Multinational Firm Tax Avoidance and Tax Policy

Abstract – *This paper considers the tax policy consequences of both real and financial types of international tax avoidance, focusing on U.S. multinational firms over the period 1982–2004. First, income shifting is examined by estimating the relationship between U.S. affiliate profit rates and foreign country tax rates. Second, the effects of taxes on multinational firms' real operations across countries are considered. Estimates of both financial and real responsiveness to tax rate differences among countries are used to calculate how profits would differ from their current levels absent tax incentives, and thus how U.S. government revenues are affected. Finally, several policy alternatives are discussed.*

I. INTRODUCTION

At the intersection of an increasingly global world economy and the continued sovereignty of national governments lie many of the most interesting questions in international and public economics. A crucial subset of these questions considers the relationship between the inherently global behavior of multinational firms and the corporate tax policies of national governments. This relationship is multifaceted; decisions of governments regarding corporate taxation affect the decisions of multinational firms regarding where to locate economic activity and where to book profits. Yet, multinational firm decisions also impact governments, affecting the amount of revenue that they receive and ultimately the types of tax policies that they choose.

Multinational firms have both financial and real responses to the taxation of corporate income. Financial responses to corporate taxation include efforts to shift income to more lightly taxed locations. For instance, multinational firms may alter the transfer prices assigned to international trade with affiliates, alter the structure of affiliate finance, or change the location of royalties or intangibles. Real responses to international tax incentives include locating more assets, employment, and economic activity in low tax countries. While both financial and real types of responses are likely to affect government revenues, they have distinct policy implications.

The following analysis estimates the degree of responsiveness to international tax incentives of U.S. multinational

Kimberly A. Clausing
Department of Economics, Reed College Portland, OR 97202-8199

firms and their affiliates abroad, using a panel data set covering the period 1982–2004. The first part considers how tax avoidance takes the form of income shifting, recognizing that multinational firms have many methods for shifting profits. The second part examines how international tax incentives affect the real operations (especially employment) of U.S. multinational firms across countries.

In each part of the analysis, measurements of tax responsiveness are used to estimate how profits would have differed in the absence of tax incentives. This allows an estimate of the net effects of tax avoidance activity on tax revenues in the United States. By the end of the sample period, the estimates indicate that income shifting incentives cost the U.S. government approximately 35 percent of corporate income tax revenues, over $60 billion in 2004. Lost revenue due to real responses to corporate tax rate differences is estimated to be less than half as large, at the upper bound. These calculations are necessarily limited by both data constraints and the moving target of tax planning strategies in an increasingly global economy. Also, forming estimates is impossible without numerous assumptions. Still, this paper takes a step toward a thorough consideration of the revenue consequences of multinational firm tax avoidance.

While government revenues are one concern of tax policy, there are other important objectives of international tax policy, including promoting an efficient worldwide allocation of capital and promoting the competitiveness of home-based multinational firms. After discussing the revenue consequences of multinational firm tax avoidance, this paper discusses formulary apportionment as a possible policy alternative to the current system. The consequences of formulary apportionment are also briefly contrasted with other possible reforms.

II. BACKGROUND

The U.S. government taxes U.S. multinational firms on a residence basis, and thus U.S. resident firms incur taxation on income earned abroad as well as income earned in the United States. This system is sometimes referred to as a credit system, as U.S. firms receive a tax credit for taxes paid to foreign governments. The tax credit is limited to the U.S. tax liability that would have been assessed on such income in the absence of foreign taxation, although firms may generally use excess credits from income earned in high tax countries to offset U.S. tax due on income earned in low tax countries, a process known as cross-crediting. Taxation only occurs when income is repatriated. Thus, income can grow free of U.S. tax prior to repatriation, a process known as deferral.[1] Deferral and cross-crediting provide strong incentives to earn income in low tax countries. There is also typically an incentive to avoid income in high tax countries due to the limited tax credit.[2]

As an example, consider a U.S. based multinational firm that operates a subsidiary in Ireland. The U.S. corporate income tax rate is 35 percent while the Irish corporate income tax rate is 12.5 percent. The Irish subsidiary earns income but repatriates only a fraction of that income to the United States parent. So, the Irish

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[1] The Subpart F provisions of U.S. tax law prevent some firms from taking full advantage of deferral. Under Subpart F, certain foreign income of controlled foreign corporations is subject to immediate taxation. This includes income from passive investments.

[2] Some countries exempt foreign income from taxation; this is referred to as a territorial system of international taxation. In theory, multinational firms based in these countries have an even greater incentive to incur income in low tax countries as such income will not typically be taxed upon repatriation. Still, many authors argue that excess foreign tax credits, cross-crediting, and deferral blur the distinction between these two systems.

affiliate pays tax to the Irish government on their total profit. The firm must pay U.S. tax on the income that is repatriated, but it is eligible for a foreign tax credit, equal to the product of taxes paid to the Irish government and the ratio of repatriated dividends to total after-tax profits.[3] The remaining profits can grow abroad tax-free prior to repatriation.

Multinational firms have many methods for shifting profits across locations. For example, it may be advantageous for multinational firms to alter the debt/equity ratios of affiliated firms in high and low tax countries in order to maximize interest deductions in high tax countries and taxable profits in low tax countries. Further, multinational firms have a tax incentive to distort the prices on intrafirm transactions. For example, firms can follow a strategy of under-pricing intrafirm sales to low tax countries and over-pricing intrafirm purchases from low tax countries, following the opposite strategy with respect to high tax countries. There are also numerous other margins along which income shifting incentives influence multinational firm behavior, including the location of intangible property, the payment of royalties, and the timing and planning of repatriation decisions.

In the following analysis, it is assumed that profit shifting from the United States to low tax countries results in an equivalent amount of foregone taxable profits from the perspective of the U.S. government. While this assumption holds in the year of the profit shifting, the loss could be overstated if such income will eventu-

ally be repatriated and taxed by the U.S. government. However, there are several practical considerations that limit this expected future tax gain. First, repatriation rates from low tax countries are very low (Grubert and Mutti, 2001). Second, firms are adept at using cross-crediting and other strategies to repatriate profits from low tax countries when the tax price of doing so is low. As a consequence, the effective tax burden on the foreign income of U.S. multinational firms is estimated to be quite small.[4] Third, the American Jobs Creation Act of 2004 provided a purportedly one-time tax holiday for repatriated dividends from low tax countries. Such tax holidays raise the perceived probability of future repatriation tax relief or a move toward an exemption system, making firms reluctant to repatriate profits without favorable tax treatment.

A. Empirical Work on International Tax Responses

Many studies have considered the tax responsiveness of foreign direct investment. de Mooij and Ederveen (2005) perform a meta-analysis of 31 such studies; they find that the median value of the tax rate semi-elasticity is –2.9, indicating that a 1 percentage point reduction in the host country tax rate raises foreign direct investment by 2.9 percent.[5] They also note that the elasticities estimated in the reviewed studies increase over time.

Low tax locations are attractive places in which to locate new real investments, and more multinational economic activ-

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[3] This assumes that the U.S. multinational firm does not have excess foreign tax credits from its operations in high tax countries; if it does, it can use these credits to offset taxes due on the repatriated Irish profits.

[4] Grubert and Mutti (1995) estimate that the effective U.S. tax rate on active foreign income in 1990 is approximately 2.7 percent, or less under some assumptions. For example, lower tax rates result if one accounts for unrepatriated foreign income in the denominator of the tax payments/income fraction. Other adjustments allow royalty and sales source income to be domestic source income rather than foreign source income, adjust for artificial income allocation rules, and allow for worldwide fungibility. Grubert (2001) and Altshuler and Grubert (2001) obtain similar conclusions using 1996 data. Desai and Hines (2004) infer that the tax burden on foreign income is rather higher; however, their calculations are based on far less detailed data.

[5] They remove the outlier estimates, considering 95 percent of their studies' observed elasticities.

ity occurs in these locations as a result. In addition, the ability to reduce worldwide tax burdens by shifting income to lightly taxed locations enhances the attractiveness of such locations. There is substantial evidence of tax-motivated income shifting in the literature. Hines (1997, 1999) and de Mooij (2005) provide excellent reviews. Due to data limitations, most previous evidence is necessarily indirect, relying on statistical relationships between country tax rates and affiliate profitabilities or tax liabilities. Examples of important studies using this approach include Grubert and Mutti (1991), Hines and Rice (1994), Klassen and Shackelford (1998), Bartelsman and Beetsma (2003), and Mintz and Smart (2004). Almost all studies indicate a large elasticity of the tax base with respect to the tax rate; de Mooij (2005) calculates a mean semi-elasticity for such studies of 2.

There is also some concrete evidence regarding particular income shifting strategies. For example, there is evidence that firms alter debt/equity ratios across countries in order to incur more interest expense in high tax countries and more interest income in low tax countries. Weichenrieder (1996) provides some evidence of such tax responses for Germany. Grubert (1998) finds that there is a positive association between country tax rates and subsidiary interest payments. Altshuler and Grubert (2003) also find that high tax rates are positively associated with increased affiliate debt ratios. Desai, Foley, and Hines (2007) also find that tax considerations influence the structure of affiliate finance.

In addition, there is some direct evidence of tax-motivated transfer pricing in the literature. Clausing (2001, 2006) finds substantial evidence of international tax influences on the balance and pattern of intrafirm trade, evidence that is consistent with tax-motivated transfer pricing. There have also been a few studies that directly consider the impact of transfer pricing incentives on trade prices, including Clausing (2003) and Bernard, Jensen, and Schott (2006). Both studies find that tax influences have large effects on intrafirm trade prices.

B. A Brief Model of Corporate Income Tax Revenues

For the country as a whole, corporate tax revenues (denoted R) are equal to the effective tax rate, T, times the reported profits of corporations in the economy, Π_r[6]

(1) $R = T\,\Pi_r$.

Let μ represent the amount by which reported profits are less than actual profits, Π_a. The parameter μ can be positive or negative; for instance, one would expect affiliate firms based in low tax countries to overstate reported profits

(2) $\Pi_a = \Pi_r + \mu$.

Revenue collections (R) will reflect tax avoidance of both types, real and financial. Financial responses to taxation affect μ, and real responses affect firms' real economic decisions regarding employment, investment, and economic activity across countries, and thus the amount of actual profits generated in each country, Π_a. Both types of responses affect the tax base, and hence government revenues

(3) $R = T * (\Pi_a - \mu)$.

As a government changes T, revenues change as follows

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[6] Government legislation affects both the statutory tax rate and the breadth of the tax base (through the provision of various deductions and credits). Together, the statutory tax rate and the tax base determine the effective tax rate applied to profits.

(4) $\quad \dfrac{\partial R}{\partial T} = (\Pi_a - \mu)$

$$+ \left(T * \dfrac{\partial \Pi_a}{\partial T} \right) - \left(T * \dfrac{\partial \mu}{\partial T} \right).$$

The three terms on the right hand side of (4) describe three different effects. The first term is the direct effect of the tax increase on revenues. If taxable income were perfectly inelastic with respect to the tax rate, this would be the only effect of changing tax rates. With no behavioral response to the tax change, revenues would increase proportionately.

However, as tax rates increase, more tax avoidance activity occurs, as firms have increased incentives to take steps that reduce their tax burden. The second and third terms of (4) demonstrate two types of firm responses. The second term captures tax avoidance activities that reduce the actual corporate profits generated in the economy. For example, if firms locate employment and investment activities in low tax countries at the expense of high tax countries, that will reduce the actual amount of profits earned in the high tax countries, and corporate income tax revenues in those locations will decrease.[7]

The third term captures tax avoidance activities that affect firms' decisions regarding the amount by which they manipulate reported profits, μ. As a country's tax rate is high relative to those in foreign countries, reported profits will be lower than actual profits. Similarly, reported profits may be higher than actual profits for low tax countries. This relationship is the result of multinational firms' abilities to shift profits across countries due to transfer price manipulation and other techniques.

This paper will consider the tax avoidance activities of U.S. multinational firms over the period 1982–2004. During this time, there were some important changes in statutory corporate income tax rates. Most notably, after the Tax Reform Act of 1986, the U.S. corporate income tax rate declined from 46 percent to 34 percent; it then increased to 35 percent in 1993. In addition, foreign tax rates changed substantially. The average statutory tax rate fell from 42 percent to 29 percent over this period for the countries in the sample. The average effective tax rate also fell, by approximately 15 percentage points. The standard deviation of both tax rates across the sample also fell during this time period, by approximately one third. Figure 1 charts the evolution of U.S. and foreign statutory tax rates. In addition to changes in tax rates, there were other important changes in tax policy by both the U.S. and foreign governments. For example, in 1997, the U.S. government introduced "check-the-box" regulations that greatly simplified the use of aggressive tax planning techniques.[8]

III. TAX AVOIDANCE AND THE FINANCIAL RESPONSES OF U.S. MULTINATIONAL FIRMS

This section considers how affiliate profitability across countries varies with tax rate differences. The ratio of pretax income to total sales by affiliates in a given country is the measure of profitability. Pretax income is the net income of affiliates in a given country and year, adding back the taxes that were paid to foreign governments.[9] Sales include all sales by affiliates,

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[7] Also, to the extent that corporations respond to increases in taxation by simply undertaking less economic activity or shifting economic activity from the corporate to the non-corporate sector domestically, actual profits will also be lower, although these responses are not considered in this paper. Gordon and Slemrod (2000) and de Mooij and Nicodeme (2006) find evidence of income shifting between the corporate and personal income tax bases.

[8] This development is discussed in more detail in Altshuler and Grubert (2005).

[9] See Appendix A for more discussion of these variables.

Figure 1
U.S. and Foreign Corporate Income Tax Rates, 1982–2004
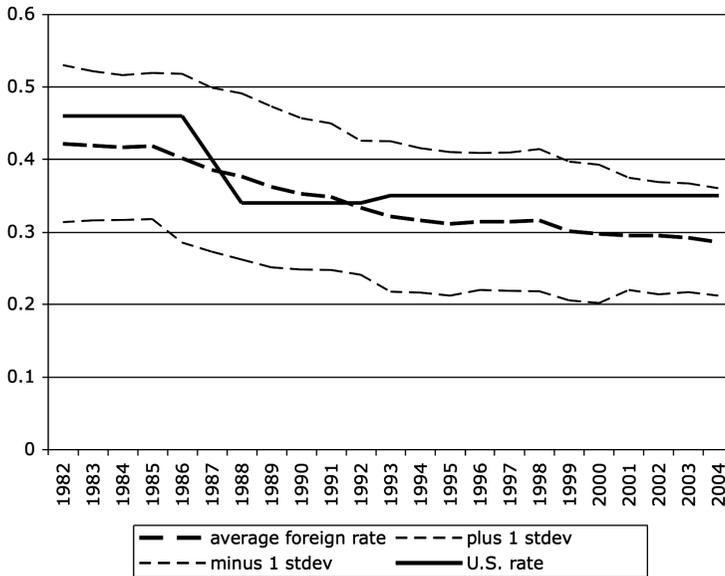
Note: These statutory tax rate data are from PricewaterhouseCoopers, *Corporate Taxes: Worldwide Summaries*.

both in the local market as well as to affiliated and unaffiliated entities abroad. Sales are used in the denominator of the profit variable in order to control for the scale of firm operations across different countries; one would expect total profits across countries to be higher as affiliates have larger operations. Operations could be measured by assets, employment, or sales. However, scaling pre-tax profits by assets or employment could create difficulties. For example, we might expect industries with different factor intensities to be concentrated in different countries in ways that are not completely independent of profitability.[10]

The following specification is estimated

(5) $\quad Profit\ Rate_{it} = \alpha + \beta_1\ (Tax\ Rate_{it}$

$\quad - Tax\ Rate_{u,s,t}) + \upsilon_{it}$.

Data cover the period 1982–2004 for the complete set of countries for which the Bureau of Economic Analysis reports data on U.S. multinational firm operations. The data set is discussed in more detail in Appendix A. Summary statistics for the main variables used in this paper are provided in Table 1.

Effective tax rates are used in the baseline specifications here and below, although results are also checked with statutory tax rates. Statutory tax rates are an imperfect proxy for the actual tax rates firms face since such rates do not account for the many subtleties (tax holidays, ad hoc arrangements, etc.) that determine the true tax treatment of firms. However, some have argued that they might better proxy for the marginal incentive to shift income. Still, many of these subtleties can affect marginal as well as average tax

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[10] The general character of the results is not sensitive to this choice of denominator, although the estimates are larger if employment is used instead of sales, as discussed at the end of this section.

Table 1
Summary Statistics

Variable	N	Mean	Standard Deviation
Effective corporate tax rate	1,360	0.268	0.139
Statutory corporate tax rate	1,279	0.342	0.107
Profit rate (Gross income/sales)	1,256	0.150	0.201
Intrafirm trade balance (Exports-imports/total)	1,024	0.228	0.467
Unaffiliated trade balance (Exports-imports/total)	1,018	0.213	0.531
Non-intrafirm trade balance (Exports-imports/total)	1,009	–0.121	0.317
Share of sales, manufacturing	1,218	0.332	0.252
Share of sales, wholesale	1,124	0.176	0.153
GDP, billions constant $	1,196	322	637
GDP per-capita (constant $, in PPP terms)	1,196	14,147	9,445
Distance from U.S., miles	1,440	4,229	2,242
Employment, thousands	1,330	103	191
Assets, $ million	1,331	44,311	131,454
Sales, $ million	1,330	26,629	53,410
Gross income, $ million	1,257	2,693	5,007

Note: Data sources are described and variables are defined in more detail in the appendix.

rates, and the two variables are highly correlated. In cases where they differ substantially, common sense dictates that the effective tax rate may be the better measure of the true tax treatment of firms.[11]

We would expect tax-motivated income shifting to generate a negative coefficient on the effective tax rate difference variable β_1. Countries with higher tax rates are expected to experience lower affiliate profitability, as profits are shifted to lower-tax countries.[12] Results from this specification are reported in Table 2; column 1 reports the full data set, and columns (2), (3) and (4) break down the sample into three subperiods. The early period is before the Tax Reform Act of 1986 was in place (when the United States had relatively high tax

[11] The variables have a correlation of 0.64. The countries where the differences are substantial are Barbados, Belgium (just in recent years), Jamaica, Luxembourg, the Netherlands, the Netherlands Antilles, Panama, Singapore, and Switzerland. In all cases, effective tax rates are far below statutory rates, which is consistent with the observation that most of these countries have ad hoc tax regimes that substantially lower tax burdens on many multinational firms.

[12] Still, if we consider multinational firms as financial intermediaries, absent income shifting incentives one would expect the coefficient on β_1 to be positive, as pre-tax profitability would need to be higher to justify the higher tax burden associated with operating in a high tax country. As Gordon and Hines (2002) note in their comprehensive survey of international taxation, however, there is little evidence supporting models of multinational firms as financial intermediaries. Rather, there is more support for models of multinational firms as facilitators of tax avoidance or owners of firm-specific intangible capital.

Table 2
Regressions Explaining Profit Rate (Gross Income/Sales)

	(1)	(2) 1982–1986	(3) 1987–1992	(4) 1993–2004
Effective tax rate difference (Foreign ETR – US ETR)	–0.548 (0.157)*	–0.157 (0.129)	–0.502 (0.166)*	–0.828 (0.246)*
Constant	0.102 (0.015)*	0.105 (0.017)*	0.114 (0.014)*	0.081 (0.017)*
Observations	1,227	244	315	668
R-squared	0.13	0.04	0.20	0.17

Notes: Robust standard errors in parentheses, clustered by country. Asterisk indicates significance at the 5 percent level.

rates), during the middle period U.S. tax rates were closer to the average, and the final period is characterized by relatively high U.S. tax rates. The baseline regression (Table 2, column 1) indicates that a tax rate one percentage point higher (relative to the United States) is associated with a profit rate that is 0.5 percentage points lower. Other results indicate that this tax responsiveness generally increases over time.

It may seem odd to not include other control variables. However, theory does not suggest any obvious influences on country level affiliate profitability other than taxation. Still, I experimented with specifications that also controlled for the country's GDP, GDP per-capita, a time trend, and year-specific intercept terms. All of these variables lowered the adjusted R^2 but did not affect inferences regarding the sign or statistical significance of the tax coefficient. When country specific fixed effects are included, the point estimate of the tax coefficient in equation (1) drops from 0.54 to 0.42, and remains highly statistically significant. While country-specific fixed effects would allow for other country-level influences to affect profit rates, the tax coefficient would only be estimated based on within country variation.[13]

These estimates of tax responsiveness are used, together with information regarding profits and sales for each country and year in the sample, to calculate how revenue would be different in the United States absent such income shifting. This calculation entails several steps. First, new profit rates are calculated for each observation by removing the tax effect. Second, these new profit rates are translated into actual profit levels by multiplying each new profit rate by sales (the denominator of the profit rate). Third, for each year, the change in profits for each country in the sample is added together to generate an estimate of the total profit change abroad. This number indicates what worldwide foreign profits would be if there were no differences between foreign and U.S. tax rates. Fourth, a fraction (α) of the these profits are then assigned to the United States; this fraction is based on the share of affiliate intrafirm transactions that occur with the United States, relative to the fraction of affiliate intrafirm transactions that occur with affiliates in other countries. Fifth, this estimate is then multiplied by $(1 + \beta)$ to account for the fact that the estimate is based only on the income shifting activities of U.S. multinational firms. The parameter β indicates the scale of foreign-based multinational firms

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[13] While the F test rejects the hypothesis that the country level fixed effects are jointly statistically insignificant, the fixed effects specification loses the variation between countries that is captured in Table 2. Given that the emphasis of this analysis is on income shifting behavior *between* countries, making use of between country variation in tax rates is desirable.

in the United States relative to the operations of U.S. parents; it is simply the ratio of the sales of majority-owned affiliates of foreign-based multinational companies (MNCs) to sales of U.S. parent firms in the United States.

An example will clarify this methodology. In 2002, the profit rate in Ireland was 0.34; there were 34 cents of profit for each $1 of sales. Using the tax rate coefficient from Table 2, column 4, absent the tax rate difference between Ireland and the United States, the profit rate is estimated to be 0.14 instead. Given the actual levels of profits and sales in Ireland, this implies that there would have been $17 billion fewer Irish profits absent income shifting.

Adding up all countries for which the Bureau of Economic Analysis provides data, one finds that there would have been $157 billion less foreign profit in 2002 absent tax rate differences. Of course, some foreign countries experience lower profits due to income shifting, so these totals reflect the combination of many countries with different circumstances.

This figure is then scaled by α, the share of intrafirm affiliate transactions that are with the United States relative to those in other countries. For 2002, $\alpha = 0.41$, and thus 41 percent of these excess foreign profits are attributed to the United States, which implies U.S. profits would be $64 billion higher absent income shifting due to tax rate differences. These figures are then scaled by $1+\beta$, where β is the size of foreign-based U.S. affiliate operations relative to U.S. parent operations; in 2002, $\beta = 0.35$. Assuming that foreign multinationals are similarly responsive to tax rate differences, the $64 billion is increased by 35 percent. Thus, the total estimate of reduced income in the United States due to income shifting is estimated to be $87 billion in 2002.

Figure 2 shows the estimates of income shifting out of the United States due to tax avoidance for the entire period of the

Figure 2
Profits Shifted Out of the United States due to Income Shifting
($ Billion)
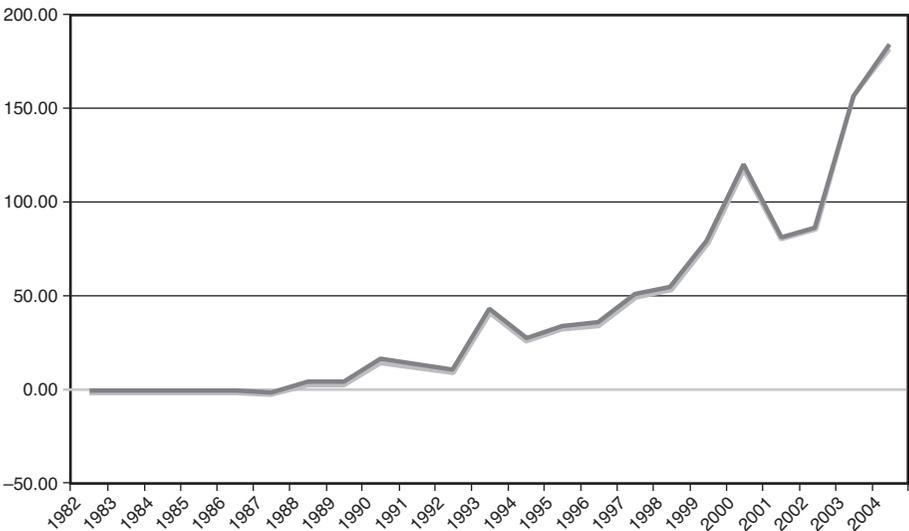
Note: Figures are based on estimates from Table 2, columns 2–4.

analysis, 1982–2004. The estimates are based on the coefficients from Table 2, columns 2-4. If the coefficients from column 1 were used instead, the estimates of profit shifting would increase slightly for the early years of the sample, and decrease slightly for the later years of the sample, but the overall pattern would be similar.

Figure 3 shows the implied revenue loss from the perspective of the U.S. government, assuming that new U.S. profits would be taxed at the U.S. statutory rate of 35 percent. By the end of the sample period, revenue losses due to income shifting are about 35 percent of total corporate tax revenues.

There are several assumptions embedded in this analysis. First, it is assumed that profits shifted from the United States to low tax countries would normally escape U.S. taxation. As discussed in Section II, despite the fact that the U.S. government attempts to tax the foreign income of U.S. multinational firms, in practice there is

very little revenue collected on foreign profits. Second, it is assumed that the fraction of foreign income that would be booked in the United States absent income shifting is equivalent to the fraction of affiliate transactions that occur with the United States parent firm relative to other affiliates abroad. Third, it is assumed that the magnitude of foreign MNC income shifting activity, in comparison to U.S. MNC income shifting activity, is proportional to the scale of foreign-based U.S. affiliate sales in the United States relative to U.S. parent sales. This assumption may bias the estimates downward, if profits are disproportionately low for foreign affiliate firms relative to their sales in the United States. For example, in 2003, net income of U.S. parent multinational firms is 6.5 percent of their U.S. sales, while net income for U.S. affiliates of foreign parent firms is 1.4 percent of their U.S. sales.

Fourth, the sales values in the denominator of the profit rate variable may be

Figure 3
Revenue Loss due to Income Shifting
(As a Percentage of Total Revenues from Corporate Income Tax)
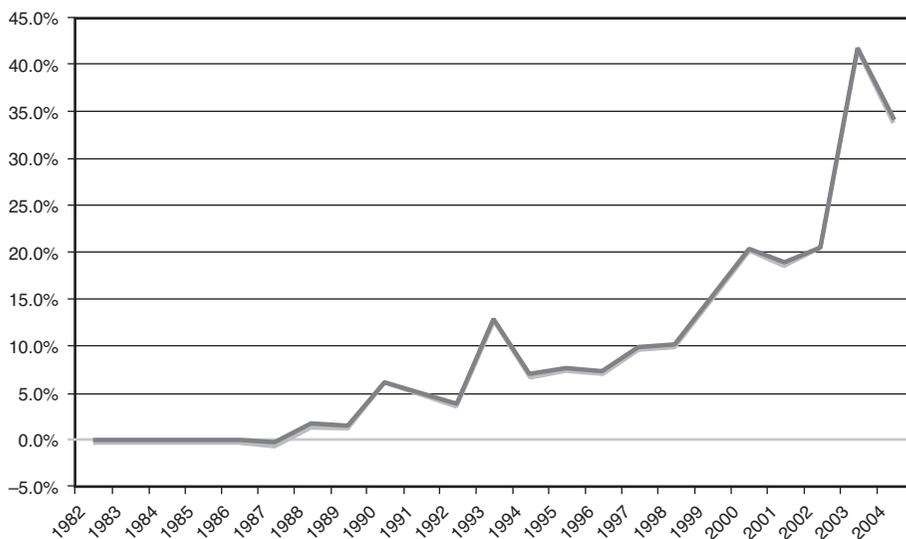
Note: Figures are based on estimates from Table 2, columns 2–4.

influenced by profit shifting incentives. For example, in order to make affiliates in low tax countries appear more profitable to tax authorities, sales in such countries may be overstated relative to their actual levels. Further, the overall scale of activity in low tax countries is also influenced by the ability of real operations to facilitate income shifting. These considerations imply that any distortion to the level of profits relative to sales due to tax rate differences across countries would understate the influence of income-shifting incentives on profit levels across countries.

As a separate analysis, I replicated the analysis using gross profits relative to employment as the measure of profit rates. An advantage of this alternative approach is that employment is less sensitive to tax-motivated financial manipulation than are sales, so the effects of income shifting would be less understated, even if employment is still higher in low tax locations in part to facilitate tax avoidance. A disadvantage of this alternative is that levels of profit per employee may depend on variations in industrial composition by country in ways that muddle the tax effect. This set of specifications produces estimates of profit shifted out of the United States that are typically about twice as large as the estimates reported in Figures 2 and 3 above.

IV. TAX AVOIDANCE AND THE REAL ACTIVITIES OF U.S. MULTINATIONAL FIRMS

At first glance, it appears that the financial responses of U.S. multinational firms to taxation would far exceed the real responses. For example, Figure 4 shows the top ten profit locations for U.S. multinational firms in 2005, based on the share of worldwide (non-U.S.) profits earned in each location, and the effective

tax rates in those countries. Eight of the top ten profit countries have effective tax rates of less than 10 percent. Approximately 45 percent of all foreign profits are earned in just five of these countries (Netherlands, Luxembourg, Bermuda, Ireland, and Switzerland), countries with a combined population less than two-thirds that of Spain. On the other hand, Figure 5 shows the high employment locations for U.S. multinational firms in 2005 and their effective tax rates; they are the usual suspects—large economies with close economic ties to the United States. The average effective tax rate for the top ten employment countries is very close to the U.S. tax rate.[14]

To examine the real responses of U.S. multinational firms to tax differences across countries, I analyzed the tax sensitivity of affiliate employment, controlling for other variables that might influence the scale of employment. Employment is used rather than measures of assets since the location of assets is likely to be more influenced by income shifting incentives. For instance, one might prefer to hold intangible assets in low tax countries in order to book the associated income there. Still, it remains impossible to completely separate real and financial responses to taxation, as the possibility of income shifting strengthens the incentive to locate real activities in low tax countries. Still, one would expect real measures of economic activity such as employment to be less responsive to tax differences across countries than financial measures of income.

The following specification is estimated

$$(6) \quad ln(Employment)_{it} = \alpha + \beta_1 \, (Tax \, Rate_{it}$$
$$- Tax \, Rate_{u.s,t}) + \beta_2 \, ln \, (GDP_{it})$$
$$+ \beta_3 \, ln \, (GDP \, per\text{-}capita_{it})$$
$$+ \beta_4 \, ln(Distance_i) + \upsilon_{it} \, .$$

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[14] Figures 4 and 5 are updated versions of figures originally presented in Avi-Yonah and Clausing (2008).

**Figure 4**
Where Were the Profits in 2005?
(Profits as a Percentage of the Worldwide Total)
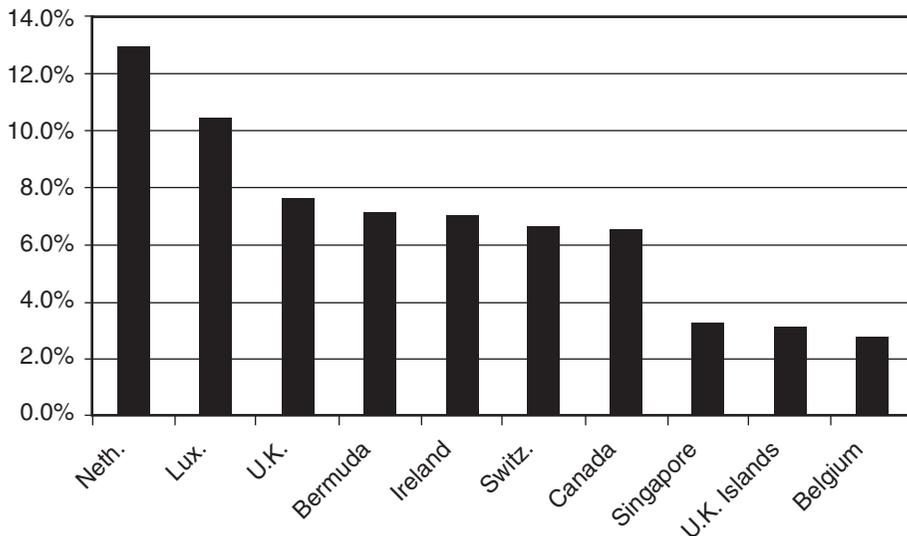
Country	Effective Tax Rate (Percent)
Netherlands	5.1
Luxembourg	0.9
United Kingdom	28.9
Bermuda	0.9
Ireland	5.9
Switzerland	3.5
Canada	21.4
Singapore	3.2
U.K. Islands	1.9
Belgium	8.7

Notes: In 2005, majority-owned affiliates of U.S. multinational firms earned $336 billion of net income. This figure shows the percentages of the worldwide (non-U.S.) total net income occurring in each of the top-10 income countries. Thus, each percentage point translates into approximately $3.4 billion of net income. Effective tax rates are calculated as foreign income taxes paid relative to net (pre-tax) income. Data are from the Bureau of Economic Analysis (BEA) web page; see http://www.bea.gov/scb/account_articles/international/iidguide. htm#page3. The most recent year with revised data available is 2005. The Bureau of Economic Analysis conducts annual surveys of *Operations of U.S. Parent Companies and Their Foreign Affiliates*. These data are discussed in more detail in Appendix A.

Figure 5
Where Were the Jobs in 2005?
(Employment as a Percentage of the Worldwide Total)
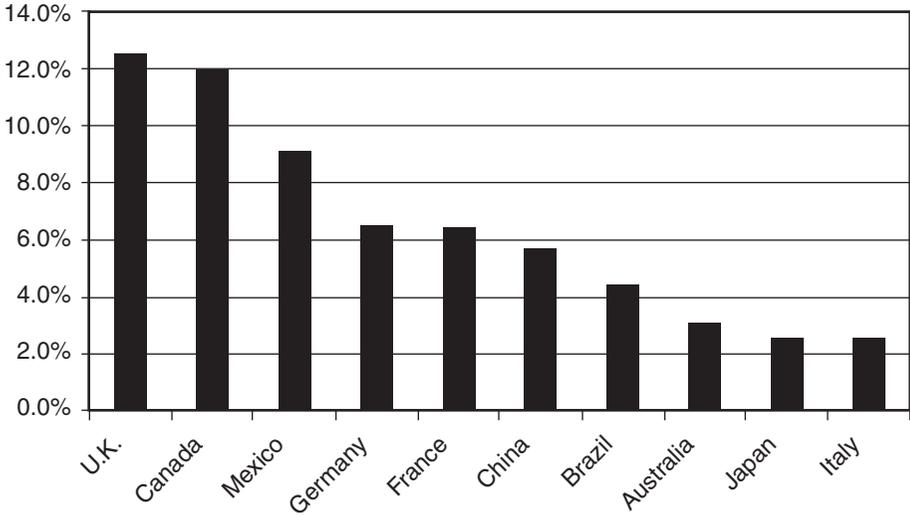
Country	Effective Tax Rate (Percent)
United Kingdom	28.9
Canada	21.4
Mexico	21.8
Germany	26.2
France	21.3
China	14.8
Brazil	18.1
Australia	12.1
Japan	34.7
Italy	24.9

Notes: In 2005, majority-owned affiliates of U.S. multinational firms employed 9.1 million employees. This figure shows percentages of the worldwide (non-U.S.) total employment occurring in each of the top 10 countries. Thus, each percentage point translates into approximately 91,000 jobs. Effective tax rates are calculated as foreign income taxes paid relative to net (pre-tax) income. Data are from the Bureau of Economic Analysis (BEA) web page: see http://www.bea.gov/scb/account_articles/international/iidguide.htm#page3. The most recent year with revised data available is 2005. The Bureau of Economic Analysis conducts annual surveys of *Operations of U.S. Parent Companies and Their Foreign Affiliates*. These data are discussed in more detail in Appendix A.

It is hypothesized that low tax countries will be attractive places to undertake real economic activity, and thus the coefficient β_1 will be negative. However, tax responses are expected to be greater for other measures of economic activity, such as sales, assets, and gross income. Variables are included to control for other factors that may increase the scale of affiliate operations in a given country, such as the market size of that country (GDP), the wealth of the country (measured by GDP per capita in purchasing power parity (PPP) terms), and the distance from the multinational parent home country, the United States.[15]

Table 3 shows results for this specification in column 1; for purposes of comparison, columns 2-4 include results for similar specifications explaining sales, assets, and gross income. It is expected that tax responsiveness would increase as one moved to the right of this table, as the measures become more sensitive to income-shifting

motivations. Indeed, that is the pattern visible in Table 3. Employment is the least responsive variable; elasticities indicate that a 1 percentage-point reduction in the tax rate difference variable would increase employment by 1.6 percent, sales by 2.9 percent, assets by 4.8 percent, and gross income by 5.2 percent. Results using statutory tax rates show the same relative pattern; tax coefficients are about 30 percent smaller.[16]

The control variables have the expected signs. A 1 percent increase in the size of foreign economies increases the scale of affiliate activities by about 0.75 percent. As countries' citizens are richer, some types of multinational activity (assets and sales) also increase. Distance from the United States results in a statistically significant reduction in U.S. affiliate multinational activity in all cases.

In order to consider the revenue effects of the real responsiveness of multinational firms to tax rate differences, a similar method is followed as in Section III.

Table 3
Regressions Explaining Multinational Activity Levels

	(1) ln(Employment)	(2) ln(Sales)	(3) ln(Asset)	(4) ln(Gross Income)
Tax rate difference	−1.585	−2.896	−4.766	−5.236
(Foreign ETR − US ETR)	(0.716)*	(0.727)*	(0.779)*	(0.947)*
ln(GDP)	0.707	0.790	0.793	0.736
	(0.082)*	(0.078)*	(0.086)*	(0.094)*
ln(GDP per-capita)	0.020	0.394	0.415	0.197
	(0.126)	(0.160)*	(0.177)*	(0.267)
ln(distance)	−0.496	−0.352	−0.386	−0.313
	(0.110)*	(0.123)*	(0.117)*	(0.131)*
Constant	−0.652	−1.092	−1.042	−1.439
	(1.487)	(1.539)	(1.768)	(2.078)
Observations	1,123	1,123	1,123	1,054
R-squared	0.58	0.65	0.61	0.50

Notes: Robust standard errors in parentheses, clustered by country. Asterisk indicates significance at the 5 percent level.

[15] GDP per capita likely captures two effects on multinational activity. First, richer countries may attract more activity since they are attractive markets to serve. Second, rich countries have higher wages; GDP per capita is very highly correlated with economy-wide wage levels. High wages, ceteris paribus, would discourage multinational activity. Thus, the coefficient sign for this variable is ambiguous.

[16] Results using country fixed effects also show the same relative pattern; these results are available from the author upon request.

Employment is used as the best measure of real economic activity. First, using coefficients from column 1 of Table 3, new employment levels are calculated by removing the tax rate difference effect. For example, in Ireland in 2002, there were 83,400 employees of U.S. multinational affiliates. Absent the tax rate difference, according to this specification, there would have been 56,200 employees. Second, in order to find an estimate of how income earned in different countries would differ absent these employment effects, the *average* amount of gross income per foreign employee is used to scale this variable. One could instead use the *country-specific* version of this variable but that would confound the analysis of real tax responses, since multinational firms have an incentive to book more profit per employee in low tax countries. Since the average amount of gross income per employee is $127,000, this implies that profits earned in Ireland would have been reduced by $127,000 × (83,400 – 56,200), or $3.5 billion, absent real employment responses to Ireland's lower tax rate.

Third, this calculation is summed for all countries in each year; in 2002, there would be $63 billion less foreign income absent these tax-related employment effects. Fourth, as above, this number is adjusted to account for the fact that only a fraction (α) of the excess foreign income would end up in the United States. Finally, the estimate is adjusted by multiplying by $(1 + \beta)$ in order to account for the fact that foreign multinational firms are also likely to be sensitive to tax rate differences in their employment decisions. Recall that β measures the scale of foreign-based MNC activity in the United States relative to U.S. parent MNC activity.

The net estimate of revenue lost due to employment responses to taxation is illustrated in Figure 6.[17] The same assumptions embedded in the analysis of Section III are present here. Yet comparing the two analyses provides one estimate of the revenue consequences of real and financial tax responses for U.S. multinational firms. Comparing Figure 6 to Figures 2 and 3, it is clear that income shifting has a larger effect on government revenues than real responses to taxation. Revenue effects are more than twice as large.

Still, financial and real responses to taxation are difficult to disentangle. For instance, the estimates of revenue lost due to financial types of tax avoidance may be understated since they are based on relationships between profit rates and tax rates. To the extent that the overall scale of multinational operations is larger due to the possibility of income shifting, more profits will be generated independent of effects on profit rates. This consideration also implies that the estimates of revenue lost due to real responses to tax rate differences are overstated since part of what causes employment to be larger in low tax countries is the facilitation of income-shifting. Therefore, some fraction of the tax revenue lost due to real responses to taxation likely should be attributed to financial motives. Without more detailed data, these channels can not be completely disentangled, but the estimates here provide an upper bound of the relative importance of real responses to taxation in comparison to financial responses for U.S. multinational firms.

V. TAX POLICY IMPLICATIONS

Financial and real responses to taxation likely have different policy implications.

Figure 6
Revenue Loss due to Employment Tax Response

Note: Based on Estimates from Table 4, column 1.

As demonstrated here, financial responses have larger consequences for government revenues. Yet real responses can potentially have large implications for other types of tax policy goals, including minimizing the tax distortions affecting the worldwide allocation of capital, and fostering efficient ownership patterns that do not discourage multinational firm headquarters activities in the United States.

Avi-Yonah and Clausing (2008) discuss a system of formulary apportionment for taxing the income of multinational firms. Instead of requiring multinational firms to account separately for their income and expenses in each country, a formulary apportionment system would allocate worldwide income to individual countries by formula. The formula could take any number of forms, but it would be intended to reflect the distribution of the firm's real economic activities, as measured by some combination of sales, payroll, and capital stocks. The firm would then pay U.S. taxes on the share of its worldwide income that is allocated to the United States by the formula.

One common formula would equally weight assets, sales, and payroll shares in the United States. Thus tax payments in the United States would be given by the following formula

(7) $\quad Tax_{us} = t_{us}\, \Pi_w \left[\frac{1}{3} \left(\frac{A_{us}}{A_w} + \frac{S_{us}}{S_w} + \frac{P_{us}}{P_w} \right) \right],$

where the subscript *US* indicates the United States, the subscript *w* indicates the world, t_{us} is the tax rate, Π_w is world profits, *A* is assets, *S* is Sales, and *P* is payroll.

Formulary apportionment is used by the U.S. states to allocate national income across states.[18] The state system was motivated by the perception that high integration of the state economies makes it impractical to account separately for income and expenses by state. In an

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[18] It is also used by subnational governments in both Canada and Germany.

increasingly global economy, moving to such a system internationally could prove similarly practical for assigning world income. There would be no need to allocate income or expenses, to worry about subpart F and the foreign tax credit (because there would be no deferral and no U.S. taxation of foreign-source income), or to cope with cumbersome transfer pricing regimes.

A formulary apportionment system would also remove the incentive to undertake financial responses to tax differences among countries. The incentive to shift income to low tax countries would be eliminated, as firms' tax liabilities would be independent of where income was booked. Firms' tax liabilities would depend instead on the allocation of the factors in the apportionment formula across countries, and thus sales, payroll, and employment would be discouraged in high tax countries; these quantities, however, are likely to be far less responsive to tax differences among countries.

As summarized by Slemrod and Bakija (2008) and Auerbach and Slemrod (1997), there is a vast amount of empirical research on taxation that suggests a hierarchy of behavioral responses: (1) taxpayers are most responsive when the timing of transactions affects taxation, (2) taxpayers are also responsive in undertaking financial or accounting responses to taxation, and (3) real economic decisions concerning employment or investment are far less responsive to taxation. As demonstrated in the above analysis, there is a similar pattern of tax response for U.S. multinational firms and their affiliates.

Some authors, such as Altshuler and Grubert (2008) and Hines (2008), fear that formulary apportionment could introduce its own distortions. For example, both of these studies emphasize that formula apportionment could lead to tax incentives for mergers or divestitures. For example, in high tax countries, firms would have an incentive to sell low-margin affiliated product lines in order to lower the formula factor weights in such countries. Also, in low tax countries, firms would have an incentive to acquire companies in order to increase factor weights. However, it remains an empirical question whether the tax incentives created by formula weights would be sufficient to induce significant tax-motivated reorganization activity. The organization of ownership is a substantial real behavioral response, and thus it is likely to be less sensitive to taxation than accounting or financial manipulations aimed at shifting income.

The European Union has recently been considering a common consolidated corporate tax base, using a formulary approach to allocate EU income, without applying the formula to income beyond the "water's edge" of the EU. In that context, several recent studies have considered the efficiency consequences of formulary apportionment. Eggert and Haufler (2006) provide an overview of the literature, noting that it provides no unequivocal lessons regarding the desirability of formulary apportionment, which will depend on the details of implementation. Gerard (2007) argues that the common consolidated corporate tax base is a worthy change, if the formula focuses on criteria that are not easy to manipulate, if consolidation is made compulsory, and if a credit system is adopted with respect to the rest of the world. Devereux and Loretz (2008a) find that formulary apportionment may reduce both tax distortions affecting the international allocation of capital (or capital export neutrality) and the tax distortions influencing the international ownership patterns of capital (which they term market neutrality), although improvements to the latter are larger.

In considering ideal formula weights, Eicher and Runkel (2008) suggest that formulary apportionment with a sales factor would best mitigate fiscal externalities due to tax competition. Pethig and

Wagener (2007) also analyze corporate tax competition under formulary apportionment, finding that tax competition will lead to lower tax rates as the tax base is more elastic. In their model, the asset elasticity exceeds the employment elasticity, which in turn exceeds the sales elasticity.

Like other high tax countries, if the United States were to adopt formulary apportionment, it would likely gain revenue as a result.[19] Under the current system, high tax countries have disproportionately low shares of the worldwide income of multinational firms compared to their shares of world employment, assets, or sales, so they are likely to gain tax revenue under formulary apportionment. Low tax countries are likely to lose revenue for a similar reason. Devereux and Loretz (2008b) study the effects of formulary apportionment on corporate tax revenues in the European Union, under the assumption that the formula would allocate EU income only, applying a water's edge principle. Devereux and Loretz find that the countries that gain revenue are those with high factor shares relative to their income shares, generally high tax countries. Yet, revenue gains or losses are sensitive to assumptions regarding whether the formulary system is optional or mandatory as well as how loss consolidation is handled. Fuest et al. (2007) also consider this question, and find that loss consolidation has a negative impact on the overall EU tax base, but their results may be sensitive to their use of a data base of German firms over a period when these firms were experiencing large losses. In general, they find that tax revenues increase for high tax countries relative to low tax countries.

Formulary apportionment could result in double taxation (or double non-taxation) if other countries do not adopt similar schemes. However, since the European Union is already considering a move to formulary apportionment, that might facilitate broader international cooperation. Further, non-adopting countries would be likely to lose revenue to formulary countries, since multinational firms operating in both types of countries would have an incentive to shift reported income to formulary countries, because their tax liability in such countries would no longer depend on the income reported there. The consequent loss of tax revenue in the non-adopting countries would give them a strong incentive to adopt formulary apportionment.[20]

In addition to addressing income shifting concerns, formulary apportionment would also address competitiveness concerns. Taxation would not depend on the residence of the parent firm or its legal form (e.g., branch or subsidiary). Thus, it would remove the incentive for corporate inversions as well as any competitive disadvantage associated with being a U.S.-based multinational firm.

Another alternative worthy of consideration is a formulary profit-split, such as that proposed by Avi-Yonah, Clausing, and Durst (2009). Under a formulary profit-split, the U.S. tax base for multinational corporations would also be calculated based on a fraction of their worldwide income. This fraction would be the sum of (1) a fixed return on their expenses in the United States and (2) the share of their worldwide sales that occurs in the United States. This system is similar in significant respects to the current "residual profit split" method of the U.S. transfer

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[19] Of course, the move to formulary apportionment could be made revenue neutral by reducing the corporate income tax rate.

[20] The transition to formulary apportionment would require careful attention to a number of details, discussed further in Avi-Yonah and Clausing (2008). Care would be required to define the unitary business, determine the appropriate apportionment formula, insulate against possible behavioral responses to the chosen formula weights, create common accounting standards (or reconcile differences between standards), and handle international tax treaty issues.

pricing regulations and the Organisation for Economic Co-operation and Development (OECD) Guidelines. Altshuler and Grubert (2008) suggest that such a method may prove less distortionary than either a strict formulary system or the current separate accounting system. They focus on the potential for both separate accounting and formulary apportionment approaches to distort the decisions regarding whether to perform activities within the firm and whether to organize firms across national borders. In their simulations, they find that a profit-split method can result in less distortion to the location of capital.

Other approaches to reforming the taxation of multinational corporate income have been suggested; two prominent options are (1) adopting an exemption system, and (2) eliminating deferral of U.S. taxation of foreign income under the current system. When comparing these reforms, one should consider several important, yet at times conflicting, tax policy goals. In addition to raising revenue, the tax system should attempt to promote an efficient worldwide allocation of capital, and it should attempt to not distort ownership patterns or discourage multinational firm headquarters activities in the United States. Formulary apportionment does well on many of these criteria: it would likely raise revenue, and it eliminates the tax consequences of residence and legal form, thus reducing any tax disincentive associated with basing operations in the United States. However, a formulary system would need to be carefully designed to minimize distortionary tax responses of firms to the factors in the formulas, and tax-induced firm reorganization.

An exemption system, by exempting the foreign income of U.S. firms from taxation, would further increase income shifting incentives and erode the U.S. tax base. It would be difficult to avoid more aggressive use of transfer price manipulation and other income shifting techniques. While U.S. firms would not be disad-

vantaged relative to firms based in other countries, the allocation of capital would be skewed in favor of low tax locations.

In contrast, ending deferral of the U.S. taxation of foreign income under the current system would lessen the incentive to book income in low tax countries. Such a provision would likely increase U.S. government revenues. However, ending deferral would disadvantage U.S. based multinational firms compared to those based in other countries, and this could distort ownership patterns and the location of headquarters activities. It may induce corporate inversions, whereby the residences of corporations would be relocated overseas, although anti-inversion provisions could be included to combat this problem. In general, these concerns would be lessened by a revenue-neutral version of the proposal, if the corporate tax rate were lowered at the same time.

VI. CONCLUSION

This paper considers how both financial and real types of tax avoidance by U.S. multinational firms are likely to affect U.S. government revenues. Financial tax avoidance is examined by estimating the relationship between affiliate profit rates and tax rate differences across countries. A host country tax rate one percentage point lower relative to the United States is associated with a 0.5 percentage point higher profit rate for affiliates in that host country. This responsiveness is used to generate estimates of profit shifting and the resultant changes in U.S. government revenue. By 2004, it is estimated that tax-motivated income shifting shifts over $180 billion in corporate income out of the United States, resulting in 35 percent lower corporate income tax revenues.

Real responses to international tax incentives are considered by estimating the relationship between employment and tax rate differences across countries. Results indicate that employment-based

tax responses result in approximately $80 billion lower U.S. profits, and about 15 percent lower corporate tax revenues. It thus appears that revenues lost due to real responses to tax rate differences among countries are less than half of revenues lost due to financial responses.

Still, financial and real responses to taxation are difficult to disentangle. Some of the tax response of employment likely reflects the desire to locate real operations in low tax countries in order to facilitate income shifting; this consideration implies that estimates of real responsiveness are overstated as some of these responses should be attributed as financial. Without more detailed data, a more precise division is not possible, but these estimates provide an upper bound on the relative importance of real responses to multinational firm taxation in comparison to financial responses.

These estimates are useful for examining the implications of tax avoidance activity over time. This problem has worsened as U.S. corporate rates have become increasingly out of line with other countries. In the past twenty years, many countries have lowered their corporate income tax rates, whereas U.S. rates have been relatively constant. The increasing discrepancy between U.S. rates and foreign rates results in increasing amounts of revenue loss for the U.S. government due to increasing incentives for tax avoidance.

One should caution that the precise estimates of revenue lost due to tax avoidance activity are sensitive to many parameters, including how the tax rate is specified, the econometric specifications employed, and assumptions made regarding the residual U.S. taxation of foreign income, foreign multinational firm behavior, and the share of excess foreign income earned in low tax countries that should be attributed to the United States. Thus, the estimates should be viewed with substantial caution. Still, the nature of the main findings is robust. In particular,

the sign and statistical significance of the tax coefficients are always as expected, the consequences of tax avoidance are always growing dramatically over the previous decade, and the magnitudes of financial responses to taxation always far exceed the magnitudes of real responses to taxation.

The ideal policy responses to these types of tax avoidance behavior are likely to differ. The importance of financial responses to tax differences among countries suggests that formulary apportionment of international income may be an attractive alternative, since it removes income shifting incentives. However, care should be taken in the construction of the formula to minimize the distortions introduced by the formula weights themselves; in this context, a formulary profit-split may prove attractive. Other policy alternatives also present tradeoffs. While an exemption system would remove any tax disincentive associated with U.S. residence, it would worsen income shifting incentives. While the elimination of deferral would reduce income shifting incentives, it would increase the tax disincentive associated with U.S. residence. Finally, as always, it should be cautioned that the policy details are crucial.

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APPENDIX A: DATA SOURCES

The countries included in the data set are the approximately 60 countries for which the Bureau of Economic Analysis provides detailed disaggregate data on U.S. multinational operations over this time period. The time period covered is 1982–2004. The Bureau of Economic Analysis (BEA) conducts an annual survey regarding the activities of U.S. multinational firms; this data source is used frequently in the literature. The effective tax rate is calculated from these data as the ratio of foreign income taxes paid in a given country and year to the pre-tax income earned. The effective tax rate is then adjusted to be non-zero and bounded at the higher end by the statutory rate. For the United States, I do not have data on parents tax payments' relative to income, so I employ effective tax rates from Devereux and Griffith (2003) who have estimated effective tax rates for several OECD countries.

Data on statutory tax rates are taken from various editions of PriceWaterhouseCoopers' *Corporate Taxes: A Worldwide Summary*. Data on GDP and GDP per-capita are from the World Bank's *World Development Indicators* database. Distance is calculated between the closest major port cities in the United States and the partner country.[21]

One possible issue with the data concerns the possibility of double counting in the BEA income figures. These figures include "income from equity investments," some of which may be counted more than once if there are tiers of holdings within the same country. Unfortunately, from existing BEA data, it is impossible to tell exactly how large this problem is, or how much this problem is correlated with the tax rate of the country in question. Using German data, Weichenrieder (2006) finds no relationship between the tax rates of host countries and more complicated ownership chains. However, other tax factors are important, including whether the investing country has a credit or exemption tax system.

Still, using an alternative data series from the BEA on direct investment earnings, one can exclude all income from equity investments. These data are also available from the BEA web site: http://www.bea.gov/scb/account_articles/international/iidguide.htm#page3

While that avoids the double-counting problem, this method may be conceptually inappropriate, as income from equity investments can be an important source of income, and firm decisions regarding where such income is earned may be influenced by income shifting incentives. Nonetheless, when the analysis of Table 2 and Figures 2 and 3 is repeated with this data series, the magnitudes of profit shifted out of the United States due to income shifting (and the resulting revenue losses) are nearly identical to those presented in the main text of the paper.[22]

Note that these data report book income figures, not taxable income. It would be preferable to utilize data on taxable income, which is also presumably more responsive to tax incentives; however, this is not possible, absent access to Department of the U.S. Treasury data. Also note that the estimates of income shifting activity do not address methods that firms utilize to lower their taxable income overall; the focus is instead on the sourcing of income.

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[21] These data are available from many sources, including on-line calculators such as http://www.export911.com/convert/distaCaIc.htm.

[22] Due to data availability, this analysis is only possible for 1994–2004, so the comparison is based on results that are limited to those years.