Taxes and the Location of U.S. Business Activity Abroad

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Abstract

In 1991, Harry Grubert and Jack Mutti published a seminal paper in the field of international taxation. Using cross-sectional data from 1982, Grubert and Mutti (1991) showed that U.S. multinational real business activity was concentrated in countries with low effective tax rates, suggesting taxation plays a first order role in determining not only the location of international profits, but also in determining the location of U.S. business activity abroad.

In honor of the late Harry Grubert and his contributions to international tax research over the last four decades, we use data on the activities of U.S. Multinational Enterprises (MNEs) from 1989 to 2014 and a panel fixed effects framework to extend and update results from the seminal 1991 paper. We focus on three findings. First, although our constant elasticity estimates. with values near unity, are smaller than most other papers in the literature, we continue to find that effective tax rates influence the business location decisions of U.S. MNEs. Second, our estimates demonstrate remarkable stability over the sample period, across the various measures of MNE real business activity, and across various effective tax rate specifications. Finally, we address an early critique of the international tax literature – that effective tax rates are endogenous to business activity measures – by using changes in statutory tax rates and bases to instrument for changes in effective rates. Consistent with the critique, our IV estimates are larger than baseline elasticities, especially for current year investment and R&D.

We believe Harry would be pleased to see that his early work remains relevant, but would approach our results with his characteristic skepticism.

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1 Introduction

Of the many aspects of international taxation that Harry Grubert pursued, one important interest was the influence of taxation on the location of real economic activity of US Multinational Enterprises (MNEs). The choices that MNEs make influence tax revenue collected by the US government, and they feed the political debate over the benefits versus costs of globalization and the consequences of hosting affiliates of MNEs. From the standpoint of world economic efficiency, taxes that cannot specifically target economic rents result in a loss in economic efficiency, because activity is shifted away from locations with the highest before-tax productivity.

Consider a cursory summary of Grubert's contributions to this thread. Grubert and Mutti (1991) used data aggregated at the country level for a cross-section of manufacturing affiliates of US MNEs in 1982. Controlling for other country conditions, they found that MNEs placed more fixed capital in those countries where affiliates faced lower effective tax rates. Based on aggregated 1992 Treasury tax data, Grubert and Mutti (2000) reported that the tax responsiveness of manufacturing affiliates varied across countries, especially with respect to the trade policy of the host country: in a more closed economy, taxes made less difference to a producer's competitive position, but in open economies the response to taxation was greater than in the 1982 study. Altshuler et al. (2001) used aggregate data to consider whether *changes* in tax rates explained *changes* in economic activity. Not only could they more effectively control for fixed country effects, they also found that the responsiveness to taxation increased significantly from 1984 to 1992.[1]

In this paper we extend the analysis applied in the preceding articles to a panel fixed effects environment. Based on data from 1989 to 2014 we assess whether the real activity of MNE affiliates still is responsive to host country taxation and whether that sensitivity has changed in any systematic way over time. For a larger set of countries across a wider set of real activities, and using different functional forms of the tax variable, we find that taxes continue to influence the location of real activity. That characterization applies to fixed capital, employment, investment, assets, R&D, employee compensation, and the number of affiliates, even after including fixed country and time effects. Although Altshuler et al. (2001) found a significant increase in tax sensitivity following the Tax Reform Act of 1986, our estimates do not suggest any continuation of that trend, as the relationship has remained stable over the past 28 years.

The degree of responsiveness to taxation is smaller in our OLS estimates than in work by others. In a constant elasticity specification, a one percent increase in the net-of-effective-tax rate results

[1] Although, we do not utilize firm data, a different set of issues has been addressed using IRS micro data. Based on 1996 Treasury data, Mutti and Grubert (2004) reported that older, larger, more labor-intensive firms with more intangible assets were more likely to establish affiliates abroad. Additionally, firms that produced electronics, cars, and computers were more sensitive to host country taxation than firms that produced food, drugs, or oil. In contrasting US parent firms in 1996 and 2004, Grubert (2012) found that as they faced a lower effective tax rate on foreign income, they declared a greater share of profits abroad but did not make a comparably greater share of sales abroad. That behavior is an indication that taxes are less relevant to real activity than to the allocation of profits.

in a 1.0% increase in real activity. This value is much smaller than the 2.8 estimate by Altshuler et al. (2001). Or, for those who favor the semi-elasticity specification, we find that a one percentage point increase in the tax rate results in a 1.5% increase in real activity. The meta-analysis of de Mooij and Ederveen (2003) and de Mooij and Ederveen (2008) report values of 2.0 for property, plant, and equipment, with higher values for more recent studies. An observer might wonder whether our estimates are subject to a downward bias due to potential endogeneity of the tax rate and real activity. In a more limited sample for which information is available to derive a strong instrumental variable, we address this concern. Investment and the amount of R&D in a given year are the dependent variables most likely to be affected by the reverse causation of greater activity resulting in a lower tax rate. The instrumental variable estimates for these variable in particular yield larger and more precisely estimated tax coefficients. Several other robustness tests and the observation of little difference from two common specifications of the tax variable lend confidence to our findings of the continued influence of taxes on real activity of MNE affiliates.

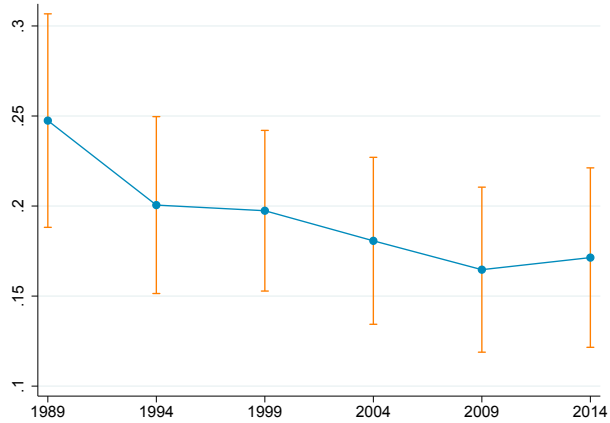
2 A Changing International Investment Environment

As shown in Figure 1, two notable trends among the countries included in this study are the rise in US direct investment abroad and the reduction in the average effective tax rate paid by US affiliates on their foreign income. From 1989 to 2014 real capital of US affiliates abroad rose more than fourfold, while the average effective tax rate faced by affiliates across host countries fell from 25 percent to less than 17 percent. Tax competition fostered by UK and US tax reforms in the 1980s did not result in a one-time adjustment in rates worldwide. Rather, reductions in statutory corporate tax rates continued, combined with many other provisions that altered the tax base or attempted to attract mobile intangible assets. The dispersion around those average tax rates is also shown in Figure 1. While the rate fell sharply, the dispersion fell much less. The world has not converged to an equilibrium with all countries levying zero tax on capital income. Differences across countries in tax rates are still apparent. How those differences are reflected in the pattern of MNE activity across potential locations is what the current paper explores.

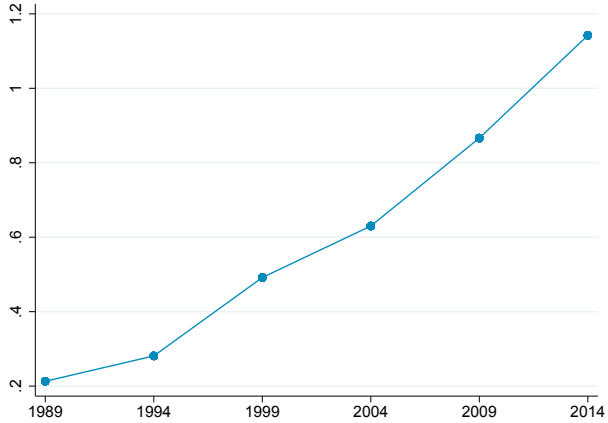
Some observers are skeptical that past relationships of taxation and affiliate activity will be observed, because modern manufacturing's reliance on carefully organized global value chains may make MNEs less sensitive to taxes in a given location. If the aggregate measures of MNE activity include a greater role for natural resource production, that sector also may demonstrate less sensitivity to taxation. Other observers point to the more aggressive tax planning strategies that firms have adopted, which may allow profits to be shifted so easily from high-tax locations that taxes no longer represent a deterrent to production. Partially in reaction to such strategies and the shifting tax bases that resulted, many European countries warned of the harmful effect of tax competition. An early indication was the Code of Conduct for business taxation adopted in 1997 by the Coun-

Figure 1: Trends in Effective Tax Rates and US Capital Installed Abroad

(a) Average Effective Tax Rates



(b) Total US Capital Abroad ($ Trillions)



Notes: Panel (a) of Figure 1 presents average effective tax rates for affiliates of US multinational enterprises located abroad. Effective tax rates are computed at the affiliate-country level using SOI data as described in Section 3. Verticals represent one standard deviation in affiliate-country level effective rates for each year. Panel (b) presents the real total capital installed abroad by affiliates of US MNEs. Total capital is computed using BEA data on the operations of majority-owned foreign affiliates. Data presented in both figures is limited to the balanced panel of countries for which both effective tax rates and capital abroad are observed during the years 1989 to 2014.

cil of Economics and Finance Ministers (ECOFIN). In the last three years, the EU Competition Commissioner has directed countries such as Ireland and Luxembourg to recover back taxes from arrangements that constituted unfair competitive subsidies to favored MNEs such as Apple and Amazon. Similarly, an OECD report from 1998 over the harmful effects of tax competition has evolved into the Base Erosion and Profit Shifting initiative, which reflects a related concern over the disconnect between the location of real activity and the allocation of profits. Whether these concerns have resulted in policy changes that would accentuate the sensitivity of real activity to differences in taxation can only be addressed in an incomplete way here, because the nature and focus of host country taxation and MNE strategies continues to change.

A potentially contrary influence that may increase the sensitivity of real activity to taxation is the existence of many new potential host country locations. The dissolution of the Soviet Union, the greater independence of Eastern European countries, and the decision of many developing countries to adopt more outwardly oriented policies have added many new opportunities in terms of trade and investment. Even for those countries characterized by more gradual liberalization than shock therapy, special enterprise zones and other experimental steps represent policy regimes that differ from prominent headline measures and statutory rates. Under new paradigms, countries now seek to attract foreign direct investment, rather than regard it as an instrument of exploitation.

3 Framework for Empirical Analysis

Consider the common formulation from several of Grubert's papers that the amount of **Capital** that a US MNE will locate in a foreign affiliate will be a function of host country taxes, represented by the average effective tax rate **Avg. ETR**, and a matrix of exogenous variables, **X**. We express the variables in log-linear form and include country and year fixed effects appropriate for panel data estimation:

$$\ln(\text{Capital}_{it}) = \alpha_i + \beta_t + \gamma \ln(1 - \text{Avg. ETR})_{it} + \delta \ln(\mathbf{X}_{ijt}) + \epsilon_{it} \tag{1}$$

where α_i represents the role of a country dummy and β_t for a year dummy.

Although many of Grubert's contributions used Treasury data to measure MNE activity abroad, the updated analysis in this study relies on data released publicly by the Bureau of Economic Analysis, based on Benchmark Surveys of US Direct Investment Abroad completed every five years from 1989 to 2014. One advantage of such data is the wider range of country-level aggregates available from this source, both financial variables from the affiliate's balance sheet and also indicators of affiliate operations: net property, plant and equipment, employee compensation, employment, sales, value added, assets, number of affiliates, and research and development. In the body of the paper we focus primarily on property, plant and equipment, employment, current period capital investment, and assets. A further benefit of the BEA data is that the aggregates are based on establishment level activity. Regardless of the ownership structure or use of hybrid arrangements that allow some entities to be disregarded for tax purposes, the establishment measures apply to activity that occurs within a given country. Because BEA data include foreign branches as well as controlled foreign corporations, the BEA total for property, plant, and equipment exceeds the SOI total. In the 2014 data the SOI measure relative to the BEA measure tends to be lower in high-tax countries.

Grubert often focused on manufacturing affiliates alone, to ensure greater uniformity of the economic activity measured, but manufacturing as a share of MNE activity abroad has fallen significantly over time. In 1982 manufacturing's share of affiliate employment was 67 percent and net property plant and equipment 41 percent, but the corresponding shares in 2014 were 39 percent and 30 percent, respectively. The current study is based on the activity of majority-owned affiliates aggregated across all sectors. Although we are not able to explicitly control on all possible reasons for the rising importance of non-manufacturing sectors, the year dummies represent one way of controlling on general trends in tastes and technology that apply across our sample of countries.

Host country taxation of capital income raises the before-tax cost of capital for an MNE that expects to earn the same after-tax return worldwide. The explicit functional form in which this tax variable is represented in equation (1), as $\ln(1 - \textbf{Avg. ETR})$, allows a direct interpretation of the coefficient as the elasticity of the MNE response to a one percent increase in the net-of-effective-tax

rate. In the subsequent empirical estimates, several additional functional forms are reported, which address potential distinctions appropriate for observations of very low or very high tax rates.

The average effective tax rates used here are calculated from publicly available Statistics of Income figures, aggregated across all industries for affiliates that had positive profits, based on income taxes paid and pre-tax earnings and profits. That distinction is more useful than the BEA figure for net income based on all affiliates, which includes those that have losses. Including loss companies can result in negative tax rates, and in the present sample winsorizing the BEA rates to truncate the top and bottom 6% of observations eliminates negative values. That process results in an average tax rate of 40%, twice the rate calculated from the SOI data. Hines Jr. and Rice (1994) noted such an upward bias due to the inclusion of companies with losses in the reported total for net income, and they imposed the standard that any imputed rate that exceeded the statutory rate would be replaced by the statutory rate. With regard to the development of the literature on the effects of taxation on MNE operations, access to the SOI data was an important step forward. Because affiliates report income using US definitions, rather than the host country definition of the relevant tax base, the SOI data offer an advantage of uniformity that does not occur if attention instead centers on an average effective tax rate calculated from a potentially quite different host country definition of taxable income.[2]

Since the adoption of check-the-box strategies by US MNEs after 1997, a disadvantage of the Treasury figure is that it need not apply to operations that occur within a given country but could include activity of disregarded entities operating in other countries but reporting consolidated income in the given country. Mintz (2001) notes further possible drawbacks of using the SOI-based measure, including loss carry forward provisions that make current taxes paid dependent on past tax rates, as well as rules for the allocation of interest expenses. As noted by Dowd et al. (2017), taxes may appear to be paid in a country that has no statutory tax rate, because the consolidated figure reported includes activity in other locations where taxes are paid. A possible indication of countries where this tendency may be more pronounced comes from the SOI tabulations for 2012. The five countries for which the number of disregarded entities outnumbers the number of US controlled foreign corporations located there are Bermuda, the Cayman Islands, Ireland, Luxembourg, and the Netherlands. Yet, for the three OECD countries included in the present sample, the downward trend in tax rates after 1997 is no different from the rest of the sample. For high-tax countries that are not tax havens, the SOI implicit tax rates are a useful indication of the attractiveness of producing there, because tax saving strategies available may reduce the effective

[2]In our empirical estimates, the SOI implicit tax rates are winsorized to drop the top 1 percent and bottom 1 percent of observations. Because the SOI data are available every other year in even numbered years, they do not precisely match the odd numbered years in which BEA benchmark surveys are completed. For 2009, the corresponding tax rate is based on an average of the values for 2008 and 2010. The same procedure applies to 1999. Because digital files are only available for 1988 and 1992, the 1989 value is based on a weighted-average of those two values, with 1988 receiving three times the weight of 1992.

tax rate in high-tax locations.[3]

Other researchers have extended the framework that shows how the cost of capital is affected by tax rates and special tax allowances. Devereux et al. (2002) generated forward looking effective marginal tax rates and effective average tax rates for prototype investments that earned different rates of economic rents. More recently Steinmüller et al. (2018) have calculated similar effective marginal and average tax rates for 185 countries. Such rates offer the advantage of being exogenously determined, independent of the amount of investment in a country. Nevertheless, for many countries there are significant additional incentives beyond the statutory rate, investment tax credits and depreciation schedules, which have been important to MNEs.

A further innovation in the assessment of tax policy which we do apply in this study is the work of Kawano and Slemrod (2016) to measure not only changes in the statutory tax rate but also changes in the relevant tax base. For OECD countries over the period 1980–2004 they indicate whether several different measures to expand or restrict the tax base were adopted.

Regarding the relevant variables to include in the X matrix of exogeneous variables, recognize that our focus is on changes in real activity over time. Therefore, we ignore factors that often are important in cross-sectional analysis but remain constant over time, such as distance, common borders, or common languages. Country dummies control for such factors, as well as those of competitors, and time dummies control for unobserved time-varying effects in each benchmark year for which data are available. Our analysis focuses on a relatively small number of explanatory factors that vary over time.

GDP per capita and population often serve as useful indicators of the size of host country markets, which is especially relevant if most production is to be sold locally and the type of good or service is favored by higher income buyers. Including these two variables, rather than GDP alone, lets us consider the relative importance of these two sources of growth, a country growing larger when the standard of living remains unchanged versus a country's standard of living rising at an unchanged population. GDP per capita also may reflect the relative productivity of the host economy. These two variables, **Population** and real **GDP per capita** are available from the World Bank. Because our interest is in the influence of GDP growth over time, as indicated by real GDP in local currency units, we do not pursue refinements in the measurement of GDP based on purchasing power parity, which may be important in comparisons across countries, as reported in the Penn World Tables.

Although a wide range of other policy measures or cost factors may also be changing, we limit our attention to a few that we regard as most relevant and likely to be correlated with the tax variable. Greater openness to international trade will provide an advantage to producers who rely

[3] Several analyses have noted that the existence of a tax haven affiliate may promote the activity of a parent firm's affiliates in high-tax locations (Desai et al. (2006), Overesch (2009), Gumpert et al. (2016), Suárez Serrato (2018)). Due to the lack of information on control variables for Bermuda and the Cayman Islands, they are not part of this study.

on imported inputs or export markets. Empirically, allowing for other policy changes that may occur at the same time as tax policy changes is important to accurately assess the importance of taxation. If taxes and trade barriers decline at the same time, omitting the latter influence will give a misleading indication of the importance of taxation. In relatively closed economies affiliate investment is likely to be discouraged, because of a presumed host country objective to limit outside influences on the economy. In Grubert's previous work, allowing for the interaction of trade and tax policy variables resulted in taxation having less of a deterrent effect on investment as trade restrictions rose. This outcome likely occurs because all local producers are subject to the same competitive disadvantage of higher taxes.

In the analysis reported here, the indicators of such trade and policy variables are based on three different measures: (1) the value of exports plus imports divided by host country GDP which we construct using World Bank data and label **Trade Openness**; (2) the **Real Exchange Rate**, reported as the purchasing power parity value of the host country's currency relative to the US dollar divided by its market exchange rate, which we take from the Penn World Tables, Version 9.0;[4] and (3), the **Fraser Index**, compiled by the Fraser Institute in Canada, a general indicator of the market orientation of the economy. Although other such measures are possible, which assign different weights to the importance of different policies, an advantage of the Fraser index is that it is available for a sufficient number of years to match the BEA Benchmark studies.

The first factor is an indication of how open the economy is to influences from abroad and the potential significance of foreign competition. A rising value of Trade Openness may reflect the more globalized nature of production. It will overstate the importance of foreign trade, however, compared to measures based on domestic value added in traded goods, which can only be calculated for countries included in the world input-output project. The influence of the exchange rate is more ambiguous. A real appreciation may be disadvantageous to producers oriented to the export market, but advantageous to those who have borrowed in foreign currencies or rely heavily on imported inputs.[5] The market liberalization measure will be more important if MNEs seek locations where there has been an improvement in the predictability of the rule of law and the orthodoxy of macroeconomic policy, and a decline in the burden of regulation and barriers to trade and investment.

The baseline equation to be estimated is

$$\begin{aligned}\ln(\text{Capital}_{it}) = \alpha_i + \beta_t + \gamma \ln(1 - \text{Avg. ETR})_{it} + \delta_1 \ln(\text{Population}_{it}) + \delta_2 \ln(\text{GDP per Capita}_{it}) \\ + \delta_3 \text{Trade Openness}_{it} + \delta_4 \text{Real Exchange Rate}_{it} + \delta_5 \text{Fraser Index}_{it} + \epsilon_{it} \qquad (2)\end{aligned}$$

[4] We focus on the domestic absorption Real Exchange Rate. See Feenstra et al. (2015) for an elaboration of this concept.

[5] Alfaro et al. (2018) provides a broader discussion of potentially conflicting exchange rate effects, data sources, and econometric issues.

where γ is the coefficient of interest. The fixed effect perspective utilized here is most relevant to a country interested in what changes in its market size or tax policy might attract additional investment. Following the advice provided in Cameron and Miller (2015), we cluster standard errors at the country level.

Table 1 shows summary statistics for the main variables included in our analysis. Several forms of the tax variable appear first, followed by the BEA measures of affiliate activity in the host country. Toward the bottom of the table are the macroeconomic scale variables and the international policy variables discussed above. The **Domestic Sales Ratio** offers another way to assess the extent to which the affiliate faces much foreign competition, but note that this variable is not available for as many countries. Dummy variables show whether a country is a member of the OECD and whether the country is part of the balanced panel used to derive the tax and fixed capital measures shown in Figure 1.

Table 1: Descriptive Statistics

	mean	std dev	25th Percentile	75th Percentile	obs
Avg. ETR	0.201	0.103	0.125	0.258	323
Ln(1–Avg ETR)	-0.233	0.139	-0.298	-0.134	323
Ln(Capital)	3.441	1.823	2.133	4.735	323
Ln(Employees)	3.837	1.640	2.779	4.918	323
Ln(Investment)	1.870	1.868	0.609	3.184	294
Ln(Assets)	5.295	2.135	3.732	6.734	322
Ln(Affiliates)	5.112	1.333	4.143	6.236	323
Ln(R&D)	4.785	2.194	3.099	6.566	254
Ln(Compensation)	2.437	2.008	0.966	3.984	323
Ln(Population)	16.688	1.688	15.524	17.888	323
Ln(GDP per capita)	10.978	1.986	9.829	11.687	323
Trade Openness	84.518	67.913	46.862	94.909	323
Real Exchange Rate	0.665	0.310	0.412	0.900	323
Fraser Index	6.958	1.002	6.385	7.594	323
Local Sales Ratio	0.650	0.199	0.529	0.791	249
OECD Member	0.440	0.497	0.000	1.000	323
Balanced	0.613	0.488	0.000	1.000	323

Notes: Table 1 presents descriptive statistics for the analysis sample. Variable definitions are discussed in the text.

4 Results

Table 2 shows the baseline results from the OLS regressions for four different dependent variables, capital, employees, investment, and assets.[6] The baseline analysis sample consists of all countries for which data are available in at least two consecutive BEA benchmark years and for which all other control variables are available. Taking these requirements into consideration, our sample consists of 330 country-year observations representing 76 countries in most specifications.[7]

For three of the four cases, the tax variable is statistically significant at the 5% level, with a value close to one, implying a one percent increase in the net-of-effective-tax rate increases capital, employees, and assets by approximately 1%. Capital responds positively both to population and GDP per capita. The nearly identical size of the coefficients on these terms implies that focusing on GDP alone would be adequate in determining the responsiveness of capital to market size. Capital also responds positively to the Fraser Index suggesting improvements in host country market orientation can attract fixed investment. For the other dependent variables, GDP per capita also has a significant positive effect. That outcome may reflect the role of demand for MNE output, but it also may indicate the attractiveness of a more productive economy. Only the stock of assets shows a significant positive response to the appreciation of the Real Exchange Rate.[8]

A visual representation of the tax coefficients reported in Table 2 is given in Figure 2. The binscatter procedure used to produce the visuals begins with residualizing the activity outcomes and tax variable, thereby controlling for country and year fixed effects as well as all five control variables included in the Table 2 analysis. These residuals are then sorted into 30 equal-sized bins based on the tax variable. Activity averages within each bin are then plotted. A fitted line based on the underlying residual data is overlaid. The slope of the line is the same as the coefficient in Table 2. For a sample with many observations, this approach demonstrates more clearly the

[6] Appendix Table A1 shows estimates for the manufacturing sector only, and Table A2 applies to the aggregate of all non-manufacturing sectors. The number of observations is smaller than in the complete sample, because only totals are reported for several countries. Because the tax variable calculated from the SOI data is not one specifically limited to manufacturing affiliates or to non-manufacturing affiliates, potential errors in this variable may result in less precise and downwardly biased estimates, especially for the relatively smaller sector, manufacturing. Consistent with the meta analysis of de Mooij and Ederveen (2003), the estimates of tax responsiveness in manufacturing are less than in non-manufacturing. That characterization contrasts to the cross-section results for purchases of new machinery and equipment in manufacturing versus services reported by Djankov et al. (2010).

[7] The country-years included in our sample are given in Appendix Table A7 and Table A8.

[8] A further indication of the robustness of the effect of taxation is shown in Appendix Table A3, which reports first difference estimates. Compared to the panel fixed effects results in Table, the tax coefficients appear somewhat larger and more precisely estimated for Capital and Investment, but somewhat smaller and less precisely estimated for Employment and Assets. First difference estimates may be particularly insightful in demonstrating the response to a change in taxation when the comparison is based on the rate change over the five year interval of observation, not the tax rate in a given year relative to the average over the whole period as in the fixed effects estimates. A further robustness check is shown in Appendix Table A4 which includes country-specific time trends. Controlling for such trends (perhaps the growth of the service sector) may avoid omitted variable bias in our estimates. We do not include these trend variables in the baseline estimates, because effective tax rate regimes with one or two reductions in the statutory rate over the period may look approximately linear.

Table 2: Sensitivity of US Business Activity Abroad to Effective Tax Rates

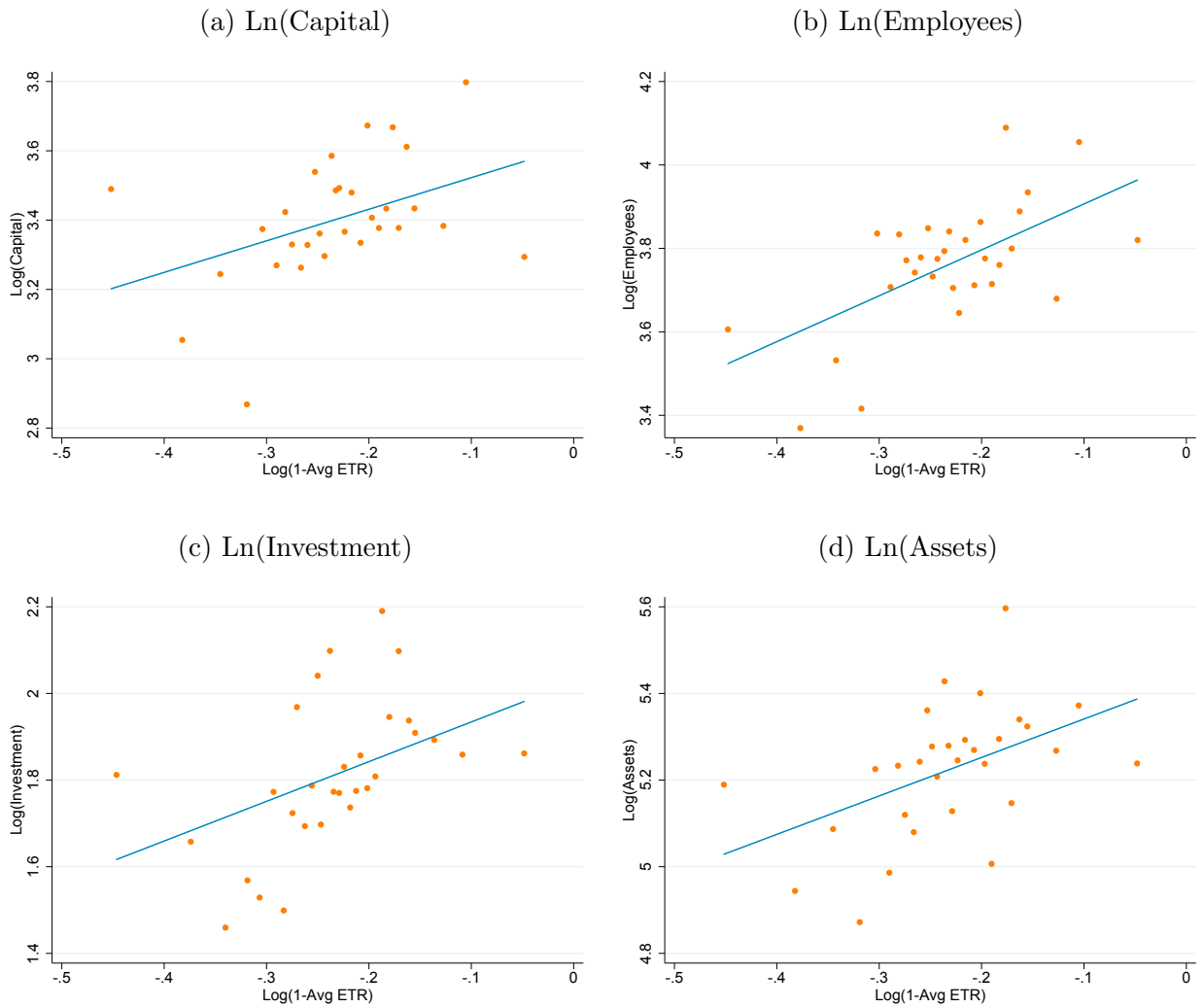
	(1) Ln(Capital)	(2) Ln(Employees)	(3) Ln(Investment)	(4) Ln(Assets)
Ln(1–Avg ETR)	0.911**	1.100***	0.916	0.888***
	(0.408)	(0.346)	(0.579)	(0.327)
Ln(Population)	1.542***	0.395	0.702	0.684
	(0.515)	(0.642)	(0.630)	(0.762)
Ln(GDP per capita)	1.567***	1.963***	1.969***	1.302***
	(0.258)	(0.454)	(0.303)	(0.449)
Trade Openness	-0.000980	0.000345	0.000566	0.00700*
	(0.00263)	(0.00138)	(0.00338)	(0.00419)
Real Exchange Rate	0.165	-0.0102	0.426	0.768**
	(0.196)	(0.284)	(0.297)	(0.318)
Fraser Index	0.173**	0.105	0.0361	0.0917
	(0.0690)	(0.0663)	(0.105)	(0.0667)
Year FE	✓	✓	✓	✓
Country FE	✓	✓	✓	✓
Observations	330	332	300	330
Countries	76	76	74	76
Adj. R^2	0.802	0.650	0.619	0.858

Notes: Table 2 presents estimates from regression of the form in equation (2) indicating the effect of taxation on the location of real activity by majority-owned affiliates of US MNEs. All specifications include country and year fixed effects. Standard errors are presented in parentheses and clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

dispersion in the estimated influence of taxes on MNE activity. That outliers seem to flatten the slope in some of the panels suggests alternative functional forms may better fit the data, which we explore in Section 7.

The regressions in Table 2 impose the constraint that the coefficient for a given independent variable must be the same in all years. Our primary interest is in the tax variable, and we can allow that coefficient to vary by year if we include an interaction term of a year dummy times the tax variable for all years other than one, say 1989. Those interaction coefficients will show whether the tax coefficient in a later year differs from the value that would apply to 1989. We can also test the null hypothesis that the coefficients for each of the interaction terms equals zero. In the case of employment, the interaction coefficients in 4 of the 5 years after 1989 are negative and significantly different from the 1989 value. In the case of capital and assets only 1994 is significantly different from the 1989 value, and no significant differences appear in the case of investment. The

Figure 2: Sensitivity of U.S. Business Activity Abroad to Effective Tax Rates; Bin-scatters



Notes: Figure 2 presents bin-scatterplots corresponding to the regression results presented in Table 2. Each bin-scatterplot controls on the time-varying country variables other than taxes, as well as country and year fixed effects.

smaller elasticity value obtained in 1994 can be related to the analysis of Altshuler and Hubbard (2003), who noted that for financial service firms the Tax Reform Act of 1986 eliminated the benefits of deferral. Therefore, those firms were subject to immediate U.S. taxation of their foreign source income. Altshuler and Hubbard (2003) found host country taxes were no longer a significant determinant of financial service affiliate assets in 1992 and 1994. This tax treatment of financial services was reversed in 1997. We return to possible distinctions over time, particularly for the case of employment, in our broader discussion of possible heterogeneity in the estimated tax responses and any potential trend in that responsiveness over time.

The information from such a regression can also be used to show graphically the extent to

which the tax coefficient appears to differ over time. The relevant confidence intervals applicable to the coefficient obtained for each year are easiest to see directly by repeating the same procedure outlined above, but now omitting an interaction term for the new year of interest. Figure 3 shows the result of that visual representation, and the verticals indicate the corresponding 95% confidence intervals. Note that the confidence interval for the 2014 value tends to be unusually large compared to other years. That follows because fewer country SOI tax rates were available in 2014. With fewer observations, the precision of the estimate not surprisingly falls.

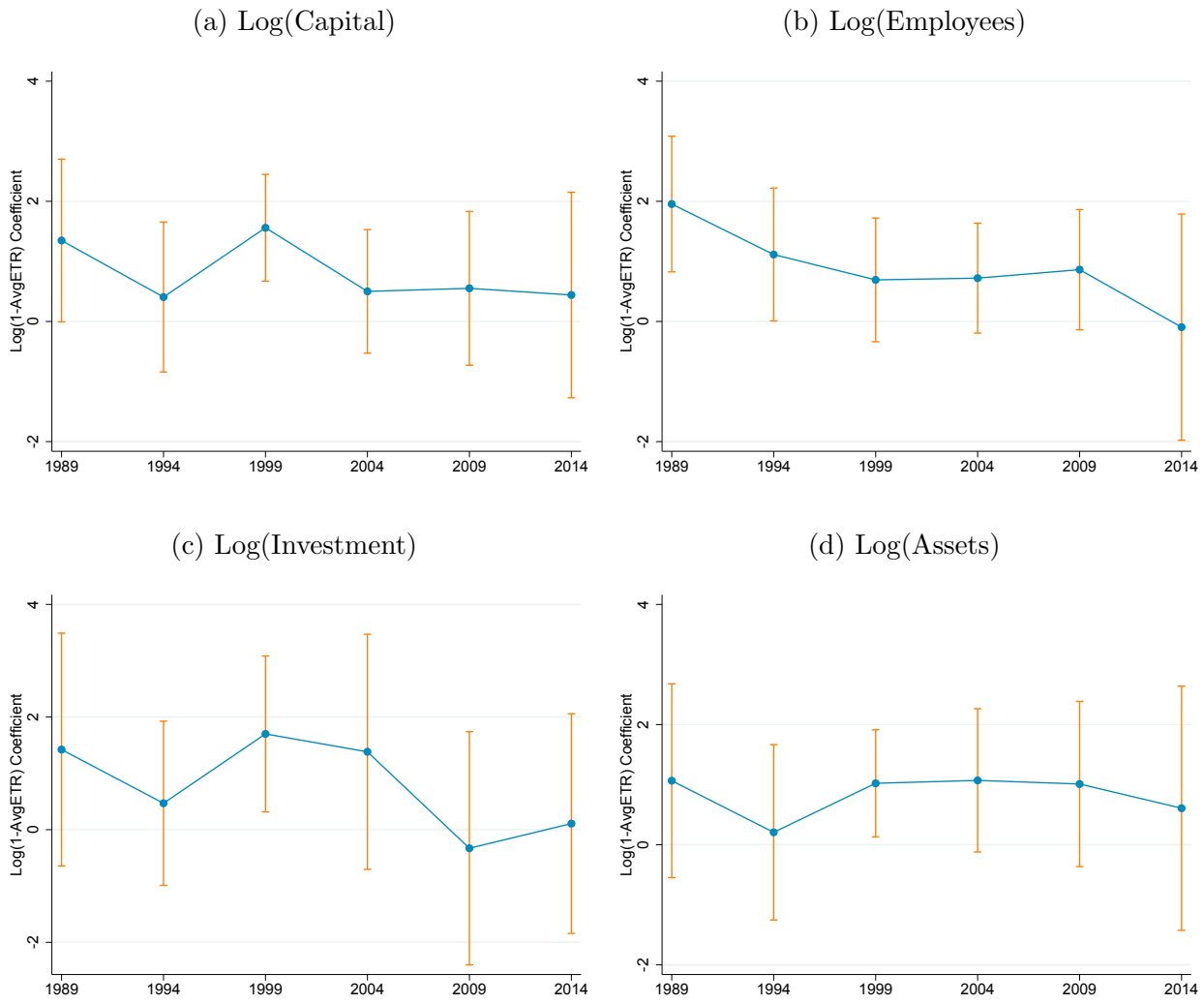
Overall, the dynamic estimates suggest the stability of the estimates over time; in no two consecutive estimates do the 95% confidence intervals not overlap. The one semi-obvious trend is presented in Panel (b), which focuses on the employment outcome. The effect of taxation on the number of employees seems to drop throughout the time frame with especially large drops in 1994, 1999, and 2014. Decreasing sensitivity of employment to net-of-effective-tax rates accords with the increasing importance of good and services of a digital nature. Formal tests for whether employment sensitivity declines over time are presented in Table 5.

5 Attention to Endogeneity

A criticism of using tax measures like the average effective tax rates calculated here (sometimes pejoratively labeled "backward looking" tax rates) is that they may be subject to reverse causality: greater investment may lead to a lower observed tax rate. The result of such endogeneity, as noted by Hines Jr. and Rice (1994), is to bias downward the estimated tax coefficient. That effect is most likely to influence the flow of Investment in single year, in contrast to variables like Capital and Assets. In this section, we also consider expenditures on research and development, another measure of MNE activity that may benefit from favorable tax treatment depending upon the amount of R&D performed in a given year. Identifying appropriate instruments to address such potential endogeneity is not straightforward. For example, Altshuler et al. (2001) did not find that statutory tax rates were an adequate instrumental variable in their analysis.

As noted above, the study by Kawano and Slemrod (2016) provides a particularly useful quantification of policy changes that can be exploited to predict effective tax rates in the presence of country and year fixed effects. Those scholars construct a dataset by evaluating whether tax reform in a given (OECD) country tightened or relaxed the following provisions: the R&D tax credit, the foreign tax credit, the treatment of foreign tax credits when host incentives are offered (such as tax sparing), the investment tax credit, accelerated depreciation, loss carry-backs, loss carry-forwards, thin capitalization rules, CFC legislation, other rate changes, and other base changes. We use these changes in combination with statutory corporate income tax rates to instrument for net-of-effective-tax rates. Table 3 presents the OLS results based on the more limited OECD sample and

Figure 3: Dynamic Sensitivity of U.S. Business Activity Abroad to Effective Tax Rates



Notes: Figure 3 presents estimates of the effect of Log(1-ETR) on each of the four primary outcomes in each survey year 1989, 1994, 1999, 2004, 2009, and 2014. To estimate a coefficient for a given year, run a regression similar to that represented by Equation (2) but include interaction terms between Log(1-ETR) and each of the other years.

then reports the corresponding instrumental variables results.[9]

In considering the OLS estimates, additional commentary is warranted with respect to the R&D variable. Several scholars have demonstrated the sensitivity of firms' R&D spending to its tax cost. Bloom et al. (2002) and Rao (2016) assessed the effectiveness of R&D tax credits. Hines Jr. (1993) found that domestic R&D expenditures by MNEs with excess foreign tax credits declined as a

[9]We present summary statistics for the Kawano and Slemrod (2016) dataset as well as first-stage estimation results in Appendix tables A5 and A6. Within each five year period represented by the BEA benchmark surveys, we count the number of policy changes that a country makes in each category identified by Kawano and Slemrod. We follow their convention that a positive value corresponds to a measure that expands the tax base by tightening or reducing the generosity of a provision.

result of 1986 tax reform provisions that required a greater allocation of R&D expenses to foreign income. However, Hines Jr. (1994) noted that no large shift occurred toward R&D performed abroad because the tax cost of domestic R&D declined for firms that shifted from a position of deficit foreign tax credits to a position of excess foreign tax credits and thereby benefited from the favorable treatment of royalty income received from affiliates. Although these scholars did not address the distribution across countries of R&D performed abroad, we might expect the role of taxation to affect that choice, too.

Table 3: Sensitivity of US Business Activity Abroad to Effective Tax Rates; IV Estimates

(a) OLS Estimates; IV Sample

	(1) Ln(Capital)	(2) Ln(Emp)	(3) Ln(Investment)	(4) Ln(Assets)	(5) Ln(R&D)
Ln(1–Avg ETR)	0.686	0.441	0.265	0.820*	1.676*
	(0.472)	(0.319)	(0.455)	(0.403)	(0.916)
Observations	96	96	87	96	86
Countries	26	26	26	26	25
Adj. R^2	0.850	0.689	0.775	0.932	0.583

(b) Instrumental Variables Estimates

	(1) Ln(Capital)	(2) Ln(Emp)	(3) Ln(Investment)	(4) Ln(Assets)	(5) Ln(R&D)
Ln(1–Avg ETR)	1.811*	0.747	3.602**	1.790*	3.175*
	(2.05)	(1.05)	(2.78)	(2.03)	(1.78)
Observations	96	96	87	96	86
Countries	26	26	26	26	25
Adj. R^2	0.968	0.983	0.899	0.973	0.935
First Stage F Stat	14.58	14.58	53.66	14.58	15.14
Hansen J Stat	12.19	12.23	5.804	15.07	6.834
J Stat p-value	0.272	0.270	0.831	0.130	0.741

Notes: Panel (a) of Table 3 presents estimates from regressions of the form of equation (2), as in Table 2, using only the subsample of country-year observations for which the Kawano and Slemrod (2016) data are available. Panel (b) presents estimates of the effect of average effective tax rates on measures of MNE affiliate activity abroad for the sample in Panel (a) in which effective tax rates are instrumented using statutory tax rates and base expansion and contraction data from Kawano and Slemrod (2016). All specifications include country and year fixed effects. Standard errors are presented in parentheses and clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We adjust the R&D value reported by the BEA for purchasing power parity, the convention used by the OECD and the NSF in making international comparisons. The rationale is that a 100 euro expenditure translated into dollars at the market exchange rate will understate the amount of R&D effectively performed if the euro is undervalued relative to the dollar.

The OLS estimates suggest that the average effective tax rate does affect the five different measures of MNE activity, but the precision of the estimates declines in this smaller sample. For both assets and R&D the tax coefficient is marginally significant, even though this tax measure may not be as directly linked to the tax cost of R&D.[10] The lower panel of Table 3 shows the IV estimates. The F-statistic in all five regressions indicates a strong first stage, and with the exception of employment, the net-of-effective tax point estimates are larger than in the full baseline sample of Table 2, as the discussion above would suggest. The contrast in the size of the estimated magnitudes is even more stark compared to the OLS estimates based on the OECD sample, which are smaller than those from the baseline. These patterns are particularly striking in the case of investment and R&D, the dependent variables most likely to decrease "backward looking" tax rates.

Another approach to address the reverse causation described above is simply to replace effective-tax-rates with their lagged values.[11] Table 4 presents the lagged-ETR results. Estimated tax effects are slightly smaller and less-precise than baseline estimates but continue to suggest a strong effect of taxation on real business activity.

Table 4: Sensitivity of US Business Activity to Effective Tax Rates; Lagged ETR

	(1) Ln(Capital)	(2) Ln(Employees)	(3) Ln(Investment)	(4) Ln(Assets)
Ln(1–Lagged Avg ETR)	0.741**	0.957***	0.411	0.650**
	(0.371)	(0.308)	(0.518)	(0.304)
Observations	320	322	292	320
Countries	76	76	74	76
Adj. R^2	0.797	0.651	0.637	0.854

Notes: All specifications include country and year fixed effects, as well as the control variables in Table 2. Standard errors are presented in parentheses and clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6 Heterogeneous Responses to Taxation

To further reinforce the plausibility of our estimates we test whether several sources of heterogeneity affect the responsiveness of the real activity of US MNE affiliates to taxation. We are particularly concerned whether the responsiveness has increased or declined over time or whether it has been limited to MNE activity in certain locations or with a particular focus. One way to consider

[10] For the full sample the tax coefficient for R&D is 0.80 but not statistically significant, as shown in Appendix Table A9. Because R&D requires a competent pool of technically trained workers, physical infrastructure, and a supportive legal system, the viability of major research effort is limited in many low tax locations. Also, manufacturing affiliates account for over 70 percent of all affiliate R&D, and therefore a tax measure specifically focused on manufacturing likely would be more appropriate than the overall rate calculated here.

[11] SOI tax rate data is not available in every year. As in the baseline analysis, lagged variables are interpolated in years where there is no direct observation.

the stability of the tax coefficient is to introduce a time trend, whose value increases from 1 to 5 after the initial year observed, 1989. We interact this variable with the tax variable. For three of the dependent variables, this coefficient is negative, but only significant in the case of employment, as shown in the top panel of Table 5. Recall the graphical representation of the tax coefficient's dynamic sensitivity from Figure 3. Visually, the tax sensitivity of employment appeared the most likely to have systematically declined over time, and as reported above, interacting year dummies with the tax variable yielded significantly negative coefficients for four of the five post-1989 observations. Here the initial 1989 value of 1.73 is greater than the period average effect of 1.10 reported in Table 2, but allowing for a downward trend suggests that the corresponding value in 2014 would only be 0.21. Such a downward trend does not appear applicable to the other activity measures.

An additional element of potential heterogeneity of the tax term is the destination of affiliate sales. In Grubert's work, sales in a protected home market were not as tax sensitive as the sales of firms that exported to other markets. We include an interaction term based on the tax term multiplied by the share of affiliate sales made in the local market. The results are distinctly different than those Grubert observed for the manufacturing sector. The interaction coefficient is positive rather than negative. The coefficient values imply that at the average ratio of local sales (0.65), the combined effect of the two tax terms shows little sensitivity to taxation. Only at higher local sales ratios does the responsiveness to taxes become much larger. The BEA data show that services are much more locally oriented than manufacturing, and as found by other researchers surveyed by de Mooij and Ederveen (2003), they are more tax sensitive, too. The pattern reported here is consistent with the greater tax sensitivity found by Hines Jr. and Rice (1994) in a cross section that included many tax havens where little manufacturing activity occurred.

A related approach based on possible distinctions across countries is to interact the composite policy index, the Fraser Index, with the tax variable. As shown in the bottom panel of Table 5, the interaction coefficient is negative in all four cases, but only reaches border-line significance for employment. The coefficient of the tax variable is less precisely estimated but larger in value. The interaction term implies that the positive effect of lower taxes and greater market orientation of the economy is somewhat lower than these two elements suggest separately. The adjustment is greater at lower tax rates and greater market orientation. Thus, having greater market orientation is less important if taxes are falling. Because the estimated effect of the market orientation measure is based on changes in the index, countries that already have achieved a high rank may demonstrate little further change; the greatest changes may appear for countries embarking on major economic reforms and opening up to the outside world. The general lack of significance of the coefficient for the Fraser index and its interaction with the tax variable in fixed effect estimates suggests this policy measure does not appear to be a major determinant in attracting MNE activity.

Table 5: Heterogeneity in Sensitivity of Business Activity to Effective Tax Rates

(a) Heterogeneity over Time

	(1) Ln(Capital)	(2) Ln(Employees)	(3) Ln(Investment)	(4) Ln(Assets)
Ln(1–Avg ETR)	1.268**	1.730***	1.455**	0.791
	(0.566)	(0.541)	(0.712)	(0.736)
5 Year Interval x Log(1-ETR)	-0.181	-0.304*	-0.256	0.0936
	(0.175)	(0.177)	(0.229)	(0.271)
Observations	330	332	300	330
Countries	76	76	74	76
Adj. R^2	0.804	0.664	0.624	0.848

(b) Heterogeneity in Local Sales Ratio

	(1) Ln(Capital)	(2) Ln(Employees)	(3) Ln(Investment)	(4) Ln(Assets)
Ln(1–Avg ETR)	-2.543***	-2.625**	-2.126	0.661
	(0.648)	(1.022)	(1.374)	(1.570)
Local Sale Ratio x Log(1–ETR)	4.297***	4.491***	3.473*	0.230
	(1.052)	(1.499)	(1.873)	(2.173)
Observations	249	249	229	249
Countries	54	54	53	54
Adj. R^2	0.838	0.763	0.729	0.904

(c) Heterogeneity in Market Orientation

	(1) Ln(Capital)	(2) Ln(Employees)	(3) Ln(Investment)	(4) Ln(Assets)
Ln(1–Avg ETR)	2.752	4.706**	5.149	1.133
	(2.490)	(2.117)	(3.841)	(2.527)
Fraser Index x Log(1-ETR)	-0.280	-0.548*	-0.634	-0.0372
	(0.349)	(0.298)	(0.528)	(0.359)
Observations	330	332	300	330
Countries	76	76	74	76
Adj. R^2	0.803	0.659	0.624	0.858

Notes: The coefficients of the tax terms presented in this table are based on regression estimates of the form in equation 2. All specifications include country and year fixed effects, as well as the control variables in Table 2. Standard errors are presented in parentheses and clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

7 Alternative Specifications and Comparisons to Past Analysis

Thus far, we have relied on a log-linear specification where the coefficient on the ln(1 − Avg. ETR) term represents a constant elasticity indicating the percent increase in MNC activity resulting from an 1% increase in the net-of-effective-tax rate. This formulation makes interpretation of results more intuitive, but prior research has investigated other functional forms.[12] Hines Jr. and Rice (1994) found the semi-log linear response of MNE activity to the tax rate best fit their sample with a large share of tax havens. In a recent contribution focused on income shifting, Dowd et al. (2017), reported that a semi-log quadratic form in the tax rate was particularly relevant, with a progressively greater degree of responsiveness observed for tax rates less than 20 percent.

Panel (a) of Table 6 presents estimates of the semi-log linear specification, and Panel (b) presents the quadratic results. The linear specifications fit the data well across all four outcomes and predict similar tax effects for all of them. That pattern of uniformity is similar to the Table 2 results for the constant elasticity formulation specification. If we multiply the linear coefficient by (1-t) at the sample average value of 0.8, the resulting elasticity value for capital is somewhat higher than the constant elasticity estimate, 1.08 versus 0.91. The quadratic specification, on the other hand, only seems more appropriate for the investment data. Recall from the bin-scatter plots in Figure 2 that the existence of several outliers under the constant elasticity specification gave the impression that alternative specifications might yield a better fit for the case of investment.

To help in interpreting whether these different approaches result in different predicted outcomes from a change in the tax rate, Figure 4 demonstrates how any comparison depends upon the range of tax rates chosen. A logical point of comparison is the variation around the sample average tax rate of 20 percent. As the tax rate is raised or lowered from that point, multiply the estimated coefficient times the chosen tax rate and subtract the comparable value obtained at 20 percent to obtain the change in log points predicted from a given approach.

Panel (a) contrasts the constant elasticity results found in this study with those in the 1982 cross-section of Grubert and Mutti (1991) and the 1992-1984 first difference estimates of Altshuler et al. (2001). The Altshuler estimate for the manufacturing sector in open economies shows the greatest degree of tax sensitivity, perhaps an indication of the MNE response to particularly large variation in tax changes abroad that followed the 1986 US tax reform. The within-country variation observed over the longer, more recent time frame suggests less responsiveness if all majority-owned MNEs are considered. Panel (b) shows the linear specification from the 1982 cross-section of Hines Jr. and Rice (1994), the average response reported in the meta analysis of de Mooij and Ederveen (2003), and the corresponding results from the current study. Again, the within-country variation over a

[12] Grubert and Mutti (1991) reported that there was greater sensitivity to taxation at very low rates, as captured by the inverse of the tax rate. The inverse tax coefficient is quite significant statistically in the current sample, too, but the value obtained implies very little responsiveness to the tax rate over a wide range of rates, with large changes in the dependent variables occurring only for tax rates less than 5 percent.

Table 6: Sensitivity of Business Activity to Effective Tax Rates; Alternate Specifications

(a) Linear Specification

	(1) Ln(Capital)	(2) Ln(Employees)	(3) Ln(Investment)	(4) Ln(Assets)
Tax Rate	-1.328**	-1.520***	-1.503*	-1.469***
	(0.553)	(0.467)	(0.777)	(0.485)
Observations	330	332	300	330
Countries	76	76	74	76
Adj. R^2	0.804	0.651	0.625	0.849

(b) Quadratic Specification

	(1) Ln(Capital)	(2) Ln(Employees)	(3) Ln(Investment)	(4) Ln(Assets)
Tax Rate	-3.243**	-1.330	-7.620***	-4.311**
	(1.364)	(1.305)	(1.526)	(1.930)
Tax Rate ^{2}	3.762	-0.372	11.93***	5.584
	(2.543)	(2.389)	(2.901)	(3.475)
Observations	330	332	300	330
Countries	76	76	74	76
Adj. R^2	0.806	0.649	0.646	0.851

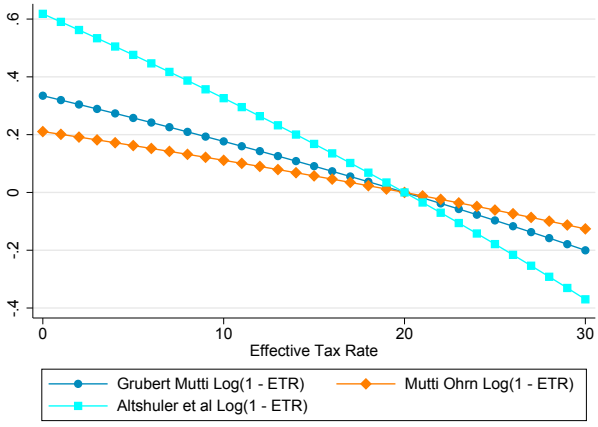
Notes: Table 6 uses alternative specifications of the tax rate to estimate the effect of average effective corporate tax rates on the real activity of US multinational subsidiaries operating abroad. All specifications include country and year fixed effects, as well as the control variables in Table 2. Standard errors are presented in parentheses and clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

more recent time frame suggests somewhat less tax responsiveness than the earlier studies. Panel (c) demonstrates the much larger predicted responses if coefficients from the quadratic estimates are used, although for the capital stock regressions from Hines Jr. and Rice (1994) and the current study neither find the quadratic term is statistically significant. Panel (d) contrasts the three different specifications for the sample in this study.

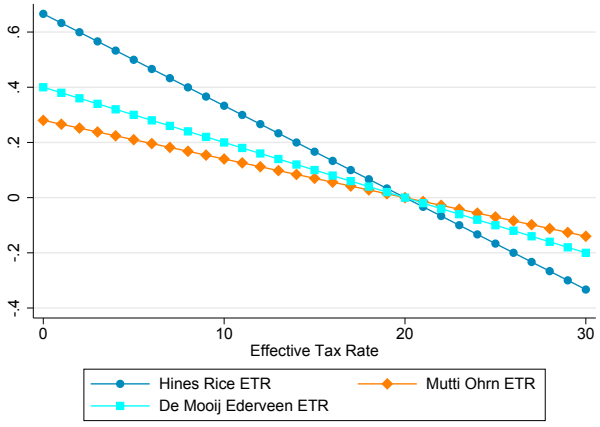
From the estimates in this study, the constant elasticity and semi-log linear tax rate approaches yield quite similar predicted changes in capital, unless extreme values are chosen. The current estimates are smaller than those from earlier periods. A small portion of that difference might be attributable to the fact that BEA data include the operations of branches whose income is subject to immediate US taxation. Additionally, the lower elasticity values and their stability over time are a contrast to the more recent meta-analysis of de Mooij and Ederveen (2008), which noted a tendency for studies with post-1990 data to report greater tax responsiveness. We cannot judge whether any differences can be attributed to the availability of better data, better econometric techniques, or a focus on different countries. We regard the availability of panel data to be a definite advantage of

Figure 4: Comparison of Estimates Across Papers and Specifications

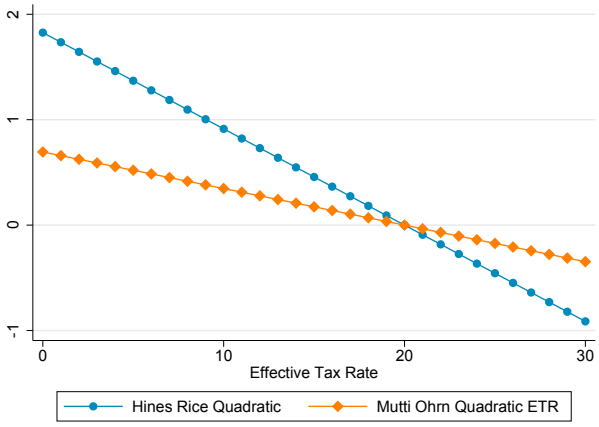
(a) $Log(Capital) = \beta_1 Log(1 - ETR)$



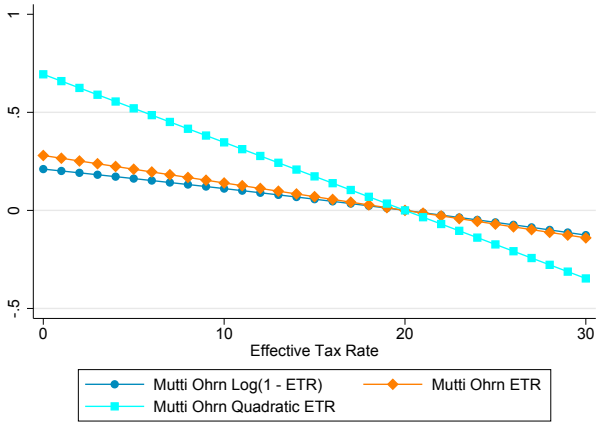
(b) $Log(Capital) = \beta_1 ETR$



(c) $Log(Capital) = \beta_1 ETR + \beta_2 ETR^2$



(d) Alternate Mutti Ohrn (2018) Specifications



Notes: The projections for each of the studies presented are based on setting to zero the product of the estimated tax coefficient times the relevant tax term calculated for a tax rate of 20 percent. For other values of the tax rate the predicted change in log points of capital is the product of the estimated tax coefficient times the difference in the relevant tax term at the new tax rate minus the value of the tax term at the 20 percent tax rate.

the current study, because the extent of any changes over time can be addressed within a data set for the the same group of countries and control variables. The suggestive instrumental variables results indicate that there are plausible ways to address the potential endogeneity of the average effective tax rate. Therefore, we would not rule out the usefulness of this measure, given the broader set of tax provisions it reflects.

8 Reflections and Conclusions

The present study utilizes the framework that Grubert's work introduced to assess how the allocation of real activity by MNEs across their foreign affiliates responds to taxation. We believe this extension of Grubert's empirical analysis is persuasive confirmation of many of his original insights. This study does not rest on a cross section for a single year or even the change between two years. Rather, the availability of data for many more years and many more countries allows us to more effectively control for fixed country and year effects. Our results are less likely to be influenced by idiosyncratic factors of particular years or countries.

Our estimates confirm that taxes have a significant effect on the location of affiliate capital, employment, investment, and assets, the four variables that are the focus of our analysis in the body of the paper. In Appendix Table A9 we additionally show this outcome applies to employee compensation, with estimates remarkably similar to those using property, plant, and equipment, and also to the number of affiliates in a host country. As noted by de Mooij and Ederveen (2008), estimates based on the count of affiliates are sometimes treated as adjustments on the extensive margin, regarding the choice to locate in a given country rather than the expansion of an existing affiliate. In interpreting the results from aggregate data, however, a total that includes both greenfield investment with mergers and acquisitions combines two different sets of tax incentives, with the latter potentially being less sensitive to host country taxation.

While we find there is some variation in the tax coefficient from year to year, only in the case of employment do we observe a significant downward trend. In spite of the possibility that check-the-box provisions adopted by the United States in 1997 would make profit shifting so easy that high-tax foreign locations would not face the loss of real activity, that extreme outcome does not seem to have occurred. Perhaps we find continued responsiveness to taxation because the average effective tax rates incorporate the ability to avoid high statutory rate. As shown in Appendix Table A10, limiting our analysis to the benchmark years in 1999 and beyond results in tax coefficients of a similar magnitude to those from the whole sample.

Additionally, the creativity of others in monitoring changes in foreign tax provisions of OECD countries allows more appropriate instrumental variables to be created in addressing potential issues of endogeneity in the measurement of average effective tax rate. We show this approach is particularly relevant in the case of current year investment and expenditures on R&D. Expanding the number of years and the number of countries for which such information is available will allow a more general assessment of its usefulness in this context.

The form in which the tax variable enters, either as a constant elasticity or as a linear semi-elasticity, appears to play a minor role if greatest interest focuses on tax rates near the sample average. As extreme values become more prevalent in the sample or are of interest for policy projections, the semi-elasticity suggests greater tax responsiveness occurs at lower tax rates. Re-

gardless of the functional form applied, our estimates over a longer and more recent time frame yield somewhat less tax responsiveness than the central values from the meta analysis of de Mooij and Ederveen (2003), which incorporates the higher values obtained in intra-European analyses. The current estimates are substantially lower than those from the greater focus on tax haven locations by Hines Jr. and Rice (1994).

The meta analysis reported by de Mooij and Ederveen (2008) found significantly greater responsiveness to host country taxes from parents whose home countries did not apply a residual tax on foreign earnings. Whether that pattern will be matched by US experience under legislation adopted in 2017 to exempt active foreign income from US taxation will, with the passage of time, be a useful issue to pursue in subsequent research.

So, what would Harry Grubert think of our results? With respect to the data we have used, Harry was always partial to the SOI data from Form 5471, because he noted that there were more severe penalties for filling out tax forms incorrectly than for filling out the BEA survey incorrectly. Because Harry recognized the inaccuracies in SOI data for recording activity that actually occurred in a country in the post-check-the-box era, Grubert (2012) instead used firm-level data to address an alternative timely question, what activity occurred abroad versus in the United States. Perhaps Harry would grant that the BEA macro data still allow us to address some relevant tax issues about the allocation of activity among alternative foreign locations.

Regarding a relevant tax variable, Harry was an early proponent of the average effective tax rate based on SOI data, which he could request for more homogeneous groupings of affiliates, such as manufacturing. Countries continue to be creative in offering many different incentives beyond investment tax credits and accelerated depreciation, and the average effective tax rate, in spite of recognized flaws, captures this wider set of provisions. He would likely be skeptical of our focus on all affiliates, as reported in the publicly available data. With many different activities included in the aggregate, one could question whether a reduction in the calculated rate represented a change in policy or a shift in activity toward lower taxed services. We attempt to control on possible reasons for such a shift in activities with year dummies and country specific time trends. While Harry would have been concerned over the accuracy of a calculated tax rate for a country in the post-check-the-box era, he probably would agree that it was appropriate to show a lower cost of operating in Germany, say, when income shifting strategies he and Rosanne Altshuler explored reduce the deterrent effect of host country taxation in high-tax locations.

Harry might be surprised that we report less elastic responsiveness to taxes than others do, because in comparing pre- and post-check-the-box activity of MNEs, he found that not only income shifting had accelerated but also there was a slightly greater influence of taxes on the share of sales made abroad. In general, though, he was often skeptical of extremely high values reported by others. Whether he would be disappointed that the higher value reported by Altshuler et al. (2001) was not replicated here we cannot say. We are confident that he would be impressed that both fixed

effects and first difference estimates over a longer time frame do give a coherent story. That an alternative approach to instrumental variable estimation appears promising, even if possible only for OECD countries, would be a plus. We would not try to speak for Harry, given his ability to appreciate features of the law and the data that we may have completely missed, but we hope that he would approve a careful attempt to address a tax policy issue that remains important.

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A Manufacturing / Non-Manufacturing Baseline

Table A1: Sensitivity of Business Activity to Effective Tax Rates; Manufacturing

	(1) Ln(Capital)	(2) Ln(Employees)	(3) Ln(Investment)	(4) Ln(Assets)
Ln(1–Avg ETR)	0.312	0.393	0.00964	-0.0510
	(0.570)	(0.411)	(0.548)	(0.537)
Ln(Population)	1.523**	0.295	0.992	0.143
	(0.653)	(0.800)	(0.851)	(0.571)
Ln(GDP per capita)	2.041***	1.673***	2.153***	2.046***
	(0.370)	(0.502)	(0.339)	(0.275)
Trade Openness	0.000443	0.000181	-0.000106	0.00234**
	(0.00184)	(0.00159)	(0.00192)	(0.00105)
Real Exchange Rate	0.463	0.379	0.329	0.440
	(0.308)	(0.315)	(0.466)	(0.340)
Fraser Index	0.108*	0.109	0.199**	0.128**
	(0.0636)	(0.100)	(0.0787)	(0.0591)
Year FE	✓	✓	✓	✓
Country FE	✓	✓	✓	✓
Observations	270	274	266	221
Countries	55	55	55	55
Adj. R^2	0.780	0.468	0.562	0.880

Notes: Table A1 performs the same analysis as is presented in Table 2 but limits the analysis only to manufacturing affiliates of US MNEs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A2: Sensitivity of Business Activity to Effective Tax Rates; Non-Manufacturing

	(1) Ln(Capital)	(2) Ln(Employees)	(3) Ln(Investment)	(4) Ln(Assets)
Ln(1–Avg ETR)	0.657	1.199*	0.426	0.892**
	(0.568)	(0.611)	(0.665)	(0.444)
Ln(Population)	2.259***	0.975	1.980*	0.810
	(0.725)	(0.849)	(0.998)	(0.992)
Ln(GDP per capita)	1.039***	2.625***	1.156***	1.417***
	(0.370)	(0.651)	(0.417)	(0.474)
Trade Openness	0.000841	0.00189	0.00266	0.00934
	(0.00512)	(0.00246)	(0.00519)	(0.00585)
Real Exchange Rate	0.277	0.257	0.762	0.907*
	(0.348)	(0.409)	(0.471)	(0.484)
Fraser Index	0.192*	0.0879	0.169	0.0784
	(0.102)	(0.0949)	(0.144)	(0.0974)
Year FE	✓	✓	✓	✓
Country FE	✓	✓	✓	✓
Observations	270	274	242	221
Countries	55	55	53	55
Adj. R^2	0.719	0.674	0.610	0.870

Notes: Table A2 performs the same analysis as is presented in Table 2 but limits the analysis only to non-manufacturing affiliates of US MNEs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B First-Difference Estimates

Table A3: Sensitivity of US Business Activity Tax Rates, First-Difference Esimtates

	(1) D.Ln(Capital)	(2) D.Ln(Employees)	(3) D.Ln(Investment)	(4) D.Ln(Assets)
D.Ln(1- Avg ETR)	1.047***	0.644**	1.228**	0.572**
	(0.379)	(0.276)	(0.545)	(0.284)
Year FE	✓	✓	✓	✓
Country FE	✓	✓	✓	✓
Observations	247	249	207	247
Adj. R^2	0.215	0.211	0.297	0.226

Notes: Table A3 performs the same analysis as is presented in Table 2 but uses a first-difference estimator instead of a panel fixed effects model. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C Estimates with Country-Specific Linear Time Trends

Table A4: Sensitivity of US Business Activity Tax Rates, Country-Specific Linear Time Trends

	(1) Ln(Capital)	(2) Ln(Employees)	(3) Ln(Investment)	(4) Ln(Assets)
Ln(1–Avg ETR)	1.183**	0.509	1.357*	0.759**
	(0.544)	(0.331)	(0.682)	(0.324)
Year FE	✓	✓	✓	✓
Country FE	✓	✓	✓	✓
Observations	330	332	300	330
Countries	76	76	74	76
Adj. R^2	0.880	0.845	0.743	0.954

Notes: Table A3 performs the same analysis as is presented in Table 2 but uses includes country-specific linear time trends. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D Kawano Slemord Instrumental Variables

Table A5: Descriptive Statistics

	mean	std dev	25th Percentile	75th Percentile	obs
Stat. Corp. Tax Rate	30.559	8.544	28.000	35.000	123
Δ R&D Tax Credit	0.000	0.000	0.000	0.000	97
Δ Foreign Tax Credit	-0.010	0.176	0.000	0.000	97
Δ For. Tax Credits / Incentives	-0.010	0.228	0.000	0.000	97
Δ Evasion / Avoidance Policies	0.144	0.353	0.000	0.000	97
Δ Investment Tax Credit	0.010	0.306	0.000	0.000	97
Δ Accelerated Depreciation	-0.021	0.143	0.000	0.000	97
Δ Loss Carry Back	0.000	0.144	0.000	0.000	97
Δ Loss Carry Forward	-0.021	0.203	0.000	0.000	97
Δ Thin Capitalization	0.031	0.174	0.000	0.000	97
Δ CFC Legislation	0.000	0.000	0.000	0.000	97
Δ Other Rate Change	0.021	0.288	0.000	0.000	97
Δ Other Base Change	0.082	0.277	0.000	0.000	97

Notes: Table A5 presents descriptive statistics for the Kawano and Slemrod (2016) instrumental variables.

Table A6: First Stage Estimates

	(1) Ln(1–Avg ETR)	(2) Ln(1–Avg ETR)	(3) Ln(1–Avg ETR)
Ln(1–Stat Rate)	0.395	0.476	0.349
	(1.37)	(1.50)	(1.07)
Δ Other Base Change	-0.0269	-0.0182	-0.0460
	(-0.61)	(-0.37)	(-0.93)
Δ Foreign Tax Credit	0.0516	0.0411	0.0516
	(1.46)	(1.15)	(1.08)
Δ For. Tax Credits / Incentives	-0.0393	-0.0649	-0.0357
	(-1.09)	(-1.61)	(-0.91)
Δ Evasion / Avoidance Policies	0.0464	0.0425	0.0489
	(1.65)	(1.17)	(1.72)
Δ Investment Tax Credit	0.0259	0.0312	0.0423
	(0.79)	(0.94)	(0.95)
Δ Accelerated Depreciation	-0.0750**	-0.0514	-0.0642*
	(-2.07)	(-1.02)	(-2.03)
Δ Loss Carry Forward	-0.0550	-0.0820	0.00973
	(-0.70)	(-1.10)	(0.15)
Δ Loss Carry Back	0.0148	0.0355	-0.0507
	(0.19)	(0.49)	(-0.76)
Δ Thin Capitalization	0.0318	0.0409	-0.0155
	(0.54)	(0.67)	(-0.29)
Δ Other Rate Change	0.0194	0.0290	0.0189
	(0.58)	(0.88)	(0.58)
Observations	96	87	86
Countries	26	26	25
First Stage F-Stat	11.29	54.16	14.37

Notes: Table A6 presents first stage estimates from the IV estimation presented in Table 3 Panel (b) using the Kawano and Slemrod (2016) instrumental variables. Specification (1) is the first stage for Table 3 Panel (b), Column headings (1), (2), and (4) based on the country-year sample that applies to the observations for capital, employees, and assets. Specification (2) is the first stage for Table 3 Panel (b), Column heading (3) based on the country-year sample that applies to investment. Specification (3) is the first stage for Table 3 Panel (b), Column heading (5), based on the country-year sample that applies to R&D.

E Sample

Table A7: Sample Part 1

Country	1989	1994	1999	2004	2009	2014
Argentina	✓	✓	✓	✓	✓	✓
Austria	✓	✓	✓	✓	✓	✓
Bahrain	✓					
Belgium	✓	✓	✓	✓	✓	✓
Bolivia			✓	✓	✓	
Brazil	✓	✓	✓	✓	✓	✓
Bulgaria					✓	
Canada	✓	✓	✓	✓	✓	✓
Chile	✓	✓	✓	✓	✓	✓
China	✓	✓	✓	✓	✓	✓
Colombia	✓	✓	✓	✓	✓	✓
Costa Rica	✓		✓	✓	✓	
Croatia					✓	
Cyprus					✓	
Czech Republic			✓	✓	✓	✓
Denmark	✓	✓	✓	✓	✓	✓
Dominican Republic	✓			✓	✓	✓
Ecuador			✓	✓	✓	
Egypt	✓		✓	✓	✓	
El Salvador			✓	✓	✓	
Estonia					✓	
Finland	✓	✓	✓	✓	✓	
France	✓	✓	✓	✓	✓	✓
Germany	✓	✓	✓	✓	✓	✓
Greece	✓	✓	✓	✓	✓	
Guatamala	✓		✓	✓	✓	
Honduras	✓			✓	✓	
Hong Kong	✓	✓	✓	✓	✓	✓
Hungary				✓	✓	✓
India	✓	✓	✓	✓	✓	✓
Indonesia	✓	✓	✓	✓	✓	
Ireland	✓	✓	✓	✓	✓	✓
Israel	✓	✓	✓	✓	✓	✓
Italy	✓	✓	✓	✓	✓	✓
Jamaica	✓			✓	✓	
Japan	✓	✓	✓	✓	✓	✓

Notes: Table A7 shows the country-year sample for which the SOI tax variable, the BEA real activity variables, and the corresponding control variables for population, GDP per capita, openness, the real exchange rate, and the Fraser Index of economic policy all were available. Bolded countries are those used in calculating the Figure 1 tax and capital values.

Table A8: Sample Part 2

Country	1989	1994	1999	2004	2009	2014
Kazakhstan					✓	
Kenya		✓	✓			
Latvia				✓	✓	
Lithuania					✓	
Luxembourg	✓	✓	✓	✓	✓	✓
Malaysia	✓	✓	✓	✓	✓	✓
Malta				✓	✓	
Mauritius				✓	✓	
Mexica	✓	✓	✓	✓	✓	✓
Morocco	✓	✓	✓	✓	✓	
Netherlands	✓	✓	✓	✓	✓	✓
New Zealand	✓	✓	✓	✓	✓	
Nigeria	✓	✓	✓	✓	✓	
Norway	✓	✓	✓	✓	✓	✓
Pakistan				✓	✓	
Panama	✓	✓	✓	✓	✓	✓
Peru		✓	✓	✓	✓	✓
Phillipines	✓	✓	✓	✓	✓	✓
Poland			✓	✓	✓	✓
Portugal	✓	✓	✓	✓	✓	✓
Russia			✓	✓	✓	
Serbia					✓	
Singapore	✓	✓	✓	✓	✓	✓
Slovenia				✓	✓	
South Africa	✓	✓	✓	✓	✓	
Spain	✓	✓	✓	✓	✓	✓
Sweden	✓	✓	✓	✓	✓	✓
Switzerland	✓	✓	✓	✓	✓	✓
Thailand	✓	✓	✓	✓	✓	
The Bahamas	✓	✓	✓	✓	✓	✓
Trinidad and Tobago	✓		✓	✓	✓	
Turkey	✓	✓	✓	✓	✓	✓
Ukraine				✓	✓	
United Arab Emirates				✓	✓	
United Kingdom	✓	✓	✓	✓	✓	✓
Uruguay	✓	✓	✓	✓	✓	
Venezuela	✓	✓	✓	✓	✓	
Vietnam				✓	✓	
Zimbabwe	✓	✓				

Notes: Table A8 is a continuation of Table A7 and shows the country-year sample for which the SOI tax variable, the BEA real activity variables, and the corresponding control variables for population, GDP per capita, openness, the real exchange rate, and the Fraser Index of economic policy all were available.

F Other Outcomes

Table A9: Sensitivity of US Business Activity Abroad to Effective Tax Rates; Other Outcomes

	(1) Ln(R&D)	(2) Ln(Compensation)	(3) Ln(Affiliates)
Ln(1–Avg ETR)	0.811	0.881***	0.600**
	(0.577)	(0.328)	(0.249)
Year FE	✓	✓	✓
Country FE	✓	✓	✓
Observations	259	332	332
Countries	62	76	76
Adj. R^2	0.693	0.872	0.534

Notes: Table A9 performs the same analysis as is presented in Table 2 but now focuses on the outcomes Ln(R&D) in Column heading (1), Ln(Compensation) in Column heading (2), and Ln(Affiliates) in Column heading (3). All specifications include country and year fixed effects. Standard errors are presented in parentheses and clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

G Post "Check the Box"

Table A10: Post "Check the Box"

	(1) Ln(Capital)	(2) Ln(Employees)	(3) Ln(Investment)	(4) Ln(Assets)
Ln(1–Avg ETR)	1.220**	0.796**	1.681**	0.824
	(0.544)	(0.327)	(0.730)	(0.498)
Year FE	✓	✓	✓	✓
Country FE	✓	✓	✓	✓
Observations	232	234	213	232
Countries	74	74	73	74
Adj. R^2	0.549	0.530	0.361	0.761

Notes: Table A10 performs the same analysis as is presented in Table 2 but limits the analysis to years after 1997, when "check-the-box" rules were implemented. All specifications include country and year fixed effects. Standard errors are presented in parentheses and clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$