive.

We estimate the magnitude of trade-flow adjustments to be

$$\begin{aligned}\text{Underreported export value}_c &= RPEX_c \cdot \hat{\beta} (UStax - tax_c) \\ \text{Overreported import value}_c &= RPIM_c \cdot \hat{\beta} (UStax - tax_c)\end{aligned}$$

where  $RPEX_c$  and  $RPIM_c$  are total reported values of related-party exports to and imports from country  $c$ , respectively,  $UStax_c$  and  $tax_c$  are the top marginal tax rates for the United States and country  $c$ , respectively, and  $\hat{\beta}$  is an estimated tax elasticity from the previous section. Our preferred estimate comes from Table 7, column 1. We compute the foregone tax revenue to the U.S. Treasury by assuming that all under- or over-reported trade would be subject to the top marginal U.S. corporate tax rate.

Our 2004 estimates of under-reported exports and over-reported imports for sixteen trading partners, accounting for three quarters of U.S. trade, are reported in the top and bottom panels of Table 9, respectively. Somewhat surprisingly, the magnitude of adjustment to exports, and the resulting tax loss, are relatively modest. Exports are estimated to be underreported by \$1.9 billion in 2004 with a corresponding tax loss of \$666 million. This small size of the tax loss is driven by the fact that the U.S. exports primarily to developed economies that have similar, or even higher corporate tax rates. Without the large value of related-party exports to Canada, the lost tax revenue rises to \$1.2 billion.<sup>47</sup>

The import numbers, shown in the bottom panel, are substantially larger. Related party imports are estimated to be inflated by over \$13 billion with a corresponding loss to the U.S. Treasury of \$4.8 billion. The disparity between the export numbers and the import numbers is driven by the differences in sources and destinations. Imports are more likely to come from countries with relatively low corporate tax rates.

## 8. 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 67 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 minimiza-

---

<sup>47</sup>The estimated tax losses are substantially larger if we use the point estimates from the median wedge regression in Table 8, column 5; \$4 billion for exports and \$29 billion for imports.

tion 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

- Aitken, Brian, Harrison, Ann, Lipsey, Robert E., 1996. Wages and foreign ownership: a comparative study of Mexico, Venezuela, and the United States. *Journal of International Economics* 40, 345–371.
- Baldenius, Tim, Nahum D. Melumad, and Stefan Reichelstein. 2004 Intergating Managerial and Tax Objectives in Transfer Pricing. *The Accounting Review* Vol. 79, No. 3, 591-615.
- Bartelsman, Eric, J, and Roel M.W.J. Beetsma. 2003. Why pay more? Corporate tax avoidance through transfer pricing in OECD countries. *Journal of Public Economics*. 87, 2225-2252.
- Bernard, Andrew B., J. Bradford Jensen and Peter K. Schott. 2005. Importers, Exporters and Multinationals: A Portrait of Firms in the U.S. that Trade Goods. NBER Working Paper 11404.
- Bernard, Jean-Thomas and Robert J. Weiner. 1990, Multinational corporations, transfer prices, and taxes: Evidence from the U.S. petroleum industry. in Assaf Razin and Joel Slemrod eds. *Taxation in the global economy* (Chicago: University of Chicago Press).
- Business Week. 2005. Profits Head Homeward, But where are the Jobs?. Michael Arndt, August 1, p.34.
- Capithorne, L.W. 1971. International corporate transfer prices and government policy. *Canadian Journal of Economics*. 4 (August): 324-341.
- Clausing, Kimberly A. 2003. Tax-motivated Transfer Pricing and US Intrafirm Trade Prices. *Journal of Public Economics*, 87, pp. 2207-2223
- Collins, Julie H., Deen Kemsley, and Mark Lang. 1998. Cross-jurisdictional income shifting and earnings valuation. *Journal of Accounting Research*.
- Criscuolo, Chiara, Jonathan E. Haskel and Matthew J. Slaughter, 2005. Global Engagement and the Innovation Activities of Firms. NBER Working Paper No. 11479 July.
- De Waegenaere, A., J. Wielhouwer, and R. Sansing. 2005. Who benefits from ambiguous multinational tax transfer pricing rules?. *Contemporary Accounting Research*, forthcoming.
- Diewert, W. Edwin, William F. Alterman, and Lorraine Eden. 2005. Transfer Prices and Import and Export Price Indices: Theory and Practice. Forthcoming in *Price and Productivity Measurement*, Volumes 1 and 2, ed.s W. Erwin Diewert, Bert M. Balk, Dennis Fixler, Kevin J. Fox, and Alice O. Nakamura, Trafford Press.
- Doms, Mark E. , and J. Bradford Jensen. 1998. Comparing wages, skills and productivity between domestically and foreign-owned manufacturing establishments in the United States. in R.E. Lipsey R.E. Baldwin and J.D. Richardson, ed.s. *Geography and Ownership as bases for economic accounting*. University of Chicago Press, 235-258.
- Economist, 2005. Taxing Times. April 8, 2005, *The Economist Global Agenda*.
- Eden, Lorraine. 1998. *Taxing Multinationals: Transfer Pricing and Corporate Income Taxation in North America*. University of Toronto Press, Toronto.

- Ernst and Young. 2003. Transfer Pricing 2003 Global Survey. available at [http://www.ey.com/global/content.nsf/UK/IT\\_-\\_Library](http://www.ey.com/global/content.nsf/UK/IT_-_Library)
- Feenstra, Robert C., John Romalis and Peter K. Schott. 2002. U.S. Imports, Exports and Tariff Data, 1989 to 2001. NBER Working Paper 9387.
- Goldberg, Pinelopi K. and Michael M. Knetter. 1997. Goods Prices and Exchange Rates: What Have We Learned? *Journal of Economic Literature*. Vol. XXXV (September), 1243-1272.
- Graetz, M., J. Reinganum, and L. Wilde. 1986. The tax compliance game: Toward an interactive theory of law enforcement. *Journal of Law, Economics, and Organization* 2 (Spring): 1-32.
- Halperin, Robert M., and Bin Srinidhi. 1987. The effects of U.S. income tax regulations' transfer pricing rules on allocative efficiency. *The Accounting Review*. 62 (October): 686-706
- Halperin, Robert M., and Bin Srinidhi. 1991. U.S. income tax transfer-pricing rules and resource allocation: The case of decentralized multinational firms. *The Accounting Review*. 66 (January):141-157.
- Harrigan, James. 2005. Airplanes and Comparative Advantage. NBER Working Paper No. 11688.
- Harris, David G., Randall Morck, Joel Slemrod, and Bernard Yeung. 1993. Income Shifting in U.S. Multinational Corporations. in Giovannini, Alberto; Hubbard, R. Glenn; Slemrod, Joel, eds, *Studies in International Taxation*. National Bureau of Economic Research Project Report. Chicago: University of Chicago Press, 277-302.
- Harris, David G. and Richard C. Sansing. 1998. Distortions caused by the use of arm's-length transfer prices. *The Journal of the American Taxation Association* (Spring):40-50.
- Helpman, Elhanan, Marc J. Melitz, and Stephen R. Yeaple. 2004. Export Versus FDI with Heterogeneous Firms. *American Economic Review*. 94(1), 300-316.
- Hines, James, R. 1997. Tax Policy and the Activities of Multinational Corporations. In Auerbach, A.J. (Ed.), *Fiscal Policy: Lessons from Economic Research*. MIT Press, Cambridge, pp. 401-445.
- Horst Thomas. 1971. The theory of the multinational firm: Optimal behavior under different tariff and tax rates. *Journal of Political Economy*. 79 (September/October): 1059-1072.
- Hummels, David L. and Alexander Skiba. 2004. Shipping the Good Apples Out: An Empirical Confirmation of the Alchian-Allen Conjecture. *Journal of Political Economy*. 112: 1384-1402.
- Hyde, Charles E. and Chongwoo Choe. 2005. Keeping Two Sets of Books: The Relationship Between Tax and Incentive Transfer Prices. *Journal of Economics, Management and Strategy*, March Vol. 14(1), pp.
- Jarmin, Ron S and Javier Miranda. 2002. The Longitudinal Business Database. *Economic Studies* 02-17, US Census.
- Jenkins, Glenn P., Jr. and Brian D. Wright. 1975. Taxation of income of multinational corporations: The case of the United States petroleum industry. *Review of Economics and Statistics*. 57, 1-11.

- Kaufman, D., A Kraay, and P Zoido-Lobaton. 2004. *Governance Matters*. World Bank, Washington, DC.
- Kemsley, Deen, 1995, The effect of taxes on the choice between exports and foreign production. Working Paper, Columbia University Business School.
- Klassen, Kenneth, Mark Lang, and Mark Wolfson, 1993, Geographic incoming shifting by multinational corporations in response to tax rate changes. *Journal of Accounting Research Supplement*, 31, 141-173.
- Knetter, Michael. 1989. Price Discrimination by U.S. and German Exporters. *American Economic Review*. March 79(1), 198-210.
- Knetter, Michael. 1993. International Comparisons of Pricing-to-Market Behavior. *American Economic Review*. June 83(3), 473-486.
- Lall, Sanjaya, 1973. Transfer-pricing by multinational manufacturing firms. *Oxford Bulletin of Economics and Statistics*, 35(3):173-195.
- Lipsey, Robert E., and Fredrik Sjöholm, 2004. Foreign direct investment, education and wages in Indonesian manufacturing. *Journal of Development Economics* 73 415– 422.
- Narayanan, V.G. and Michael Smith. 2000. Impact of Competition and Taxes on Responsibility Center Organization and Transfer Prices. *Contemporary Accounting Research*, Vol. 17(3), Fall, 497 - 529.
- OECD. 1995. *Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations*. OECD, Paris.
- Rangan, Subramanian and Robert Z. Lawrence. 1993. The Responses of U.S. Firms to Exchange Rate Fluctuations: Peircing the Corporate Veil. *Brookings Papers on Economic Activity*, 2, 341-379.
- Rauch, James E. 1999. Networks Versus Markets in International Trade. *Journal of International Economics* 48:7-35.
- Samuelson, Larry. 1982. The multinational firm with arm's length transfer pricing limits. *Journal of International Economics*. 13:365-374.
- Swenson, Deborah L. 2001. Tax Reforms and Evidence of Transfer Pricing. *National Tax Journal*, Vol. LIV, No. 1, 7-25.
- Tirole, Jean. 1988. *The Theory of Industrial Organization*. The MIT Press, Cambridge, Massachusetts.
- Wall Street Journal. 2005. Rising Stock Buybacks Align With Repatriated Profits. Timothy Aepfel. October 24.

## 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 4 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<sup>48</sup>:

- 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.

---

<sup>48</sup>See <http://www.census.gov/foreign-trade/regulations/forms/correct-way-to-complete-the-sed.pdf>.



Two-Digit HS Category	Number of Products	Related-Party Share		Share of U.S. Exports		Mean High-Low Tariff Rate
		1993	2000	1993	2000	
01-05 Animal & Animal Products	340	0.121	0.087	0.017	0.013	87
06-15 Vegetable Products	495	0.152	0.167	0.055	0.032	56
16-24 Foodstuffs	402	0.312	0.226	0.038	0.030	134
25-27 Mineral Products	211	0.140	0.157	0.028	0.016	51
28-38 Chemicals & Allied Industries	1,079	0.427	0.444	0.090	0.110	45
39-40 Plastics / Rubbers	281	0.461	0.385	0.038	0.044	61
41-43 Raw Hides, Skins, Leather, & Furs	107	0.106	0.152	0.005	0.040	53
44-49 Wood & Wood Products	447	0.228	0.200	0.042	0.030	58
50-63 Textiles	1,168	0.251	0.252	0.027	0.025	66
64-67 Footwear / Headgear	91	0.247	0.249	0.002	0.001	60
68-71 Stone / Glass	261	0.317	0.161	0.039	0.021	56
72-83 Metals	804	0.284	0.265	0.034	0.035	54
84-85 Machinery / Electrical	1,983	0.465	0.336	0.346	0.409	49
86-89 Transportation	283	0.271	0.391	0.156	0.140	64
90-97 Miscellaneous	607	0.386	0.297	0.074	0.081	59
98-99 Services	13	0.345	0.273	0.009	0.008	--

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 1: Exports and Related-Party Exports by Two-Digit HS Categoryr

Country	WTD	BEA	Country	WTD	BEA	Country	WTD	BEA
Albania	30	.	Germany	45	16	Pakistan	45	.
Angola	40	.	Ghana	35	.	Panama	30	15
Antigua	40	.	Greece	40	27	Papua New Guinea	25	.
Argentina	35	30	Guatemala	30	.	Paraguay	30	.
Armenia	25	.	Guinea	35	.	Peru	30	21
Australia	34	17	Guyana	45	.	Philippines	32	13
Austria	34	17	Haiti	35	.	Poland	28	29
Azerbaijan	32	.	Honduras	25	22	Portugal	32	19
Bahamas	0	.	Hong Kong	16	8	Qatar	35	.
Bahrain	0	.	Hungary	18	10	Romania	38	.
Bangladesh	40	.	Iceland	30	.	Russia	35	.
Barbados	40	10	India	35	24	Saudi Arabia	45	13
Belarus	30	.	Indonesia	30	37	Senegal	35	.
Belgium	39	12	Iran	54	.	Sierra Leone	45	.
Belize	35	.	Ireland	24	7	Singapore	26	6
Bermuda	0	3	Israel	36	10	Slovakia	40	.
Bolivia	25	.	Israel	36	10	Slovenia	25	.
Botswana	25	.	Italy	37	24	South Africa	30	14
Brazil	15	9	Ivory Coast	35	.	South Korea	28	18
British Virgin Islands	15	.	Jamaica	33	.	Spain	35	14
Bulgaria	30	.	Japan	30	32	Sri Lanka	35	.
Burma	30	.	Jordan	35	.	Sudan	40	.
Cambodia	20	.	Kazakhstan	30	.	Suriname	38	.
Cameroon	39	.	Kenya	30	.	Swaziland	38	.
Canada	38	24	Kyrgyzstan	30	.	Sweden	28	10
Cayman Islands	0	.	Latvia	25	.	Switzerland	32	5
Chile	15	10	Lebanon	10	.	Tanzania	30	.
China (Mainland)	30	14	Lesotho	35	.	Thailand	30	21
China (Taiwan)	25	19	Libya	35	.	The Gambia	35	.
Colombia	35	25	Liechtenstein	15	.	Trinidad And Tobago	35	.
Costa Rica	30	16	Lithuania	29	.	Tunisia	35	.
Croatia	35	.	Luxembourg	30	2	Turkey	30	24
Cyprus	25	.	Macao	15	.	Uganda	30	.
Czech Republic	35	19	Malawi	38	.	Ukraine	30	.
Denmark	32	5	Malaysia	28	19	United Kingdom	30	17
Dominican Republic	25	7	Malta And Gozo	35	.	Uruguay	30	.
Ecuador	25	31	Mauritius	35	.	Uzbekistan	33	.
Egypt	40	14	Mexico	35	19	Vanuatu	0	.
El Salvador	25	.	Monaco	33	.	Venezuela	34	16
Estonia	26	.	Morocco	35	.	Vietnam	32	.
Ethiopia	40	.	Mozambique	35	.	Virgin Islands	39	.
Ethiopia	40	.	Namibia	35	.	Western Samoa	39	.
Fiji	35	.	Netherlands	35	7	Yemen Arab Republic	35	.
Finland	29	19	New Zealand	33	13	Zambia	35	.
France	33	19	Nigeria	30	58	Zimbabwe	35	.
Gabon	35	.	Norway	28	59			
Georgia	20	.	Oman	30	.			

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.

Table 2: Country Tax Rates

<u>Bins Within Which Arm's Length Prices Are Averaged</u>	<u>Mean</u>	<u>Std Dev</u>
Within product, month	1.92	2.42
Within product, month, country	1.22	2.26
Within product, month, country, transport mode	1.13	2.20
Within product, month, country, transport mode, firm	0.43	1.77

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 (3,980,529) is held constant.

Table 3: Mean Log Difference (i.e., Wedge) Between Arm's Length and Related Party Prices

	Method for Assessing Product Differentiation		
	HS	Rauch Conservative	Rauch Liberal
Commodity Goods	0.088	0.176	0.124
	0.671	1.096	0.743
Differentiated Goods	0.667	0.528	0.530
	2.229	1.953	1.977

Notes: Table reports mean and standard deviation of log difference in firms' arm's length and related party prices by product type. Standard deviations are reported below each mean. Three methods are used to distinguish commodities from differentiated products. The first uses two-digit Harmonized System categories: commodities are HS categories 1 to 21 and 25 to 29 while differentiated products are HS categories 84-97. The second and third methods use the conservative and liberal definitions of differentiated goods from Rauch(1999). Reported statistics are based on the full sample of 3,980,529 related party observations.

Table 4: Price Wedge by Product Type

	Price Wedge	Price Wedge	Price Wedge	Price Wedge	Price Wedge	Price Wedge
Tax Rate (WTD)	-4.178 *** 0.665	-1.638 *** 0.447				
Tax Rate (BEA)			-1.679 *** 0.580	-0.548 ** 0.213		
Tariff Rate					-0.597 *** 0.232	0.634 *** 0.187
Fixed Effects	No	Product	No	Product	No	Product
R-Squared	0.00	0.15	0.00	0.17	0.00	0.16
Observations	3,585,777	3,585,777	2,601,981	2,601,981	1,673,133	1,673,133

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 5: Country Characteristics and the Price Wedge

	Price Wedge	Price Wedge	Price Wedge
Ln Employment	0.010 *** 0.001		
Firm Export Share (%)		0.001 *** 0.000	
Exporters per Product-Country <sup>a</sup>			-0.399 *** 0.022
Tax Rate (WTD)	-0.664 *** 0.045	-0.664 *** 0.045	-0.559 *** 0.045
Tariff	0.575 *** 0.021	0.596 *** 0.021	0.563 *** 0.021
Fixed Effects	Product	Product	Product
R-Squared	0.16	0.16	0.16
Observations	1,669,341	1,669,341	1,669,341

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. <sup>a</sup> Coefficient and standard errors for exporters per product-country have been multiplied by 1000 to increase readability.

Table 6: Firms, Countries and the Price Wedge

	Price Wedge	Price Wedge
Exporters per Product-Country (000)	-0.346 *** 0.022	-0.369 *** 0.022
Tax Rate (WTD)	-0.646 *** 0.048	
Tax Rate (BEA)		-0.391 *** 0.030
Tariff Rate	0.662 *** 0.023	0.645 *** 0.024
Ln RER <sub>m</sub>	-0.225 *** 0.021	-0.195 *** 0.021
Fixed Effects	Product	Product
R-Squared	0.16	0.16
Observations	1,573,343	1,573,343

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. Long-run real exchange rate elasticity is the percent change in the wedge induced by a permanent one-percent appreciation of the dollar.

Table 7: Exchange Rates and the Price Wedge

	Weighted Price Wedge	Weighted Price Wedge	Median Price Wedge	Median Price Wedge	Price Wedge	Price Wedge
Exporters per Product-Country (000)	-0.495 *** 0.022	-0.524 *** 0.022	-0.234 *** 0.022	-0.429 *** 0.021	-0.324 *** 0.022	-0.345 *** 0.022
Tax Rate (WTD)	-0.768 *** 0.044		-3.962 *** 0.049		-0.748 *** 0.060	
Tax Rate (BEA)		-0.433 *** 0.027		-1.455 *** 0.030		-0.391 *** 0.030
Tariff Rate	0.753 *** 0.022	0.742 *** 0.023	0.129 *** 0.004	0.284 *** 0.024	0.673 *** 0.024	0.604 *** 0.025
Ln RER <sub>m</sub>	-0.088 *** 0.019	-0.058 *** 0.004	0.106 *** 0.021	0.112 *** 0.021	-0.222 *** 0.021	-0.206 *** 0.021
ln(PCGDP)					0.009 0.007	-0.018 *** 0.006
Fixed Effects	Product	Product	Product	Product	Product	Product
R-Squared	0.45	0.45	0.45	0.45	0.17	0.17
Observations	1,567,401	1,567,401	1,567,401	1,567,401	1,567,401	1,567,401

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. Columns one through four use alternate price wedges as defined in the text. 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. Long-run real exchange rate elasticity is the percent change in the wedge induced by a permanent one-percent appreciation of the dollar.

Table 8: Robustness



## Exports

Selected Countries	Total Exports		RP Imports		AL Imports		WTD Tax Rate (%)	Estimate of Under-reported Exports	Estimate of Tax Receipt Loss
	Value	Percent	Value	Percent	Value	Percent			
Total Exports <sup>a</sup>	728,362	89	218,688	30	478,301	65.7			
Argentina	3,022	0.4	621	20.5	2,263	74.9	35	0	0
Brazil	12,462	1.5	2,483	19.9	9,688	77.7	15	321	112
Canada	164,347	20.1	69,029	42	82,665	50.3	38	(1,338)	(468)
Chile	3,236	0.4	365	11.3	2,735	84.5	16	45	16
China	32,606	4	4,616	14.2	27,693	84.9	30	149	52
Colombia	4,145	0.5	528	12.7	3,415	82.4	35	0	0
France	19,626	2.4	6,246	31.8	12,837	65.4	33.3	69	24
Germany	27,223	3.3	8,778	32.2	17,692	65	25	567	198
Hong Kong	11,984	1.5	1,692	14.1	9,953	83.1	16	208	73
Ireland	7,615	0.9	2,361	31	5,047	66.3	16	290	101
Japan	50,493	6.2	16,200	32.1	33,513	66.4	30	523	183
Korea	24,994	3.1	3,538	14.2	21,142	84.6	27	183	64
Mexico	93,018	11.4	38,602	41.5	48,996	52.7	35	0	0
Netherlands	22,462	2.7	8,064	35.9	13,988	62.3	34.5	26	9
Singapore	17,850	2.2	5,332	29.9	12,046	67.5	24.5	362	127
Taiwan	20,343	2.5	3,333	16.4	16,597	81.6	25	215	75
United Kingdom	31,734	3.9	8,803	27.7	21,859	68.9	30	284	100
Total - Selected Countries	547,160	75	180,591	83	342,129	72		1,904	666

## Imports

Selected Countries	Total Imports		RP Imports		AL Imports		WTD Tax Rate (%)	Estimate of Over-reported Imports	Estimate of Tax Receipt Loss
	Value	Percent	Value	Percent	Value	Percent			
Total Imports	1,460,160	100	697,561	47.8	724,028	49.6			
Argentina	3,772	0.3	1,103	29.2	2,656	70.4	35	0	0
Brazil	21,098	1.4	7,026	33.3	14,012	66.4	15	908	318
Canada	255,660	17.5	116,261	45.5	113,429	44.4	38	(2,253)	(789)
Chile	5,007	0.3	982	19.6	4,004	80	16	121	42
China	196,160	13.4	53,172	27.1	141,288	72	30	1,717	601
Colombia	7,361	0.5	997	13.5	6,052	82.2	35	0	0
France	31,505	2.2	15,394	48.9	15,652	49.7	33.3	169	59
Germany	75,622	5.2	46,959	62.1	27,103	35.8	25	3,034	1,062
Hong Kong	9,241	0.6	1,244	13.5	7,901	85.5	16	153	53
Ireland	27,401	1.9	24,480	89.3	2,696	9.8	16	3,005	1,052
Japan	129,535	8.9	102,207	78.9	25,803	19.9	30	3,301	1,155
Korea	45,064	3.1	28,091	62.3	16,748	37.2	27	1,452	508
Mexico	154,959	10.6	94,716	61.1	58,408	37.7	35	0	0
Netherlands	12,471	0.9	6,652	53.3	5,589	44.8	34.5	21	8
Singapore	14,848	1	11,082	74.6	3,637	24.5	24.5	752	263
Taiwan	34,462	2.4	8,254	24	25,779	74.8	25	533	187
United Kingdom	45,920	3.1	26,863	58.5	18,161	39.6	30	868	304
Total - Selected Countries	1,070,086	73	545,483	78	488,918	68		13,780	4,823

Note: Values in millions of U.S. dollars. AL=arm's length and RP=related party. Trade Data Sources: <http://www.census.gov/foreign-trade/Press-Release/2004pr/aip/rp04-exh-2.pdf> (exports); <http://www.census.gov/foreign-trade/Press-Release/2004pr/aip/rp04-exh-1.pdf> (imports); <http://www.bus.umich.edu/OTPR/otpr/introduction.htm> (tax rates). Related-party and arms-length exports (imports) do not sum to total exports (imports) as 4.3 percent of exports (2.3 percent of imports) do not have a record of the related-party status. Estimates of trade changes and tax losses are calculated using the point estimate from Table 7, column 1. <sup>a</sup>Total exports excluding reexports.

Table 9: Estimated Aggregate Effects on U.S. Trade and Tax Receipts

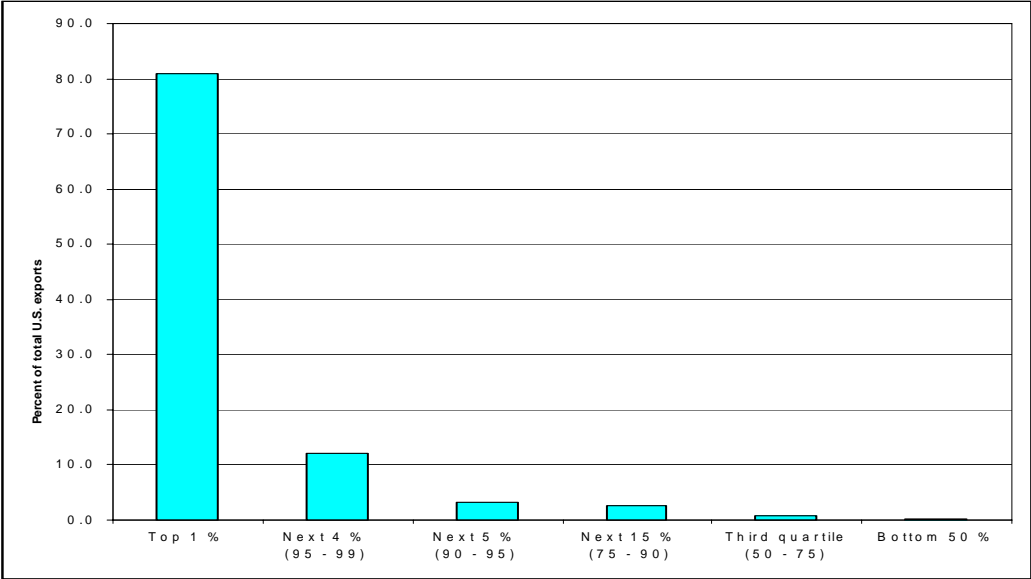


Figure 1: Distribution of U.S. Exports Across Firms in 2000

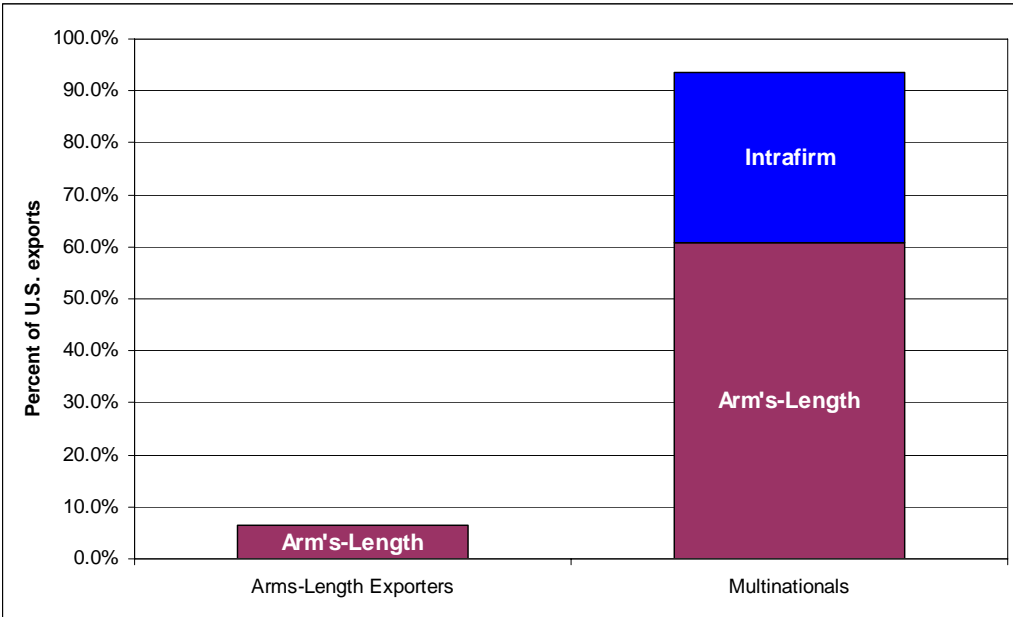


Figure 2: U.S. Exports by Multinationals and Arms-Length Exporters in 2000

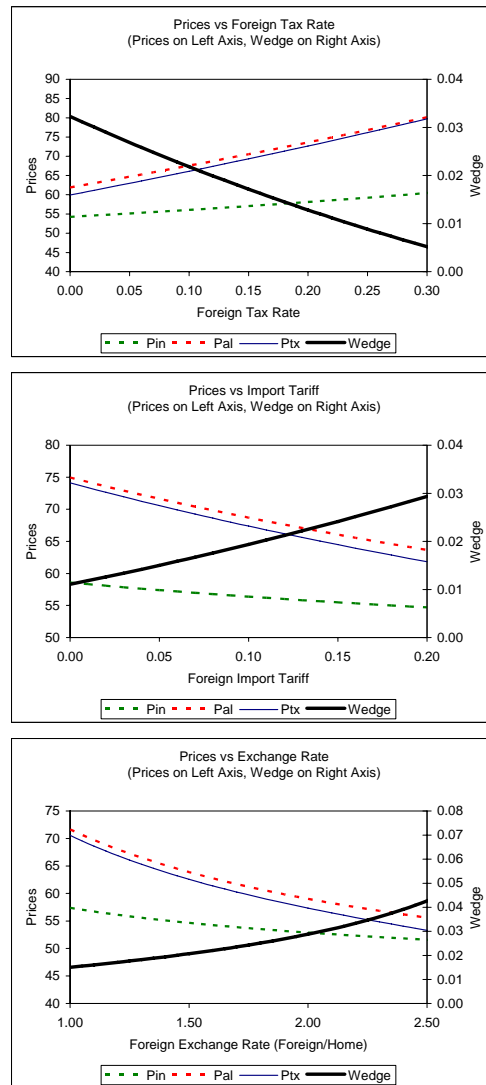


Figure 3: Numerical Solution of the Price Wedge as a Function of Model Parameters

U.S. DEPARTMENT OF COMMERCE – Economics and Statistics Administration – U.S. CENSUS BUREAU – BUREAU OF EXPORT ADMINISTRATION  
 FORM **7525-V** (7-18-2003) **SHIPPER'S EXPORT DECLARATION** OMB No. 0607-0152

<b>1a. U.S. PRINCIPAL PARTY IN INTEREST (USPPI)</b> (Complete name and address)		<b>2. DATE OF EXPORTATION</b>	<b>3. TRANSPORTATION REFERENCE NO.</b>		
<b>b. USPPI'S EIN (IRS) OR ID NO.</b>	<b>ZIP CODE</b>				
<b>c. PARTIES TO TRANSACTION</b> <input type="checkbox"/> Related <input type="checkbox"/> Non-related					
<b>4a. ULTIMATE CONSIGNEE</b> (Complete name and address)					
<b>b. INTERMEDIATE CONSIGNEE</b> (Complete name and address)					
<b>5a. FORWARDING AGENT</b> (Complete name and address)					
<b>5b. FORWARDING AGENT'S EIN (IRS) NO.</b>					
<b>6. POINT (STATE) OF ORIGIN OR FTZ NO.</b>		<b>7. COUNTRY OF ULTIMATE DESTINATION</b>			
<b>8. LOADING PIER</b> (Vessel only)	<b>9. METHOD OF TRANSPORTATION</b> (Specify)	<b>14. CARRIER IDENTIFICATION CODE</b>	<b>15. SHIPMENT REFERENCE NO.</b>		
<b>10. EXPORTING CARRIER</b>	<b>11. PORT OF EXPORT</b>	<b>16. ENTRY NUMBER</b>	<b>17. HAZARDOUS MATERIALS</b> <input type="checkbox"/> Yes <input type="checkbox"/> No		
<b>12. PORT OF UNLOADING</b> (Vessel and air only)	<b>13. CONTAINERIZED</b> (Vessel only) <input type="checkbox"/> Yes <input type="checkbox"/> No	<b>18. IN BOND CODE</b>	<b>19. ROUTED EXPORT TRANSACTION</b> <input type="checkbox"/> Yes <input type="checkbox"/> No		
<b>20. SCHEDULE B DESCRIPTION OF COMMODITIES</b> (Use columns 22-24)					
D/F or M (21)	SCHEDULE B NUMBER (22)	QUANTITY – SCHEDULE B UNIT(S) (23)	SHIPPING WEIGHT (kilograms) (24)	VIN/PRODUCT NUMBER/ VEHICLE TITLE NUMBER (25)	VALUE (U.S. dollars, unit cents) (selling price or cost if not sold) (26)
<b>27. LICENSE NO./LICENSE EXCEPTION SYMBOL/AUTHORIZATION</b>			<b>28. ECCN</b> (When required)		
<b>29. Duty authorized officer or employee</b>			The USPPI authorizes the forwarder named above to act as forwarding agent for export control and customs purposes.		
<b>30. I certify that all statements made and all information contained herein are true and correct and that I have read and understand the instructions for preparation of this document, set forth in the "Correct Way to Fill Out the Shipper's Export Declaration." I understand that civil and criminal penalties, including forfeiture and sale, may be imposed for making false or fraudulent statements herein, failing to provide the requested information or for violation of U.S. laws on exportation (19 U.S.C. Sec. 306, 22 U.S.C. Sec. 401, 19 U.S.C. Sec. 1001, 50 U.S.C. App. 2410).</b>					
<b>Signature</b>		<b>Confidential</b> – Shipper's Export Declarations (or any successor document) wherever located, shall be exempt from public disclosure unless the Secretary determines that such exemption would be contrary to the national interest (Title 18, Chapter 9, Section 301 (g)).			
<b>Title</b>		Export shipments are subject to inspection by U.S. Customs Service and/or Office of Export Enforcement.			
<b>Date</b>		<b>31. AUTHENTICATION</b> (When required)			
<b>Telephone No. (Include Area Code)</b>		E-mail address			

<b>Clear fields 1 to 19</b>
<b>Clear Fields 20 to 26</b>
<b>Clear Fields 27 to 31</b>
<b>Clear all fields</b>

This form may be printed by private parties provided it conforms to the official form. For sale by the Superintendent of Documents, Government Printing Office, Washington, DC 20402, and local Customs District Directors. The "Correct Way to Fill Out the Shipper's Export Declaration" is available from the U.S. Census Bureau, Washington, DC 20233.

Figure 4: Shipper's Export Declaration Form