THE IMPACT OF TRANSFER
PRICING ON INTRAFIRM TRADE

Kimberly A. Clausing

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ABSTRACT

Using data on the operations of U.S. parent firms and their foreign affiliates between 1982

and 1994, this paper examines the extent to which tax minimizing behavior influences intrafirm

trade. The results indicate that taxes have a substantial influence on intrafirm trade flows between

U.S. parent firms and their affiliates abroad; the United States has less favorable intrafirm trade

balances with low tax countries. This result is anticipated if U.S. sales to affiliates in low tax

countries are underpriced and U.S. purchases from affiliates in high tax countries are overpriced.

Taxes are also shown to have an influence on intrafirm trade flows between different foreign

affiliates of U.S. firms.

Kimberly A. Clausing
Department of Economics
Reed College
3203 SE Woodstock Blvd.
Portland, OR 97202-8199
clausing@reed.edu

I. Introduction

Multinational firms play a very large role in international trade. Not only is there a substantial amount of arms length trade between multinational firms and unaffiliated buyers, but trade within multinational firms is also quite considerable. For instance, in 1994, this intrafirm trade accounted for approximately 36% of U.S. exports and 43% of U.S. imports. These fractions vary somewhat from year to year, but intrafirm trade has been a similarly large share of international trade since 1977.[1]

Recently, researchers have devoted some attention to examining how intrafirm trade may be different from arms length trade.[2] One essential reason why intrafirm trade may have distinct motivations from non-intrafirm trade results from the fact that multinational firms may alter their transactions in order to minimize worldwide tax burdens. It has long been recognized, for example, that firms may employ transfer pricing techniques that allow them to shift profits to low tax locations, thus lowering their overall tax burden. The empirical evidence indicates that such motivations are not just a theoretical possibility.

Using data on the operations of U.S. parent companies and their foreign affiliates, this paper examines the extent to which tax minimizing behavior influences intrafirm trade patterns. The results indicate that taxes have a substantial influence on intrafirm trade flows. First, controlling for other factors that are likely to influence intrafirm trade balances, the data indicate that the United States has less favorable intrafirm trade balances with low tax countries. This result is anticipated if U.S. sales to affiliates in low tax countries are underpriced and U.S. purchases from affiliates in low tax countries are overpriced. Second, additional evidence indicates that trade between U.S. affiliates in different foreign countries is also likely influenced by tax considerations. Sales by affiliates based in low tax countries are greater than one would otherwise expect relative to sales by affiliates based in high tax countries.

These results have several interesting implications. First, they indicate an important way in which intrafirm trade flows may indeed be different from international trade

conducted at arms-length. Intrafirm trade flows are influenced by the tax minimization strategies of multinational firms. Second, the results add evidence that transfer prices are influenced by tax considerations. Much of the previous literature has considered this question by focusing on firm profitabilities or tax liabilities; this paper shows how the actual transactions between countries are affected by transfer pricing strategies.

The following section will discuss the relationship between the tax minimization strategies of multinational firms and intrafirm trade. It will review the previous theoretical and empirical literature in this area, and generate a simple model that demonstrates the relationship between taxes and intrafirm trade. Section III will consider the data on intrafirm trade between U.S. parents and their affiliates abroad, examining specifications that relate such intrafirm trade to the tax rates faced by affiliates in different countries. Section IV considers the data on intrafirm trade between different foreign affiliates of U.S. firms, examining both the impact of transfer pricing on intrafirm trade and the potential impact of the Subpart F provisions of U.S. tax law on intrafirm trade. Section V concludes.

II. The Impact of Tax Minimization Strategies on Intrafirm Trade

Multinational firms can typically lower their overall tax burden by shifting profits toward low tax countries and away from high tax countries. Horst (1971) generated a simple model that shows how multinational firms choose transfer prices in order to maximize their after-tax earnings. The model analyzes the choices of a monopolistic firm selling in two countries simultaneously. The firms earnings are equal to their after tax profits in the two countries plus a term that shows the impact of intrafirm trade. This generates a situation where firms choose either the lowest or highest transfer price possible, depending on a comparison of the relative differential in tax rates between the importing and exporting countries with the tariff rate.

Eden (1985) and Diewert (1985) have demonstrated that such transfer pricing can affect intrafirm trade. Kant (1990, 1995) has elaborated on these insights, considering the likely impact of transfer pricing on intrafirm trade and government revenues. The 1990 model incorporates transfer pricing penalties and partial ownership. Transfer pricing penalties imply that there is a tradeoff between the optimal transfer price and the probability of a penalty, leading to a solution where the price is set closer to the arms length price than would be optimal from a profit perspective. Partial ownership implies that firms may be encouraged to shift profits home, ceteris paribus, since firms may own only a part of affiliates. Kant (1995) broadens the model to consider the impact of deferral of non-repatriated foreign profits on intrafirm trade, and finds that both deferral and partial ownership can lead to situations where intrafirm trade is perverse, such that intrafirm exports originate in the country with the higher marginal cost.

Many empirical studies (such as Lall (1973), Jenkins and Wright (1975), Kopits (1976), Bernard and Weiner (1990), Grubert and Mutti (1991), Harris et al. (1993), Hines and Rice (1994), and Collins, Kemsley, and Lang (1996)) have estimated the magnitude of tax-induced transfer pricing. Due to data limitations, the evidence is necessarily indirect, but most studies indicate that transfer prices are likely to be influenced by tax considerations. Many studies focus on the profitability of affiliates in different countries. Jenkins and Wright (1975) examine the profitability of U.S. oil companies, finding that affiliates in low tax rate countries are more profitable. Grubert and Mutti (1991) find that high taxes reduce after- tax profitabilities of local operations. Hines and Rice (1994) find even larger effects, suggesting that 1% tax rate differences are associated with 2.3% differences in before-tax profitability.

Collins, Kemsley, and Lang (1996) study the relationship between profit margins of U.S. multinational firms and foreign tax rates, finding evidence of tax-motivated income shifting, particularly income shifting into the United States from high tax countries. Harris et al. (1993) consider U.S. tax liabilities, finding that U.S. multinational firms with tax

haven affiliates have significantly lower tax liabilities than would otherwise be expected. Finally, Kemsley (1997) finds a positive relationship between a firm's propensity to serve (unaffiliated) customers by exporting (relative to foreign production) and the foreign tax rate, due to special export tax rules (Section 863b of the Internal Revenue Code) which raise the tax incentive favoring exports.

If U.S. multinational firms manipulate transfer prices in order to minimize worldwide tax burdens, then one may expect a country's tax rate to have an influence on the magnitudes of intrafirm trade flows between the United States and that country. For example, one method for shifting profits between countries is to underprice goods sold *to* affiliates in low tax countries and overprice goods sold *by* affiliates in low tax countries, following the opposite pattern for transactions with affiliates in high tax countries. Such a strategy would suggest that intrafirm trade flows to (from) low tax country affiliates should be low (high) relative to intrafirm trade flows to (from) high tax country affiliates, ceteris paribus. On net, these tax considerations imply that U.S. intrafirm trade balances should be more favorable with high tax countries than low tax countries.

Following Horst (1971) and Kant (1995), one can produce a simple model that generates this prediction. Consider a multinational firm with some degree of market power that is operating in two countries. It produces and sells in each country, and also exports part of its output from the home country (1) to the affiliate abroad (2).[3] For now, assume that the affiliate is fully owned.[4]

Profit functions for operations in the two countries are given by the following equations:

$$\pi_1 = R_1(s_1) - C_1(s_1 + m) + pm \qquad (1)$$

$$\pi_2 = R_2(s_2) - C_2(s_2 - m) - pm \qquad (2)$$

π_1 is profit in the home country, which depends on revenues R_1 that are a function of sales, s_1, and costs C_1 that are a function of production. Production includes both those goods sold at home, and those sent to the affiliate abroad, m. The output that is exported to the affiliates abroad is given the transfer price p.

Consider the case where tax rates at home are greater than tax rates abroad ($t_1 > t_2$) and deferral is allowed. Let f represent the fraction of profits that are repatriated. The effective tax rate on income earned in the affiliate country is then:

$$t_2^e = t_2 + (t_1 - t_2) f \tag{3}$$

The net profit function for the firm's global operations is:

$$\pi = (1-t_1) \pi_1 + (1-t_2^e) \pi_2 \tag{4}$$

To illustrate how the firm may choose a transfer price in order to maximize these net profits, consider the derivative of (4) with respect to the transfer price, p.

$$\pi_p = (1-t_1) m - (1-t_2^e) m \tag{5}$$

Substituting for t_2^e using (3) and rearranging,

$$\pi_p = -(t_1-t_2) (1-f) m \tag{6}$$

So, if $t_1 > t_2$, the above expression is negative, and the firm's net profits decrease with the transfer price. Thus, firms have an incentive to underprice goods sold to low tax countries in order to shift profits to low tax locations. Similarly, one can show that firms have an incentive to overprice goods sold to high tax affiliates when $t_2 > t_1$.[5]

This analysis implies that firms will want to charge the lowest transfer price possible when $t_1 > t_2$. As Kant (1990) reminds us, though, two considerations may interfere with this motivation. First of all, firms may be subject to penalties if their manipulation of transfer prices is too flagrant. If the probability of receiving a penalty increases as the transfer price is further from the arms-length price, firms will likely choose a transfer price that balances the gain from profit shifting with the possibility of a penalty.[6] Second, affiliates may not be wholly owned. This creates a second profit shifting incentive, as firms may choose to overprice shipments to affiliates to transfer profits to sources that are wholly owned and away from partially owned sources.[7]

The tax minimization incentives demonstrated above generate similar predictions regarding intrafirm trade among different foreign affiliates of U.S. firms. One would expect, *ceteris paribus*, affiliates from low tax countries to have higher sales to other foreign affiliates than do affiliates from high tax countries. However, here the incentives are slightly more complicated. Under the subpart F provisions of U.S. tax law, US firms are not eligible to defer taxation on unrepatriated foreign income that is derived from sales of goods between related parties where the goods are both manufactured outside the base country and sold for use outside the base country.[8] Basically, this provision implies that trade between foreign affiliates will be discouraged *if* such trade generates subpart F income and *if* affiliates find deferral a clear advantage. Affiliates that are located in low tax countries are more likely to find deferral advantageous, ceteris paribus. Thus, subpart F acts as a second effect influencing trade between different foreign affiliates of US firms that may act to offset the profit shifting incentives discussed above.

III. Intrafirm Trade Between U.S. Parents and Affiliates

Using data on intrafirm trade flows from the Bureau of Economic Analysis (BEA) surveys of U.S. direct investment abroad, this paper attempts to clarify the impact of tax minimizing behavior on intrafirm trade flows. The analysis employs country level data,

since tax rates vary primarily by country (rather than by industry). It is possible to consider these relationships both across countries and over time, since BEA surveys are available on an annual basis between 1982 and 1994. In this section, the analysis will focus on intrafirm trade flows between U.S. parents and their affiliates abroad, as illustrated in figure one. In the following section, the analysis will turn to intrafirm trade between different foreign affiliates of U.S. firms.

The basic specification explains intrafirm trade flows as a function of tax rates and other exogenous variables that are likely to affect trade flows.

$$\text{Intrafirm Trade Balance}_{it} = \alpha + \beta_1 \text{ Effective Tax Rate}_{it} + \beta_2 \text{ Real Exchange Rate}_{it} + \beta_3 \text{ Income Growth}_{it} + \beta_4 \text{ ShareWh}_{it} + \beta_5 \text{ ShareM}_{it} + \beta_5 \text{ Trade Balance}_{it} + \beta_6 \text{ Unaffiliated Trade Balance}_{it} + e_{it}$$

Table 1 defines and summarizes the variables used in the analysis. The dependent variable is the intrafirm trade balance between the United States and the country hosting U.S. affiliates. The intrafirm trade balance is the amount of U.S. exports sent from parent firms to their affiliates abroad minus the amount of U.S. imports sent from affiliates to U.S. parents, relative to the total amount of trade between the U.S. parents and affiliates.

The tax rate variable utilized is an effective tax rate: foreign income taxes paid relative to income. While using marginal tax rates is a theoretically superior alternative, the published marginal tax rates are an imperfect proxy for the actual tax rates firms face since such rates do not account for the many subtleties (tax holidays, ad hoc arrangements, etc.) that determine the true tax treatment of firms.[9]

This basic specification offers a starting point for examining the influence of taxes on trade patterns between the United States and host countries. If host country taxes are low, and firms systematically employ transfer pricing to shift profits to low tax countries, one would expect U.S. intrafirm trade balances to be less favorable with such countries, as intrafirm exports from the United States are underpriced and intrafirm imports into the

United States are overpriced. Thus, if taxes affect trade patterns in the manner hypothesized above, the expected sign of β_1 is positive.

The specification also includes other variables that are likely to affect intrafirm trade flows. These variables fall into three categories. First of all, I include variables that reflect bilateral economic conditions. The first is the strength of the dollar relative to the affiliate country currency, measured by the real exchange rate between the two countries. The second is the income growth of the affiliate country; one expects the United States to have more favorable trade balances when income growth abroad is relatively strong.[10]

Second, I include variables that reflect the character of affiliate operations in the host country. Countries where affiliate activities are primarily concentrated in wholesale trade may have substantially different trade patterns with the United States than do countries where affiliate activities are concentrated in manufacturing, finance, petroleum, or service industries. $ShareWh_{it}$ is the share of affiliate sales in country i (and year t) that are in the wholesale trade industry; $ShareM_{it}$ is the share of affiliate sales that are in manufacturing industries. Dummy variables are also included in some specifications for countries that may have unique intrafirm trade relationships.[11]

Finally, I include other types of trade balances between the United States and the country in question. I include the total (excluding intrafirm trade) trade balance between the two countries, as a possible control for other factors that may influence the pattern of trade between the two countries. I also include the trade balance between affiliates abroad and non-affiliated persons in the United States, as a possible control for characteristics of affiliates that may influence their trade with the United States.

Results are shown in table 2. The basic specification just described is equation one. The coefficient on the effective tax rate variable indicates that an effective tax rate in the affiliate country ten percentage points higher is associated with an intrafirm trade balance relative to country i that is 4.4 percentage points greater. The fitted values from these regression results imply that the United States would have an intrafirm trade balance of .26

with a country that had an effective tax rate at the mean (.33). Holding the other variables constant, the results suggest that the intrafirm trade balance with a country with an effective tax rate in the 10th percentile would be .14, while the intrafirm trade balance with a country with an effective tax rate in the 90th percentile would be .39.

Most of the other coefficients in the regression were approximately as expected. The real exchange rate coefficient indicates that as the dollar is stronger, intrafirm trade balances improve.[12] This contradicts one's expectation that the US trade balances should be more favorable when the dollar is depreciated. On the other hand, if intrafirm trade quantities are relatively fixed or slow to change, than intrafirm trade balances may actually improve in dollar terms when the dollar is appreciated, due to J curve type effects. Income growth abroad does not have a statistically discernible impact on intrafirm trade balances.

Both the share of sales in wholesale trade and the share of sales in manufacturing are positively associated with intrafirm trade balances, with the share of sales in wholesale trade having a particularly large effect. For instance, if affiliates in country i have a ten percent higher share of their total sales in wholesale trade, one can expect the United States to have intrafirm trade balances with country i that are twelve percentage points greater. The United States tends to have more favorable intrafirm trade balances with European countries and Japan. Equation two shows the same specification as equation one, excluding these dummy variables. This specification indicates that the inclusion of these variables does not affect most other coefficients in a statistically discernible fashion.

There is a strong and statistically significant positive relationship between the United States overall trade balance (excluding intrafirm trade) with a country and the intrafirm trade balance. This is perhaps due to common country specific factors that affect both types of trade balances, including the relative savings/investment balance in the two countries.[13] The relationship between the intrafirm trade balance and the trade balance between affiliates in country i and unaffiliated U.S. persons is not statistically significant.

Equation three tests the basic specification excluding countries that are defined as tax havens. For simplicity, I define tax havens to be those countries where the effective tax rate is less than 10 percent.[14] The results from this specification indicate that the tax effects shown are not dependent solely on those countries in the sample with the lowest tax rates.

However, it is the case that the tax sensitivity of intrafirm trade is driven by the countries in the sample who have effective tax rates that are less than the U.S. tax rate. In particular, if one divides the sample into two groups of observations based on whether the effective tax rate is lower or higher than the U.S. marginal tax rate, one finds that the relationship between taxes and intrafirm trade is much more dramatic for the low tax group. Results are shown in table 3.[15] [16]

One advantage of considering these specifications in the context of a panel data set is that this allows a closer inspection of the influence of taxes on intrafirm trade both across countries and over time. It is also possible to check whether the basic relationships shown in the regressions of Table 2 also hold for subperiods. Table 4 breaks down the sample into two time periods before and after 1988. Although the 95% confidence interval for the effective tax rate variable coefficient overlaps, the point estimate for this coefficient is much higher in the earlier subperiod. This result may be due in part to the lesser dispersion of effective tax rates across countries in the later subperiod.[17]

In addition, the greater number of observations available using a panel of data improves the degrees of freedom, enabling more precise estimates of the coefficients. One might question, however, whether the overall tax effects are still discernible in individual cross sections. Table 5 shows estimates of the coefficients on the effective tax rate variable for the individual cross sections between 1982 and 1994. Of the 13 years of cross sections, 12 of the coefficients on the effective tax rate variable are positive. Although only one of the coefficients is statistically significant at a 95% confidence level, ten are statistically positive with greater than 70% confidence. These ten coefficients are estimated

between .38 and 1.1, implying tax effects of a similar magnitude to those found in the panel regression.

IV. Intrafirm Trade Between Foreign Affiliates of U.S. Firms

Analyzing intrafirm trade patterns between different foreign affiliates of U.S. firms may be more complicated due to the combined influence of two effects: the incentive to shift profits to low tax countries, and the incentive to avoid subpart F income in low tax countries. Since the available trade data do not distinguish between the type of trade that triggers subpart F income and other trade, the influence of tax minimizing incentives on intrafirm trade between foreign affiliates may be more difficult to isolate.

I consider a specification that explains sales from affiliates in a given host country to other foreign affiliates as a function of tax rates and other variables that are likely to affect these trade flows.

$$\text{Sales to Affiliates in Other Countries}_{it} = \alpha + \beta_1 \text{ Effective Tax Rate}_{it} + \beta_2 \text{ Real Exchange Rate}_{it} + \beta_3 \text{ ShareWh}_{it} + \beta_4 \text{ ShareM}_{it} + \beta_5 \text{ Sales}_{it} + \beta_6 \text{ Sales to Non-Affiliates in Other Countries}_{it} + e_{it}$$

The dependent variable is the sales of affiliates in country i (during year t) to affiliates in other foreign countries. This variable is no longer a trade balance since we do not have data on purchases of affiliates of a given host country from other foreign affiliates. (See figure one for an illustration.) In addition, the data used are sales data rather than trade flows.[18] These data differ from trade data in several respects, the most important of which is that sales data include services as well as goods.[19] [20]

In this regression, if income shifting effects predominate, we would expect the coefficient β_1 to be negative, indicating that affiliates based in low tax countries overprice their sales to affiliates in other countries in order to shift income to low tax locations. If subpart F provisions are very important, on the other hand, one might expect sales to other

foreign affiliates to be lower for affiliates based in low tax countries since such affiliates would want to avoid generating subpart F income.

Many of the independent variables are defined as in the previous analysis. A few changes are noteworthy, however. First, it is no longer meaningful to include a variable measuring economic growth in country i since we are trying to explain sales to foreign countries other than country i.[21] Second, the control variables are defined to be analogous to the dependent variable. In particular, total sales by affiliates in country i (minus sales to other foreign affiliates) are included to proxy for influences that increase overall sales by affiliates in a given country. Sales to non-affiliates in other foreign countries control for characteristics of host country affiliates that may make them more likely to ship goods to other countries. Third, I consider a specification in natural logs. Since both the dependent variables and the control variables are no longer in percentage terms, such a specification makes the results easier to interpret.

Table 6 shows the results. In equation one, the coefficient on the effective tax variable suggests that a one percent increase in the effective tax rate in country i is associated with a .82 percent reduction in sales to other foreign affiliates.[22] Sales to other foreign affiliates are positively related to the share of total sales in manufacturing in country i, the total sales of affiliates in country i (excluding sales to other foreign affiliates), and the sales by affiliates in country i to non-affiliates in other foreign countries. Affiliates based in Europe and Japan also sell more to other foreign affiliates. When these dummy variables are excluded in equation two, the point estimate of the coefficient on the effective tax rate is smaller and, as one might expect, the coefficient on the share of sales in wholesale trade becomes much more important and statistically significant.[23] Equation three excludes from the sample those countries with effective tax rates less than ten percent that are defined to be tax havens. Excluding tax havens has little effect on the results, so the demonstrated tax sensitivity is unlikely to be primarily a result of operations in very low tax countries.[24]

There are several ways to interpret the tax coefficient results. It is possible that

these results indicate tax induced income shifting. Affiliates based in low tax countries overprice their sales to other foreign affiliates in order to shift income from high tax sources to low tax sources. While subpart F encourages affiliates in low tax countries to avoid the type of sales to other affiliates that generates subpart F income, this influence is not apparent in the results, perhaps due to the fact that many types of trade do not generate subpart F income.

It is also possible that the tax coefficient result does not indicate tax induced income shifting, but rather reflects the fact that low tax locations are more attractive places to invest, and hence generate more trading activity of all types. One might hope that including the total level of sales in such countries as an independent variable would capture some of this influence, but it may not be adequate.

Another approach to this question would be to consider the *share* of total sales that are destined for affiliates in other countries as a dependent variable. Figure two shows how total sales are typically divided between different destinations in the sample. If affiliates are attempting to shift income to low tax locations, one would expect that affiliates in low tax countries would see a higher share of their total sales going toward affiliates in other countries, relative to affiliates based in high tax locations. While there is no incentive to alter prices on local sales or sales to non-affiliates, affiliates in low tax countries have an incentive to overprice affiliate sales, while affiliates in high tax countries have an incentive to underprice affiliate sales. Table 7 shows the results of these specifications. The estimates from equation one indicate that an effective tax rate one percentage point higher in country i is associated with a .26 percentage point lower share of sales that are destined for affiliates in other foreign countries. Figure three shows a graphical representation of this negative relationship between the effective tax rate of the affiliate country and the share of total sales that is destined for affiliates in other countries.

One would expect a similar relationship between tax rates and the share of sales destined for parents in the United States. Equation two considers this hypothesis.

However, the coefficient on the effective tax rate is not estimated precisely, and is statistically indistinguishable from zero. Equation three looks at the relationship between effective tax rates in country i and the combined share of sales to all other affiliates, both in other foreign countries and parent firms in the United States. Here the coefficient on the effective tax rate implies that a one percentage point increase in the effective tax rate in country i is associated with a .32 percentage point reduction in the share of sales to affiliates.[25]

These results provide evidence that the tax minimization strategies of multinational firms may influence intrafirm trade. There is also a piece of indirect evidence regarding the effects of subpart F. While concerns over triggering subpart F income do not appear to reduce sales from affiliates in low tax countries to other affiliates, it is the case that affiliates operating in countries where a large share of sales are in wholesale trade have a lower share of sales to affiliates in other countries. Subpart F income is more likely when trade is in wholesale products since subpart F income is only generated when trade between affiliates is in goods that are both manufactured outside the country of origin and sold for final use outside the country of origin. So while subpart F may not substantially reduce most types of trade by affiliates in low tax countries, it may reduce wholesale trade by such affiliates.

V. Conclusions

This paper studies the impact of tax minimizing behavior on intrafirm trade patterns. Using data on the operations of U.S. parent companies and their foreign affiliates between 1982 and 1994, the paper examines the relationship between the effective tax rates faced by U.S. affiliates in different countries and intrafirm trade both between U.S. parents and their affiliates abroad and between different foreign affiliates of U.S. firms. The results indicate a clear relationship between taxes and intrafirm trade flows.

First, controlling for other factors that are likely to influence intrafirm trade balances, the data indicate that the United States has less favorable intrafirm trade balances

with low tax countries. This result fits with the theoretical expectation that firms minimizing their worldwide tax burden will underprice U.S. exports to affiliates in low tax countries and overprice U.S. imports from affiliates in low tax countries. An effective tax rate in the affiliate country ten percentage points lower is associated with an intrafirm trade balance relative to that country that is 4.4 percentage points smaller.

Second, additional evidence indicates that trade between U.S. affiliates in different foreign countries is also likely influenced by tax considerations. Sales by affiliates based in low tax countries to affiliates in other countries are greater than one would otherwise expect. In addition, the share of affiliates' total sales that are destined for other affiliates is negatively related to the effective tax rate of the affiliate country. These results, along with those above, provide evidence that tax minimizing motivations may be influencing intrafirm trade patterns.

These results have several noteworthy implications. First, they indicate an important way in which intrafirm trade may be different from international trade conducted at arms-length. Intrafirm trade flows are influenced by the tax minimization strategies of multinational firms. As Kant (1995) demonstrates, this tax minimizing behavior can lead to situations where intrafirm trade is perverse, such that intrafirm exports originate in the country with the higher marginal cost.

Second, the results add more evidence to the body of literature that has measured the magnitude of tax-induced transfer pricing. Much of the previous literature has found evidence of transfer price manipulation by focusing on the relationship between the taxes faced by affiliates located in different countries and firm profitabilities or U.S. tax liabilities. This paper adds evidence showing a clear relationship between the taxes faced by affiliates abroad and their intrafirm trade transactions.

Endnotes

1. 1977 is the earliest year for which comparable data are available. See Zeile (1997) for additional information regarding trends in intrafirm trade.

2. For example, Lawrence and Rangan (1993) examine the response of US multinational firms to exchange rate fluctuations. In addition, a large literature (Blomstrom Lipsey and Kulchycky (1988), Lipsey and Weiss (1981 and 1984), Grubert and Mutti (1991), and Clausing (1997), among others) considers the relationship between trade and multinational activity.

3. It is straightforward to extend this model to consider trade that originates in the affiliate country. One can also consider this trade to be in intermediate products without affecting the basic insights developed here.

4. The implications of relaxing this assumption are considered in Kant (1995) and briefly discussed below.

5. Note that these models implicitly assume that there is only one transfer price p; that is, firms keep just one set of books. Firms in reality may keep more than one set of books, using one set of prices to minimize tax liabilities and other sets of prices for other purposes such as determining the relative performance of affiliates.

6. This consideration alters the degree of transfer price manipulation, but would not alter the desired direction of underpricing or overpricing.

7. While this consideration may influence the desired direction of transfer price changes, it also assumes that firms are free to manipulate transfer prices without the need to be responsive to the profits of their minority interests.

8. See Rapakko (1990) for a detailed description of these provisions.

9. In addition, the average tax rates for this sample (of 58 countries and 13 years) are more readily available.

10. Most empirical studies of trade flows have utilized such variables, as there are strong theoretical rationale for including them. See Deardorff (1995).

11. I include dummies for Japan and for the European countries as a group in some specifications.

12. When exchange rate lags were included, they were not statistically significant nor did they improve the fit of the regression or noticeably change the other coefficients of interest. Therefore, they are not included for the results presented here.

13. Countries that save more than they invest run global trade surpluses, while those that invest more than they save run deficits. These global deficits and surpluses are likely to influence levels of bilateral deficits and surpluses.

14. This definition follows that of Grubert and Mutti (1996).

15. One can also break down the sample to see if the tax effects remain the same for rich and poor countries. I broke down the sample into high income countries (those with per capita incomes greater than $9000) and other countries. The coefficients on the effective tax variable were statistically indistinguishable from each other in the two regressions.

16. I also tried specifications that looked at an inverse tax rate (equal to 1/(.1+effective tax rate), following Grubert and Mutti (1996)) to test the hypothesis that there may be magnified sensitivity to low tax rates. In my specifications, however, I did not find that this variable improved the explanatory power of the regression, nor did it appear to be more statistically significant than the more conventional tax variable.

17. In particular, the variation of the effective tax rate variable is smaller during the later time period. In addition, the mean of this variable is closer to the U.S. marginal tax rate during the later period as well.

18. Trade data are not available.

19. Also, trade data is calculated on a shipped basis, which usually requires firms to use shipping department invoices rather than accounting data.

20. One can take a similar approach to the previous specifications too, of course. In that case, one would be explaining sales from affiliates in country i to U.S. parents as a function of the standard independent variables, in addition to total sales by affiliates in country i and sales by affiliates in country i to non-affiliates in the United States. Results from such a specification are shown in appendix table A1. A tax rate 1 percentage point higher is associated with .36 percentage points fewer sales to the parent. (The elasticity of parent sales with respect to (1-effective tax rate) is .72; at the mean taxes/income ratio, this corresponds to an elasticity with respect to the effective tax rate of -.36.)

21. Dummy variables continue to be appropriate. For example, affiliates in European countries may be particularly likely to sell to affiliates in other countries due to their close geographical proximity to other European countries.

22. The coefficient in the table indicates an elasticity of other country affiliated sales with respect to 1-ETR of 1.65. At the mean effective tax rate, this corresponds to an elasticity with respect to the effective tax rate of -.82.

23. Affiliates based in European countries have an average of 29% of their total sales in wholesale trade, and affiliates based in Japan have an average of 26% of their sales in wholesale trade. Affiliates based in other countries average only 14% of their total sales in wholesale trade.

24. Taking advantage of the panel aspect of this data set, one can also break the data set into two subperiods to examine whether these relationships are changing over time. Table A2 shows these results. In addition, one can look at these relationships in a series of cross sections for each year between 1982 and 1994. In all 13 cross sections, there is a negative relationship between the effective tax rate and sales to other foreign affiliates. In 6 of the cross sections, this relationship is statistically significant at a 95% confidence level; in five more, this relationship is statistically significant with greater than 70% confidence.

25. Again, one can divide the sample into two subsets based on whether the effective tax rate is lower or higher than the U.S. marginal tax rate. Results, shown in tables A3 and A4, confirm the previous conclusion that the relationship between taxes and intrafirm trade is much stronger for low tax countries.

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Figure 1

Parent Firms
in the U.S.

U.S. Imports

U.S. Exports

U.S. Exports

U.S. Imports

High Tax
Affiliate

Low Tax
Affiliate

Sales

Sales

Other
Foreign
Affiliates
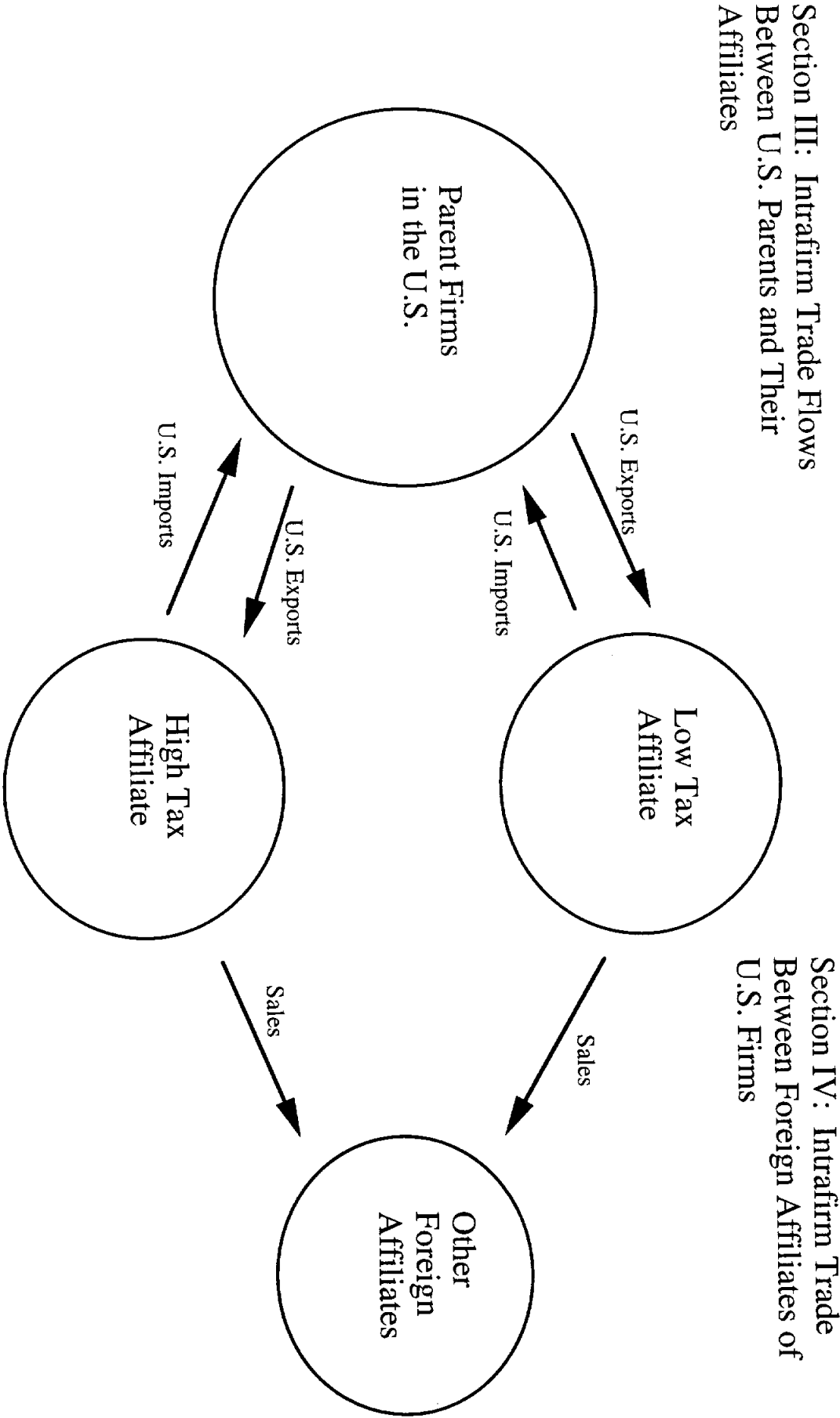
Figure 2

The Distribution of Total Sales to Affiliates and Non-Affiliates
in the United States, Locally, and in Other Countries

Sales in the United States

Local Sales

Sales in Other
Countries

Sales to Parent
Firms in the
United States:
9% of Total
Sales

Sales to
Unaffiliated
Persons in the
United States:
2% of Total
Sales

Sales to
Affiliates in
Country i:
3% of Total
Sales

Affiliates in
Country i

Unaffiliated
Sales
in Country i:
64% of Total
Sales

Sales to
Affiliates in
Other Countries:
13% of Total
Sales

Sales to
Unaffiliated
Persons in
Other Countries:
9% of Total
Sales

Figure 3: The Share of Total Sales Destined for Affiliates in Other Countries

Effective Tax Rate Bracket
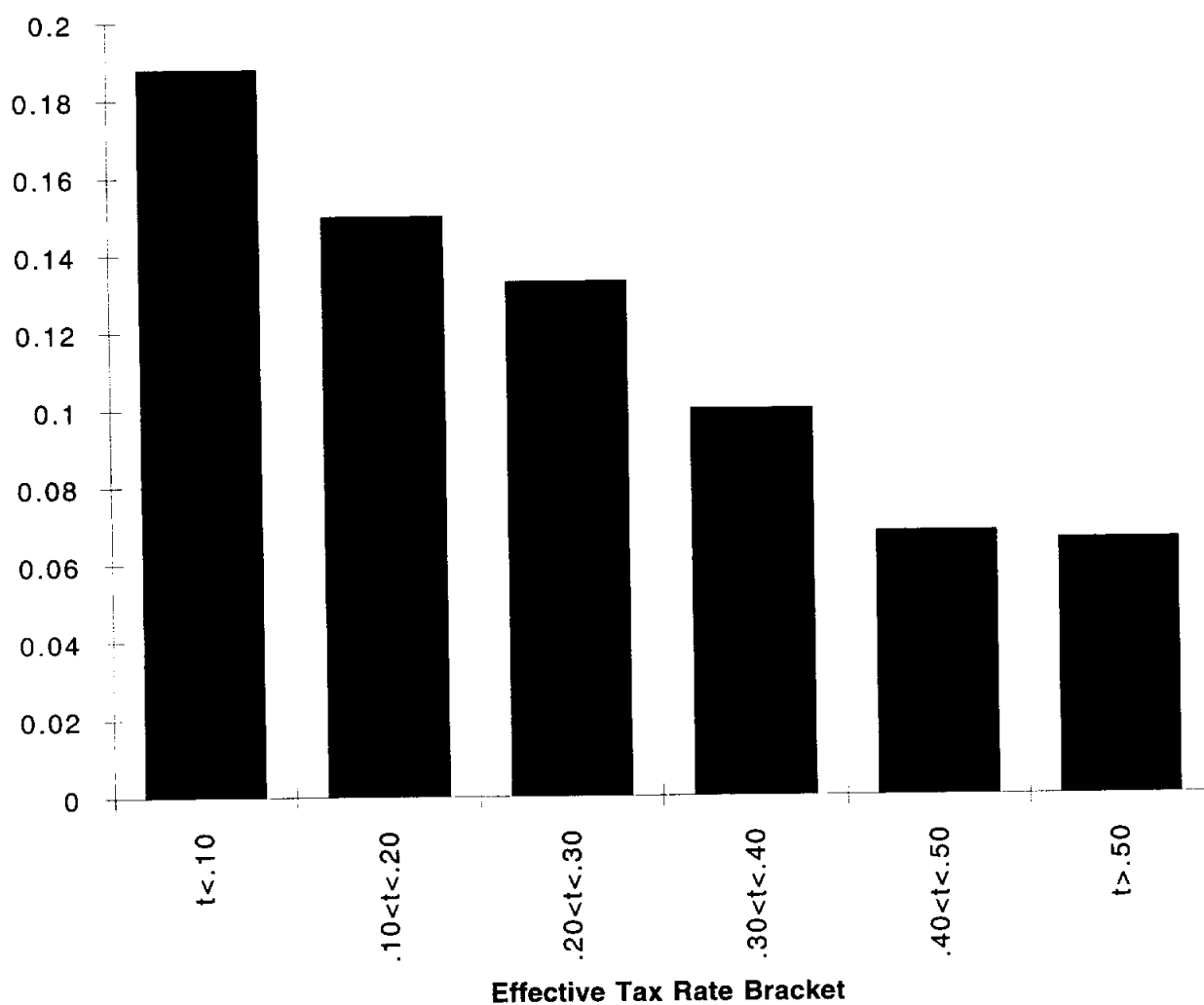
Table 1

Variable	Obs.	Mean	St.Dev.
Intrafirm Trade Balance	524	.2627	.4843
Effective Tax Rate	651	.3450	.2231
Real Exchange Rate	612	133.1	47.75
Income Growth	605	3.395	4.091
Share of Sales in Wholesale Trade	583	.1976	.1479
Share of Sales in Manufacturing	629	.3841	.2481
Overall Trade Balance	635	-.0649	.3200
Unaffiliated Trade Balance	561	.2932	.5291
Sales to Affiliates in Other Countries	589	2530	5149
Sales to Non-Affiliates in Other Countries	595	2292	4317
Total Sales	651	19171	35543

Note: The data cover the period 1982 to 1994. 58 countries are included. Each observation represents one country (i) and one year (t). The intrafirm trade balance is the amount of U.S. exports sent from parent firms to U.S. affiliates in country i minus the amount of U.S. imports sent from U.S. affiliates in country i to U.S. parents, relative to the total amount of trade between U.S. parents and their affiliates in country i. The effective tax rate is foreign income taxes paid relative to income. The real exchange rate is an index where 1980=100, calculated using nominal exchange rates and price indices in the U.S. and country i. Income growth is the growth in real GDP for country i in year t. The share of sales in wholesale trade/manufacturing is the share of total sales that are in wholesale trade/manufacturing. The overall trade balance is total U.S. exports to country i minus total U.S. imports from country i, relative to total trade between the U.S. and

country i (excluding intrafirm trade between parents and affiliates in country i). The unaffiliated trade balance is U.S. exports by unaffiliated persons to affiliates in country i minus U.S. imports sent from U.S. affiliates in country i to unaffiliated persons in the U.S., relative to the total trade between unaffiliated persons in the U.S. and affiliates in country i. Sales to affiliates in other countries are sales by affiliates in country i to affiliates in other foreign countries. Sales to non-affiliates in other countries are sales by affiliates in country i to unaffiliated persons in other foreign countries. Total sales are the total sales in all locations by affiliates in country i. Real exchange rate and income growth data come from the IMF's International Financial Statistics yearbooks. Overall trade data come from the United States International Trade Commission. All other data come from the Bureau of Economic Analysis annual surveys of U.S. Direct Investment abroad.

Table 2
Dependent Variable : Intrafirm Trade Balance

Independent Variables	(1)	(2)	(3)
Effective Tax Rate	.4353 (.0956)	.5179 (.0967)	.4226 (.1090)
Real Exchange Rate	.0013 (.0004)	.0009 (.0004)	.0011 (.0004)
Income Growth	-.0058 (.0046)	-.0090 (.0047)	-.0095 (.0050)
Share of Sales in Wholesale Trade	1.179 (0.154)	1.506 (.141)	1.236 (0.167)
Share of Sales in Manufacturing	.1913 (.0830)	.2496 (.0832)	.2892 (.0873)
Overall Trade Balance	.8607 (.0644)	.8367 (.0649)	.8999 (.0685)
Unaffiliated Trade Balance	.0231 (.0346)	.0566 (.0349)	-.0201 (.0363)
European Dummy	.1660 (.0400)		.1445 (.0416)
Japan Dummy	.4292 (.1071)		.4385 (.1060)
Constant	-.3580 (.0884)	-.3548 (.0909)	-.3392 (.0965)
Number of Observations	449	449	397
Adjusted R^2	.425	.392	.447

Note: Variables are defined as in table 1. Standard errors are in parentheses. Equations one and two include all country/year pairs for which data are available. Equation three excludes those countries defined as tax havens, where the effective tax rate is less than .10.

Table 3
Dependent Variable : Intrafirm Trade Balance

Independent Variables	(1) Effective Tax Rate < US Rate	(2) Effective Tax Rate > US Rate
Effective Tax Rate	.8772 (.1770)	-.0230 (.2005)
Real Exchange Rate	.0028 (.0004)	.0003 (.0005)
Income Growth	-.0027 (.0053)	-.0049 (.0076)
Share of Sales in Wholesale Trade	.7163 (.1849)	1.657 (.2758)
Share of Sales in Manufacturing	-.2042 (.1148)	.2920 (.1161)
Overall Trade Balance	.5776 (.0762)	1.107 (.1068)
Unaffiliated Trade Balance	.0472 (.0413)	-.1030 (.0532)
European Dummy	.2689 (.0482)	.0374 (.0689)
Japan Dummy		.4213 (.1175)
Constant	-.4606 (.1068)	-.0112 (.1596)
Number of Observations	279	170
Adjusted R^2	.474	.570

Note: Variables are defined as in table 1. The sample is divided into two subsets based on a comparison of the average effective tax rate with the U.S. marginal tax rate.

Table 4
Dependent Variable : Intrafirm Trade Balance

Independent Variables	(1) Before 1988	(2) After 1988
Effective Tax Rate	.7147 (.1315)	.2922 (.1274)
Real Exchange Rate	.0013 (.0005)	.0008 (.0005)
Income Growth	.0036 (.0059)	-.0149 (.0061)
Share of Sales in Wholesale Trade	1.804 (0.220)	.8360 (.1971)
Share of Sales in Manufacturing	.6107 (.1066)	-.1274 (.1135)
Overall Trade Balance	.9011 (.0871)	.8260 (.0883)
Unaffiliated Trade Balance	-.0059 (.0496)	.0457 (.0441)
European Dummy	.1301 (.0520)	.1381 (.0547)
Japan Dummy	.3255 (.1369)	.4672 (.1471)
Constant	-.7597 (.1188)	-.0137 (.1212)
Number of Observations	226	257
Adjusted R^2	.531	.390

Note: Variables are defined as in table 1.

Table 5
Tax Coefficient Estimates for Cross Sections, 1982-1994

Year	Coefficient on Effective Tax Rate	Significance Level
1982	.6213 (.2897)	87%
1983	.2059 (.5754)	27%
1984	.8270 (.4903)	89%
1985	.8558 (.4407)	93%
1986	.9180 (.5760)	87%
1987	.7900 (.4082)	93%
1988	1.118 (.380)	99%
1989	.3835 (.2953)	79%
1990	.5680 (.3322)	90%
1991	.2469 (.5681)	33%
1992	.4308 (.3193)	81%
1993	-.0324 (.3305)	7%
1994	.4276 (.3984)	71%

Note: Standard errors are in parentheses.

Table 6
Dependent Variable : Sales to Affiliates in Other Foreign Countries

Independent Variables	(1)	(2)	(3)
1- Effective Tax Rate	1.648 (.286)	.8934 (.2987)	1.870 (.316)
Real Exchange Rate	-.0432 (.1464)	-.1374 (.1574)	.0704 (.1484)
1- Share of Sales in Wholesale Trade	.1859 (.4268)	-1.608 (.414)	.4159 (.4675)
1- Share of Sales in Manufacturing	-1.507 (.259)	-2.185 (.263)	-1.353 (.278)
Total Sales	.4569 (.0654)	.3617 (.0667)	.4374 (.0683)
Sales to Non-affiliates in Other Foreign Countries	.4606 (.0507)	.6403 (.0480)	.4484 (.0526)
European Dummy	1.126 (.307)		1.192 (.130)
Japan Dummy	1.286 (.307)		1.423 (.306)
Year	.0207 (.0126)	.0119 (.0137)	.0247 (.0130)
Constant	-2.288 (1.419)	-2.288 (1.541)	-3.268 (1.463)
Number of Observations	480	480	421
Adjusted R^2	.789	.751	.794

Note: Variables are defined as in table 1. All variables are in lns with the exception of dummy variables and year. Standard errors are in parentheses. Equations one and two include all country/year pairs for which data are available. Equation three excludes those countries defined as tax havens, where the effective tax rate is less than .10.

Table 7
Dependent Variables : Shares of Total Sales
(1) to Affiliates in Other Foreign Countries,
(2) to Affiliates (Parents) in the U.S.,
and (3) to Affiliates both in the U.S. and in Other Foreign Countries

Independent Variables	(1)	(2)	(3)
Effective Tax Rate	-.2603 (.0182)	.0093 (.0295)	-.3181 (.0331)
Real Exchange Rate	.0001 (.0001)	.0000 (.0000)	-.0005 (.0001)
Income Growth	.0023 (.0009)	.0017 (.0015)	.0024 (.0017)
Share of Sales in Wholesale Trade	-.1807 (.0302)	-.2333 (.0501)	-.3281 (.0555)
Share of Sales in Manufacturing	.0663 (.0163)	-.1547 (.0262)	.0010 (.0297)
European Dummy	.1380 (.0078)	-.0716 (.0130)	.0615 (.0141)
Japan Dummy	.0587 (.0212)	-.0716 (.0353)	-.0188 (.0383)
Constant	.1355 (.0171)	.2230 (.0283)	.4062 (.0321)
Number of Observations	477	484	467
Adjusted R^2	.536	.210	.231

Note: Standard errors are in parentheses.

Table A1
Dependent Variable : Sales to U.S. Parents

Independent Variables	
1-Effective Tax Rate	.7224 (.2979)
1- Share of Sales in Wholesale Trade	2.700 (.495)
1- Share of Sales in Manufacturing	-1.598 (.273)
Total Sales	1.024 (.0672)
Sales to non-affiliates in the U.S.	.1607 (.0425)
European Dummy	-.7818 (.1515)
Japan Dummy	-.1392 (.3843)
Constant	-2.255 (.450)
Number of Observations	508
Adjusted R^2	.640

Note: Sales to U.S. parents are sales by affiliates in country i to U.S. parent companies. Unaffiliated sales in the U.S. are sales by affiliates in country i to nonaffiliated persons in the U.S. Other variables are defined as in table 1. All variables are in lns with the exception of dummy variables. Standard errors are in parentheses.

Table A2
Dependent Variable : Sales to Affiliates in Other Foreign Countries

Independent Variables	(1) Before 1988	(2) After 1988
1- Effective Tax Rate	1.854 (.470)	1.701 (.356)
Real Exchange Rate	.2187 (.2463)	-.2267 (.1757)
1- Share of Sales in Wholesale Trade	1.055 (.714)	.0012 (.5184)
1- Share of Sales in Manufacturing	-.7970 (.4097)	-2.069 (.3381)
Total Sales	.3947 (.1003)	.4750 (.0829)
Sales to Non-affiliates in Other Foreign Countries	.5419 (.0791)	.3974 (.0628)
European Dummy	1.285 (.196)	1.045 (.160)
Japan Dummy	1.468 (.441)	1.290 (.407)
Year	-.0063 (.0374)	.0376 (.0297)
Constant	-1.303 (3.375)	-3.461 (2.909)
Number of Observations	235	272
Adjusted R^2	.758	.815

Note: Variables are defined as in table 1. All variables are in lns with the exception of dummy variables and year. Standard errors are in parentheses.

Table A3: Low Effective Tax Rate Sample

Dependent Variables : Shares of Total Sales
(1) to Affiliates in Other Foreign Countries,
(2) to Affiliates (Parents) in the U.S.,
and (3) to Affiliates both in the U.S. and in Other Foreign Countries

Independent Variables	(1)	(2)	(3)
Effective Tax Rate	-.4607 (.0405)	-.1693 (.0419)	-.6300 (.0600)
Real Exchange Rate	.0001 (.0001)	-.0007 (.0001)	-.0006 (.0002)
Income Growth	.0021 (.0013)	.0011 (.0013)	.0027 (.0019)
Share of Sales in Wholesale Trade	-.1933 (.0418)	-.0452 (.0439)	-.2388 (.0625)
Share of Sales in Manufacturing	.1127 (.0273)	.0212 (.0284)	.1371 (.0404)
European Dummy	.1540 (.0113)	-.0990 (.0117)	.0556 (.0167)
Constant	.1594 (.0237)	.2575 (.0252)	.4169 (.0362)
Number of Observations	293	293	288
Adjusted R^2	.545	.379	.362

Note: Standard errors are in parentheses. Sample includes only those observations where the effective tax rate is less than the U.S. marginal tax rate.

(1) to Affiliates in Other Foreign Countries

Table A4: High Effective Tax Rate Sample

Dependent Variables : Shares of Total Sales
(1) to Affiliates in Other Foreign Countries,
(2) to Affiliates (Parents) in the U.S.,
and (3) to Affiliates both in the U.S. and in Other Foreign Countries

Independent Variables	(1)	(2)	(3)
Effective Tax Rate	-.0342 (.0240)	.0743 (.0780)	.0054 (.0761)
Real Exchange Rate	.0001 (.0001)	.0008 (.0002)	-.0002 (.0003)
Income Growth	.0021 (.0009)	-.0028 (.0030)	-.0014 (.0029)
Share of Sales in Wholesale Trade	-.0901 (.0329)	-.3678 (.1106)	-.3951 (.1066)
Share of Sales in Manufacturing	.0483 (.0138)	-.2280 (.0447)	-.0622 (.0443)
European Dummy	.1046 (.0081)	-.0436 (.0278)	.0677 (.0259)
Japan Dummy	.0320 (.0136)	-.0099 (.0453)	-.0050 (.0429)
Constant	.0247 (.0188)	.1309 (.0629)	.2448 (.0613)
Number of Observations	184	191	179
Adjusted R^2	.516	.331	.063

Note: Standard errors are in parentheses. Sample includes only those observations where the effective tax rate is greater than the U.S. marginal tax rate.