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EXCHANGE RATES AND TAX-BASED EXPORT PROMOTION

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**ABSTRACT**

This paper examines the impact of tax-based export promotion on exchange rates and patterns of trade. The threatened removal of Foreign Sales Corporations (FSCs) due to the 1997 European Union complaint before the World Trade Organization (WTO) is used to identify the adjustment of exchange rates to reduced after-tax margins for American exporters. The evidence indicates that days associated with significant developments in the European complaint are characterized by predicted changes in the value of the U.S. dollar. Additionally, foreign trading relationships with the United States appear to influence currency responses to the possibility of FSC repeal. Exchange rate movements on the date of the initial European complaint indicate that 10 percent greater net trade deficits with the United States are associated with currency appreciations of 0.2 percent against the U.S. dollar. This evidence is consistent with a combination of trade-based exchange rate determination and important effects of U.S. export promotion policies.

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## ***1. Introduction.***

Many countries attempt to encourage exports by improving the after-tax margins earned by their exporters. The United States offers one such attractive menu of export incentives through its income tax. Of these incentives, the best known is the opportunity to exclude from U.S. tax roughly 15 percent of profits earned by exporting products from the United States. For the years 1984-2000, this 15 percent income exclusion was available by routing exports through offshore tax-avoidance devices known as Foreign Sales Corporations (FSCs). On November 18, 1997, the European Union brought a complaint before the World Trade Organization (WTO), in which it alleged that the American policy of permitting exporters to use FSCs violated WTO rules that prohibit members from subsidizing exports. The ensuing lengthy dispute culminated in a WTO finding against the United States, and subsequent U.S. adoption in November 2000 of a new export incentive regime in which a broad-based 15 percent export income exclusion replaced the FSC system. This latest U.S. reform may not resolve the dispute with Europe, however, since the WTO is currently (as of January 2001) reviewing the conformance of this American policy with WTO guidelines.

Controversies over export promotion policies rest on certain largely untested economic premises concerning the ability of tax and other policies effectively to stimulate greater exports. The purpose of this paper is to evaluate the impact of tax incentives for U.S. exports by examining exchange rate reactions to the announcement of the European complaint against the United States on November 18, 1997. Filing of the European complaint introduced the possibility that the existing 15 percent income exclusion would be eliminated or greatly reduced. To the extent that real exchange rates are determined by purchasing power parity, it follows that removal of export incentives that effectively stimulate American exports should be accompanied by a fall in the value

of the U.S. dollar relative to foreign currencies. Furthermore, this exchange rate movement should vary between countries, since the currencies of countries that import from the United States will exhibit very different reactions than those of countries that are major exporters to the United States.

The results presented in this paper are quite consistent with a major effect of tax provisions on exchange rate movements and patterns of international trade. The U.S. dollar fell against benchmark currencies on November 18, 1997, and on other days in the ensuing three years when events suggested that the United States would be required to repeal its tax-based export incentives. Further indication of a link between exchange rates and tax-based export incentives appears in the pattern of exchange rate reactions on November 18, 1997, when 10 percent greater net trade deficits with the United States were associated with currency appreciations of 0.2 percent against the U.S. dollar. This evidence is consistent with a combination of trade-based exchange rate determination and important effects of U.S. export promotion policies.

Section 2 of the paper describes U.S. efforts to encourage exports by exempting certain fractions of export profits from taxable income. Section 3 presents time series evidence of the effect of the European FSC complaint on the value of the U.S. dollar, identifying the extent to which dollar movements correspond to predicted effects of developments in the ongoing controversy. Section 4 offers a cross-sectional analysis of exchange rate movements on November 18, 1997, in which foreign currencies react in a way that is consistent with the trade implications of possible FSC repeal. Section 5 is the conclusion.

## **2. *Foreign Sales Corporations.***

Firms exporting goods from the United States during the years 1971 – 2000 were entitled to do so in legally roundabout fashions that enabled them to exempt a fraction of export profits from

taxation.<sup>1</sup> While complying with the necessary rules was cumbersome, the tax advantages were large enough to make it well worth the while of most large American exporters to take advantage of this opportunity.

In order to obtain this export subsidy from 1984 to 2000,<sup>2</sup> it was necessary to establish an FSC in an offshore location such as Guam, Barbados, or the Virgin Islands. For legal purposes, exports might then travel from the United States to their ultimate foreign destinations via the FSC. Hence, an American computer company selling a computer manufactured in Texas to a buyer in northern Italy first sold the computer to its FSC located in Guam, which in turn sells the computer to the buyer in Italy. The computer did not travel to Guam in the course of this sale, nor were the FSC offices located in Guam typically very active; instead, these were largely paper transactions. In the course of these transactions, the FSC located in Guam earned a profit; some of this profit was immediately subject to U.S. taxation, but a fraction equal to 15/23 was forever exempt, thereby providing a tax subsidy for exporters.<sup>3</sup>

For an American firm whose profits are fully taxed by the United States at the 35 percent corporate tax rate, there was a benefit associated with making the FSC's share of total export profits as large as possible.<sup>4</sup> Consider the case in which the American computer manufacturer produced its computer for \$1,500 in the United States and sold the computer in Italy for \$2,000. Without the use of an FSC, all \$500 of this profit was subject to U.S. taxation at the 35 percent

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<sup>1</sup> Portions of the following brief description of FSCs and summary of the relevant literature are excerpted from Desai and Hines (forthcoming).

<sup>2</sup> The phrase "export subsidy" appearing here and elsewhere refers only to the economic concept of export subsidy (as used, for example, by Krugman and Obstfeld (1991, pp. 108-111)), and not the legal concept of "export subsidy" as defined by WTO rules. A far more elaborate legal and textual analysis than that provided in this paper is necessary in order to determine whether or not U.S. export tax incentives represent "export subsidies" for WTO purposes.

<sup>3</sup> Alternatively, the Guamanian FSC might not take title to the export property, but instead receive a commission for facilitating the export sale. According to data reported by Belmonte (2000), 21% of FSCs in 1996 bought and sold export property, while the remaining 79% simply received commissions for export sales.

<sup>4</sup> The tax benefits of exporting through FSCs were available to all corporations in the United States, including those that are foreign-owned.

rate. With the FSC involved in the transaction, the FSC might have purchased the computer for \$1,885 and sold it in Italy for \$2,000, thereby earning an export profit of \$115. The American exporting company therefore would owe taxes on the remaining \$385 of export profits, and its FSC would likewise owe U.S. taxes on  $(8/23)*\$115$ , or \$40. The remaining \$75 [ $(15/23)*\$115 = \$75$ ] of FSC profit was exempt from U.S. taxation, and, since FSCs were located in offshore jurisdictions that impose no taxes, the \$75 was also exempt from foreign taxation. At a tax rate of 35 percent, this translates into a tax saving of \$26.25. Since law fixes the 15/23 exclusion ratio, it was therefore in the taxpayer's interest to establish that the FSC export profits were as large as possible.<sup>5</sup>

As a consequence, U.S. law also required taxpayers to calculate the profit of an FSC based on methods that limited the exempt fraction of total export profits. Taxpayers were entitled to choose among several different methods of distributing export profits between the exporter located in the United States and its offshore FSC. The first, and most commonly used, method was simply to assign the FSC a commission equal to 23 percent of export profits. In the previous example, \$115 of FSC profit was arrived at through the application of this method. It is on the basis of the prevalence with which exporters assigned their FSCs 23 percent of export profits, together with the 15/23 exclusion ratio, that FSCs are typically described as having exempted 15 percent of export profits from taxation. Other methods of determining FSC income are described in Desai and Hines (forthcoming).

There were restrictions on the kinds of export sales that could be routed through an FSC, as well as restrictions on the details of FSC management. In order to be eligible for the tax benefits offered by FSCs, export property could not have more than 50 percent of non-U.S. content and

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<sup>5</sup> Taxpayers were not entitled to defer U.S. taxation of FSC profits. Corporations exporting through FSCs instead receive tax benefits in the form of the exemption of 15/23 of FSC profits.

could not be intended for ultimate use in the United States. Qualifying export property was required to be tangible; meaning that patents, copyrights, trademarks, and like property could not receive FSC treatment.<sup>6</sup> Furthermore, certain specific items were ineligible for FSC treatment. These included oil and gas products (other than petrochemicals), 50 percent of military equipment sales, and various idiosyncratic commodities, including unprocessed softwood timber, western red cedar, and horses for slaughter shipped by sea. FSCs were subject to strict administrative requirements that could be daunting for small exporters. As a result, legislation establishing FSCs also authorized the creation of entities known as “small FSCs,” “shared FSCs” and “IC-DISCs” with similarly attractive tax attributes but reduced administrative requirements, that served to facilitate the exports of small companies.

An entirely separate type of export subsidy is available to American multinational firms with excess foreign tax credits. The nature of the subsidy is that part or all of export profits can be treated as foreign source income for the purpose of U.S. income taxation. This sales source rule is more generous to qualifying firms than is the subsidy provided by the use of FSCs. Since many American multinational firms have excess foreign tax credits,<sup>7</sup> and the parent companies of American multinational firms account for 58 percent of all U.S. exports of goods,<sup>8</sup> it follows that this export subsidy is potentially quite important. Notably, this export subsidy is not available to American exporters that are not multinational firms. While official U.S. government figures indicate that FSCs were responsible for roughly \$4 billion of tax saving for American exporters by

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<sup>6</sup> Exporters of intangible property such as patent rights are typically compensated in the form of royalties that are treated as foreign-source income under U.S. law and therefore effectively untaxed if received by domestic taxpayers with excess foreign tax credits. See Hines (1995) for an analysis of the economic impact of this treatment of royalty income. Additionally, the Taxpayer Relief Act of 1997 permitted computer software to receive FSC treatment starting in 1998.

<sup>7</sup> Grubert et al. (1996) report that firms with excess foreign tax credits received 33 percent of the foreign income of American corporations in 1984, and 66 percent in 1990, which follows the U.S. tax rate reduction in 1986. They also note that the fraction of foreign income received by firms with excess foreign tax credits appears to be falling over time, reaching 35 percent in 1992.

2000, Desai and Hines (forthcoming) conclude that the opportunity to allocate export income to foreign source for U.S. tax purposes may be even more valuable to American multinational exporters.

Ongoing trade disputes between the United States and Europe took an interesting turn on November 18, 1997, when the European Union lodged a complaint with the WTO alleging that the American FSC program represented an illegal export subsidy. Contemporaneous observers noted that the European complaint represented a retaliation for successful American claims that European import regimes for bananas and hormone-treated beef violated WTO rules. The original FSC complaint was followed by inconclusive consultations between the United States and the European Union on December 17, 1997, and continued unfruitful consultations on February 10, 1998. On July 23, 1999 the WTO's Dispute Resolution Panel issued its interim report stating that the American FSC program violated WTO rules. The July 23 report also indicated that the United States would be required to rescind its FSC provisions by October 1, 2000 or else face retaliatory penalties. Following the appearance of the interim report, the European Union and the United States together requested on August 6, 1999 that the panel review the precise aspects of the interim report. The WTO's final ruling against the United States appeared on September 17, 1999.

On October 28, 1999, the United States indicated its intention to appeal the WTO's report, and filed a formal notice of appeal. The U.S. appeal was withdrawn on November 2, 1999, but refiled on November 26, 1999. Following rounds of submissions by all parties to the dispute, as well as oral hearings, the WTO formally ruled on the legality of FSCs on February 24, 2000, finding that the FSC program violates WTO rules and must be replaced by October 1, 2000.

The American response came quickly. On February 28, 2000 American Treasury Secretary Lawrence Summers said that the United States would not abandon its program of subsidizing

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<sup>8</sup> See the data for 1997 reported in Mataloni (1999, p. 14).

exports, and would instead start consultations with the European Union to determine appropriate compensation. On April 7, 2000, the United States informed the Dispute Resolution body of its intention to implement its recommendations consistently with WTO obligations. On September 13, 2000, the House of Representatives voted in favor of legislation (H.R. 4986, the FSC Repeal and Extraterritorial Income Exclusion Act of 2000) that would effectively retain current export subsidies while also adding small subsidies for sales by foreign affiliates of American multinational corporations. This legislation was signed into law on November 17, 2000 by President Clinton who referred specifically to the WTO dispute at the signing of the legislation.

### **3. *Time series evidence of the impact of the WTO controversy.***

U.S. tax policies encourage exports by improving the after-tax margins received by American exporters. As a result, the introduction of an export subsidy typically makes exporters eager to expand their sales abroad, which in competitive markets results in reduced purchase prices for foreign buyers and greater export volume.<sup>9</sup> Long-run trade balance then implies that the prices of American goods must appreciate relative to the prices of foreign goods, since otherwise the United States would become a net exporter. This price adjustment can be accomplished either by greater inflation differentials between the United States and other countries, or, more likely, by an appreciation of the value of the American dollar relative to the values of foreign currencies.<sup>10</sup> One simple way to think about how this happens is to note that the export subsidy makes American

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<sup>9</sup> Portions of this section are drawn from Desai and Hines (forthcoming). The situation is somewhat more complex when firms export to their own foreign affiliates, since then the existence of export subsidies encourages exporters to charge higher export prices. This incentive conflicts with regulations that require firms to charge arm's-length prices for exports to related parties, so the net effect on final prices is unclear. See Rangan and Lawrence (1993) and Clausing (forthcoming).

<sup>10</sup> While the assumption of purchasing power parity (PPP) is commonly made, the available evidence (reviewed by Froot and Rogoff (1995)) suggests that PPP is best understood as a long-run phenomenon. Recent attention in international macroeconomics (see, for example, Obstfeld and Rogoff (2000)) has identified distortions to international

goods more attractive to foreign buyers, which leads to dollar appreciation. The endogenous change in the value of the dollar in turn serves to attenuate the effect of the export subsidy on export volumes, since American goods become less attractive to foreign buyers as the dollar appreciates. The net effect of the subsidy and the endogenous change in the value of the dollar is to expand the volumes of both American exports and American imports. These expansions are of course nonuniform, and in particular, exports of goods that are ineligible for the tax subsidy will fall, even as exports of those that are eligible for the tax subsidy will rise.

This section considers evidence of the impact of the FSC program on the value of the American dollar relative to the values of foreign currencies. Over the course of November 1997–April 2000 there were several twists and turns in the negotiations between the United States and the World Trade Organization over the likelihood of the retention of American export subsidies. By looking at changes in the value of the American dollar on those dates, it is possible to infer the effect of the FSC program on proclivities to export from the United States. Since many other factors also influence exchange rates, it is necessary to interpret this information carefully.

The leftmost column of Table 1 identifies the dates of major events surrounding the FSC controversy between the United States and the WTO.<sup>11</sup> Of these, two are prominent: November 18, 1997, when the EU complaint was first lodged with the WTO, and July 23, 1999, when the WTO's Dispute Resolution Panel issued its interim report stating that the American FSC program violated WTO rules. The July 23 report also indicated that the United States would be required to rescind its FSC provisions by October 1, 2000. Contemporaneous press accounts indicate that both the November 18, 1997 and July 23, 1999 dates were considered momentous for the history of the trade dispute; other dates are significant to differing degrees.

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goods markets (such as those introduced by FSCs) as a possible explanation for a variety of puzzles in international finance, including deviations from PPP.

A simple way to identify the impact of the events surrounding the WTO controversy is to regress daily changes in the value of the U.S. dollar against dummy variables for event dates, controlling for other observable factors. Table 1 presents estimated coefficients from such regressions. The sample for these regressions consists of foreign exchange trading days between January 1, 1997 and June 13, 2000. The dependent variable is the daily percent change in the value of the American dollar relative to the British pound sterling.<sup>12</sup> Since the dependent variable is calculated as the percentage change in numbers of pounds to the dollar, it follows that a negative value of the dependent variable corresponds to dollar weakening. Exchange rates are calculated as of market closing in New York, so prices will reflect any impact of European news on the same days.

The results reported in the first column of Table 1 indicate that the dollar weakened on November 18, 1997, falling by 0.1092 percent against the pound sterling. This decline is statistically significant and quite consistent with the predicted effect of removing U.S. export subsidies, since doing so shifts the supply schedule for American exports. Of course, the foreign exchange market could not be confident, on the basis of the November 18, 1997 action, that the United States would ultimately remove the FSC portion of its export tax subsidies. Nonetheless, it was known at the time that the United States was vulnerable to charges such as those brought by the European Union, given that the FSC's predecessor program (in place from 1971 to 1984) had been subject to a successful complaint under the General Agreement on Tariffs and Trade in 1982. All that was necessary was for a major complainant to appear with charges against the United States, and that happened on November 18, 1997.

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<sup>11</sup> Table 1 is drawn from Desai and Hines (forthcoming).

<sup>12</sup> The British pound is chosen as the alternative to the U.S. dollar for these calculations because it is a common benchmark currency, and one that was not buffeted either by events surrounding the European Monetary Union or the economic crises in Japan and Asia.

Given uncertainty over the ultimate impact of any WTO action, an exchange rate response of roughly 0.1 percent is quite in line with the effect of estimated supply and demand elasticities. At an average profit margin of 10 percent, a 15 percent tax exclusion reduces taxable income by 1.5 percent of sales. At a tax rate of 35 percent, this generates a tax saving of 0.5 percent of sales – which, given the 35 percent tax rate, produces approximately a 0.75 percent reduction in prices at which exporters would be willing to offer goods for foreign sale. Of course, elimination of the FSC program would not necessarily entail elimination of export subsidies through the sales source rules, so not all the value of FSCs is likely to be lost in the course of a successful dispute brought by the European Union.

Taking the aggregate price elasticity of U.S. exports to be roughly equal to -1.0, and the aggregate price elasticity of U.S. imports to be roughly equal to -0.5,<sup>13</sup> it follows that an offsetting exchange rate movement of two thirds the size of the lost export subsidy – or 0.5 percent – is required to restore trade balance.<sup>14</sup> Then allowing for the incomplete use of FSCs, and the backstop use of the sales source rules by firms currently electing FSC treatment of their exports, together reduces this predicted effect, as does uncertainty over the final disposition of the FSC program. So the likely impact of the European Union action is to reduce the value of the dollar by perhaps 0.1 percent, which appears to be what happened on November 18, 1997.

Subsequent events in the WTO controversy are also associated with changes in the value of the dollar, though these events are likely to be less important from the standpoint of their direct impact on dollar values. As reported in column one of Table 1, the failure of initial consultations between the United States and the European Union on December 17, 1997 is associated with a fall

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<sup>13</sup> Sawyer and Sprinkle (1996) suggest these estimates on the basis of their survey of empirical studies of aggregate U.S. export and import elasticities. See also Hooper, Johnson, and Marquez (1998).

<sup>14</sup> Starting from trade balance, loss of FSC benefits reduces exports by  $(0.75 + e)$  percent and reduces imports by  $(-0.5)e$  percent, in which  $e$  is the change in the dollar exchange rate. Trade balance then implies that  $e = -0.5$ .

of 0.7160 percent of dollar value, though other major news items of the day no doubt contributed to the dollar's fall in value. Most other event dates are associated with dollar movements whose signs are consistent with the impact of FSC removal on foreign exchange values, though magnitudes of estimated coefficients are significantly greater than what might be expected from FSC removal alone. Thus the failed second consultations between the European Union and the United States on February 10, 1998 were associated with a 0.5695 percent drop in the value of the dollar, the (largely anticipated) July 23, 1999 interim report of the Dispute Resolution Panel with a 0.3004 percent drop in the dollar's value. The attempted reconciliation of the United States and the European Union on August 6, 1999 is associated with a 0.1050 percent strengthening of the dollar, while the (anticipated) September 17, 1999 WTO ruling against the United States is associated with a fall of 0.0078 percent of the dollar's value. The American appeal on October 28, 1999 coincides with an appreciation of 0.3342 percent of the dollar's value, and the withdrawal of this appeal on November 2, 1999 coincides with a fall of 0.3922 percent of dollar value.

The only anomalous sign appears on February 24, 2000, when the fully anticipated WTO final ruling against the United States is associated with a rise in the value of the dollar of 0.4503 percent. The aggressive February 28 response by U.S. Treasury Secretary Lawrence Summers is associated with a dollar appreciation of 0.4981 percent, while the formal American reply to the Dispute Resolution Board on April 7, 2000 is associated with an appreciation of 0.1320 percent.

Since many events in the course of a day are likely to influence exchange rates, and the expected impact of the FSC program is subtle, it is a mistake to overinterpret the results reported in column one of Table 1. Columns 2-4 of the same table report estimated coefficients from regressions that add daily measures of changes in stock market indices and short-term interest rates. Specifically, the stock market variable is the daily difference in the performance (measured

in percentage terms) of the U.S. S&P 500 index and the British FTSE 100 index. The benefit of including such a variable in the regression is that stock market prices reflect the impact of omitted news variables, such as economic news, inflation fears, and various political developments that may be correlated with exchange rate movements and therefore impart a correlation between exchange rates and equity prices. When included in the regression reported in column two of Table 1, this variable takes the expected positive sign, while the absolute value of the coefficient on the dummy variable for November 18, 1997 falls slightly to 0.1076. Column three introduces a variable equal to the difference in the daily change in U.S. and British short-term (90 day) government interest rates, which, when included, has little effect on daily event coefficients. The regression reported in column four of Table 1 includes both the stock index and interest rate differences, with results that are similar to those reported in column two.

While the results reported in Table 1 appear to be robust to the inclusion of additional explanatory variables that reflect the economic significance of daily events, it is inevitable that important factors are omitted. November 18, 1997 differs from most others in being a very slow news day, the main international trade-related nuggets being the (anticipated) failure of a large Japanese bank and the lifting of the European ban on imports of Iranian pistachios. Hence, the filing of a European complaint against the United States was a major development, and it is reasonable to infer that the exchange rate movement on that day reflects the impact of that news. While the consistency of the sign pattern for other event days, as reported in Table 1, is reassuring, these coefficients reflect the cumulative impact of many factors unrelated to FSCs.

The November 18, 1997 evidence indicates that the market reaction to news of the European Union filing against the United States is consistent with other evidence of aggregate trade demand and supply elasticities, and with an expectation that the inability to use FSCs would

affect American exports. Hence this evidence serves the function of offering a market-based test of previous conjectures as to the likely impact of FSCs on export patterns.<sup>15</sup>

#### **4. *Cross sectional evidence of the impact of the WTO controversy.***

The exchange rate regressions reported in the previous section correlate daily movements in value of the U.S. dollar with events surrounding the European Union complaint about the U.S. Foreign Sales Corporation program. This section takes a close look at daily exchange rate changes on November 18, 1997, the day on which the European complaint was first aired. The purpose of this analysis is to subject the theory that the European complaint is the source of dollar weakening on that day to a more powerful test than that provided by examination of a single aggregate price movement. This section develops a model that predicts cross-sectional differences in exchange rate reactions as a function of proclivities to trade with the United States. The available evidence indicates that relative currency movements on November 18, 1997 are indeed related to foreign exposures to U.S. markets, providing further evidence of a link between exchange rate movements and the WTO complaint, and suggesting an important impact of FSCs on trade patterns.

##### **4.1. *A Model of Export Incentives and Exchange Rates.***

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<sup>15</sup> Most previous studies of U.S. export tax incentives use estimated export and import elasticities to predict the impact of export promotion, rather than estimate actual impacts. Examples include reports by the U.S. Treasury (1993, 1997) that estimate that FSC repeal would reduce U.S. exports by \$1.5 billion in 1992; Horst and Pugel (1977), who estimate that repeal of DISCs (a predecessor to FSCs) would reduce U.S. exports by \$2.1 billion in 1974; and Mutti and Grubert (1984), who likewise find that DISC repeal would reduce U.S. exports by 3.1 percent in 1979. Rousslang and Tokarick (1994) estimate that the FSC and sales source rules together have the same effect on trade volume as would reducing American tariffs by more than one third. Kemsley (1998) differs from this literature in estimating the impact of tax policy changes on export proclivities; he finds that firms with excess foreign tax credits (and therefore that are able to benefit from the sales source rules) have higher ratios of exports to sales by foreign affiliates than do firms with deficit foreign tax credits. Desai and Hines (forthcoming) estimate that the 1984 repeal of DISCs and introduction of the less generous FSCs were responsible for a 3.1 percent decline in U.S. exports. Desai and Hines (2001) also report that the European complaint on November 18, 1997 is associated with a 0.5 percent drop in market value for the average American exporter.

In order to predict the cross-sectional impact of potential FSC repeal, it is helpful to consider country  $i$ 's trade balance, its net exports being denoted  $y_i$  and defined as the difference between aggregate exports and aggregate imports:

$$(1) \quad y_i \equiv \sum_{j=1}^n S_j^i(\mathbf{e}) - \sum_{j=1}^n D_j^i(\mathbf{p}).$$

In equation (1),  $S_j^i(\mathbf{e})$  is the supply of country  $i$ 's exports to country  $j$ . This supply is a function of the prices that country  $i$  exporters receive (as measured in units country  $i$ 's currency), which is in turn a function of the vector of real exchange rates, denoted  $\mathbf{e}$ .  $D_j^i(\mathbf{p})$  is country  $i$ 's demand for imports from country  $j$ , which is a function of  $\mathbf{p}$ , the vector of real prices (in units of country  $i$ 's currency) paid by country  $i$  importers. The vector  $\mathbf{p}$  differs from  $\mathbf{e}$  due to export subsidies; assuming that foreign markets are perfectly competitive, it follows that export subsidies are fully passed through to buyers in the form of lower prices, so the elements of  $\mathbf{p}$  are  $(1 - s_k)e_k, \forall k$ , in which  $e_k$  is the real value of country  $k$ 's currency, and  $s_k$  is the rate at which country  $k$  subsidizes exports. Trade balance implies that  $y_i = 0$ .

Consider a small increase in the export subsidy provided by country one. This policy change affects country  $i$ 's trade balance in four ways: first, by reducing  $i$ 's cost of importing from country one; second, by strengthening the value of country one's currency and therefore attracting exports from country  $i$ ; third, by influencing the value of country  $i$ 's currency; and fourth, by influencing the values of all other currencies. Taking the fourth effect to be small enough (from country  $i$ 's standpoint) safely to ignore, it is convenient to define starting units so that all exchange rates are unity and initial export subsidies are zero. Imposing the trade balance condition, the first three effects are captured by differentiating equation (1):

$$(2) \quad \frac{dy_i}{ds_1} = \frac{\partial S_1^i}{\partial e_1} \frac{de_1}{ds_1} + \frac{\partial D_1^i}{\partial e_1} \left(1 - \frac{de_1}{ds_1}\right) + \frac{\partial y_1}{\partial e_i} \frac{de_i}{ds_1} = 0.$$

Equation (2), in turn, implies:

$$(3) \quad \frac{de_i}{ds_1} = \frac{\frac{\partial S_1^i}{\partial e_1} \frac{de_1}{ds_1} + \frac{\partial D_1^i}{\partial e_1} \left(1 - \frac{de_1}{ds_1}\right)}{-\frac{\partial y_1}{\partial e_i}}.$$

The denominator of (3) contains the derivative  $\frac{\partial y_1}{\partial e_i}$  that captures the effect of movements in

country i's exchange rate on changes in its trade balance. Since exports contract and imports expand as the value of country i's currency appreciates, it follows that this derivative is negative.

Furthermore, its value is likely to be a function of the economic size of country i. If countries have identical export and import elasticities, then the value of this derivative is simply a scalar multiple of exports or imports (which are identical if trade is balanced):

$$(4) \quad \frac{\partial y_1}{\partial e_i} = -g\bar{S}^i = -g\bar{D}^i,$$

in which  $\bar{S}^i \equiv \sum_{j=1}^n S_j^i(\mathbf{e})$  equals country i's total exports, and  $\bar{D}^i \equiv \sum_{j=1}^n D_j^i(\mathbf{p})$  equals its total imports.

It is reasonable, as well as expedient, to assume that the supply of exports and the demand for imports each takes constant elasticity form:

$$(5a) \quad \frac{\partial S_j^i}{\partial e_j} = h_S \frac{S_j^i}{e_j} \forall i, j$$

$$(5b) \quad \frac{\partial D_j^i}{\partial p_j} = h_D \frac{D_j^i}{p_j} \forall i, j,$$

in which  $h_S$  is the elasticity of export supply and  $h_D$  is the elasticity of import demand. Then starting from a situation in which export subsidies are zero and  $e_j = p_j = 1, \forall j$ , equations (3), (4), (5a), and (5b) together imply:

$$(6) \quad \frac{de_i}{ds_1} = \frac{h_S}{g} s_{E1}^i \frac{de_1}{ds_1} + \frac{h_D}{g} s_{I1}^i \left( 1 - \frac{de_1}{ds_1} \right),$$

in which  $s_{E1}^i \equiv \frac{S_1^i}{S^i}$  is the share of country  $i$ 's total exports accounted for by country one, and

$s_{I1}^i \equiv \frac{D_1^i}{D^i}$  is the share of country  $i$ 's total imports accounted for by country one.

Since  $h_D$ ,  $h_S$  and  $g$ , and  $\frac{de_1}{ds_1}$  are common for all countries  $i$ , equation (6) suggests the

following estimating equation:

$$(7) \quad \frac{de_i}{ds_1} = a + b_1 s_{E1}^i + b_2 s_{I1}^i + u_i,$$

in which  $a$ ,  $b_1$  and  $b_2$  are parameters to be estimated, and  $u_i$  is the residual. The theory predicts that  $b_1 < 0$  and  $b_2 > 0$ , with magnitudes that depend on aggregate supply and demand elasticities, as well as the extent to which the average value of country 1's currency is affected by its own export subsidies.

#### 4.2 Data and Evidence.

In order to test the implications of this model of the influence of tax policies on real exchange rates, it is necessary to analyze the relationship between exchange rate reactions to the potential removal of U.S. export subsidies through FSCs and proclivities to trade with the United States. For this purpose, the exchange rate reaction,  $\frac{de_i}{ds_1}$  in equation (7), is taken to be the one-day

percent change in the value of country  $i$ 's currency (relative to the U.S. dollar) on November 18, 1997. Country  $i$ 's export share,  $s_{E1}^i$ , is the share of its exports sold to the United States in 1997; its import share,  $s_{I1}^i$ , is the share of its imports purchased from the United States in 1997. The sample consists of 58 countries for which these data are available. Table 2 presents means and standard deviations of the variables for the entire sample, as well as for a subsample of countries for whom the United States is a "major trading partner" (meaning that their U.S. export shares exceed the median value for the entire sample).

The results of estimating (7) for the whole sample are reported in column 1 of Table 3, in which the coefficients on both the import and export shares have the predicted signs. The coefficient of 1.36 on the import share implies that the currency of a country with one hundred percent of its imports coming from the United States appreciates relative to the U.S. dollar by 1.36 percent more on November 18, 1997 than would the currency of a country with no imports from the United States. While large relative to the mean for the entire sample, this predicted exchange rate movement is consistent with the time series evidence presented in Table 1. Table 3 provides OLS standard errors as well as heteroskedasticity-consistent standard errors; levels of statistical significance are notably higher with the OLS standard errors. In order to control directly for one potential source of heteroskedasticity, the regression reported in column 3 is run on the major trading partners subsample; the estimated coefficients are of similar magnitude and significance to those obtained with the full sample.

The specifications in columns 2 and 4 define the independent variable as the difference between import and export shares. This specification effectively constrains the  $b_1$  and  $b_2$  coefficients in (7) to be of equal magnitude and opposite sign. The coefficient on the difference in column 2 is positive, as predicted, and on the borderline of being statistically significant. The

estimated coefficient of 1.85 implies that ten percent differences in net trade shares are associated with 0.185 percent differences in exchange rate reactions on the event day. Since the sample standard deviation of the trade share difference (as reported in Table 2) is 8.2 percent, it follows that a one standard deviation trade share difference is responsible for exchange rate reactions that differ by 0.15 percent. This is of similar magnitude to the 0.11 percent daily reaction estimated in the time series results reported in Table 1 and, in that sense, quite consistent with those results. The specification reported in column two of Table 3 is used to estimate the model on the subsample of data for major trading partners, again generating a coefficient of similar magnitude to that obtained from estimating the model on the whole sample. This cross-country evidence of an important association between trading patterns and magnitudes of exchange rate movements on November 18, 1997 reinforces the time series evidence linking exchange rate movements and developments in the WTO controversy.

## **5. Conclusion.**

The practice of using tax incentives and other commercial policies to encourage exports relies on the premise that such policies are likely to be effective at stimulating exports. To date, this premise has had limited empirical foundation. This paper provides evidence on the effect of U.S. tax-based export promotion policies on patterns of international trade by examining the movement of exchange rates in response to developments surrounding the 1997 European complaint before the WTO. The time series evidence demonstrates that significant developments in the WTO dispute were associated with predicted changes in the value of the dollar versus a benchmark currency. Purchasing power parity implies that cross-country differences in trade relations with the United States should predict the magnitudes of relative currency movements.

The cross-country evidence of exchange rate reactions to the filing of the European complaint on November 18, 1997 conforms to these predictions, thereby reinforcing the link between exchange rate movements and developments in the WTO dispute. Since exchange rate reactions should materialize only if export incentives influence export propensities, this exchange rate evidence illustrates the impact of tax-based export incentives on patterns of international trade.

## **References**

- Belmonte, Cynthia, Foreign sales corporations, 1996, *SOI Bulletin*, Spring 2000, 19(4), 87-122.
- Clausing, Kimberly A., The impact of transfer pricing on intrafirm trade, in: James R. Hines Jr., ed. *International taxation and multinational activity* (Chicago: University of Chicago Press, forthcoming.)
- Desai, Mihir A. and James R. Hines Jr., The uneasy marriage of export incentives and the income tax, in: James M. Poterba, ed. *Tax policy and the economy, volume 15* (Cambridge, MA: MIT Press, forthcoming).
- Desai, Mihir A. and James R. Hines Jr., The incidence of export subsidies as revealed by market reactions, working paper, University of Michigan, 2001.
- Froot, Kenneth A. and Kenneth Rogoff, Perspectives on PPP and long-run real exchange rates, in: Gene M. Grossman and Kenneth Rogoff, eds. *Handbook of international economics, volume 3*, (Amsterdam: North-Holland, 1995), 1647-1688.
- Grubert, Harry, William C. Randolph and Donald J. Rousslang, Country and multinational company responses to the Tax Reform Act of 1986, *National Tax Journal*, September 1996, 49 (3), 341-358.
- Hines, James R., Jr., Taxes, technology transfer, and the R&D activities of multinational firms, in: Martin Feldstein, James R. Hines Jr., and R. Glenn Hubbard, eds. *The effects of taxation on multinational corporations* (Chicago: University of Chicago Press, 1995), 225-248.
- Hooper, Peter, Karen Johnson, and Jaime Marquez, Trade elasticities for G-7 countries, Federal Reserve Board of Governors International Finance Discussion Paper No. 609, April 1998.
- Horst, Thomas and Thomas Pugel, The impact of DISC on the prices and profitability of U.S. exports, *Journal of Public Economics*, February 1977, 7 (1), 73-87.
- Kemsley, Deen, The effect of taxes on production location, *Journal of Accounting Research*, Autumn 1998, 36 (2), 321-341.
- Krugman, Paul R. and Maurice Obstfeld, *International economics: Theory and policy*, second edition, (New York: HarperCollins, 1991).
- Mataloni, Raymond J., Jr., U.S. multinational companies: Operations in 1997, *Survey of Current Business*, July 1999, 79 (7), 8-35.
- Mutti, John and Harry Grubert, The Domestic International Sales Corporation and its effects, in: Robert E. Baldwin and Anne O. Krueger, eds. *The structure and evolution of recent U.S. trade policy* (Chicago: University of Chicago Press, 1984), 279-317.
- Obstfeld, Maurice and Kenneth Rogoff, The six major puzzles in international macroeconomics: is there a common cause?, National Bureau of Economic Research Working Paper No. 7777, July 2000.

Rangan, Subramanian and Robert Z. Lawrence, The responses of U.S. firms to exchange rate fluctuations: Piercing the corporate veil, *Brookings Papers on Economic Activity*, 1993 (2), 341-369.

Rousslang, Donald J. and Stephen P. Tokarick, The trade and welfare consequences of U.S. export-enhancing tax provisions, *IMF Staff Papers*, December 1994, 41 (4), 675-683.

Sawyer, W. Charles and Richard L. Sprinkle, The demand for imports and exports in the U.S.: A survey, *Journal of Economics and Finance*, Spring 1996, 20 (1), 147-178.

United States Department of the Treasury, *Report to the Congress on the sales source rules*, January 1993.

United States Department of the Treasury, *The operation and effect of the foreign sales corporation legislation: July 1, 1992 to June 30, 1993*, November 1997.

**Table 1: Exchange Rate Responses to WTO Events**

Dependent variable: One-day % change in £/\$ exchange rate

	(1)	(2)	(3)	(4)
Constant	0.0094 (0.0165)	0.0099 (0.0169)	0.0093 (0.0165)	0.0099 (0.0169)
<b>November 18, 1997 Charges Filed (-)</b>	-0.1092 (0.0165)	-0.1076 (0.0181)	-0.1099 (0.0170)	-0.1080 (0.0186)
December 17, 1997 Inconclusive Consultations (-)	-0.7160 (0.0165)	-0.7165 (0.0174)	-0.7101 (0.0332)	-0.7128 (0.0376)
February 10, 1998 Inconclusive Consultations (-)	-0.5695 (0.0165)	-0.5732 (0.0180)	-0.5758 (0.0175)	-0.5738 (0.0188)
<b>July 23, 1999 Interim Report Issued (-)</b>	-0.3004 (0.0165)	-0.3070 (0.0217)	-0.3018 (0.0183)	-0.3078 (0.0227)
August 6, 1999 Joint Review Request (+)	0.1050 (0.0165)	0.1117 (0.0255)	0.1028 (0.0205)	0.1103 (0.0290)
September 17, 1999 WTO Ruling (-)	-0.0078 (0.0165)	-0.0130 (0.0196)	0.0054 (0.0209)	-0.0115 (0.0241)
October 28, 1999 American Appeal (+)	0.3342 (0.0165)	0.3239 (0.0282)	0.3362 (0.0197)	0.3252 (0.0310)
November 2, 1999 Appeal Withdrawal (-)	-0.3922 (0.0165)	-0.3930 (0.0168)	-0.3921 (0.0165)	-0.3929 (0.0169)
February 24, 2000 Final Ruling (-)	0.4503 (0.0165)	0.4476 (0.0173)	0.4504 (0.0165)	0.4477 (0.0173)
February 28, 2000 Summers Rebuttal (+)	0.4981 (0.0165)	0.4831 (0.0381)	0.4918 (0.0389)	0.4793 (0.0503)
April 7, 2000 Formal American Response (+)	0.1320 (0.0165)	0.1360 (0.0210)	0.1328 (0.0171)	0.1365 (0.0214)
% change [S&P 500 (US) – FTSE 100 index (UK)]		0.5398 (1.3269)		0.5372 (1.3295)
Change (US-UK interest rate difference)			-0.0374 (0.2068)	-0.0230 (0.2106)
R-Squared	0.0090	0.0096	0.0091	0.0096
Number of observations	840	810	840	810

Note: The sample consists of observations of foreign exchange trading days between January 1, 1997 – June 13, 2000. The columns report coefficients from OLS regressions in which the dependent variable equals the daily percent change in the value of the American dollar relative to the British pound sterling. Since the dependent variable is calculated as the percent change in numbers of pounds to the dollar, a negative value of the dependent variable corresponds to dollar weakening. The table reports estimated coefficients for dummy variables for each of the eleven event dates; expected signs are indicated in parentheses. "% change [S&P 500 (US) - FTSE 100 index (UK)]" is the daily difference in percentage performance of the S&P 500 and FTSE 100 Indices. "Change (US-UK interest rate difference)" is the daily change in U.S. and British 90-day government interest rates. Heteroskedasticity-consistent standard errors are in parentheses.

**Table 2**  
**Variable Means and Standard Deviations**

	<u>Mean</u>	<u>Standard Deviation</u>	<u>Number of Observations</u>
<b><i>Whole sample</i></b>			
Daily % change in value of foreign currency	0.0440	0.5987	58
Share of imports from U.S.	0.1594	0.1626	58
Share of exports to U.S.	0.1570	0.1694	58
(Import share - export share)	0.0024	0.0820	58
<hr/>			
<b><i>Major trading partners sample</i></b>			
Daily % change in value of foreign currency	0.2625	0.7430	29
Share of imports from U.S.	0.2404	0.1923	29
Share of exports to U.S.	0.2591	0.1903	29
(Import share - export share)	-0.0186	0.1003	29

Note: "Daily % change in value of foreign currency" is the percentage change in the value of a country's currency relative to the U.S. dollar on November 18, 1997. "Share of imports from U.S." is the ratio of a country's imports from the U.S. to all imports for that country. "Share of exports to U.S." is the ratio of a country's exports to the U.S. to all exports from that country. "(Import share - export share)" is the difference between "Share of imports from U.S." and "Share of exports to U.S." The bottom panel restricts the sample to those countries which have "Share of exports to U.S." above the median for the whole sample.

**Table 3**  
**Determinants of Foreign Exchange Movements, November 18, 1997**

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Dependent Variable: One-day % change in value of foreign currency relative to U.S. dollar,  
November 18, 1997

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	<u>Whole Sample</u>		<u>Major Trading Partners</u>	
	(1)	(2)	(3)	(4)
Constant	0.0679 (0.0898) [0.1071]	-0.0484 (0.0789) [0.0768]	-0.2376 (0.2010) [0.2354]	-0.2231 (0.1165) [0.1371]
Share of imports from U.S.	1.3597 (1.3489) [0.9859]		2.1384 (1.6351) [1.4360]	
Share of exports to U.S.	-2.0928 (1.4475) [0.9462]		-2.0806 (1.6109) [1.4510]	
(Import share - export share)		1.8500 (1.4134) [0.9442]		2.1117 (1.5780) [1.3669]
R-Squared	0.1030	0.0642	0.1030	0.0810
Number of Observations	58	58	29	29

Note: The columns report coefficients from OLS regressions in which the dependent variable equals the percent change in the value of a country's currency relative to the U.S. dollar on November 18, 1997. The regressions in columns (1) and (2) employ the full sample of 58 countries; the regressions presented in columns (3) and (4) restrict the sample to those countries which are major trading partners of the U.S.. "Share of imports from U.S." is the ratio of a country's imports from the U.S. to all imports for that country. "Share of exports to U.S." is the ratio of a country's exports to the U.S. to all exports from that country. "(Import share - export share)" is the difference between "Share of imports from U.S." and "Share of exports to U.S." Heteroskedasticity-consistent standard errors are in parentheses and OLS standard errors are in brackets. The dependent variable is defined so that a value of 1.5 represents a 1.5 percent strengthening of the foreign currency against the U.S. dollar - i.e., a 1.5 percent reduction in the foreign currency/U.S. dollar exchange rate - on the event date.