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I am submitting herewith a dissertation written by Hapuarachilage Albert Wijeweera entitled "Two Essays on Corporate Income Tax Rates and Foreign Direct Investment in the United States." I have examined the final paper copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

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Two Essays on Corporate Income Tax Rates and Foreign Direct Investment in the United States

A Dissertation
Presented for the
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Hapuarachilage Albert Wijeweera
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Dedication

This dissertation is dedicated to my mother for her love and support throughout my life.

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Abstract

This dissertation investigates the relationship between corporate income tax rates and inbound foreign direct investment in the United States. In the two essays presented, the first estimates the effect of the corporate income tax rate on FDI inflows, while controlling for other non-tax variables. The study uses time series data over the period 1957-2002 and employs cointegration techniques and error correction models to estimate the long run and the short run tax responses. The corporate income tax rate is found to exert a significant negative effect on total FDI inflows in the long run. A one percent decrease in the tax rate will increase total FDI by 2.4 percent. The tax rate is also found to exert significant negative effect on transfer funds in the long and short run. Tax rate elasticities are larger in absolute value terms for the transfer funds than for total FDI. In the long run, reinvested component of FDI is not responsive to the U.S. corporate income tax rate.

The second essay investigates whether the corporate income tax rate is an important determinant of inbound FDI by incorporating both host country and home country tax rates into the analysis. We find that inbound FDI shares a significantly negative relationship with the host country corporate income tax rate, and a positive relationship with the home country tax rates. This essay also examines whether investors' decisions are affected differently by the various corporate taxation systems of the investing countries. Findings suggest that investors from exemption countries are more responsive to the U.S. corporate income tax rate than are those from tax credit countries. However, the groups are not systematically different in their response to home country corporate income tax rates.

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Introduction

Considerable research effort has been devoted to identifying determinants of foreign direct investment (FDI) in the United States. Interest in this area of research has been stimulated by the unprecedented growth in FDI and by recognition of the importance FDI holds for investment and growth in the host country. A number of empirical studies have investigated the impacts of corporate income tax rates on FDI in the United States. Although these studies have not reached an agreement regarding the relative responses of individual FDI components to changes in tax rates, there is a general consensus that FDI is sensitive to changes in the corporate income tax rate. This finding has lead to concern over the possibility of tax competition among countries to attract FDI. Governments might enact tax policies to attract FDI inflows and to counter the threat of FDI outflows.

This dissertation investigates the role of corporate income tax rates on FDI in the United States, while controlling for other important macroeconomic factors. There are two closely related essays of this dissertation. The first essay revisits the time series literature on taxation and aggregate FDI inflows in the United States. The second essay examines the impacts of host country and home country corporate tax rate changes on the amount of FDI flows into the United States.

Several features of the first essay represent improvements over earlier time series studies to examine the responsiveness of FDI to changes in the corporate income tax rate. First, this essay uses cointegration techniques to investigate the long run relationship between tax rate and FDI. A single equation approach suggested by Engle and Granger (1987) and multi-equation method proposed by Johansen (1991) are used to analyze cointegration relationships. Second, this essay also estimates short run impacts of tax rate changes on FDI. An error correction model is used to illustrate short run dynamics of the

variables. These relationships are examined for aggregated FDI as well as for disaggregated components of FDI (transfer funds and reinvested funds).

The second essay uses panel estimation techniques to investigate the effects of host country and home country tax policies on the amount of FDI flows into the United States. This contributes to the literature by employing pooled estimation techniques such as, fixed effects and random effects models to analyze possible relationship between corporate tax rates and FDI inflows. This essay uses foreign direct investment data from nine investing countries into the United States over 1982-2000 period. The study investigates whether investors' decisions are affected by the various taxation systems used in their own countries. We control for the different tax systems by including countries that adopt tax credit system and countries that adopt tax exemption system. Our sample consists of 4 tax credit countries and 5 tax exemption countries. We investigate whether results vary between tax credit countries and tax exemption countries.

Essay One

The Corporate Income Tax Rate and Foreign Direct Investment:

Time Series Evidence from the United States

Introduction

One of the most impressive economic developments since early 1970 has been the increasing importance of foreign capital over domestic capital in the United States. Foreign capital consists of two major components: Foreign Direct Investments (FDI), in which investors wield substantial control over the management of invested capital, and Foreign Portfolio Investments (FPI), in which such power is relatively minimal. Though both types of investments have been on the rise over the last five decades, the former has received more attention than the latter due to its stronger influence on the economy.

During the most part of the 20th century, the U.S. was not considered a leading destination for foreign direct investment. However, beginning in 1980, the United States started to experience a remarkable increase in its FDI capital inflow and this trend continued throughout the next two decades. To illustrate, annual US FDI inflows grew from about $20 billion in 1980 to $294 billion in 1999. During this period, the annual growth rate also showed an extraordinary upward trend. The annual growth rate of FDI reached an astonishing 100 percent mark in 1983 and 1993. This trend helped the United States surpass China to become the world's largest foreign direct investment recipient in 1992, and it was able to maintain this status until 2001[1]. According to the world Investment Report (UNCTAD), the United States received approximately one third of total world foreign direct investments in 1999. This surge has affected many other sectors such as international trade, gross domestic product, and employment. For instance, sales

[1] However, in 2002, US fell from its leading position and China regained its status as the major FDI recipient attracting approximately $53 billion.

by foreign-owned U.S. affiliates totaled $1717 billion in 1997.[2] Further, US affiliates employed approximately 5.2 million workers in the same year. This unprecedented growth in FDI, and recognition of the importance that FDI holds for investment and growth in the host country have stimulated a growing interest especially among international and public policy oriented economists. A considerable research effort has been devoted to identifying determinants of foreign direct investment in the United States. Analyses have been conducted using both time series and panel estimation techniques.

However, only a few studies have accounted for the impact of corporate income tax policies even though a mere casual observation suggests a close a relationship between the two variables. It is also consistent with the eclectic theory (Dunning, 1981), which is arguably the most appealing model for understanding foreign direct investment. It suggests that an investor take three factors into account before undertaking an investment project in another country. They are the so-called ownership advantage, location advantage, and internalization advantage. In general, corporate taxes could affect all three of these conditions (Mooij and Ederveen, 2001). Researchers, who favor this notion, are of the opinion that major tax reform acts, such as TRA1986 have preceded the emergence of FDI inflows in late 1980s.

Although these studies have not reached an agreement regarding the size of the tax effect, there is a general consensus that FDI does respond to the corporate income tax rate. This finding has led to concern over the possibility of tax

[2] U.S. International Trade Commissions (2001).

competition among countries to attract foreign capital in the form of FDI and to counter the threat of FDI outflows. The ability of governments to use tax policies to influence FDI flows will depend on the long run and short run responsiveness of FDI to changes in the corporate income tax rate.

The major purpose of this essay is to revisit the time series literature on FDI and corporate income taxation on FDI in the United States using modern time series techniques. To my knowledge, the most recent time series study that uses the U.S. data dates back to 1990 (Slemrod, 1990), and all of the exiting studies have only used traditional time series methods for estimation and analysis.

This study makes at least two contributions. First, this makes use of the modern time series techniques to estimate the long run and short run tax rate elasticity. It is important because a substantial improvement has occurred in the time series literature beginning in the late 1980s through most part of the 1990s. Second, previous time series studies were unable to incorporate the most recent FDI and corporate tax rate data into their analyses. Therefore, utilizing modern estimation techniques along with a data set that spans nearly five decades will broaden our understanding of the relationship between corporate income tax rate and FDI in the United States.

Literature Review

An extraordinary surge in the FDI flows into the United States since late 1970s spurred unprecedented interest among researchers on the subject. However, early time series studies on determinants of FDI did not include the tax rate as an explanatory variable. Hartman (1984) is the first study to investigate the effects of

taxation on inbound FDI[3]. Since Hartman, several well-known studies have been undertaken on this issue. We could categorize them into two components: time series studies and panel data studies. This section is confined to the time series literature by leaving the discussion of panel studies to the second essay.

As suggested before, many agree that time series study on FDI and taxation begins with Hartman (1984). Because virtually all of the subsequent studies have used Hartman as the base line model, it is extremely important to understand the basic features of this seminal paper in detail.

Motivation for the study came as a result of his investigation of 1981 tax reforms, which was designed to accelerate rate of savings and rate of investments in the United States. Hartman points out that savings and investment incentives did not only affect domestic investors but also resulted in large increases in investments by foreigners. He hypothesizes that investment incentives, which apply to both domestic and foreign investors, may result in increased foreign investment in the United States. The standard investment theories suggest that investors determine their capital investments according to the value of real after tax rate of return on alternative investments. Using the FDI data over the period of 1965-1979, Hartman estimates the model given in equation (1.1) to understand the effect of tax policy on FDI in the United States.

$$\ln\left(\frac{FDI}{GNP}\right) = a_0 + a_1 \ln[\gamma(1-t)] + a_2 \ln[\gamma'(1-t)] + a_3 \ln\left[\frac{(1-t')}{(1-t)}\right] \qquad (1.1)$$

Here t measures the tax rate on U.S. capital owned by foreigners and t′ denotes the tax rate on U.S. capital owned by U.S. investors. Three types of rate of return

[3] Detailed study on tax rates and FDI can be found in Hines (1997) and Mooij and Ederveen (2001).

variables are used to explain the variance of FDI inflows in which all of them are expressed in terms of rate of return variables. The first term, $\gamma(1-t)$ is the after tax rate of return actually realized by foreign investors. This rate is included for capturing the tax impact on foreign firms that are already in the business and are considering expansion of current operations. The second term, $\gamma'(1-t)$ estimates the overall gross rate of return on capital in the United States. Hartman states that even though this term seems similar to the first term, it serves a different purpose. In particular, second rate of return variable is applicable to firms, which are acquiring existing assets. The third term, $(1-t')/(1-t)$ measures the tax rate on United States' capital owned by foreigners. This has also defined as net of tax rate of return received by domestic investors relative to that received by domestic investors on the same investment.

In short, after tax rate of return is meant to control for the expansion of current corporations and the net after rate of return on gross capital represents for acquisition of existing assets, while the relative term is included to capture the tax changes that applicable only to the United States investors. Since the first two terms are expressed in linear form he expects positive coefficients for the rates of return variables. A positive a_1 and a_2 would support the hypotheses that United States taxes would have a negative effect on foreign direct investments. Hartman expects to capture the valuation effect by coefficient a_3. In other words, he controls for the tax change that causes investments to become more appealing to domestic investors but makes no change in cost to the foreign investors.

The role of home country taxes was ignored in his analysis because foreign statutory corporate income tax rates have not varied much during the period. Hartman

further argues that home country taxes do not matter for the investments that come from the tax exemption countries. Not every type of investment is affected even in the case of investments from tax credit countries. As he argued, the home country taxes applied to United States source income plays no role in the firm's marginal investment decisions. Simply, only newly formed subsidiaries whose desired investment exceed earnings find that tax rates on repatriation of earnings matter. Therefore Hartman does not expect any detrimental effect on his results from this exclusion.

Hartman estimates two separate regressions: one for the reinvested earnings part of investment (reinvested funds) and the other for the transfers from parent part of the investments (transfer funds). According to the author, the reason behind this categorization is that investment decisions of firms, which are reinvesting earnings at the margin, could be affected differently by transfer funds. Since repatriated profit is taxed in the home country, investors can decide to reinvest them rather than repatriating to the parent company. This would allow the subsidiary to defer its tax obligations. Hence, Hartman points out that United States tax impacts are different depending on whether the funds are already in this country in the form of reinvested funds or they are in the investing country in the form of transfer funds.

He further suggests that the difference may also depend on whether the firm is established or an emerging at the time of investment decision is made. In general, mature firms have sufficient funds to invest in the form of reinvested funds. However emerging firms have to transfer new funds to their affiliates in the form of equities or loans. Hence for mature firms, the home country tax rate should not play a significant role in their

investment decision. These considerations motivated Hartman to analyze reinvested funds and transfer funds separately.

Hartman finds that both reinvested funds and transfer funds are significantly correlated with the tax rates. However, he points out that reinvested funds have much more explanatory power than that of transfer funds. To illustrate, while the former explains more than 90 percent of the variation, the latter explains only 28 percent of the total variation of the dependent variable. Hence, the author suggests that his model should not be used for policy recommendation purposes, which involve transfers from parent component of FDI. However Hartman concludes that in general, his model provides strong evidence for the negative relationship between tax rates and foreign direct investments in the United States.

Hartman's results were criticized on the grounds of a small sample size, omission of control variables to represent non-tax effects, and an imperfect specification of the model (Newlon 1987, Slemrod 1990). Several subsequent time series studies have been undertaken as a result of their effort to minimize the shortcomings of Hartman's paper.

Boskin and Gale (1987) introduce several modifications into the Hartman analysis. In particular, they update the series including FDI data until 1984 and use the rate of return series calculated by Feldestein and Jun (1987) as explanatory variables. Further, they try a different specification instead of relying on standard double log specification. For this purpose they estimate the model assuming both linear specification as well as double log specification. However, these modifications have been unable to produce significantly different qualitative results from those of Hartman. In other words, they confirmed the basic Hartman conclusion that tax rate changes explain reinvested

earnings investment better than transfers from parent component of FDI. Nevertheless, Boskin and Gale study emphasizes that results can still be somewhat sensitive to the form of specification and size of the sample.

Newlon (1987) questions the validity of the data set that has used by Hartman (1984) and Boskin and Gale (1987). He points out that both of the above studies have miscalculated the rates of return data. Rates of returns were calculated by taking the ratio of total earnings of foreign owned corporations over total invested capital. This overestimates the rate of return data because total earnings consist of two components: reinvested earnings and repatriations. He also observes a spurious relation of the rate of return data. Newlon recalculates the rates of return data, but does not find a substantial difference in the results of previous studies. However, he reports a slight change in the explanatory power of the two equations due to this corrected series. While new data explains transfer funds better, reinvested funds do not fit as well. Then Newlon estimates transfer funds and reinvested funds equations for a longer data set from 1956 to 1984 and finds that both models fit very poorly.

Young (1988) provides another time series analysis of the effects of domestic taxes and rates of return on FDI in the United States. He mainly expands Hartman (1984) analysis by using revised international investments and United States Gross National Product data for a longer (1953-1984) period. Similar to previous studies he refers to FDI as a financial transaction rather than real physical property and plant investments. Further, as Hartman and others, he uses realized rate of return data though he admits that expected rate of return data may be more relevant for the purpose.

The econometric model used by Young can be considered as a modified Hartman model. It is written as in the equation (1.2).

$$\ln(FDI) = a_0 + a_1 \ln[\gamma(1-t)] + a_2 \ln[\gamma'(1-t)] + a_3 \ln\left[\frac{(1-t')}{(1-t)}\right] + a_4 \ln GNP + a_5 \ln FDI_{t-1} \qquad (1.2)$$

Notations are the same as in Hartman (1984) except there are two additional regressors. GNP is included to control for the non-tax variables, while lag FDI term is meant to capture short run variations. Specifically, if we restrict last two coefficients to one and zero, respectively then this model is identical to Hartman (1984).

Previous studies added an arbitrary constant to the observed investment data to construct log linear model. However, Young prefers to omit the observations with negative values and then proceeds to estimate log linear model. In 1974, the Bureau of Economic Analysis the official data collection agency for foreign investments changed the definition of FDI. Young included a simple dummy variable to represent this change but found the variable was statistically insignificant and hence dropped it from the final specification.

Young compares results with those of earlier studies. In general, results are similar to those of Hartman (1984) and Boskin and Gale (1987). However, he points out that the results obtained by dropping negative values are much better than results derived using constructed values that have obtained by adding arbitrary constant to all observations. According to Young, an insignificant and small value of the estimated coefficient of the lagged dependent variable indicates that the adjustment process is immediate.

Empirical results for transfer funds are extremely poor. The model is not able to explain even a quarter of the variation of the dependent variable. Hence, he questions the ability to use tax variables to explain FDI inflows in the United States because transfer funds themselves contributed approximately 60 percent of the total FDI inflows at the time of his study. However, Young's results suggest that if one wants to focus only on reinvested funds, then he or she can satisfactorily use the Hartman analysis to understand the taxation and FDI issue.

Based on his regression results, Young reports a higher (-1.81) tax rate elasticity for FDI through reinvested earnings, and a lower (-0.47) elasticity for FDI through transfers from parent component of FDI than do earlier studies. This study also indicates that tax incentives generated by the 1981/1982 tax reforms have increased FDI in the United States substantially.

Murthy (1989) points out that Young's regression results are quite misleading due to the presence of autocorrelation between the residuals in the time series data. Murthy re-estimates Young's model to adjust for the presence of autocorrelation. Specifically, he uses a maximum likelihood estimation instead of Ordinary Least Squares. Applying various types of tests such as Durbin h-test, Durbin m-test and Lagrange multiplier test he rejects the null hypothesis of no autocorrelation.

Murthy describes two possible ways to correct for the autocorrelation problem. One is to use the Cochrane-Orcutt procedure and the other is to use maximum likelihood estimation. However, Murthy explains that the Cochrane-Orcutt procedure is not advisable here because Young's model includes a lagged dependent variable as an explanatory variable. This will lead to inconsistent and sometimes biased estimates. On

the other hand, maximum likelihood estimators are consistent in larger samples and are more efficient than the ordinary least squares estimators.

Although the general findings are quite similar, the overall tax rate elasticity in Murthy (1989) is much larger than Young's (1988) elasticity. To illustrate, the long run tax rate elasticity for the reinvested funds in Murthy is -0.7, while Young's estimate is - 0.32. The same is true for the short run elasticities. However, Murthy's results seem statistically superior to those of Young due to several reasons. First, standard errors are smaller. Second, adjusted R^2 is slightly higher. Third, most of the coefficients have the expected sign. Unlike reinvested funds, results based on transfer funds are not comparable between two studies. For instance, Murthy emphasizes that long term overall tax rate responses for transfer funds are elastic while Young maintains that they are inelastic.

Arguably, after Hartman, the most important time series studies on taxation and foreign direct investment is Slemrod (1990). It is worthwhile to have a fair amount of discussion about his methodology and results. Slemrod criticizes the earlier results in the literature for several reasons and introduces some modifications to improve the results.

First, he suggests that since FDI data consist of measurement error we have to correct for them before we undertake any kind of estimation. Measurement error occurs due to the way the Bureau of Economic Analysis (BEA) collects data. BEA collects data using benchmark surveys. This method of collection is likely to make more errors when farther away from the benchmark years. To control for this data discrepancy he includes a drift term, which is equal to the number of years elapsed since the previous benchmark survey of FDI conducted by the BEA. Second, improvement is also related to the data

definition issue. It is known that the BEA changed the definition of FDI in 1974. According to the change, minimum ownership requirement that needs to be considered as FDI was decreased from 25 percent to 10 percent. Previous studies except Boskin and Gale (1987), have not taken this into consideration when they estimate the model. In order to account for this, Slemrod includes a dummy variable for post 1974 observations. Third, he uses marginal effective tax rates that were derived by Auerbach and Hines (1988) to estimate tax coefficients. Fourth, he introduces some non-tax variables such as relative gross national product, unemployment rate of prime age males, and real exchange rate into the analysis. Fifth, he uses lagged tax term as an explanatory variable in his estimation. According to Slemrod, because of the time it takes to implement an investment decision, there may be a lag between changes in the tax rate on FDI.

With all these adjustments, he finds completely opposite results from those of Hartman and previous researchers. In other words, Slemrod finds that only transfer funds are significantly negatively correlated with tax rates. Results do not suggest a negative association between tax rates and retained earnings. Rather he finds a positive relationship between these two variables. He does not provide any reason for the significantly positive correlation between corporate income tax rate and reinvested funds. Although the inclusion of non-tax variables improves the explanatory power of the model, he finds that the unemployment rate, the ratio of gross national product, and drift variables are not significantly different from zero.

In the second part of the paper, Slemrod separates total FDI in the United States by investing country and controls for the tax system in the home country of the parent company. He expects that investors from tax exemption countries respond differently

than those from tax credit countries. He uses only statutory corporate income tax rates for the tax variables. However, outcomes of the regression do not provide convincing evidence to support the hypothesis. Surprisingly, his regression results on FDI using manufacturing sector investments indicate a significantly negative relationship with tax rates only for investments by United Kingdom and Japan, which adopt tax credit system. Most of the results in the latter part of the Slemrod study can be described as mixed rather than clear-cut results.

While exiting studies largely agree on a negative correlation between corporate tax rates and FDI in the United States, they have not reached an agreement regarding the size of the tax effect. After reviewing the exiting literature, Hines (1997) finds that the tax rate elasticity is between –0.5 and –0.6. However, Mooij and Ederveen (2001) suggest that the mean value of the tax rate elasticity is considerably larger than that of Hines.

Their calculation is based on a meta analysis of 25 published and unpublished studies on corporate taxation and FDI. Meta analysis refers to a statistical analysis from individual studies. It goes beyond a regular survey of the literature because it takes into account the underlying differences in study characteristics. This type of study is particularly useful for a review of FDI and corporate taxation literature for several reasons.

First, the dependent variable is not the same in every study. As we have seen, researchers have expressed FDI as a ratio of some form of macroeconomic variablesWhen the dependent variable is different, it is not recommended to use coefficient of determination to compare studies. Second, different studies use different

specifications, sample size, and non-tax variables. While some studies, such as Hartman's completely ignored non-tax variables, others (Slemrod, 1990) have controlled for some non-tax effects.

In order to address these differences Mooij and Ederveen calculate the tax rate elasticity for some well-known studies under a uniform definition. Equation (1.3) displays the regression equation in their study.

$$y = BX + \varepsilon \tag{1.3}$$

where y represents the vector of elasticities and X is a matrix of dummy variables to control for different study characteristics. The semi-elasticity is defined as the percentage change in FDI in response to a one- percentage point change in tax rates. They provide a convenient way of transforming semi-elasticity into an ordinary elasticity. The ordinary elasticity is measured as the impact on FDI due to a one-percent change in the tax rate, while semi-elasticity measures the impact on FDI to a one-percentage point change in the tax rate.

They conclude that the absolute mean value of the tax rate elasticity is quite large. To illustrate, the study suggests that one- percent reduction in the host country corporate income tax rate raises FDI in that country by 3.3 percent. Table 1.1 shows median and mean tax rate elasticity for some well-known time series studies on taxation and foreign direct investment. A good understanding about the tax rate elasticity is important because it has important welfare implications for an economy. Young (1988) provides a very good explanation of the welfare effects. Welfare effects associated with the impact of a tax change on FDI can be measured by studying the impacts on tax revenue. Theoretically, an increase in the tax rate will increase tax revenue provided tax

Table 1.1 Tax Rate Elasticities		
Study	Mean Semi-Elasticity	Median Semi-Elasticity
Hartman (1984)	-2.6	-3.5
Boskin and Gale (1987)	-5.8	-2.7
Newlon (1987)	-0.4	-0.4
Young (1988)	-1.1	-2.1
Murthy (1989)	-0.6	-0.7
Slemrod (1990)	-5.5	-3.5

$$Semi-Elasticity = \frac{\partial \ln FDI}{\partial TAXRATE} \text{ , } Elasticity = \frac{\partial \ln FDI}{\partial \ln TAXRATE}$$

Source: Mooij and Ederveen (2001)

rates are inelastic. Since tax rate in the United States seems elastic, a reduction of the tax rate should increase tax revenue. Therefore, studies that estimate tax rate elasticities are useful for designing a tax policy that aims to enhance the welfare of the United States.

Contribution

There are two purposes of this study. The first is to investigate both long run and short run relationships between corporate income tax rates and FDI in the United States. A single equation based cointegration approach, suggested by Engle and Granger (1987), and multi-equation method of Johansen (1991) are used to analyze the long run relationship between tax rates and FDI. We distinguish between long run and short run tax effects by estimating an error correction model. This distinction is important because multinational investors generally do not respond to tax rate changes until they are assured that changes would not be reversed in a short period of time. The existence of a cointegration relationship would enable us to calculate both short run and long run tax rate elasticities. Findings can be compared with studies that have used traditional time series techniques.

The second purpose is to determine whether different components of FDI respond differently to corporate income tax rate changes. Empirical studies distinguish between FDI that is financed by reinvested funds and transfer funds. Previous studies are not in agreement regarding the relative responsiveness of FDI components to corporate income tax rate changes. For example, Hartman (1984), Boskin and Gale (1987), Murthy (1989), and Young (1988) suggest that FDI from reinvested funds are more responsive to taxes than FDI financed by transfer funds. Slemrod (1990) and Cassou (1997) find the reverse to hold.

Several features of the present study represent improvements over earlier attempts to examine the responsiveness of FDI to changes in corporate income tax rates. First, this study uses modern time series techniques to identify effects of tax rates on FDI. Most importantly, we examine stationarity and cointegration properties of the series. As Granger and Newbold (1974) have shown, spurious results are often obtained when nonstationary variables are used to estimate a long run relationship. However, it is still possible to find a meaningful long run relationship with non-stationary time series variables if at least one cointegration relationship exists among the variables (Engle and Granger 1987). To our knowledge, previous studies have not used these techniques to estimate the effects of tax rates on FDI.

Second, this study estimates short run dynamics of impacts of tax changes on FDI. An Error Correction Model (ECM) is used to illustrate short run dynamics of the model. This approach will enable us to gather information about the length of time that foreign investors take to respond to changes in corporate tax rates and other control variables. In other words, adjustment parameter provides information about the length of time it takes to re-establish the long run equilibrium after a shock to the model. Furthermore, the existence of an ECM can be used to confirm the long run equilibrium relationship among the variables.

A third improvement pertains to the type of corporate tax rate used to estimate the tax rate elasticity. Previous time series studies generally use some form of an effective marginal corporate income tax rate, while we use the statutory corporate tax rate. The effective marginal tax rate is commonly interpreted as a forward-looking measure of

investment incentives. According to Mackie (2002), this tax rate is a hypothetical tax rate that measures capital costs attributed to taxes on marginally profitable investments. Methods used to calculate effective tax rates are rather subjective because they involve assumptions regarding the inflation rate, depreciation rate, and so on. When estimating the real tax burden, effective tax rates should be used rather than statutory tax rates. Our purpose is to understand how foreign direct investors respond to changes in tax rates. Policymakers and investors probably know little about effective tax rates and base their decisions on statutory corporate income tax rates. Employing statutory tax rates will enable us to construct a data set spanning five decades to capture more variation in tax rates and FDI. This study would enable us to compare our findings with those based on effective marginal corporate income tax rates.

Finally, we employ a larger sample size than used in earlier studies. Tax and FDI data for the period 1957-2002 will capture tax policy changes for five decades. Previous studies have used samples ranging shortest from 1965 to 1979 (Hartman 1984) and longest from 1953 to 1987 (Slemrod 1990). We also account for other important determinants of FDI such as the real minimum wage, imports, gross domestic product, and effective exchange rates. By capturing more variation over time and controlling for a variety of other FDI determinants, we expect to obtain more precise estimates of the tax rate elasticities.

Empirical Strategy

We use the same specification that has been used in the FDI and taxation literature to investigate the issue. In other words, this study investigates the relationship

between natural logarithm of FDI and natural logarithm of statutory federal corporate income tax rate (CITR) and other control variables. We apply modern time series techniques to analyze the following issues:

1. Investigate whether a long run relationship exits between foreign direct investment and corporate income tax rate in the United States.
2. Determine if the different components of FDI respond differently to the changes in corporate income tax rate.
3. Investigate the short run dynamics of the model. More specifically, examine if corporate tax rate changes incur any significant short run impacts on the amount of inbound FDI to the United States.

It is standard in the time series literature to check for the unit roots in each series before estimating any equation. If there is a unit root, that series is considered to be non-stationary because then it contains a stochastic component. Granger and Newbold (1974) point out that estimation based on non-stationary variables may lead to what they called spurious results. A spurious regression has a high R^2 and t-statistics that appear to be significant, but the results are without any economic meaning (Enders, 2003). Following this guidance, this study begins the estimation procedure assessing the properties of each variable to determine if any of them are non-stationary.

Although non-stationary variables can lead to spurious results, it is possible to obtain a linear combination of integrated variables that is stationary. Such a relationship is called a cointegration equation in the time series literature. A cointegration equation suggests a long run equilibrium relationship between the variables that move together.

Two methods are currently available for identifying cointegration relationships: Engle Granger cointegration test (1987) and a Johansen (1991) cointegration test. We use both of them even though Engle and Granger results are analyzed in greater detail.

This study uses data that spans five decades. It is possible that some series have undergone permanent shifts during this period. Results could be misleading if we do not take structural breaks into account. It is especially so because some unit root tests such as Dickey-Fuller do not account for breaks in the series. This may have serious consequences because it generally leads to acceptance of the null of unit root in the series against the alternative. Hence, we use Chow test to identify any structural break in the series and then cointegration relationships are re-estimated with any possible break.

Last step of the empirical method is to estimate the short run relationship between the variables under consideration. Here we specifically use the Error Correction Model (ECM) suggested by Engle and Granger (1987). The short run model serves several important purposes. First, it can be used to identify whether the tax effects are permanent or temporary. If tax responses are significant in the short run only, then the impacts of the changes in tax rates are temporary. On the other hand, if responses in both long and short run are significant, then we will have both transitory and permanent effects. Second, ECM can be used to confirm the outcomes of the cointegration equation. According to the Granger Representation Theorem, for any integrated of order one, I (1) variables, error correction and cointegration are equivalent representations (Enders, 2003). Finally, ECM provides information about the speed of adjustment in response to a deviation from the long run equilibrium, which can be very useful for the policy analysis.

Data Definitions and Sources

This paper examines the inbound FDI flows for the US economy over the period 1957-2002. Annual data for FDI and other explanatory variables are needed for estimating the models outlined in the previous section. Following the literature, I rely on the FDI data provided by the BEA. It provides total FDI data, which includes reinvested earnings by subsidiaries of foreign parents and transfer funds from the parent company to the US firms. FDI data pertaining to the 1957-1987 period are obtained from Young (1988) while data for the other years are drawn from various issues of the *Survey of Current Business*, which is published by the BEA. Figures on total foreign direct investment (FDI) transfer funds (TFDI) and reinvested funds (RFDI) are expressed in millions of US dollars. TFDI and RFDI cover the period 1957-1999 while FDI covers a slightly longer period 1957-2002.

In order to assess tax responses, the top corporate income tax rate (CITR) is used. Only federal corporate income tax rates are utilized and hence no inferences should be deduced regarding the state corporate income tax impacts on inbound FDI. CITR data are obtained from the various issues of *US Master Tax Guide*. Following Slemrod (1990), one-year lag corporate income tax rate is also used as an explanatory variable in this study.

The series for gross domestic product (GDP) and prime interest rate (INT) have been collected from the *Federal Reserve Bank of St. Louis's FRED II* database. GDP are provided in real terms using 1996 dollars while nominal interest rate variable is expressed in terms of percentages.

Data for the other control variables are obtained from several different sources. For instance, total annual US imports (IMPORT) are directly from the Council of *Economic Advisers' Economic Report of the President*, February 2003 issue while real minimum wage rate (MWR) data are extracted from the mimimumwage.com web site[4]. Source for the effective exchange rate (EEXR) data is the various issues of *International Financial Statistics* published by the International Monetary Fund. EEXR data are based on 1995. A decrease in this index reflects a real depreciation of the US dollar.

Unit Root Tests

There are several tests available to determine if any series are stationary or whether the series contain a unit root. We utilize the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1981) and Phillips-Perron (PP) test (Phillips-Perron, 1988) in this study. Under both of these tests, the null hypothesis is the existence of unit root. Therefore, an acceptance of the null means the series is non-stationary. General structure of the ADF equation is given in equation (1.4).

$$\Delta y_t = \mu + \gamma t + \delta y_{t-1} + \sum_{i=k}^{K} \Delta y_{t-k} + \varepsilon_t \qquad (1.4)$$

Three different specifications of ADF tests are available. The first specification excludes both trend and intercept terms in which, both μ and γ are restricted to zero. The second specification includes intercept but excludes trend term, so only γ is restricted to zero. The third one includes both trend and intercept term. The ADF test is an improvement of the original Dickey-Fuller unit root test (DF). Unlike ADF, DF assumes

[4] http://www.minimumwage.com

that the errors are independent and have a constant variance. However, if the true data generating process contain an autoregressive component, we may not be able to obtain proper estimates using DF unit root test. So, ADF test controls for possible higher order lags including k lags of first differences of the dependent variable to the right hand side of the equation.

Therefore, one of most important steps of the ADF test is to select the appropriate lag length. As Enders (2003) points out, too few lags mean that the residuals do not behave like a white-noise process. Including too many lags reduce the power of the test to reject the null of a unit root because more lags lead to loss of degrees of freedom. There are several methods available for selecting the appropriate lag length. Here we use two of the most popular tests: Akaike Information Criterion (AIC, 1974) and Schwarz Bayesian Information Criterion (SBC, 1978). AIC and SBC are computed using the form of equations (1.5) and (1.6) respectively.

$$AIC = -2L/T + 2K/T \tag{1.5}$$

$$SBC = -2L/T + 2K(\log T)/T \tag{1.6}$$

L is the value of the maximized value of log likelihood, K is the lag length, and T is the number of observations. Adding any lag has an advantage and a disadvantage. It will decrease the value of the first term of AIC, but increase the value of the second term. So, adding an additional lag continues until the marginal cost equals marginal benefit of doing so. In other words, the appropriate lag length is chosen such that AIC achieves its minimum value. SBC has the same strategy, but imposes a larger penalty for including additional variables. Such a penalty system causes SBC to select a more parsimonious model than the AIC. However, AIC in general is better for small samples while SBC is

superior for large samples. Since these two methods have produced contradictory results regarding the optimal lag length, this study arbitrarily uses one lag for testing unit roots. It is not uncommon to use only one lag in annual data. Results indeed show that the errors obtained from each unit root test are white noise suggesting that one lag is sufficient to approximate the true data generating process.

The PP test is different from ADF unit root test because it controls for the autocorrelation to represent true data generating process better. It omits the lagged first difference terms and undertakes a non-parametric correction to the t statistics. Both the ADF and PP methods test the null hypothesis of a unit root in the series. Throughout this study, the Newey-West (1987) procedure is used for estimating the equations because it gives a more consistent covariance estimator in the presence of unknown heteroskedasticity and autocorrelation. The results of both unit root tests are given in Table 1.2. Results clearly indicate a unit root in each series suggesting they are non-stationary. On the other hand ADF and PP tests for the first differences of the variables as given in Table 1.3 show that they are stationary. Existence of a unit root in each variable requires us to test for the cointegration because it is still possible to have a long run equilibrium relationship between the variables in spite of this non-stationarity problem.

Cointegration Test: Engle and Granger Approach

Though the variables themselves are non-stationary, it is possible to have a linear combination of integrated variables that is stationary. In time series literature, such variables are called cointegrated variables. There are several alternative ways to test for cointegration. This study uses the most popular Engle and Granger (1987) procedure as

Table 1.2 Unit Root Tests Variables in Levels		
Variable	ADF Test Statistic 5% CV=-3.52	PP Test Statistic 5% CV=-3.52
Reinvested Funds	-1.49	-2.22
Transfer Funds	-1.86	2. 61
Total FDI	-3.10	-2.71
CITR	-3.10	-2.32
GDP	-0.59	-0.58
IMPORTS	1.35	0. 42
MWR	-3.06	-2.72
INT	-2.31	-1.86
EEXR	-3.31	-2.37
Note: ADF and PP test the null of a unit root. One lag is used in both tests. Results are reported for constant and trend specification only.		

Table 1.3
Unit Root Tests
Variables in First Differences

Variable	ADF Test Statistic 5% CV=-3.52	PP Test Statistic 5% CV=-3.52
Reinvested Funds	-4.93	-7.77
Transfer Funds	-5.56	-7.58
Total FDI	-4.62	-5.54
CITR	-5.57	-4.27
GDP	-6.58	-6.37
IMPORTS	-3.76	-6.30
MWR	-4.31	-6.64
INT	-4.46	-5.34
EEXR	-4.35	-4.22

Note: ADF and PP test the null of a unit root. One lag is used in both tests. Results are reported for constant and trend specification only.

the primary test. However, a Johansen test for cointegration (Johansen, 1991) is also used to confirm the primary results. Single equation based Engle and Granger approach defines the cointegration as follows.

Suppose there are two time series y_t and x_t that are both integrated of order d and denoted by, I (d). If there exits a vector β, such that the disturbance from the regression is of a lower order of integration, I (d-b), where b>0, then Engle and Granger (1987) define y_t and x_t as cointegrated of order d and b (Harris and Sollis, 2003). In this study, since all the variables are I (1), the series would be cointegrated if the disturbance term from the Ordinary Least Squares (OLS) is integrated of order zero, I (0). There are two important steps in this test. First, we estimate the best possible linear equation for total FDI and two other components of FDI using OLS to capture the residuals. Then ADF and PP tests are used to test whether residuals contain a unit root. If the residuals do not contain a unit root, we determine that the cointegration relationship exists and continue with the long run analysis. The cointegration equations are given in equations (1.7), (1.8), and (1.9), respectively.

$$FDI_t = \beta_0 + \beta_1 CITR_t + \sum_{i=2}^{7} \beta_i X_t + \varepsilon_t \quad (1.7)$$

$$TFDI_t = \beta_0 + \beta_1 CITR_t + \sum_{i=2}^{7} \beta_i X_t + \varepsilon_t \quad (1.8)$$

$$RFDI_t = \beta_0 + \beta_1 CITR_t + \sum_{i=2}^{7} \beta_i X_t + \varepsilon_t \quad (1.9)$$

FDI, TFDI, and RFDI denote total foreign direct investment, transfer funds and reinvested funds respectively and X represents non-tax explanatory variables. In order to

test for whether the above three equations represent any long run equilibrium relationship, we use the ADF test. However, Engle and Granger (1987) advocate ADF of the form given in equation (1.10).

$$\Delta e = \psi e_{t-1} + \sum_{i=1}^{k} \psi_i \Delta e_{t-i} + \mu + \delta t + \zeta_t \quad \zeta_t \sim IID(0, \sigma^2) \tag{1.10}$$

Where, e_t are the residuals from the cointegration equations. In this test we assume that μ and δ are zero because we have already included deterministic components of constants and trend terms in the cointegration equations. Deterministic components can be added to either the long run equation or error term equation, but not to both (Harris and Sollis, 2003).

Empirical Long Run Results

Table 1.4 presents results of the cointegration relationship for all three types of foreign direct investments separately. Table 1.5 gives ADF and PP unit root test results for the residuals. Results indeed suggest that the variables share a long run equilibrium relationship in each equation. Since there are three foreign direct investment equations in this study, discussion of results is carried out in the order in which they appear in the Table 1.4: total FDI, transfer funds, and reinvested funds, respectively.

Column 2 of Table 1.4 presents results of the cointegration relationship between total FDI and the explanatory variables. As expected, the corporate tax rate exerts a significant negative effect on FDI inflows to the United States. Results suggest that a one- percent decrease in the corporate tax rate would increase total FDI in the U.S. by 2.4 percent. This finding is similar to those of other studies shown in Table 1.1. The

Table 1.4

Engle and Granger Cointegration Results

Variable	Total FDI	Transfer Funds	Reinvested Funds
Constant	-56.256[a]	-24.065[c]	-62.332
	(11.600)	(13.566)	(47.144)
CITR	-2.425[c]	-4.220[a]	1.698
	(1.246)	(1.415)	(2.496)
$CITR_{t-1}$	3.281[a]	3.090[c]	5.098[b]
	(1.164)	(1.719)	(1.922)
GDP	5.813[a]	2.180	5.473
	(1.341)	(1.428)	(4.297)
IMPORTS	1.637[a]	1.422[b]	0.537
	(0.434)	(0.617)	(1.011)
MWR	-1.107[c]	-1.363	0.804
	(0.646)	(0.856)	(0.798)
INT	0.741[a]	0.838[a]	-0.038
	(0.202)	(0.258)	(0.361)
EEXR	-0.022	1.279	-0.450
	(0.771)	(1.154)	(1.492)
Adjusted R^2	0.978	0.967	0.265
Durbin-Watson	2.220	2.019	1.663

Note: Standard errors are in parentheses. [a]Significant at the 1% level. [b]Significant at the 5% level. [c]Significant at the 10% level. Linear and non-linear time trend are also included as explanatory variables in the regression. Variables are in natural logs.

Table 1.5 Unit Root Tests: Error Term		
Variable	ADF Test Statistic 5% CV=-2.93	PP Test Statistic 5% CV=-2.93
Errors of reinvested Funds	-6.09	-7.58
Errors of transfer Funds	-5.48	-5.03
Errors of total FDI	-4.83	-6.44
Note: ADF and PP test the null of a unit root. One lag is used in ADF and 3 lags are used in PP test. Results are for no constant and no trend specification only.		

similarity of tax rate elasticities across studies suggests tax rates used in these studies are highly correlated. Using the statutory corporate tax rate in the place of the effective corporate tax rate results in an elasticity that is similar to the average value of the elasticities shown in Table 1.1. This is consistent with the literature. Mooij and Ederveen (2001) find that studies using marginal effective tax rates yield higher elasticities than studies that adopt statutory tax rates. More important message is that corporate tax rate changes can have a significant long run effect on the amount of inbound FDI of the United States. This is a critical finding because the majority of studies on the determinants of FDI completely ignore the tax effects. The validity of those studies can be questioned on the ground of omitted variable bias.

Although we are primarily interested in the relationship between the current corporate tax rate and FDI, it is interesting to note that the coefficient on the lagged tax rate variable is positive and significant. This is consistent with Slemrod's (1990) findings.[5] Interpreting the coefficient of lag tax rate requires assuming that all the other variables including current tax rate remains unchanged. An increase in the lagged corporate tax rate implies a relatively smaller current rate, which should attract more FDI. On the other hand, a decrease in lagged tax rate, holding current tax rate constant implies a relative increase in current rate, which should reduce FDI inflows. Therefore, a positive relationship between lag tax rate and FDI is quite understandable and statistically consistent.

[5] Slemrod (1990) finds the one-year lag corporate tax rate elasticity is 4.28 for the 1960-1987 period. Elasticities are found to differ considerably across specifications and time periods.

GDP and FDI are positively and significantly related in the long run. GDP appears to be one of the most important determinants of FDI. This is particularly true for the U.S. because it has the largest domestic market of any country. This proves largely accepted market size hypothesis regarding determinants of FDI. It says that foreign investors take into account the size of the host country market when they make investment decisions. The theoretical foundation for this argument can be traced back to Balassa (1966). Producing in a larger market will enable investors to exploit economies of scale and also achieve higher sales. Casual observation of the GDP and FDI series alone would confirm this finding. In the late 1990s when the economy was growing at a very healthy rate the U.S. experienced a huge increase in FDI inflows. Figure 1.1 and 1.2 illustrate this close relationship growth rate of FDI and that of GDP over the last five decades.

The factor endowment approach to the determinants of FDI implies that FDI generally flows from one country to another because the former has a comparative disadvantage in the relevant industry. Due to its larger market, imports are a particularly important determinant of FDI for the United States. However, whether trade encourages FDI is still an unanswered question. Some view FDI as an alternative to trade. So, foreign companies that export goods and services to the U.S. may sometimes find it is more profitable to produce within market rather than exporting them. This generally happens after they establish their product with the domestic consumers. Producing in the foreign country can be a strategy to circumvent trade barriers such as tariffs, quantitative

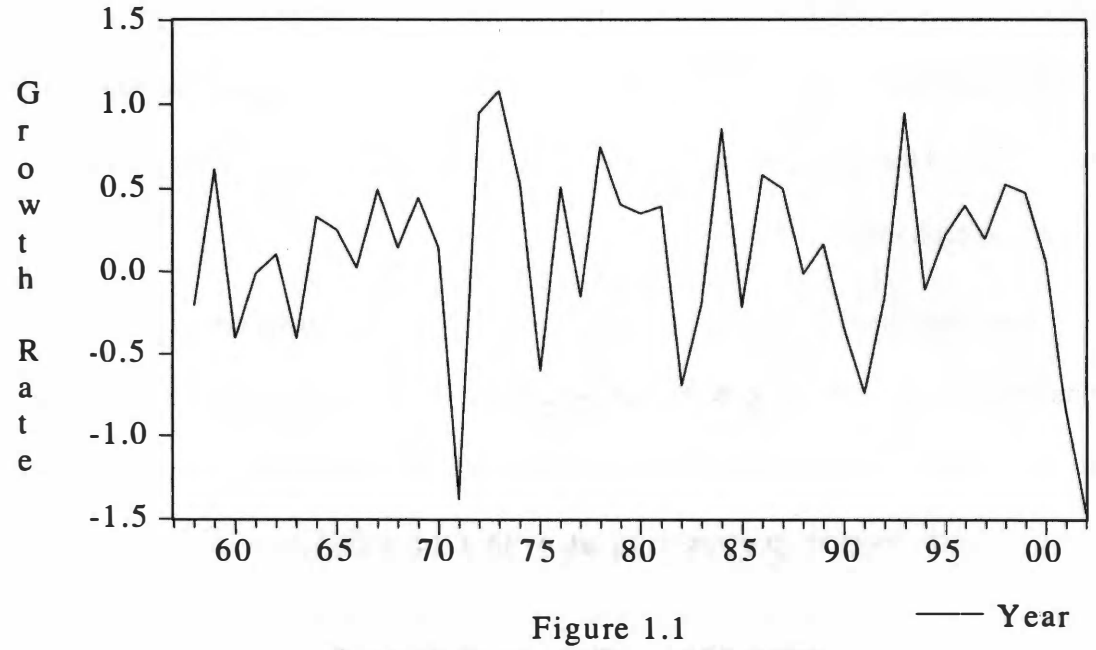

Figure 1.1
Growth Rate of FDI: 1957-2002

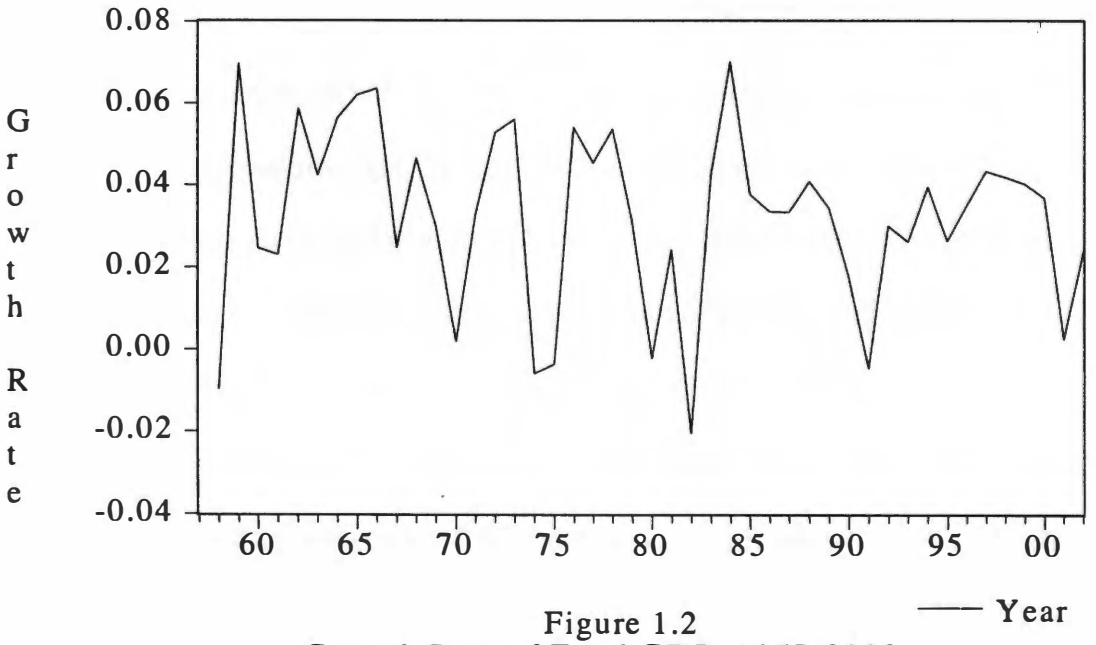

Figure 1.2
Growth Rate of Total GDP: 1957-2002

restrictions, and dumping duties. A good example is Honda's establishment of production facilities in Ohio to circumvent the tariffs and voluntary export restraints imposed by the U.S. (Moosa, 2002). However, some empirical studies have found a positive relationship between FDI and trade, suggesting they are working as complements rather than as substitutes to each other.

This study finds a significantly positive long run relationship between U.S. imports and inbound FDI. Complementarity between FDI and trade arises from a variety of sources. U.S. affiliates' sales and U.S. imports both deliver foreign goods and services to U.S. consumers. Foreign goods are important inputs into affiliate manufacturing. Greater sales in foreign markets will require improved distribution systems, advertising, and R&D activities that are facilitated by FDI inflows. Further, this result is in line with the recent studies on FDI (Billington, 1999).

Results also reveal a positive relationship between the interest rate and FDI. We hypothesized that FDI and interest rates would be negatively correlated. Cost of capital is one of the most important determinants of any type of investments regardless of whether they come from foreign or domestic sources. The interest rate can be considered as a good proxy for the cost of capital. The differential rates of return hypothesis suggest that international capital flows from one country to another until all rates of return advantages are exhausted. Earlier studies such as Hartman (1984) and Young (1988) have not used the interest rate as an explicit variable. However, studies that use statutory corporate income tax rates for representing tax impacts choose to include the interest rate explicitly into the model (Billington, 1999). Billington also reports a positive coefficient for the

import variable. Increased inbound FDI can be associated with higher U.S. interest rates when multinationals borrow in the source country rather than in the United States. Specifically, higher interest rate in the U.S. encourages foreign investors to borrow from the home country capital market and invest in the U.S., which suggest a direct relationship between the two variables.

The real minimum wage rate is included to control for the cost of labor in the host country. Differences in wages can cause significant location-related differences in the costs of production. The theoretical foundation is provided by eclectic theory (Dunning, 1981) as well by the location hypothesis developed by Horst (1972). Studies that empirically test for the wage effect oftentimes include unit labor cost to represent wage differentials and find a negative relationship between labor cost and FDI inflows (Cushman 1987, Chakraborty and Basu 2002). The real minimum wage is better suited to represent wage impacts and this is the first known study that includes it as an explanatory variable. Results indicate a significantly negative relationship at 10 percent level confirming the findings of existing literature.

The currency area hypothesis implies that the foreign exchange rate can be significant variable for determining inbound FDI. However, the exchange rate can affect FDI in different ways. If the investor targets the host country market, then appreciation of local currency would lead to increase in FDI inflows. On the other hand, if the investor were planning to export its product, then depreciation of the host country exchange rate would encourage FDI. Froot and Stein (1991) suggest that the depreciation of the United States' dollar after 1985 had been the major reason for the unprecedented increase in FDI

inflows into the United States in late 1980s. The effective exchange rate is included in this study to test the currency area hypothesis. Results fail to establish any significant relationship between the two variables. Though surprising, this finding is consistent with some well-known studies (Slemrod, 1990).

Cointegration results for transfer funds are shown in Column 2 of Table 1.4. Transfer funds and the corporate income tax rate display a significant negative long run relationship. This relationship is stronger than the total FDI-tax relationship discussed earlier. Currently, transfer funds account for more than 90 percent of total FDI flows. The corporate tax rate elasticity for transfer funds of -4.22 is considerably larger than the -2.4 value reported for total FDI. Once again, the coefficient on the lagged tax rate variable is positive and significant. Coefficients on imports and the interest rate are positive and significant, as is the case with total FDI. Time displays a positive and significant non-linear trend and a negative and significant linear trend with transfer funds. Our specifications for total FDI and transfer funds result in much higher coefficients of determination (adjusted R^2) than that reported by other studies.

Results in the final column of Table 1.4 pertain to reinvested funds. The coefficient on the current tax rate is not significant. These findings counter results reported by Hartman (1984), Boskin and Gale (1987), Murthy (1989), and Young (1988), but are consistent with findings of Slemrod (1990) and some panel studies (Cassou, 1997). Once again, the coefficient on the lagged tax rate is positive and significant. None of the other key determinants exert significant effects on reinvested funds. Time has a positive non-linear relationship with reinvested funds.

Slemrod (1990) and the present study find the tax rate is an important determinant of transfer funds, but not reinvested funds. Earlier time series studies find that the opposite holds. The changing composition of FDI flows might account for the different findings reported by these studies. During the 1953-1968 period, reinvested funds accounted for more than 50 percent of total FDI in the United States. The share of FDI attributed to reinvested funds has fallen over time. By 1999, reinvested funds accounted for about 7 percent of total FDI. Studies that include at least two or more non-tax variables find transfer funds are responsive to tax rates while reinvested funds are not. It is possible that when non-tax variables are dropped from the regression, the coefficients could capture the responses of those omitted variables distorting the pure tax responses. Later, we conduct robustness tests such as regression specification and structural break tests to investigate why studies result in different tax elasticities for the various component of FDI.

As previously stated, this essay relies on the Engle and Granger (1987) procedure to analyze cointegration relationships between corporate income tax rate and various components of FDI. Although this is the most popular and one of the easiest methods to apply, it has several limitations. The test requires considering one variable as the dependent variable and the others as explanatory variables. However, it is possible to find that one regression indicates that the variables are cointegrated, whereas reversing the order indicates no cointegration (Enders, 2003). Another disadvantage of the procedure is that it ignores the possibility of more than one cointegration relationship. When there are more than two variables in the model, there can be more than one-cointegration

relationship. Specifically, if there are n variables, it is possible for up to n-1 cointegration vectors to exist in the model. Single equation based Engle and Granger procedure produces inefficient results if there are more than one-cointegration relationships. Hence, it is necessary to check for potential multi-cointegration vectors using alternative cointegration tests. The following section uses the Johansen (1991) procedure to investigate this matter. This procedure allows for more than one cointegration vector, preventing any efficiency loss.

Johansen Cointegration Test

This procedure uses two methods to determine the number cointegrating vectors in a system. They are the so-called eigenvalue test and trace test. Both methods rely on the Vector Autoregression (VAR) model to reach conclusions. The general form of the VAR representation is given by the equation (1.11) and (1.12).

$$x_t = A_1 x_{t-1} + A_2 x_{t-2} + ... + A_p x_{t-p} + \varepsilon_t \qquad (1.11)$$

$$\Delta x_t = \pi x_{t-1} + \sum_{i=1}^{p-1} \pi_i \Delta x_{t-i} + \varepsilon_t \qquad (1.12)$$

$$where\ \pi = -(I - \sum_{i=1}^{p} A_i)\ and\ \pi_i = -\sum_{j=i+1}^{p} A_j$$

Where x_t is (nx1) and each of the A_i is an (n x n) matrix of parameters. Equation (1.12) is derived from the unrestricted VAR model given by equation (1.11). Matrix π is the most important term in this presentation. Rank of π is equal to the number of cointegrating vectors in this model and it identifies the long run relationship of the variables. It is also equal to the number of characteristic roots in the matrix π. For example, if rank or characteristic roots of matrix π is equal to one, there is only one

cointegration relationship in the system. Null hypothesis in the trace statistic method, is the number of distinct cointegrating vectors is less than or equal to some specific number, say r, where r = 0, 1,2...etc. Maximum-eigenvalue statistic tests the null hypothesis of r cointegrating vectors against the alternative of r+1. For instance, it tests r =0 against the alternative of r =1 etc. According to Chakraborty and Basu (2002), if there is any divergence of results between these tests, it is recommended that one should rely on the evidence based on the maximum-eigenvalue test since the results of the latter are more reliable for small samples. Tables 1.6 through 1.8 give results of the Johansen test for total FDI, transfer funds, and reinvested funds.

Both the trace statistic and max-eigenvalue statistic clearly shows a single cointegration relationship in each equation. This suggests the Engle and Granger single equation method is appropriate for estimating cointegrating relationships. Normalized cointegrating coefficients for all three types of foreign direct investment are given in the Table 1.9. These results are qualitatively similar to findings that based on Engle and Granger cointegration procedure. For example, both tests indicate that in the long run, the corporate tax rate exerts a significant negative effect on total FDI and transfer funds, but not on reinvested funds. This justifies the single equation method and also implies that results are robust. More standard robustness tests will be carried out in the latter part of this essay. The next section investigates whether the results would change once structural breaks are allowed to enter the model.

Table 1.6

A: Johansen Cointegration Test: Total FDI

Trace Statistic

Number of cointegration equations	Trace Statistic	5% Critical Value	1% Critical Value
None**	135.73	124.24	133.57
At most 1	85.03	94.15	103.18
At most 2	49.75	68.52	76.07

Note: *(**) Denotes rejection of the hypothesis at the 5%(1%) level.
Trace test indicates 1 cointegrating equation at both 5% and 1% levels.

Table 1.6

Continued

B: Johansen Cointegration Test: Total FDI

Max-Eigenvalue Statistic

Number of cointegration equations	Max-Eigen Statistic	5% Critical Value	1% Critical Value
None**	50.69	45.28	51.57
At most 1	35.28	39.37	45.10
At most 2	22.47	33.46	38.77

Note: *(**) Denotes rejection of the hypothesis at the 5%(1%) level. Max-eigenvalue test indicates 1 cointegrating equation at both 5% and 1% levels.

Table 1.7

A: Johansen Cointegration Test: Transfer Funds

Trace Statistic

Number of cointegration equations	Trace Statistic	5% Critical Value	1% Critical Value
None**	140.68	124.24	133.57
At most 1	91.10	94.15	103.18
At most 2	52.65	68.52	76.07

Note: *(**) Denotes rejection of the hypothesis at the 5%(1%) level. Trace test indicates 1 cointegrating equation at both 5% and 1% levels.

Table 1.7

Continued

B: Johansen Cointegration Test: Transfer Funds

Max-Eigenvalue Statistic

Number of cointegration equations	Max-Eigen Statistic	5% Critical Value	1% Critical Value
None**	49.58	45.28	51.57
At most 1	38.45	39.37	45.10
At most 2	24.26	33.46	38.77

Note: *(**) denotes rejection of the hypothesis at the 5%(1%) level. Max-eigenvalue test indicates 1 cointegrating equation at both 5% and 1% levels.

Table 1.8

A: Johansen Cointegration Test: Reinvested Funds

Trace Statistic

Number of cointegration equations	Trace Statistic	5% Critical Value	1% Critical Value
None**	143.62	124.24	133.57
At most 1	92.06	94.15	103.18
At most 2	51.85	68.52	76.07

Note: *(**) denotes rejection of the hypothesis at the 5%(1%) level. Trace test indicates 1 cointegrating equation at both 5% and 1% levels.

Table 1.8

Continued

B: Johansen Cointegration Test: Reinvested Funds

Max-Eigenvalue Statistic

Number of cointegration equations	Max-Eigen Statistic	5% Critical Value	1% Critical Value
None*	51.55	45.28	51.57
At most 1	39.37	40.21	45.10
At most 2	24.31	33.46	38.77

Note: *(**) denotes rejection of the hypothesis at the 5%(1%) level. Max-eigenvalue test indicates 1 cointegrating equation at 5% level.

Table 1.9

Johansen Cointegration Results

Variable	Total FDI	Transfer Funds	Reinvested Funds
CITR	16.434	13.930[a]	-22.213
	(2.726)	(3.727)	(3.850)
GDP	10.818[a]	9.371[a]	-11.770
	(2.628)	(3.195)	(3.027)
IMPORTS	-4.167[a]	-3.761[a]	1.571
	(0.732)	(0.923)	(0.729)
MWR	-3.130[b]	-1.874	3.101
	(0.646)	(1.542)	(1.331)
INT	1.124[b]	1.636	2.235
	(0.570)	(0.750)	(0.622)
EEXR	-14.107	-12.156[a]	8.328
	(0.771)	(3.175)	(2.026)

Note: Standard errors are in parentheses. [a]Significant at the 1%level. [b]Significant at the 5% level. [c]Significant at the 10% level. Lag corporate tax rate is not included in the VAR specification.Variables are in natural logs.

Cointegration Relationships with Structural Break

This study uses data that spans five decades. For a longer data set, it is customary to check for the potential structural break of the model. The Chow test (1960) is used for this purpose. The Chow structural break point test separates the sample into sub samples and examines whether there are significant differences in each estimated equation. Existence of a difference indicates a structural break in the relationship. This can be tested using either F-statistic or log likelihood ratio statistic. This study uses log likelihood ratio statistic. It compares the restricted and unrestricted maximum value of the log likelihood function. The test statistic has a χ^2 distribution with $(n-1)/k$ degrees of freedom under the null of no structural change in the relationships.

Researchers, including Hartman (1984) point out that it is 1981 tax reforms that spurred the interest of foreign companies of investing in the United States. Careful observation of the data set also confirms this notion. Accordingly, we use 1981 as the structural break point in the Chow test and the results are reported in the Table 1.10. Results do not provide any evidence of structural break for the total FDI and transfer funds. However, test results regarding reinvested funds decisively reject the null hypothesis of no structural break. This further confirms the complex nature of reinvested funds components. Cointegration results for the reinvested funds in the presence of structural break are presented in the Table 1.11.

Overall explanatory power of the regression has improved considerably once this break is included in the estimation. To illustrate, the cointegration equation now explains 97 percent of the variation of reinvested funds for the period 1957-1980 and 73 percent

Table 1.10 Chow Breakpoint Test		
Equation	Log Likelihood Ratio	Probability
Total FDI	17.035	0.107
Transfer Funds	32.097	0.073
Reinvested Funds	34.372	0.000

Table 1.11

Engle and Granger Cointegration Results with Break

Variable	Reinvested Funds 1957-1980	Reinvested Funds 1981-1999
C	9.615[a]	41.019
	(1.162)	(80.627)
CITR	0.008	-4.760
	(0.113)	(4.383)
$CITR_{t-1}$	-0.211	-0.797
	(0.136)	(6.464)
GDP	0.215[b]	-25.736
	(0.092)	(16.673)
IMPORTS	-0.114[b]	24.750
	(0.049)	(14.932)
MWR	0.074	-4.342
	(0.055)	(6.149)
INT	0.072[a]	-5.245
	(0.023)	(4.214)
EEXR	0.063	2.656
	(0.089)	(3.349)
R-Squared	0.970	0.730

Note: Standard errors are in parentheses. [a]Significant at the 1%level. [b]Significant at the 5% level. [c]Significant at the 10% level. Variables are in natural logs.

for the period 1981-1999. These new R^2 values are considerably higher compared to the one obtained without imposing any break. However, as far as corporate tax effects are concerned, results are not much different after the break. Both current and lag tax rates are small and insignificant.

Although overall explanatory power has improved as a result of the break, its usefulness is questionable because none of the coefficients are statistically different from zero for the period 1981-1999. Signs of some of the parameters also seem economically implausible. Hence, the model we are using seems well suited to explain total FDI and transfer funds, but it may not be appropriate to analyze reinvested funds. However, that should not be a factor to overlook the importance of findings of this essay because reinvested funds currently only comprises approximately 6 percent of total inbound FDI in the United States.

Short Run Dynamics

Long run relationship does not provide any information regarding the short run behavior and the adjustment process of the variables. Once existence of a long run model is established, it is easy to estimate the short run model applying the Engle and Granger (1987) Error Correction Model (ECM). According to the Granger representation theorem, cointegration relationship guarantees an ECM, because for any set of I(1) variables, error correction and cointegration are equivalent representations. If y_t and Z_t are cointegrated (1,1), then the variables have ECM in the form given in given (1.13).

$$\Delta y_t = \alpha_1 + \alpha_y \hat{e}_{t-1} + \alpha_2 \Delta z_t + \varepsilon_t \qquad (1.13)$$

All of the regressors except the error correction term are expressed in first differences. This makes all of the terms in equation (1.13) are stationary or integrated of order zero.

This procedure involves two important steps. The first step is to estimate the cointegration equation and capture the residuals. The second step estimates the error correction model as in equation (1.13). Equations (1.14) through (1.16) show the specific form of the error correction term (e_{t-1}) this study has followed.

$$ECT_{fdi} = FDI_{t-1} - (\beta_0 + \beta_1 CITR_{t-1} + \sum_{i=2}^{7} \beta_i X_{t-1} + \varepsilon_{t-1}) \qquad (1.14)$$

$$ECT_{trasfer} = TFDI_{t-1} - (\beta_0 + \beta_1 CITR_{t-1} + \sum_{i=2}^{7} \beta_i X_{t-1} + \varepsilon_{-1t}) \qquad (1.15)$$

$$ECT_{reinvest} = RFDI_{t-1} - (\beta_0 + \beta_1 CITR_{t-1} + \sum_{i=2}^{7} \beta_i X_{t-1} + \varepsilon_{-1t}) \qquad (1.16)$$

The ECM is practically important for many reasons. First and foremost, it provides an alternative test for any possible cointegration relationship between the variables. Statistical significance of the error correction term suggests such a meaningful relationship. Second, the magnitude of the coefficient of the error correction term contains important information regarding the dynamics of the system. This coefficient is also known as the adjustment parameter. In order to analyze short run dynamics of three components of FDI, three error correction equations are estimated. Results are reported in Table 1.12.

Table 1.12

Short Run Results

Variable	Total FDI	Transfer Funds	Reinvested Funds
Constant	-0.342[b]	0.003	-0.329
	(0.129)	(0.089)	(0.301)
ΔCITR	-1.852	-3.764[b]	2.229[b]
	(1.241)	(1.557)	(0.977)
$\Delta CITR_{t-1}$	1.225	1.795[c]	1.130
	(0.867)	(0.999)	(1.078)
ΔGDP	5.418[b]	-0.015	9.652
	(2.131)	(1.903)	(7.104)
ΔIMPORTS	1.779[a]	1.080[a]	0.527
	(0.529)	(0376)	(0.409)
ΔMWR	-0.664	-1.153[c]	-1.364
	(0.739)	(0.610)	(1.749)
ΔINT	0.469	0.530[c]	0.121
	(0.291)	(0.267)	(0.352)
ΔEEXR	-0.439	0.089	1.074
	(0.918)	(1.018)	(0.998)
Adjustment Parameter	-1.00[a]	-1.00[a]	-0.93[a]
	(0.178)	(0.219)	(0.219)
Adjusted R^2	0.64	0.50	0.53

Note: Standard errors are in parentheses. [a]Significant at the 1% level. [b]Significant at the 5% level. [c]Significant at the 10% level. Variables are in natural logs.

As expected, the corporate tax rate exerts a significant negative effect on transfer funds in the short run. A one percent decrease in the U.S. tax rate would increase the level of transfer funds in the U.S. by 3.7 percent. We find significantly positive short run coefficients for imports and interest rate, while minimum wage rate display a significant negative relationship. We find a significant positive short run relationship between the tax rate and reinvested funds. This finding counters our expectations although Slemrod (1990) and other studies have reported positive long run relationships between tax rates and FDI.[6] Scholes and Wolfson (1990) attribute this finding to tax policies in the capital-exporting country.

For example, if investors are from a country that adopts tax credit system it may not be surprising to find a positive association between host country corporate tax rate and inbound FDI. Tax credit countries tax worldwide income and give credit for foreign taxes paid. Suppose Japanese investors face a 35 percent corporate income tax rate in the U.S. and a 40 percent tax rate at home. A small increase in the U.S. tax rate, with an unchanged Japanese tax rate, will favor Japanese firms who still pay 40 percent at home while domestic U.S. investors pay a higher rate. This might be one of the reasons for this positive relationship between reinvested funds and U.S. tax rate.

A significantly negative coefficient on the adjustment parameter in all three sets of results reported in Table 1.12 confirms our findings of the cointegration relationship. This is required to assure a meaningful relationship between variables. Testing the significance of the speed of adjustment coefficient is another way to show that the model

[6] For example, Swenson's (1994) panel data study found a median tax rate elasticity of 2.7.

converges to steady state solution.[7] Adjustment to the long equilibrium completes within one-year period except for reinvested funds, in which only 93 percent of the disequilibrium is corrected during one-year period.

Robustness Check

Several diagnostic tests are used to determine whether results are robust. This includes autocorrelation tests, and regression specification tests. Satisfactory performance against these tests undoubtedly raises the level of reliability of the findings. Cointegration and error correction estimation results are valid only if the residuals of the equations are white noise. Serially correlated residuals have been identified as a frequent reason for encountering non-white noise error problem.

This study uses the Breusch-Godfrey LaGrange Multiplier (LM) test to check for serial correlation. It is more suitable because unlike the Durbin-Watson statistic, the LM test can be used to test for higher order serial correlation problem which is common in time series studies. This test captures residuals from each of cointegration equation and then estimates the error equation using the general form given in equation (1.17). Residuals are regressed on original explanatory variables and residuals up to a certain number of lags. The product of the number of observations and R^2 is called Breusch-Godfrey LM statistic. The null hypothesis of no serial correlation against the alternative is tested using this statistic.

$$e_t = X_t\gamma + (\sum_{k=1}^{p} \alpha_s e_{t-k}) + \omega_t \qquad (1.17)$$

[7] See Harris and Sollis (2003).

Results are shown in Table 1.13. Results do not indicate a serious serial correlation problem for the total FDI and transfer funds at the 5 percent level. However, residuals for the reinvested funds are serially correlated. This further strengthens the previous findings of this essay that reinvested funds are rather difficult to analyze using simple time series techniques.

A Regression Specification Test (RESET) suggested by Ramsey (1969) is used to determine whether the specification of the model is correct. RESET is widely used to check for an incorrect functional form, omission of relevant explanatory variables, and simultaneity problems. Specification errors can lead to a non-zero mean for the disturbance term that will result in biased estimates. RESET estimates the original cointegration equations including powers of the predicted values of the dependent Variable. If the original specification is correct, then these new terms should not add significant explanatory power to the new model. The null hypothesis of no specification error is tested using log likelihood ratio.

As reported in Table 1.14, RESET suggests the specification is correct for the transfer funds and total FDI regressions. However, it rejects the null of no specification error in the case of reinvested funds. This may clarify why some studies find reinvested funds are not responsive to tax rates. Incorrect specification may contribute to the poor performance of the reinvested funds equation. More research is required to determine the correct specification for reinvested funds. This finding does not obscure the importance of the FDI tax rate relationship because reinvested funds are only a small part of total FDI in the United States.

Table 1.13 Breusch-Godfrey LM Test Results		
Equation	Obs*R^2	P-Value
Total FDI	5.525	0.063
Transfer Funds	0.797	0.671
Reinvested Funds	6.356	0.041

Table 1.14 RESET Test Results		
Equation	Log Likelihood Ratio	P-Value
Total FDI	2.411	0.120
Transfer Funds	0.944	0.331
Reinvested Funds	34.352	0.000

Conclusions

This essay investigates long run and short run relationships between corporate income tax rates and FDI in the United States. The corporate income tax rate is found to exert a significant negative effect on total FDI inflows in the long run. This long run relationship is confirmed by the Engle and Granger (1987) single equation procedure as well as the VAR approach adopted by Johansen (1991) cointegration test. Results suggest that a one percent decrease in the tax rate would increase total FDI in the U.S. by 2.4 percent. This finding is similar to results reported in earlier studies that use different tax rates and FDI measures. We did not confirm a significant short run relationship between tax rates and total FDI flows. However, it is important to note that a cointegration relationship is not confirmed once non-tax variables are excluded from the model. So, it is the combination of tax and other non-tax variables that make this relationship.

Tax rates exert significant negative effects on transfer funds in both the long run and short run. Tax rate elasticities are quite large, ranging in absolute value from 3.7 in the short run to 4.2 in the long run. In the long run, investors have more time and information to respond to tax rate changes. Currently, transfer funds account for more than 90 percent of total FDI in the United States. Therefore, these findings are particularly important for policy analysis.

We did not find a significant long run relationship between tax rates and reinvested funds. An incorrect specification and a structural break contribute to this finding. A significant positive short run relationship is established between the tax rate and reinvested funds. Earlier studies that report similar positive relationships between tax

rates and FDI attribute their findings to the combined effects of foreign country and U.S. tax policies.

Collectively, results suggest that foreign investors are highly responsive to corporate income tax rates used by the United States. This suggests the U.S. has considerable scope to use tax policies to attract FDI from abroad.

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Essay Two

An Empirical Assessment of the Impacts of Host Country and Home Country Corporate Tax Rates on FDI in the United States

Introduction

This essay investigates the effects of host country and home country tax policies on the amount of FDI flows into the United States. Studies on the determinants of FDI have largely ignored home country tax rates. However, this issue is becoming more and more relevant due to the so-called race to the bottom tax competition among industrialized countries. The tax-cutting trend is continuing throughout the world and particularly in industrialized countries. Not a single OECD member country raised its corporate income tax rates in the year 2001. Instead, twelve members cut their rates (KPMG, 2002). The gap between tax rates is shrinking and quickly converging to a harmonized rate. For instance, between 1988 and 1997, the OECD average statutory corporate tax rate declined from 44 percent to 36 percent (Gropp and Kostial, 2001), which is just one percent higher than current U.S. corporate income tax rate. One of the most probable reasons for this tax-cutting trend is to attract mobile capital such as foreign direct investment from other locations and to keep domestic investors from moving out of the country. However, if a country introduces tax policies to attract foreign capital without paying due attention to this interrelationship, it may find that it is hard to realize its expectations for achieving the targeted amount of foreign mobile capital.

In addition to examining home country tax rates, this study also examines the impacts of different taxation systems on the amount of FDI inflows to the United States. It is known that foreign investors are subject to corporate income tax in the host country and then upon repatriation, the profits can also be taxed in the home country. In order to alleviate this double taxation, countries use two types of relief methods. One is called a

territorial taxation system in which investors are completely exempted from home country taxation. The other method is called a worldwide taxation system in which capital-exporting countries provide a tax credit for the taxes paid in the host country. Following literature, we refer those countries that use territorial system as exemption countries and those that use worldwide system as credit countries. So, it is expected that investors from tax exemption countries be more sensitive to tax rate changes in the U.S., while investors from tax credit countries be more responsive to tax rate changes in their home country given home country tax rates are higher than host country tax rates.

This study uses a panel of nine investing countries: Canada, France, Germany, the Netherlands, Australia, Belgium, Italy, Japan, , and the United Kingdom over the period 1982-2000. The first five countries in the list adopt the tax exemption system while the rest follow tax credit system. These nine countries altogether contribute more than 85 percent of total US FDI inflows during the sample period.

This study attempts to address two timely questions regarding corporate taxation and foreign direct investment in the United States. First, it investigates whether the corporate income tax rate is an important determinant of FDI in the United States. Compared to essay one, which is a time series analysis, we expect a better estimate for the tax rate elasticity because a panel allows for the inclusion of both host and home country tax rates. Second, we ask if investors from tax credit countries significantly differ in their tax response relative to those from tax exemption countries.

Literature Review

As pointed out in essay one, earlier time series studies have not incorporated home country tax rates into their analysis. Slemrod (1990) is the first time series study that controls for the tax system of the home country. Using FDI data for 3 credit countries and 4 exemption countries, Slemrod estimates tax rate elasticity to see if investors from tax exemption countries respond differently than those from tax credit countries. He tests the hypotheses that FDI from exemption countries should be at least as sensitive to U.S. tax rates as FDI from tax credit countries, and FDI from exemption countries should be positively related to the rate of home country taxation. However, he does not find convincing results to accept or reject these two hypotheses. Limitations of the econometric procedure that he uses may be one of the explanations for his inconclusive results. It would have been better if he used panel estimation techniques rather than estimating separate time series equations for each country. However, many still consider this as a pioneering work because it is the first study that emphasizes the importance of incorporating home country tax rates into the FDI and taxation literature.

Cassou (1997) makes an effort to extend Slemrod's work by using a panel data empirical approach. Using a panel of six investing countries (France, Germany, Italy, Japan, Sweden, and the United Kingdom), he investigates the impact of tax policy on foreign direct investment flows between the U.S. and other countries. The use of a panel approach enables him to include more non-tax variables such as the unemployment rate and interest rate into the analysis. With these modifications, he finds strong evidence regarding a negative relationship between U.S. corporate tax rate FDI inflows. His results

suggest that home country corporate income tax rate exerts a significant effect on investment flows. Unlike Slemrod, he finds that some non-tax variables such as the exchange rate and unemployment rate are significant determinants of FDI. However, he does not differentiate between tax credit and tax exemption countries.

Swenson (1994) questions the so-called negative relationship between tax rates and FDI in the United States. Her doubt is based on the general equilibrium results derived by Scholes and Wolfson (1990). They point out that in some cases, it is possible that foreign investors increase their investments in response to higher U.S. corporate taxes. To empirically test this hypothesis, she uses industry level FDI data from tax credit and tax exemption countries. Unlike previous studies, she uses the average tax rate instead of marginal or statutory corporate tax rates. Further, her study controls for one-year lag tax rate and exchange rate variables. Two separate equations are estimated: one for the tax credit countries and the other for tax exemption countries. As expected, the study finds positive tax elasticity for the investments from tax credit countries. Moreover, she concludes that the surge in FDI in the United States in the 1980s was driven by tax changes rather than changes in macro economic variables. Swenson has another interesting finding regarding the relationship between tax rates and FDI. They are positively related when average tax rate is used, but negatively related once the effective marginal tax rate is used. To explain this anomaly, she separates FDI data into two major categories; manufacturing industry, and combined industry. This study shows that only manufacturing industry data retain the positive coefficient under both types of tax rate data. Swenson also suggests that the average tax rate is a better indicator than the

effective marginal tax rate of the tax response to FDI because the latter is extremely sensitive to macroeconomic variables such as the interest rates and depreciation rates.

Over the years, studies have contributed to the literature by extending the analysis of taxation and FDI in various ways. To illustrate, some studies investigate the impact of state corporate income tax rates on the allocation of FDI in the United States. Hines (1996), uses the data from seven investing countries into 50 U.S. states to examine the effect of sub national taxes on investment location decisions. He uses real investment data rather than financial flows to study this issue and also controls for the different tax systems of investing countries. Hines's study finds that foreign investors from tax exemption countries are considerably more responsive to state taxes than are investors from tax credit countries. The study finds that investors from tax exemption countries reduce their investment shares by approximately 10 percent for every one- percent change in state corporate tax rate. Although an elasticity of that magnitude is questionable, his results support findings of previous important studies, which suggest that state taxes have significant effect on business locations within the United States (Papke, 1991). Since Hines is using single year data, it is possible that results are due to time specific features rather than to general outcomes. Agostini and Tulayasathien (2003) examine the effects of state corporate income taxes on the location of foreign direct investment using PPE data for five years. Following Hines, they also use top marginal statutory corporate tax rates to measure state tax impacts and include FDI data from tax credit countries as well as tax-exempt countries to control for the foreign tax system. However, they use a discrete choice model to estimate FDI equations. They find that FDI is sensitive to state corporate income tax rates. However, they find that the tax rate

elasticity for credit countries is not statistically different from the one for exemption countries. Another investigation of state tax effects is presented in Swenson (2001). She separates FDI into six different components: Establishment of new plants, plant expansions, mergers and acquisitions, joint ventures, equity increases, and other FDI. Then she estimates separate equations for each components. The study uses data from 46 countries into 50 U.S. States. One significant feature of the study is the use of number of investment projects instead of the value of investment flows. Swenson finds a significant negative relationship between the state corporate income tax rate and FDI in each equation. Results for some of the other variables differ across equations.

Recently, some studies have found a different approach to measure the effects of taxation of foreign direct investments. Instead of using inbound FDI data, they use outbound FDI data to evaluate tax impacts of tax rate changes on FDI flows. For instance, Cummings and Hubbard (1994) examine tax sensitivity of a panel on American companies abroad for the period of 1980-1991. This is the first known study that has used micro level firm data instead of aggregate data for the empirical part. They estimate two equations. Equation one is estimated including corporate tax rates as an explanatory variable and equation two is estimated excluding tax rate. They expect to see implausible parameters in equation two if tax rate is an important determinant in investment decision. The study finds that American investors are less sensitive to host country tax rates because of the tax credit system used by the United States.

Desai, Foley and Hines (2002) also use FDI data of American multinational firms to investigate the impacts of taxation on the location of foreign investments. Particular attention is given to tax competition and the role of chains of ownership. Under the

chains of ownership, affiliates are owned indirectly through other affiliates rather than owned directly by a parent. As discussed before, the United States follows a tax credit system of taxing its own citizens who conduct business overseas. Therefore, American companies are sensitive to both host country as well as U.S. corporate tax rates. However, chains of ownership can be used to reduce the tax burden of home country taxes. In this case, they hypothesize that investors from tax credit countries are more sensitive to foreign tax rate differences.

Based on data of American companies between 1982-1997, Desai, Foley and Hines show that investment patterns of indirectly owned affiliates are considerably more sensitive to local tax rates than that of directly owned foreign affiliates. Results also indicate a different level of tax sensitivity between American and non- American firms. The difference is due to different methods of tax systems used by the countries. Though the U.S. adopts a tax credit system, many other countries use the tax exemption method.

Most of the studies have used U.S. data to investigate the relationship between corporate tax rates and FDI. However, there are some studies that use FDI data of other countries to understand the issue. For instance, Billington (1999) uses the statutory corporate income tax rates to estimate the tax rate elasticity. He uses direct investment data from seven investing countries into the United Kingdom. Unlike the studies that based on the U.S. data, Billington uses a number of variables to control for the non-tax determinants. He includes gross domestic product, imports, and expenditure on transportation, interest rate, and unemployment rate as explanatory variables. This study uses similar steps that have adopted by the studies that use U.S. data. As explained before, Hines (1996) investigates the impact of state tax changes on FDI behavior.

Similarly, Billington estimates a multi-region model to investigate whether local determinants are any different from country level determinants. Regional dummies were also included. Since FDI data are not available at regional levels, Billington uses the annual number of foreign investment projects that were started in each of regions as a proxy variable. Further, his study does not use any regional tax rates because they are determined at the national level rather than at the local level. At the regional level, some non-tax variables, such as unit labor costs and unemployment are the most significant factors.

The majority of the existing studies on taxation and foreign direct investment are focused on FDI inflows in a single country. Quere, Fontagne, and Revil (2001) address this gap in the literature by undertaking a multi-country analysis. Findings based on the information of a single host country are harder to generalize because they may have taken place due to some host specific effects. Using a panel of bilateral FDI flows across 11 OECD countries over the 1984-1996 period, they investigate the role of tax differential between countries on foreign investments.

This paper provides a nice empirical analysis of the impact of tax rate differentials on FDI inflows. It uses both statutory and effective marginal corporate income tax rates for the estimation. Tax differentials are measured as the tax difference between two countries. This study also controls for different taxation schemes such as credit and exemption methods. They use a better way to handle tax credit and tax exemption issue in their analysis. To illustrate they set the tax differential to zero when the investor comes from a credit scheme country as long as host country tax rate is lower than that of the source country. As in Young (1988), this study also includes a lagged dependent variable

because they suspect that the whole history of taxation, and not just current taxation, matter for foreign investors' decision to relocate their capital. They report a significantly negative tax rate elasticity. As far as different tax systems are concerned, they find that a credit system would reduce fiscal incentives to relocate. Further, the study implies that tax harmonization is not the solution for the harmful tax competition among countries.

Results also refute the popular notion that smaller countries are in a better position when it comes to the tax competition. Citing agglomeration-related factors, they point out that a small peripheral country should display substantially lower tax rates in order to compensate for distance to investors and low market potential. Even after controlling for the agglomeration factors, this study finds that tax rates play a significant role determining location of foreign direct investments. According to them, this is true as long as different tax schemes such as credit and exemption systems are controlled for.

Gropp and Kostial (2001) study the link between FDI and corporate tax revenues in addition to corporate tax rates. This is the first known study that estimates the relationship between tax revenue and FDI in a host country. Previous studies have mainly focused on some form of corporate income tax rates rather than revenues. Their study finds a strong relationship between the two variables. Their sample covers 13 countries for the period 1988-1997. Another interesting feature of this study is to estimate the effects of home country tax rates on FDI outflows. They observe that tax exemption countries experience larger outflows than credit countries.

Wei (2000) contributes to the literature by using FDI stocks rather than flows. He uses FDI stock data from 12 source countries to 45 host countries. Another improvement of the study is to control for the corruption level in the host country. He finds that one-

percent increase in the top statutory marginal corporate income tax rate reduces inward FDI by 4.8 percent. In order to control for the different tax systems of the countries he includes an interaction of the tax rate and a dummy. The dummy takes on the value of 1 if the source country adopts tax credit system. Results yield no significant difference in tax responses to different taxation schemes of home countries.

Mooij and Ederveen (2001) point out that comparison among the above studies is difficult because specifications and data sets are different. In order to alleviate these difficulties, they conduct so-called meta analysis for some well-known studies. This investigation support of the view that investors from tax exemption countries are more likely to respond to changes in host country taxes than do investors from tax credit countries. Specifically they find semi-elasticities that pertain to the former group are 2.16 times larger compare to the studies that do not specify the home country of the investor. However, they also find inconsistent results regarding the effects of different taxation systems of home countries. To illustrate, the semi-elasticity for investors from tax credit countries is 0.56 larger compared to the studies that do not specify the home country of the investor. This finding is inconsistent with the theory.

Theoretical Background

Neoclassical trade theories such as the Hecksher-Ohlin theory explicitly assume factors of production are immobile. These theories focused on trade in goods and not trade in factors. Over time, more attention has been devoted to international factor mobility. Mundell (1957) incorporates trade in factors into the model and shows that trade in goods and, factor inputs can work as substitutes for each other. These developments in international trade theories had a little influence on public finance

policies[8]. As Gordon and Hines (2002) point out, the assumption of a closed economy was widely thought to have been an adequate approximation of the US economy over much of the postwar period. However, tax policies based on closed economy assumption are no longer considered appropriate.

This essay investigates how foreign investors take tax policies of both countries into consideration in deciding where to locate their mobile capital. This is a particularly interesting issue for foreign direct investors because they are required to pay corporate taxes in the host country and then in the home country upon repatriation of profits to the parent company. However, not all the countries adopt the same policy of taxing their residents' foreign source income. Currently countries follow two distinct approaches of taxing foreign source income. Countries such as Canada, Germany, and Netherlands follow an exemption system, while the U.S., Japan, and the United Kingdom follow a tax credit system.

If home country adopts an exemption system, its investors have to pay only host country taxes. Therefore, they should be more concerned about changes in host country corporate tax rates and less sensitive to tax rate changes in the home country. With the perfect capital mobility assumption, investors from tax exemption countries should achieve equal after tax rate of return in the equilibrium (Swenson, 1994).

Tax credit countries follow a worldwide system of taxing foreign source income. Sometimes, this method is also called a residence-based taxation system. This system allows investors to claim credit for the corporate taxes they paid in the host country. In

[8] However, Diamond and Mirrlees (1971) discusses about the difficulties that arise when taxing returns to capital investment in open economies.

other words, they have to pay the difference between the host tax rate and the home country rate. For example, the top corporate income tax rate in Japan is 42 percent while the U.S. adopts a 35 percent rate. As both countries adopt credit system, a Japanese firm that earns 1,000 dollars in the U.S. pays 350 dollars corporate income tax in the U.S. and an additional 70-dollar yen equivalent Japan.

If the host country tax rate exceeds the home country rate, then that country should be considered an exemption country. For example, in Ireland, the current top corporate tax rate is 16 percent. Therefore, an Irish firm that operates in the U.S. has to pay only U.S. corporate taxes. This situation is called excess foreign tax credit. Our sample mainly consists of tax credit countries that face a deficit foreign tax credit rather than an excess foreign tax credit. In other words, tax liability in the host country is smaller than that of home country. Under this situation, an increase in the host country corporate tax rate can have a subtle effect on FDI inflows. Consider our earlier example on this page and, suppose that the U.S. raises its top corporate income tax rate to 36 percent. Then the Japanese firm now pays 360 dollars in the U.S. and 60 dollars in Japan. Its total tax liability remains the same. The Japanese firm may even be in a favorable position compared to domestic investors as well as to investors from tax exemption countries. This research investigates whether we have sufficient empirical evidence to suggest that home country tax system is a critical factor for investment decisions.

Contribution

This essay addresses two major issues in the taxation and FDI literature. First, it investigates whether corporate tax rate changes can affect the amount of FDI in the United States. Both host and home country tax rates are included. This is important because it has been shown that tax systems in capital exporting countries substantially affect investors' decision of where to locate their investments. A fixed effects model is used to estimate the panel that consists of nine countries and 19 years of data. In addition, random effects and constant coefficient techniques are also used as a means of checking the accuracy of our findings.

Second, this essay investigates whether investors' decisions are affected by the various taxation systems used in their own countries. As explained before, we control for the different tax systems by including countries that adopt tax credit system and countries that adopt tax exemption system. Our sample consists of 4 tax credit and 5 tax exemption countries. The original sample is separated into these two groups and then estimated to determine whether results are significantly different from each other.

Investors from tax exemption countries should have a stronger negative response to changes in U.S. corporate tax rates compared to those who come from tax credit countries. On the other hand, a stronger negative response is expected for the changes in home country taxes from investors that come from tax credit countries. The above mentioned panel estimation techniques are used to analyze these two hypotheses.

This study contributes to the literature in several ways. First, this is the first study that uses panel estimation techniques to analyze impacts of home country tax systems on

financial flows of FDI into the United States[9]. Cassou (1997) is the only study that takes both home and host country tax rates into account, but he does not control for the different tax systems of home countries.

The second improvement is our use of a more comprehensive data set. The most recent study, covers FDI and tax data only thorough 1970-1989 (Cassou 1997). This limitation is critical because we have witnessed a considerable change in tax rate changes by major investing countries as well as a remarkable increase in FDI inflows in 1990s. This essay consists of data for nine countries over the period 1982-2000, enabling us to capture all significant changes in tax policies during the last two decades.

A third improvement pertains to the type of corporate rate used to estimate the tax rate elasticity. Previous studies have generally use only one form of the corporate tax rate. There are three popular corporate income tax rates in the literature, namely, top statutory marginal rate (SCTR), effective marginal rate (EMCTR), and effective average tax rate (EACTR). Both EMCTR and EACTR are based on tax codes and other variables such as interest rate and depreciation rate. Researchers are not in agreement regarding which taxes should be used for estimating the tax rate elasticity. This study uses all three forms of tax rates and compares findings.

Finally, this essay controls for other important determinants of FDI. Compared to time series studies that are confined to a small data set, a panel study has the advantage of including more relevant variables. Previous studies have not made use of this feature and are almost always limited to a very few explanatory variables such as gross domestic product, exchange rate and unemployment rate. Even studies that controlled for the non-

[9] Slemrod (1990) uses time series techniques to analyze this issue.

tax determinants have been unable to include them together in a single study. This essay controls for all the explanatory variables that have shown to be significant in separate studies. In addition to the above variables, I include bilateral trade, unit labor cost, interest rate, and a proxy for the infrastructure, and relative gross domestic product to control for non-tax determinants.

Empirical Strategy

This study use panel estimation techniques to estimate the model. A panel approach has a number of advantages over single time series or a cross section method of estimation. It allows researcher to use more observations and have a larger numbers of degrees of freedom. This allows the inclusion of more explanatory variables, which may lessen the omitted variable bias. It also lets the researcher investigate new issues that are impossible under pure cross sectional or time series studies. Another advantage of using panel estimation is related to distribution properties of test statistics. To illustrate, Dickey and Fuller (1981) points out that if time series are nonstationary, then even if the sample size reaches infinity, distributions of OLS parameters are no longer normally distributed. However, a panel, which comprises independent cross sectional units, may produce asymptotically normal distributions. In addition to these benefits, a panel approach is especially important for this study because it has been shown that pure time series studies have produced weaker results compared to panel studies (Ederveen and Mooij, 2001).

There are three main methods that one can use to estimate a panel. The easiest among them is the so-called constant coefficient method. In this method all time series and cross section observations are combined and then ordinary least squares is applied to

the entire data set assuming both regressions slope coefficients and intercepts are identical across countries and over time. This study uses data from 9 countries over 19-year period. The general form of the linear model is given in the equation (2.1).

$$FDI_{it} = \alpha_{it} + \beta'_{it} X_{it} + \varepsilon_{it} \qquad (2.1)$$
$$where, \quad i = 1,2,3.....9 \quad t = 1,2,3,.....19$$

α and β'_{it} are 1x1 and 1x k vectors of constants that vary across time and countries. X'_{it} is a 1x k vector of explanatory variables and ε_{it} is the error term[10]. Throughout this analysis, we assume that parameters are constant over time. This is a safe assumption because our sample uses data that spans no more than two decades. With this assumption, the general equation can be written as in the equation (2.2).

$$FDI_{it} = \alpha_i + \beta'_i X_{it} + \varepsilon_{it} \qquad (2.2)$$
$$where, \quad i = 1,2,3.....9 \quad t = 1,2,3,.....19$$

This general form varies according to the specific model used to estimate the panel. Equation (2.3) displays the constant coefficient model that ignores any country-related differences.

$$FDI_{it} = \alpha + \beta' X_{it} + \varepsilon_{it} \qquad (2.3)$$
$$where, \quad i = 1,2,3.....9 \quad t = 1,2,3,.....19$$

However, if the observations are not independent and differences exist between cross sectional or time series observations, this method may lead to false inferences. This single OLS regression generally produces biased estimators. Hence, an analysis of covariance test is conducted to determine the homogeneity of regression coefficient. If

[10] See Hsiao (2003) for detailed information about panel estimation techniques.

the test rejects overall homogeneity we have to account for that because heterogeneity bias may lead to meaningless results. Inconsistent and economically meaningless results arise due to the omitted variables that could explain heterogeneity in the model. Fixed effects and random effects models make necessary changes to the intercept term to account for this heterogeneity.

In a fixed effects model, heterogeneity is taken care of by including dummies to capture cross sectional specific effects or time specific effects. This method captures systematic differences by raising or lowering the intercept term by a fixed amount for each cross sectional units. Therefore, the fixed effects estimator allows the intercept to vary across cross sections, though each country's intercept stays constant over time. In the literature, this model sometimes called least squares dummy variable model. Equation (2.4) displays the specific form that we use to estimate fixed effects model.

$$FDI_{it} = \alpha_i + \beta_i' X_{it} + \varepsilon_{it} \qquad (2.4)$$
$$where, \quad i = 1,2,3.....9 \quad t = 1,2,3,.....19$$

A fixed effects model is easy to estimate and analyze. However, it has some limitations. The major problem is that it uses a large number of dummy variables that reduce the degrees of freedom. Further, results are not suitable to make out of sample predictions. These problems can be lessened by using a random effects model.

The random effects model treats omitted individual specific factors as random variables rather than constant terms. This model implies that unknown country specific factors are better explained through an error term rather than a constant. Hence, the error term is comprised of a traditional error term as well as a cross section specific constant term. intercept term of each cross section comprises common constant term as well as a

cross section specific random variable. Equation (2.5) illustrates random effects model that we use in this study.

$$FDI_{it} = \mu + \beta'_{ti} X_{it} + \nu_{it} \qquad (2.5)$$
$$where, \quad i = 1,2,3.....9 \quad t = 1,2,3,.....19, \ and \ \nu_{it} = \alpha_i + \lambda_t + \varepsilon_{it}$$

$\alpha_i \sim N(0, \sigma_\alpha^2)$, $\lambda_t \sim N(0, \sigma_\lambda^2)$, and $\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2)$ represent the cross section error component, the time series error component, and the combined error component, respectively. The variance of FDI_{it} can be expressed as $\sigma_{fdi}^2 = \sigma_\alpha^2 + \sigma_\lambda^2 + \sigma_\varepsilon^2$, a sum of error components. For this reason a random effects model is also called an error components model (Balestra and Nerlove, 1966). Due to our previous assumption of no time specific effects, σ_λ^2 becomes zero. We further assume that the individual error components are uncorrelated with each other and they are not correlated with explanatory variables.

Both fixed and random effects models allow the intercept term to differ across cross sectional units. However, the random effects model often assumes that the distribution of the cross sectional specific error term is normal, while the fixed effects model does not impose such restrictions. When the pool contains data for many years, both models should produce similar results. In the case where the pool is small, random and fixed specifications can lead to significantly different results. A fixed effects estimator has an advantage over a random effects estimator because it does not require assuming effects are independent of explanatory variables. If, in fact, covariance of explanatory variables and cross section specific effects are zero, then the random effects model produces unbiased, consistent and efficient results. If it were not the case, then random effects estimator generates biased and inconsistent estimates. This problem does

not arise in the fixed effects model. In other words, the fixed effects model always produces consistent estimates, despite being relatively inefficient if effects are not constant.

This study utilizes both panel estimation techniques with a particular emphasize on fixed effects results. This preference is mainly due to a technical problem that arises in estimating random effects models. In order to estimate a random effects model, it is required that the number of cross section units be higher than the number of coefficients in the model. Since we have data for only 9 investing countries, we may not be able to utilize random effects model unless one variable is dropped from the regression. Our strategy here is to drop the variable for which the statistical t-value is less than one. If there is more than one such variable, then the variable with the least t-value will be dropped from consideration. The fixed effects model does not suffer from this limitation and allows us to make use of all theoretically relevant variables in the analysis.

We also estimate a GLS version of fixed effects model and constant coefficient model as a way of correcting for a possible heteroskedasticity problem. As explained above, a fixed effects model is more appropriate for our purpose because it does not involve such restrictive assumptions as the random effects model. For practical sense, a random model is more appropriate if the researcher is expecting to make predictions outside the sample and the sample does not contain all existing cross sectional units. The data sample covers more than 85 percent of total FDI data into the United States. This makes it less likely that results will be used to make out of sample predictions. Therefore, fixed effects model is appropriate for our purpose. Nevertheless, we use results of

random effects model for comparing and contrasting with results of other alternative models.

Since this study uses three forms of corporate tax rates (statutory marginal, effective marginal, effective average), separate equations are estimated for each. This will enable us to compare the results and determine which tax rate matters most for foreign investors. Finally, the sample is divided into tax credit and tax exemption groups and utilizes similar techniques to study impacts of different tax systems on foreign investors' behavior.

Data Definitions and Sources

This study examines effects of host and home country corporate tax rates on FDI flows into the United States. A panel of nine countries covering the years 1982-2000 is used to estimate econometric models. The panel consists of 5 tax exemption countries and 4 tax credit countries. All the variables are expressed in natural logs[11].

The dependent variable is the amount of foreign direct investment (FDI) in the U.S. from each investing country. FDI are given in millions of dollars. For this study, FDI data were obtained from OECD international Direct Investment database. In order to assess tax responses on FDI inflows, three types of corporate income tax rates are used. They are: the statutory corporate income tax rate, effective marginal corporate income tax rate, and effective average corporate income tax rate. All tax data were taken from International Fiscal Studies (2002) publications.[12]

[11] A constant is added to the FDI series to make the log transformation feasible. This strategy is very common in the literature (Hartman, 1984, Slemrod 1990, Cassou 1997).
[12] IFS has obtained original data from Devereux, Griffith, and Klemm (2002).

Sum of top federal corporate income tax and average local corporate income tax rate is defined as the statutory corporate income tax rate. To illustrate, this study adds extra 4 percent to the U.S. top federal corporate income tax rate to incorporate influence of state corporate income taxes. Effective marginal and average tax rates have been calculated under a number of different assumptions. Both rates assume that FDI is financed by transfer funds or reinvested earnings. However, there are some rate-specific assumptions. To illustrate, authors consider real interest rate and depreciation rates as fixed. However, they use country and time specific rate of inflation in calculating effective marginal effective corporate income tax rate. They further, assume a fixed 10 percent rate of economic profit for calculating effective average corporate income tax rate.

Data for other explanatory variables were obtained from various sources. To illustrate, information on GDP and telephone line per 1000 people was taken from IMF world economic database. We use OECD database for information on bilateral trade and unit labor costs data, while data for other control variables were obtained from the Federal Bank of St. Louis's FRED II database. Below, we briefly describe explanatory variables and economic reasoning for their inclusion as well as expected signs for tax and non-tax coefficients.

Three types of host country tax rates along with their home country counterparts are used in this analysis. As far as whole sample is concerned, we expect FDI to be negatively correlated with the host country corporate tax rate and positively associated with the home country tax rate.

These results may differ once different tax systems are allowed to enter the model. For example, we anticipate a less severe negative effect or even a positive impact from the investors from tax credit countries for a change in the U.S. tax rate. Conversely, investors from tax exemption countries should respond strongly to tax rate changes in the U.S. because they pay only U.S. taxes. As far as home country taxes are concerned, we expect an insensitive response from tax exemption countries and a completely opposite response from tax credit countries.

Horst's location hypothesis (1972) as well as Dunning's eclectic approach (1981) suggests that wage rate differences affect location decisions by multinational corporations. Empirical evidence largely supports this notion (Culem, 1988, Chakraborty and Basu, 2002). This argument does not take account of labor productivity differences. For example, industrialized countries boast a relatively more skilled labor force than other countries. Therefore, high labor costs can be somewhat offset by higher productivity. Some researchers find no statistically significant evidence to prove that labor costs is a significant determinant of FDI flows into the U.S. (Wheeler and Mody, 1992). Still, higher labor costs should discourage foreign investors from other industrialized countries such as the United Kingdom, Japan, and Germany. So, we expect a negative relationship between unit labor costs and FDI inflows.

Market size hypothesis suggests that multinational companies always evaluate the size of the host country market when considering a location. This is particularly true for the U.S. because it has the largest domestic market of any country. The ratio of host country GDP to the home country GDP is included in this study to control for the market

size hypothesis. We expect to see a positive association between relative GDP and FDI in the United States.

There are two arguments regarding the relationship between trade and FDI. One group considers trade and FDI as compliments while some take them as substitutes. If they are compliments, then higher trade between two countries should be associated with larger FDI inflows to the U.S. and if they are substitutes, higher trade should reduce inbound FDI. The substitution argument is based on the findings that a multinational will locate production operations close to its markets and FDI will substitute for trade if trade costs are not negligible (Quere, Fontagne, and Revil, 2001). However, foreign goods are important inputs into affiliate manufacturing. Greater sales in foreign markets will require improved distribution systems, advertising and R&D activities that are facilitated by FDI. Some studies find evidence for both substitution and complementarity effects (Blonigen 2002). We expect to find a positive correlation between FDI and bilateral trade.

Foreign investors pay particular attention to infrastructure available in a host country when determining whether a subsidiary should form there. A better infrastructure should encourage investment; therefore, we should control for this to avoid an omitted variable problem. A practical problem is to determine what variable should represent infrastructure in the host country. In general, some form of transportation or communication variable is used as a proxy to the infrastructure. Some studies use proxies such as per capita energy consumption, urbanization index, or expenditure on road transport (Billington, 1999). This paper uses telephone line availability per 1,000 customers as a proxy for the infrastructure. We hypothesize a positive coefficient for this variable.

This study includes the bilateral exchange rate as an explanatory variable. It has been observed that foreign investment rises as dollar depreciates and falls as the dollar appreciates (Swenson 1994). Empirical evidence generally supports this view. For example, Froot and Stein (1991) point out that the depreciation of the United States dollar after 1985 had been the major reason for the unprecedented increase in FDI inflows into the United States in the late 1980s. Using both FDI inflows and outflows Cushman (1987) finds that currency appreciation decreases FDI inflows. Although a large majority of studies supports this notion, findings are not unanimous (Slemrod, 1990).

Difference in the cost of capital is regarded as a potential determinant of FDI inflows. We use the U.S. prime interest rate to control for the cost of capital. In addition, it can be a proxy for the rate of return that investors earn. According to the differential rate of return hypothesis, international capital flows from one country to another until rate of return advantages are exhausted. Intuitively, an increase in the cost of capital should decrease investment in that country. We expect to see a negative relationship between the interest rate and FDI inflows, though some studies find completely opposite results (Billington, 1999).

Econometric Results

Table 2.1 presents results from the constant coefficient specification. It ignores the time and cross sectional dimensions by assuming intercept and slope coefficients are constant. Any time and cross sectional effects are captured by the error term in the regression. For the sake of brevity, only heteroskedasticity corrected Generalized Least Squares (GLS) results are presented here and outputs that are based on Ordinary Least Squares (OLS) are available in the appendix B. Further, results are shown for each of the

Table 2.1

Constant Coefficient Specification: GLS Results

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Constant	19.814[b]	16.817[b]	16.944[b]
	(8.125)	(7.462)	(7.206)
Host Tax	-1.165[b]	0.531	-1.308[c]
	(0.529)	(0.856)	(0.694)
Home Tax	0.202	0.267	0.075
	(0.254)	(0.166)	(0.218)
ULC	-7.957[a]	-7.629[a]	-7.464[a]
	(1.704)	(1.559)	(1.563)
RGDP	-0.435	-0.470[a]	-0.449[a]
	(0.171)	(0.170)	(0.168)
BITR	0.256[a]	0.243[a]	0.259[a]
	(0.049)	(0.039)	(0.048)
TPLUS	3.463[a]	4.146[a]	3.498[a]
	(0.613)	(0.493)	(0.615)
INT	0.024	-0.210	0.057
	(0.253)	(0.255)	(0.247)
EXR	0.027	-0.015	0.023
	(0.024)	(0.025)	(0.024)
Adjusted R^2	0.931	0.941	0.938

Note: Standard errors are in parentheses. a, b, c, indicate significance at the 1%, 5%, and 10% levels respectively. Variables are in natural logs.

three types of tax rates: statutory tax rate, effective marginal tax rate, and the effective average tax rate. We should expect to see a negative coefficient for the host country tax rate and a positive coefficient for the home country corporate tax rate. Table B 2.1 of the appendix suggests that tax both types of tax coefficients are generally insignificant. Not only are tax rate and some of non-tax coefficients insignificant but also they are inconsistent with the theory.

Compared to the OLS results (see appendix B), GLS method appears to remove most of these problems in the OLS results. After heteroskedasticity is corrected, we are able to obtain consistent tax rate coefficients. Overall, results seems much better than those obtained from OLS method. However, we still have inconsistent outcomes for some non-tax variables such as relative GDP and exchange rate. We assume no cross sectional or time specific effects in this model. These are highly restricted assumptions that could distort the true picture of the relationship between variables.

In order to check whether constant coefficient method is misspecified, an analysis of covariance test is used. It compares error sums of squares of the constant coefficient model with other models. We expect error sums of squares to be higher for the constant coefficient model because it assumes a common intercept for all the countries. We test the null hypothesis that intercept restrictions are correct. Our results reject the null indicating that constant coefficient specification is invalid.

We conclude that a specification that allows for heterogeneity across cross section terms would improve the results. Following this guidance, we estimate a fixed effects model. This model also can be estimated using either the OLS or GLS method. Leaving

OLS results for the appendix, we describe the fixed effects GLS model in this section because it provides results that are more consistent with the theory.

As indicate in the Table 2.2, fixed effects reduces much of the impact of host country tax rate changes. For example, the host country effective average tax elasticity falls from –1.308 to –0.912, when fixed effects are allowed to enter the model. This is also true for the statutory tax rate elasticity, even though the reduction is much smaller. Results again confirm that foreign investors are responsive to the U.S. corporate income tax rate. The coefficient of the statutory tax rate is negative and statistically significant at the 5 percent level. A one percent increase in the statutory top corporate tax rate reduces FDI inflows by 1.1 percent. The coefficient on the average effective tax rate has the expected negative sign, but not statistically significant.

As we hypothesized, the home country corporate tax rate seems a significant determinant of FDI inflows to the United States. Coefficients of both effective marginal tax rate and effective average tax rate are positive and statistically significant. As far as statutory tax rate is concerned, it displays the expected positive sign, but statistically insignificant. Hence, results in general, indicates that whenever home country increases its corporate tax rate, investors experience a reduction in their existing after tax rate of return and start dislocating mobile capital from their own country and possibly invest in the United States in the from of FDI. On average, a 10 percent increase in the home country effective marginal corporate tax rate would reduce FDI inflows of the United States by approximately 6 percent. Results also reveal that the response for the home country tax rate is smaller in magnitude than for the host country tax rate. To illustrate, average significant tax rate elasticity is –1.1 for the host country tax rate, while it is only

Table 2.2

Fixed Effects Specification: GLS Results

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Host Tax	-1.100[b]	0.724	-0.912
	(0.485)	(0.570)	(0.638)
Home Tax	0.069	0.626[a]	0.512[c]
	(0.293)	(0.102)	(0.289)
ULC	-6.117[a]	-7.070[a]	-5.862[a]
	(1.206)	(1.263)	(1.197)
RGDP	5.947[a]	7.035[a]	4.891[a]
	(1.575)	(1.220)	(1.485)
BITR	1.313[b]	1.311[a]	1.371[a]
	(0.509)	(0.425)	(0.510)
TPLUS	1.631	2.570[c]	1.662
	(1.524)	(1.328)	(1.504)
INT	-0.071	-0.281	-0.051
	(0.190)	(0.187)	(0.191)
EXR	-0.432[b]	-0.900[a]	-0.401[b]
	(0.217)	(0.192)	(0.201)
Adjusted R^2	0.958	0.971	0.957

Note: Standard errors are in parentheses. a, b, c indicate significance at the 1%, 5%, and 10% levels respectively. Variables are in natural logs.

0.55 for the home country tax rate. This study supports earlier finding that coefficient of effective marginal tax rate is generally higher than statutory tax rate based on studies (Mooij and Ederveen 2001). In this study, home country marginal tax elasticity is approximately 10 times larger than that of statutory tax elasticity.

Relative GDP also appears to be one of the most important determinants of FDI. This again proves the generally accepted market size hypothesis regarding the determinants of FDI. Ample empirical evidence exists suggesting that market size is a positive and significant determinant of FDI (Lee and Mansfield, 1996). Our result is also consistent with time series evidence that is presented in the first essay. Market size is not only highly significant but also quite large in magnitude. To illustrate, one- percent increase in relative GDP would increase FDI inflows by approximately 5.5 percents.

Existing empirical evidence generally suggests that trade between host and home countries tend to be positively associated with the amount of FDI inflows implying that they are compliments rather than substitutes (Billington,1999). Results of this essay strongly support this view. Bilateral trade variable can also be considered as an openness indicator. Our results imply that openness leads to more FDI flows. It is interesting to note that the trade variable is significant on all three tax rates and is similar in magnitude in every cases. Specifically, this study shows that, on average, 10-percent increase in bilateral trade would increase FDI inflows by 13 percent.

Results reveal that investors are concerned about the infrastructure in the host country. We find that infrastructure is positively related to FDI inflows. This relationship is significant only on effective marginal tax rate. As far as magnitude is concerned, infrastructure is not as strong as other macro variables such as market size and trade. All

the countries in this sample have the reputation of having a good infrastructure. Therefore, it is understandable why they do not consider infrastructure as a critical factor when invest in the United States.

Turning to other non-tax variables, exchange rate exerts a statistically significant negative effect on the amount of FDI inflows. It means that cheap dollar is an attractive factor for the foreign investors. Statistically significant relationship holds on all three types of tax rates. As shown in Table 2.2, our study produces an inelastic coefficient for the exchange rate regardless of the type of tax rate in the model. Study suggests that interest rate is not a significant determinant of FDI inflows of the United States.

This study also estimates a random effects model and results are presented in the appendix. Results of the random effects model are not substantially different from the fixed effects specification except some minor changes in non-tax coefficients. One such difference is that exchange rate becomes insignificant though it keeps the expected sign. As pointed out before, the random effects model requires that the number of cross sections be higher than the number of parameters to be estimated. In order to estimate the model, we omit interest rate variable because it is not statistically significant in the fixed effects model and its t-value is right around zero. It is interesting to note that coefficients of both tax and non-tax variables remain almost unchanged in magnitude and significance. It strongly implies that our results do not suffer from endogeneity bias. Since this panel covers a large majority of U.S. FDI inflows, the fixed effects model is more appropriate than a random effects model (Hsiao, 2003).

A Hausman (1978) specification test is used to formally test whether fixed effects and random effects models produce significantly different results. We are unable to reject

the null hypothesis of fixed effects model and random effects model estimators do not differ considerably. Under this situation, it is safe to use fixed effects model because if the individual error component and explanatory variables are correlated, then random effects estimators are biased, whereas fixed effects estimators are unbiased (Gujarati, 2003).

This essay has raised two questions. The first question was whether host country and home country taxes matter for foreign investment decisions. Our results suggest that FDI inflows are negatively correlated with host country tax rate and positively correlated with home country tax rates. We observe that tax coefficients change slightly with different tax rates as well as different model specifications. For instance, fixed effects model produces a positive coefficient on effective marginal tax rate. Although the coefficient is insignificant, the positive relationship is still counterintuitive. Several previous studies have encountered a similar problem and they attribute this finding to tax policies in the capital exporting countries.

As previously stated, a change in the corporate income tax rate could generate varying impacts on foreign investments depending on whether investors are from a tax credit or tax exemption country. Since capital exporting countries differ in their treatment of foreign source income, investors from those countries may also differ in their response to the U.S. corporate tax rate changes. In the next section we incorporate this important issue into the analysis.

In order to analyze this question, we split the sample into tax credit and tax exemption groups. Then we estimate each pool using constant coefficient and fixed

effects models. It is not possible to estimate the random effects model because it requires the number of cross section units to be higher than the number of coefficients to be estimated. Unlike in the previous section, we do not focus on generalized least squares results. Since we split the sample into two relatively homogeneous groups, this procedure should alleviate any heteroskedasticity problem that might otherwise appear in the whole sample. Given that there is no serious heteroskedasticity problem, the OLS is the best estimator and not the GLS. Our preliminary estimation shows that GLS results are inconsistent and produce weaker results compared to those of OLS.

Table 2.3 and Table 2.4 display OLS results of fixed effects model for the tax credit panel and tax exemption pool, respectively. Table 2.3 provides some support for our previous hypothesis that tax credit countries are less responsive to the U.S. corporate tax rate changes. None of the host country tax coefficients are statistically significant for the tax credit panel implying that foreign investors are more concerned about the home country taxes than about the U.S. corporate tax rate. This is understandable because investors can deduct corporate taxes they paid in the host country when calculate home country corporate tax liability.

Unlike on credit group, statutory tax rate exerts a significantly negative effect on investors from tax exemption countries. As Table 2.4 illustrates, if the U.S. statutory corporate income tax rate decreases by 1 percent, then FDI inflows from tax exemption countries would go up by 1.9 percent. Investors from exemption countries have no corporate tax obligations in their home country. Therefore, it should not be surprising to find that they are very sensitive to the host country tax rate. Host country tax coefficients are not only significant, but also are larger in magnitude than those for the tax credit

Table 2.3
Fixed Effects Specification OLS Results: Credit Countries

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Host Tax	-0.867	0.320	-1.512
	(1.005)	(1.178)	(1.379)
Home Tax	-0.516	0.931[a]	-0.783
	(0.653)	(0.261)	(0.882)
ULC	-8.914[a]	-10.269[a]	-9.471[a]
	(2.955)	(2.857)	(3.089)
RGDP	0.240	3.903	1.251
	(3.882)	(3.597)	(4.029)
BITR	1.846[b]	2.245[a]	1.790[b]
	(0.722)	(0.694)	(0.738)
TPLUS	-1.366	-0.144	-0.419
	(1.973)	(1.886)	(2.090)
INT	0.471	0.400	0.505
	(0.401)	(0.450)	(0.410)
EXR	-0.175	-0.254	0.013
	(0.449)	(0.447)	(0.510)
Adjusted R^2	0.662	0.662	0.625

Note: Standard errors are in parentheses. a, b, c indicate significance at the 1%, 5%, and 10% levels respectively. Variables are in natural logs.

Table 2.4

Fixed Effects Specification OLS Results: Exemption Countries

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Host Tax	-1.911[c]	1.599	-1.816
	(0.966)	(1.265)	(1.157)
Home Tax	0.513	0.402	0.582
	(0.712)	(0.326)	0.623)
ULC	-6.950[a]	-8.298[a]	-6.787[a]
	(2.384)	(2.323)	(2.049)
RGDP	7.542[b]	7.795[a]	7.141[a]
	(3.063)	(2.231)	(2.654)
BITR	0.417	0.548	0.492
	(0.392)	(0.367)	(0.398)
TPLUS	5.306[a]	5.618[a]	5.226[a]
	(1.229)	(1.303)	(1.240)
INT	-0.209	-0.567	-0.194
	(0.297)	(0.372)	(0.294)
EXR	-0.440	-1.028[a]	-0.564
	(0.384)	(0.356)	(0.350)
Adjusted R^2	0.563	0.559	0.561

Note: Standard errors are in parentheses. a, b, c indicate significance at the 1%, 5%, and 10% levels respectively. Variables are in natural logs.

group. To illustrate, statutory corporate tax rate elasticity is a little more than twice the size for the exemption group than the one for the credit group.

Finally, we discuss whether home country taxes could affect differently on tax credit countries and exemption countries. As previously stated, we expect a negative response from credit countries and no response from exemption countries. Table 2.4 shows that none of the tax coefficient is statistically significant suggesting that exemption countries in fact are not sensitive to their home country tax rate changes. Since they have no tax obligations in home country, there should be no reason to be concerned about home country tax policy changes.

Results for the tax credit countries are rather ambiguous. We hypothesized a significantly negative coefficient on home country tax rate for the credit panel. Although effective marginal tax rate elasticity is statistically significant at the 1- percent level, positive sign contradicts theoretical intuition. On the other hand, statutory tax rate and effective average tax rate has the expected negative sign, but both of them are statistically insignificant. There are several reasons that might have accounted for this ambiguity.

One reason is that a tax credit system contains a lot of complications compared to an exemption system. For instance, some countries such as the U.S. and Japan allow deferring any home country tax liability until they are repatriated in the form of dividends. The possibility of indefinite deferring can turn a credit country to an exemption country.

Another complication arises if a home country reduces its corporate income tax rate such that the tax position of its investors changes from excess tax credit to deficit

credit situation. To illustrate, the U.K. has reduced its top corporate tax rates several times transforming practically it into an exemption country rather than a credit country. By 2000, the top corporate income tax rate in the United Kingdom had dropped to 30 percent. Although the U.K. still remains as a credit country, its residents who invest in the U.S. currently have no home country tax obligations. The reason is that they are now in deficit credit situation since current US tax rate is higher than the home country tax rate.

There is one more factor that could determine this relationship. As extensively detailed in the first essay, total FDI can be separated into reinvested funds and transfer funds. As far as reinvested funds are concerned, home country tax rates are not an immediate concern. Transfer funds, on the other hand, should be more responsive to home country taxes. What we have is the combine effect. Since we are using aggregate data, it is not possible to separate out the two effects.

Conclusions

In this essay we use a panel of nine capital-exporting countries to investigate the impacts of corporate income taxes on foreign direct investment in the United States. In contrast to previous studies, host country and home country tax rates are explicitly accounted for. Various measures of corporate tax rates are used and different methods of pool estimations are estimated. Empirical results presented in this paper lead to the following conclusions.

First, the U.S. corporate income tax rate exerts a significantly negative impact on inbound FDI of the United States. This finding is generally consistent with different pool specifications as well as different tax rates used in the model. However, results are more

robust for statutory tax rates than for effective rates. Investors probably know about host country statutory tax rates better than effective rates, so this finding is not surprising. A heteroskedasticity corrected fixed effects model finds an approximately unitary elasticity for the statutory tax rate, which suggests that a one percent increase in the U.S. corporate income tax rate would decrease FDI inflows by one percent. Conversely, the home country tax rate shares a positive association with FDI inflows. The coefficient for the home country tax rate is inelastic for every tax rate specification, which implies that the U.S. should not expect considerable amount of FDI inflows in an event of a tax increase in a capital exporting country.

Second, host country tax rate elasticities for exemption countries are systematically different from those of credit countries. This finding suggests that investors from exemption countries are more responsive to taxes than are those from credit countries. Compared to whole panel, the host country tax elasticity is larger in absolute value for exemption countries than for credit countries. However, the two groups are not systematically different in their response to changes in home country tax rates. For example, we hypothesized a zero or very small response from tax exemption countries and a stronger negative response from credit countries. Though results for exemption countries are in line with our expectation, inconsistency is highly visible for the case of tax credit countries. Complexities in the credit system such as tax deferral and excess foreign tax credit may have caused this anomaly.

Third, even though this study strongly suggests that the corporate tax rate is an important determinant of FDI in the United States, we should not underestimate the role of other non-tax determinants. We find that non-tax determinants such as market size,

labor costs, bilateral trade and exchange rate consistently exert statistically significant impact on FDI inflows of the United States. Therefore, this study emphasizes the importance of a combination of fiscal and macro economic policy to stimulate FDI inflows of the United States.

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Appendices

Appendix A

Table A 2.1 Descriptive Statistics		
Variable	Mean	Standard Deviation
FDI (Millions of $)	9826.33	13137.87
Host Average Tax	34.26	3.23
Home Average Tax	37.48	8.25
Host Marginal Tax	23.05	1.05
Home Marginal Tax	27.30	8.65
Host Statutory Tax	41.57	5.06
Home Statutory Tax	44.20	9.06
Relative GDP (in 1996 $)	7.81	7.83
Unit Labor Costs	95.06	3.82
Telephone Line/1000	559.57	67.70
Prime Interest Rate	9.16	1.98
Bilateral Trade (Mil. of $)	59285.64	72573.74
Exchange Rate	17.48	49.67

Appendix B

Table B 2.1

Constant Coefficient Specification: OLS Results

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Constant	31.824[a]	25.029[b]	27.037[b]
	(11.407)	(11.915)	(10.523)
Host Tax	-1.245[c]	1.095	-1.548
	(0.733)	(1.232)	(0.998)
Home tax	-0.591[c]	0.296	-0.428
	(0.326)	(0.252)	(0.296)
ULC	-10.533[a]	-9.729	-9.661[a]
	(2.346)	(2.401)	(2.234)
RGDP	-0.179	-0.038	-0.138
	(0.326)	(0.247)	(0.244)
BITR	1.637[a]	0.295	0.270[a]
	(0.434)	(0.061)	(0.798)
TPLUS	3.269[a]	4.350[a]	3.291[a]
	(0.803)	(0.698)	(0.836)
INT	-0.019	-0.237	0.057
	(0.337)	(0.388)	(0.338)
EXR	0.031	-0.018	0.032
	(0.035)	(0.041)	(0.036)
Adjusted R^2	0.383	0.375	0.376

Note: Standard errors are in parentheses. a, b, c indicate significance at the 1%, 5%, and 10% levels, respectively. Variables are in natural logs.

Table B 2.2

Fixed Effects Specification: OLS Results

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Host Tax	-1.696[b]	1.049	-1.887[b]
	(0.691)	(0.909)	(0.893)
Home Tax	-0.017	0.630[a]	-0.548
	(0.391)	(0.181)	(0.396)
ULC	-8.444[a]	-9.214[a]	-8.026[a]
	(1.726)	(1.852)	(1.698)
RGDP	4.776[b]	4.973[b]	4.105[c]
	(2.319)	(1.995)	(2.187)
BITR	0.714[c]	0.863[b]	0.754[c]
	(0.388)	(0.397)	(0.393)
TPLUS	3.228[a]	3.981[a]	3.366[a]
	(1.213)	(1.299)	(1.215)
INT	0.015	-0.195	0.084
	(0.249)	(0.294)	(0.249)
EXR	-0.232	-0.635[b]	-0.224
	(0.310)	(0.279)	(0.290)
Adjusted R^2	0.593	0.605	0.594

Note: Standard errors are in parentheses. a, b, c indicate significance at the 1%, 5%, and 10% levels, respectively. Variables are in natural logs.

Table B 2.3

Random Effects Specification: GLS Results

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Constant	21.083 [b]	20.598 [b]	18.682 [c]
	(10.337)	(9.371)	(10.200)
Host Tax	-1.423 [c]	0.687	-1.585 [c]
	(0.741)	(1.020)	(0.950)
Home Tax	0.169	0.485	0.576
	(0.462)	(0.854)	(0.468)
ULC	-9.239 [a]	-8.576 [a]	-8.996 [a]
	(1.764)	(1.625)	(1.718)
RGDP	1.980	0.747	1.837 [a]
	(1.516)	(1.222)	(1.505)
BITR	0.610 [b]	0.642 [a]	0.642 [a]
	(0.266)	(0.235)	(0.265)
TPLUS	3.134 [a]	3.263 [a]	3.316 [a]
	(0.930)	(0.839)	(0.948)
INT	*	*	*
	*	*	*
EXR	-0.050	-0.106	-0.088
	(0.201)	(0.165)	(0.201)
Adjusted R^2	0.605	0.596	0.607

Note: Standard errors are in parentheses. a, b, c indicate significance at the 1%, 5%, and 10% levels, respectively. Variables are in natural logs.

Interest Rate is dropped from random effects model because it is required that the number of cross sections are higher than the number of parameters in the equation.

Table B 2.4

Constant Coefficient Specification OLS Results: Credit Countries

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Constant	51.285[a]	62.324[a]	54.882[a]
	(14.082)	(15.152)	(15.335)
Host Tax	0.434[c]	-0.758	0.460
	(1.035)	(1.512)	(1.592)
Home Tax	-1.396[b]	0.556[c]	-0.719
	(0.582)	(0.313)	(0.687)
ULC	-10.406[a]	-13.494[a]	-10.775[a]
	(3.041)	(3.380)	(3.321)
RGDP	-3.128[b]	-3.510[a]	-3.546[b]
	(1.548)	(1.232)	(1.629)
BITR	1.734[a]	2.118[a]	1.898[a]
	(0.315)	(0.258)	(0.369)
TPLUS	-1.763	-1.809	-2.159
	(1.295)	(1.471)	(1.396)
INT	0.517	0.702	0.517
	(0.428)	(0.492)	(0.430)
EXR	-0.436[a]	-0.683	-0.515[a]
	(0.134)	(0.107)	(0.163)
Adjusted R^2	0.603	0.600	0.585

Note: Standard errors are in parentheses. a, b, c indicate significance at the 1%, 5%, and 10% levels, respectively. Variables are in natural logs.

Table B 2.5

Constant Coefficient Specification GLS Results: Credit Countries

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Constant	40.522[a]	50.499[a]	42.731[a]
	(11.271)	(13.022)	(11.710)
Host Tax	0.200	-0.286	0.056
	(0.889)	(1.206)	(1.241)
Home Tax	-1.352[b]	0.382	-0.829
	(0.512)	(0.235)	(0.540)
ULC	-6.574[a]	-9.506[a]	-6.721[b]
	(2.414)	(2.920)	(2.619)
RGDP	-2.907[c]	-3.191[b]	-3.141[b]
	(1.481)	(1.211)	(1.479)
BITR	1.766[a]	2.122[a]	1.874[a]
	(0.226)	(0.216)	(0.259)
TPLUS	-2.992[a]	-2.888[a]	-3.390[a]
	(0.783)	(1.051)	(0.893)
INT	0.644[c]	0.897[b]	0.746[b]
	(0.364)	(0.388)	(0.353)
EXR	-0.436[a]	-0.648[a]	-0.485[a]
	(0.099)	(0.094)	(0.115)
Adjusted R^2	0.947	0.947	0.952

Note: Standard errors are in parentheses. a, b, c indicate significance at the 1%, 5%, and 10% levels, respectively. Variables are in natural logs.

Table B 2.6

Fixed Effects Specification GLS Results: Credit Countries

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Host Tax	-1.032	0.383	-1.619
	(0.809)	(0.818)	(1.050)
Home Tax	-0.655	0.601[a]	0.319
	(0.548)	(0.189)	0.640)
ULC	-5.076[b]	-6.149[b]	-5.289[b]
	(2.327)	(2.505)	(2.493)
RGDP	0.788	3.754	1.866
	(3.972)	(2.836)	(4.175)
BITR	2.058[a]	1.833[a]	2.011[a]
	(0.539)	(0.482)	(0.558)
TPLUS	-3.133[a]	0.470	-2.397[c]
	(1.169)	(1.150)	(1.249)
INT	0.643[b]	0.459	0.749[b]
	(0.319)	(0.297)	(0.312)
EXR	-0.019	-0.477	-0.192
	(0.326)	(0.293)	(0.378)
Adjusted R^2	0.961	0.963	0.962

Note: Standard errors are in parentheses. a, b, c indicate significance at the 1%, 5%, and 10% levels, respectively. Variables are in natural logs.

Table B 2.7

Fixed Effects Specification GLS Results: Exemption Countries

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Host Tax	-0.826	1.004	-0.391
	(0.624)	(0.771)	(0.782)
Home Tax	0.904[c]	0.363[c]	0.886[b]
	(0.495)	(0.211)	(0.433)
ULC	-5.387[a]	-7.582[a]	-5.866[a]
	(1.524)	(1.498)	(1.409)
RGDP	5.229[b]	7.227[a]	5.269[a]
	(2.223)	(1.539)	(1.888)
BITR	1.038[c]	1.119[b]	1.121[b]
	(0.551)	(0.515)	(0.556)
TPLUS	3.584[b]	3.689[b]	3.600[b]
	(1.741)	(1.729)	(1.737)
INT	-0.258	-0.585[b]	-0.341
	(0.227)	(0.239)	(0.223)
EXR	-0.399	-1.001[a]	-0.613[b]
	(0.275)	(0.245)	(0.243)
Adjusted R^2	0.965	0.968	0.965

Note: Standard errors are in parentheses. a, b, c indicate significance at the 1%, 5%, and 10% levels, respectively. Variables are in natural logs.

Table B 2.8

Constant Coefficient Specification OLS Results: Exemption Countries

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Constant	31.342 [a]	35.926 [a]	29.541 [a]
	(9.930)	(12.166)	(9.142)
Host Tax	-0.720	1.152	-0.581
	(0.813)	(1.393)	(0.995)
Home Tax	0.188	0.217	0.188
	(0.301)	(0.218)	(0.280)
ULC	-11.583 [a]	-12.307 [a]	-11.316 [a]
	(2.034)	(2.276)	(1.913)
RGDP	-0.190	-0.124	-0.174
	(0.397)	(0.404)	(0.399)
BITR	0.133 [b]	0.149 [a]	0.139 [b]
	(0.052)	(0.051)	(0.052)
TPLUS	4.649 [a]	4.869 [a]	4.736 [a]
	(0.708)	(0.657)	(0.735)
INT	-0.385	-0.589	-0.382
	(0.365)	(0.431)	(0.366)
EXR	-0.683	-0.813	-0.729
	(0.519)	(0.470)	(0.503)
Adjusted R^2	0.488	0.492	0.486

Note: Standard errors are in parentheses. a, b, c indicate significance at the 1%, 5%, and 10% levels, respectively. Variables are in natural logs.

Table B 2.9

Constant Coefficient Specification GLS Results: Exemption Countries

Variable	Statutory Tax Rate	Effective Marginal Tax Rate	Effective Average Tax Rate
Constant	16.853 [a]	25.526 [a]	18.535 [b]
	(6.023)	(7.592)	(5.628)
Host Tax	-0.082 [b]	0.119	0.193
	(0.513)	(0.976)	(0.643)
Home Tax	0.460 [b]	0.198	0.370 [c]
	(0.255)	(0.156)	(0.221)
ULC	-8.998 [a]	-10.660 [a]	-9.384 [a]
	(1.333)	(1.504)	(1.265)
RGDP	-0.283	-0.227	-0.259
	(0.292)	(0.302)	(0.285)
BITR	0.161 [a]	0.165 [a]	0.167 [a]
	(0.037)	(0.038)	(0.038)
TPLUS	5.195 [a]	5.072 [a]	5.255 [a]
	(0.516)	(0.506)	(0.530)
INT	-0.466 [b]	-0.590 [b]	0.518
	(0.257)	(0.255)	(0.254)
EXR	-0.611	-0.801 [b]	-0.703
	(0.384)	(0.335)	(0.352)
Adjusted R^2	0.960	0.955	0.958

Note: Standard errors are in parentheses. a, b, c indicate significance at the 1%, 5%, and 10% levels, respectively. Variables are in natural logs.

Vita

Hapuarachilage Albert Wijeweera was born in Ruwanwella, Sri Lanka on October 18, 1966. He received his Bachelor of Arts degree in Economics from the university of Peradeniya in 1992. In August of 1997, he enrolled at Western Illinois University, Macomb where he received a Master of Arts degree in Economics. In the spring of 2004, he received a Ph.D. from the University of Tennessee, Knoxville. He is currently living in Armidale, Australia with his wife, Nandani and two children, Chandana and Saduni.