Worldwide taxes, agency conflicts, and investment

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ABSTRACT

Does the worldwide tax system encourage US firms to overinvest abroad? Using confidential data on the foreign subsidiaries of US multinational firms, we construct and calibrate a firm investment model that incorporates details of the US tax code, in addition to agency conflicts between managers and shareholders. We find that the worldwide tax code causes firms to invest 4.9–11.5\% more at their foreign subsidiaries relative to a territorial system. This effect is increasing in the marginal US corporate income tax rate faced by the firm. Our calibrated model indicates that agency conflicts account for only a small fraction of the excess foreign investment by the average firm. However, managers with low equity ownership have a strong incentive to overinvest. Both managers and shareholders find higher investment beneficial to reduce expected tax costs.

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1. **Introduction**

The US is one of the few developed countries that uses a worldwide tax system, i.e., the US imposes a tax liability on the foreign-derived income of US corporations. Because firms are allowed to defer paying taxes on foreign income as long as those earnings are kept overseas, US companies have accumulated large amounts of cash overseas as they seek to avoid or delay paying US taxes on their foreign earnings. In a prominent case, Apple has accumulated $253 billion in cash overseas, equaling roughly one third of its $804 billion market capitalization.\(^1\) Recent estimates put the total amount of overseas cash to be around $2.5 trillion and growing rapidly. These accumulated foreign earnings have been termed “trapped cash” because firms find it optimal to defer repatriation indefinitely.

A potential concern is that the large amount of trapped cash held by US companies encourages these firms to invest in foreign operations, potentially at the expense of US investment, or that the inability to access this cash reduces the ability of US firms to invest domestically. In addition, there may be concern that this cash exacerbates agency conflicts between management and shareholders. While some recent evidence has suggested that corporate investment may be distorted by the presence of unrepatriated cash (e.g., Hanlon, Lester, and Verdi, 2015 and Harford, Wang, and Zhang, 2016), there is still not a consensus as to whether these distortions exist, their magnitude, or the role agency conflicts play in these decisions.

We construct a structural investment model of the foreign operations of a US multinational in order to assess the effect of the worldwide tax system on real firm decisions and tax collection. In the model, foreign subsidiaries face trade offs between investment, holding “cash” in the form of financial assets, and paying dividends. Due to the worldwide tax system, the trade offs facing the foreign subsidiary are distinct from those encountered in domestic operations. The manager, who makes investment and repatriation decisions, has private incentives that come through three distinct channels shown to be significant in

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\(^1\) According to Apple’s 2017 10-K, the firm’s foreign subsidiaries held roughly $253 billion in cash, cash equivalents, and marketable securities. With a share price of $154.12 and 5,217 million shares outstanding, per the 10-K, Apple’s market capitalization was roughly $804 billion.
Nikolov and Whited (2014): managers share in firm profits, own equity in the firm, and have the ability to divert resources for private consumption. We calibrate the model using confidential data from the Bureau of Economic Analysis (BEA) on the foreign subsidiaries of US multinationals. The calibrated model reveals how tax and agency incentives interact to give rise to distortions in foreign investment, productivity, and tax collections relative to alternative tax policies.

Consistent with the data and anecdotal evidence, we find that under the current tax system it is generally optimal for foreign subsidiaries to defer repatriation indefinitely by holding cash until tax reform occurs. More importantly, we find that the worldwide tax system causes US firms to invest more in foreign operations than they would under a territorial system. In our benchmark calibration, firms choose capital 4.9% higher, resulting in a marginal product of capital 1.9% lower, relative to a territorial tax system. This is the result of two competing effects: higher average tax rates from the worldwide system lowers investment, while repatriation costs reduce the opportunity cost of investing in real assets. The latter effect dominates and firms invest more overseas under the worldwide system.

Moving to a territorial system results in an increase of 2.2% in the non-cash value of the firm, as the average effective tax rate declines and investment distortions are relieved. The territorial system eliminates US tax revenue from foreign operations, and has a modest effect on foreign tax collections. Together, global corporate income taxes are 59% higher under the worldwide system. As expected, we find that moving to a low US corporate tax rate has a similar effect on firm decisions as moving to a territorial system.

The distortions from the worldwide tax system are stronger for firms that face a higher marginal US tax rate. For example, firms that face a 35% US rate choose capital 11.5% higher under the territorial system, and experience returns of 3.4% in moving to a territorial system. This is because a higher US tax rate increases the tax cost of holding cash overseas, lowering the opportunity cost of real investment. The distortion is also stronger when firms expect higher repatriation costs under future tax reform, either because tax reform is less likely to occur or because future repatriation tax rates are expected to be higher. Expectations about
future policy action have significant effects on current investment decisions.

With respect to agency conflicts, we find that, for the average firm, the manager’s profit sharing, coming through bonus compensation, causes an increase in foreign investment because of the incentive to increase output. In contrast, the manager’s ability to divert resources decreases foreign investment as this makes holding cash more valuable. Together, these effects roughly offset each other, and we find only a modest distortion on investment or cash holdings driven by agency conflicts. Most of the distortions that affect firm value and investment come through tax incentives that affect both the manager and shareholder comparably. However, for managers with low equity ownership, the agency distortions can be large, with the profit sharing incentive generally dominating. Thus we predict low equity ownership can lead to higher foreign investment.

We also find that agency conflicts affect the decision of whether to immediately repatriate earnings or accumulate cash overseas. In particular, holding cash overseas gives the manager greater ability to divert resources for private benefit. However, under reasonable parameter values the distortion is quantitatively small, and the tax incentives are the first-order driver of the repatriation decision. In addition, we show that the nominal return the firm receives on cash holdings has a significant effect on the repatriation decision and the tax cost of holding cash. Because the firm is taxed on nominal returns, higher returns increase the tax cost of holding cash and encourages immediate repatriation.

The firm faces a variety of tradeoffs with respect to repatriation, holding cash, and investing in operations. Under most parameter specifications, the manager and shareholder both prefer holding foreign earnings as cash and wait for tax reform to allow repatriation at favorable rates. This deferral option is not without cost in that returns on cash holdings, invested in financial assets, face corporate income taxation. This tax cost is similar to that on domestic cash holdings of US firms, e.g. Riddick and Whited (2009): a dollar held inside the firm faces higher taxes on returns than that same dollar held by the shareholder. However, because of high repatriation tax costs, paying a dividend is not a feasible option as it is with domestic cash holdings. Even with no external financing costs, the firm chooses to retain
earnings and accumulate cash.

The tax cost on cash held inside the foreign subsidiary lowers the opportunity cost of real investment. This effect will tend to increase the investment in foreign operations. In contrast, a worldwide system increases the expected tax rate on foreign profits relative to the territorial system in which taxes are only paid in the foreign country. This will tend to reduce real investment. We find that under the parameterizations we consider, the former effect dominates and the firm chooses to invest more under the worldwide system. In other words, “trapped cash” does result in higher foreign investment, but this higher investment is preferred by shareholders. Thus we cannot interpret higher investment resulting from the worldwide system to be an agency distortion that results in value loss for shareholders. Instead, higher investment is a rational response to the tax incentives created by the combination of high US tax rates, US taxation of foreign earnings, and the option to defer repatriation. While agency conflicts can lead to a loss in shareholder value and a distortion in investment, we find these effects to be quantitatively small relative to the pure tax effects for firms that provide sufficient equity ownership to the manager.

The results contribute to several strands of the existing literature. First, our results inform the literature on corporate cash. Faulkender, Hankins, and Petersen (2017) present evidence that a substantial portion of the cash that has recently accumulated on firms’ balance sheets is held abroad and driven by tax incentives. Graham and Leary (2017) similarly cite the role of repatriation incentives in the recent run up in corporate cash balances. Duchin, Gilbert, Harford, and Hrdlicka (2017) show that a sizable portion of the financial assets firms hold on their balance sheets are not cash. Under certain conditions, when these non-cash financial assets are held abroad, they generate substantial income streams that are tax disadvantaged, constituting an important penalty inherent in the U.S. worldwide tax system which we address. More closely related methodologically is Gu (2017), who uses a dynamic model to show that the differential in cash holdings at multinational relative to domestic firms would diminish by 42% if repatriation taxes were eliminated. Our study builds on this work by exploring the impact of this cash on firm investment policy, particularly in
its relation to agency problems.\(^2\)

We also contribute to the corporate cash literature by exploring how the worldwide tax system distorts the cash holdings decision of firms. In Riddick and Whited (2009), firms hold cash due to a precautionary savings motive: firms trade off the reduction in the expected present value of external financing costs against the tax costs of holding cash. In our model, foreign subsidiaries do not face costly external financing but instead retain cash to avoid repatriation costs. These repatriation costs result in a distortion in their investment decisions. Nikolov and Whited (2014) builds upon Riddick and Whited (2009) to include three channels for agency conflicts to affect the firm’s cash holdings decision. Our model employs the same agency conflicts as in Nikolov and Whited (2014). In our model, however, the trade off faced by managers is different because the tax costs of repatriation are sufficiently high that the subsidiary avoids paying a dividend. Because it is optimal for both managers and shareholders to accumulate cash indefinitely, managers have a greater ability to divert resources.

Our results also relate to the literature on the role of tax policy in the location of investment. Hines and Rice (1994) and Devereux and Griffith (1998) show that corporate taxes are a key determinant in where U.S. multinational firms locate their foreign subsidiaries. Desai, Foley, and Hines (2004) highlight the importance of indirect taxes in multinational firms’ investment decisions. Hines (1996) finds that foreign direct investment in the U.S. is sensitive to state corporate tax rates.\(^3\) Our findings extend this literature in that we explore the interaction between tax incentives and financing and agency frictions in firms’ decisions to invest abroad.

Finally, our findings relate to the work on the tax holiday provided for under the American Jobs Creation Act (AJCA) of 2004. The AJCA allowed firms to repatriate foreign earnings at a reduced 5.25% tax rate provided the funds were invested in the U.S. Dharmapala, Foley, and Forbes (2011) find that while firms indeed repatriated a substantial amount of foreign

\(^2\)Bakke and Gu (2017) also study cash with a dynamic model, although they do not consider the geographic aspect of firms’ cash holdings.

\(^3\)The empirical literature is large. Devereux and Maffini (2007) provide a survey.
earnings, on average there was no significant impact on corporate investment. Instead, funds earmarked for investment were paid out to shareholders and were replaced by the repatriated foreign earnings. Faulkender and Petersen (2012) also analyzes the investment impact of the AJCA. They also find no change in investment on average. When considering a subset of financially constrained firms, however, they do find evidence that funds repatriated under the AJCA facilitated domestic investment. Our work is complementary in that we also consider the impact of a policy change permitting the repatriation of foreign earnings at a reduced tax rate but instead focus on investment by U.S. multinationals outside the U.S.

The remainder of the paper is organized as follows. In section 2 we describe the model. In section 3 we discuss the data and calibration. In Section 4 we use the model to illustrate the firm’s tradeoff between repatriating, holding cash, and investing in capital. Section 5 presents the results from model counterfactuals where we change various features of the tax code and agency conflicts. Section 6 concludes.

2. Model

Consider a foreign subsidiary of a US multinational firm. We assume that this subsidiary has operations independent of its US parent. The foreign subsidiary generates earnings before taxes of

\[ E_t = Z_t K_t^\alpha - \delta K_t - f. \]  \hspace{1cm} (1)

where \( K_t \) is physical capital, \( f \) is the fixed cost of production, \( \delta \) is the depreciation rate, and \( \alpha < 1 \) is the returns to scale. The profitability process follows an AR(1) in logs:

\[ \log(Z_{t+1}) = \rho \log(Z_t) + \sigma \epsilon_{t+1} \]  \hspace{1cm} (2)

where \( \epsilon_t \) follows a truncated standard normal distribution. The firm accumulates physical capital according to:

\[ K_{t+1} = (1 - \delta) K_t + I_t \]  \hspace{1cm} (3)
where $I_t$ is investment in new capital. The firm faces convex costs of adjustment to physical capital of

$$
\Phi(I_t, K_t) \equiv \phi \left( \frac{I_t}{K_t} \right)^2 K_t. \tag{4}
$$

The foreign government taxes earnings at a rate $\tau_F$, leaving after-tax earnings of

$$(1 - \tau_F)E_t. \tag{5}$$

We assume for simplicity that the firm receives the full value of foreign tax losses through the use of carryforwards and carrybacks.

While the US parent generates a US tax liability for the earnings of its foreign subsidiary, firms have the option to defer this tax liability by keeping the earnings at the foreign subsidiary. The subsidiary can use these unrepatriated earnings to further invest in foreign operations or to buy financial assets. We denote by $C_t \geq 0$ the accumulated unrejected by foreign earnings the firm generated in the periods prior to time $t$. These assets are held in liquid financial assets that we will refer to, for convenience, as “cash.” The firm may freely invest cash in physical assets, but must pay US corporate income tax at a rate $\tau_{US}$, less any credit for foreign taxes paid, in order for the US parent to access this cash for domestic investment or paying a dividend to shareholders.

Each period, the unrepatriated cash $C_t$ generates return at a rate $r$ that is immediately taxed at a combined rate of $\tau_{US}$. The return on financial assets is classified as passive income by the IRS, and is not eligible for deferral. The value, after repatriation tax, of the return on financial assets is

$$
F_t \equiv (1 - \tau_{US})rC_t. \tag{6}
$$

We allow for potential agency conflicts between management and shareholders by allowing management to make financing and investment decisions that maximize their own utility. We allow for distortions arising from compensation as well as perquisite consumption following the approach of Nikolov and Whited (2014). First, we specify the manager’s compensation using standard contracts observed in the data. In particular, the manager holds a fraction $\theta$ of equity in the firm, and receives fraction $b$ of per-period profits as a form of cash compensation,
i.e. a bonus. We assume that managers and shareholders are risk neutral, which means that equity holdings help to align the manager with shareholders. Bonus compensation, in contrast, may encourage managers to increase output at the expense of equity value. Finally, we allow the manager to enjoy private consumption of a portion of current cash flows and cash holdings. This captures the manager’s ability to divert firm resources towards utility-enhancing projects or for private use.

Each period, the foreign subsidiary pays the following dividend to the US parent:

$$\tilde{d}_t = (1 - b - s)(1 - \tau_F)E_t + \delta K_t + (1 - s)(1 + (1 - \tau_{US})r)C_t - C_{t+1} - I_t - \Phi(I_t, K_t).$$  \hfill (7)

When the dividend to the US parent exceeds the after-tax return on financial assets $F_t$, which is automatically repatriated, a repatriation tax occurs. The dividend to the US parent, after accounting for repatriation taxes is given by

$$d_t = \begin{cases} 
\tilde{d}_t & \text{if } \tilde{d}_t \leq F_t, \\
F_t + \frac{1 - \tau_{US}}{1 - \tau_F} (\tilde{d}_t - F_t) & \text{if } \tilde{d}_t > F_t 
\end{cases} \hfill (8)$$

In other words, there are no repatriation taxes paid if the dividend is less than the after-tax cash flow from investment in financial assets, $F_t$. Repatriation tax must be paid on any dividend paid above that amount. We can rewrite this expression as:

$$d_t = \tilde{d}_t - \frac{\tau_{US} - \tau_F}{1 - \tau_F} \max \left\{ 0, \tilde{d}_t - F_t \right\}. \hfill (9)$$

The expression $\frac{\tau_{US} - \tau_F}{1 - \tau_F}$ represents the cost of repatriating a dollar of foreign earnings, after accounting for foreign tax credits.

The manager makes investment, cash holdings, and repatriation decisions in order to maximize her own utility. Given her equity holdings $\theta$, bonus compensation $b$, and ability to divert resources at a rate $s$, the manager’s per-period utility is given by

$$u(Z_t, K_t, C_t, K_{t+1}, C_{t+1}) = \theta d_t + (b + s)(1 - \tau_F)E_t + \delta K_t + s(1 + (1 - \tau_{US})r)C_t. \hfill (10)$$

\footnote{We abstract from options holdings and account for this derivative compensation in our measurement of equity holdings.}
The manager’s total utility is then defined recursively as

$$ U(Z_t, K_t, C_t) = \max_{K_{t+1}, C_{t+1}} \{ u(Z_t, K_t, C_t, K_{t+1}, C_{t+1}) + \beta \mathbb{E}_t [ U(Z_{t+1}, K_{t+1}, C_{t+1}) ] \} $$

(11)

s.t. $C_t \geq 0$, $K_t \geq 0$. 

(12)

Given the manager’s chosen investment and financing policies, denoted $K^*(\cdot)$ and $C^*(\cdot)$, the market value of the firm is given by

$$ V(Z_t, K_t, C_t) = d_t + \mathbb{E}_t [ \beta V(Z_{t+1}, K^*(Z_t, K_t, C_t), C^*(Z_t, K_t, C_t)) ] . $$

(13)

Note that the manager will choose policies to maximize shareholder value (i.e., no agency conflicts) when $\theta = 1$, $b = 0$, and $s = 0$.

2.1. Tax reform: moving to a territorial system

Unrepatriated foreign earnings make up a significant fraction of the cash holdings of US firms. One likely explanation for this accumulation is that firms expect, with some positive probability, that tax reform or a tax holiday will occur at some future date, allowing firms to bring back unrepatriated earnings at a lower rate (De Simone, Piotroski, and Tomy (2017)). As this anticipation effect may have important consequences for the chosen cash and investment policies of firms, we build the possibility of tax reform into the model. This will also allow us to evaluate how a dynamic tax policy interacts with firm decisions.

We suppose that each period there is a time-invariant probability $\lambda$ that the US government permanently changes the tax code such that the unrepatriated cash holdings, $C_t$, are repatriated at some rate $\tau_R$ and future foreign earnings are taxed under a territorial tax system. Note that given there are no cost of financing, under the territorial tax system it is no longer shareholder-optimal to hold cash in the foreign subsidiary. However, we allow the manager to maintain cash holdings to allow for potential agency conflicts. In a territorial tax system, the dividends from the foreign subsidiary to the US parent are

$$ d^\text{terr} = (1 - b - s)(1 - \tau_F)E_t + \delta K_t + (1 - s)(1 + (1 - \tau_F)r)C_t - C_{t+1} - I_t - \Phi(I_t, K_t) $$

(14)
and the manager receives per-period utility of

$$u(Z_t, K_t, C_t, K_{t+1}) = \theta d^{\text{terr}} + (b + s)(1 - \tau_F)E_t + s(1 - \tau_F)rC_t$$  \hspace{1cm} (15)$$

with the manager maximizing her expected utility by choosing investment:

$$U(Z_t, K_t, C_t) = \max_{K_{t+1}} \{ u(Z_t, K_t, C_t, K_{t+1}) + \beta E_t[U(Z_{t+1}, K_{t+1}, C_{t+1})] \}.$$ \hspace{1cm} (16)$$

Given this manager-chosen investment and cash holdings policy, $K^{*,\text{terr}}(\cdot)$ and $C^{*,\text{terr}}(\cdot)$, the market value of the foreign subsidiary under a territorial tax system is

$$V^{\text{terr}}(Z_t, K_t, C_t) = \{ d_t^{\text{new}} + E_t[\beta V^{\text{terr}}(Z_{t+1}, K^{*,\text{terr}}(Z_t, K_t, C_t), C^{*,\text{terr}}(Z_t, K_t, C_t))] \}.$$ \hspace{1cm} (17)$$

We assume that on the arrival of tax reform, all unrepatriated cash holdings are taxed at the rate $\tau_R$. Therefore, the value of the firm prior to the realization of the tax reform shock can be written as

$$V(Z_t, K_t, C_t) = \lambda \{ (1 - \tau_R)(1 + (1 - \tau_F)r)C_t + V^{\text{terr}}(Z_t, K_t, 0) \}$$

$$+ (1 - \lambda) \max_{C_{t+1}, K_{t+1}} \{ d_t + E_t[\beta V(Z_{t+1}, K_{t+1}, C_{t+1})] \}.$$ \hspace{1cm} (18)$$

Notice that for sufficiently low repatriation tax rate $\tau_R$, it is optimal to never repatriate any foreign earnings and instead hold them until reform occurs, hence the term “trapped cash.” In fact, this will be true under our benchmark calibration. As a consequence, cash holdings $C_t$ can grow arbitrarily large. Next, we derive the shareholder and manager values for a dollar of trapped cash.

2.2. The value of cash holdings

Under realistic tax parameters, the foreign subsidiary’s optimal policy is to never repatriate any foreign earnings. This means that the foreign subsidiary will accumulate cash until tax reform occurs. Once the subsidiary has exhausted its need for internal financing of new capital, what is the value of this cash held until tax reform?
As cash holdings become large, the firm expects to hold each additional dollar of cash until tax reform occurs. Define $\eta$ as the expected present value of the after-tax value of a dollar that is held inside the subsidiary until tax reform occurs:

$$
\eta \equiv \beta \lambda (1 - \tau_R)(1 + (1 - \tau_F)r) \sum_{i=0}^{\infty} \beta (1 - \lambda) (1 + (1 - \tau_{US})r)(1 - s)^i
$$

$$
= \frac{\beta \lambda (1 - \tau_R)(1 + (1 - \tau_F)r)}{1 - \beta (1 - \lambda)(1 + (1 - \tau_{US})r)(1 - s)}.
$$

(19)

A cash-rich firm, that expects to hold a marginal dollar inside the firm until repatriation, is indifferent between having an extra dollar of unrepatriated cash holdings and $\eta$. Specifically, for sufficiently large values of $C_t$,

$$
\frac{\partial E_t V(Z_{t+1}, K_{t+1}, C_{t+1})}{\partial C_{t+1}} \approx \eta.
$$

(20)

Similarly, the present value of the manager’s resource diversion of a dollar held inside the firm until tax reform is

$$
\gamma \equiv \beta (1 - \lambda)(1 + (1 - \tau_{US})r)s \sum_{i=0}^{\infty} \beta (1 - \lambda)(1 + (1 - \tau_{US})r)(1 - s)^i
$$

$$
= \frac{\beta (1 - \lambda)(1 + (1 - \tau_{US})r)s}{1 - \beta (1 - \lambda)(1 + (1 - \tau_{US})r)(1 - s)}.
$$

(21)

We assume that the manager does no resource diversion in the period that tax reform occurs. Therefore, for sufficiently large values of $C_t$,

$$
\frac{\partial E_t U(Z_{t+1}, K_{t+1}, C_{t+1})}{\partial C_{t+1}} \approx \gamma.
$$

(22)

Given the expressions for the expected present value of a marginal dollar of cash held inside the foreign subsidiary, $\eta$, and similarly for resource diversion, $\gamma$, we can quantify under what conditions the firm will immediately repatriate a marginal dollar of earnings. The shareholder prefers immediate repatriation (rather than holding cash in the foreign subsidiary) if

$$
\left(1 - \frac{\tau_{US} - \tau_F}{1 - \tau_F}\right) \geq \eta.
$$

(23)
From the perspective of the manager, the decision to immediately repatriate trades off the tax costs with the ability to divert resources on cash held inside the subsidiary. The manager prefers immediate repatriation only when the manager’s share of the dividend exceeds the expected present value of holding the cash in the foreign subsidiary until tax reform occurs:

\[
\left(1 - \frac{\tau_{US} - \tau_F}{1 - \tau_F}\right) \theta \geq \gamma + \theta \eta.
\] (24)

Notice that when \( \theta = 1 \) and \( s = 0 \), conditions (23) and (24) are identical.

For computational convenience, we can rewrite the firm’s problem where it has the option to convert unrepatriated cash holdings into its expected present value, \( \eta \), by setting the repatriation tax rate to the minimum of the statutory rate and \( (1 - \eta) \):

\[
\hat{d}_t = \tilde{d}_t - \min\left\{ \frac{\tau_{US} - \tau_F}{1 - \tau_F}, 1 - \eta \right\} \max\left\{ 0, \tilde{d}_t - F_t \right\}
\] (25)

This specification differs from Eq. (9) only when the repatriation rate (after accounting for foreign tax credits) is greater than \( (1 - \eta) \). In this case, the foreign subsidiary can pay a dividend to the US parent equal to the expected present value of holding cash inside the firm until repatriation is forced through tax reform. One way to think of this dividend is that the firm has the option to put unrepatriated foreign earnings into a savings account that generates return \( r \) until tax reform occurs, where the balance cannot be withdrawn by the firm. This cost to the firm of this withdrawal restriction becomes small as the level of liquid assets, \( C_t \), becomes sufficiently high. Therefore, the expected present value of a marginal dollar inside the foreign subsidiary is

\[
\max\left\{ 1 - \frac{\tau_{US} - \tau_F}{1 - \tau_F}, \eta \right\}
\] (26)

The manager receives the present value of the future resource diversion from the cash holdings until tax reform occurs, given by \( \gamma \), in addition to the present value of future dividends proportional to their equity holdings. In this setting the manager’s per-period utility is given by

\[
u(Z_t, K_t, C_t, K_{t+1}, C_{t+1}) = \theta \hat{d}_t + (b + s)(1 - \tau_F)E_t + s(1 + (1 - \tau_{US})r)C_t + \gamma \max\left\{ 0, \tilde{d}_t - F_t \right\}.
\] (27)
Given this new per-period utility, the manager’s total utility is still defined by Eq. (11), with the additional constraint that $C_t < \bar{C}$. For $\bar{C}$ is sufficiently large, the firm’s value will closely approximate the firm with unconstrained cash.

3. Data and calibration

We focus on a sample of foreign affiliates of US multinationals from BEA’s annual surveys on US Direct Investment Abroad.\textsuperscript{5} The surveys are conducted pursuant to the International Investment and Trade in Services Survey Act (hereafter the Act). The Act stipulates that the use of an individual company’s data for tax, investigative, or regulatory purposes is prohibited. Willful noncompliance with the Act may result in imprisonment for up to one year. For these reasons, in addition to their monitoring of corporate events and a system of internal data integrity checks, BEA believes the surveys accurately capture virtually complete data on the universe of U.S. direct investment abroad.

BEA’s surveys provide detailed data on the foreign affiliates’ financial and operating characteristics, including information on their income statements and balance sheets. We limit the sample to majority-owned affiliates, which are commonly referred to as "subsidiaries," the term used in this paper. In addition, we omit subsidiaries in the financial services (SIC 6000-6999) and regulated utilities (SIC 4900-4999) industries.

We merge these data with Execucomp to obtain data on managers’ bonus compensation and their equity ownership. This results in a sample period of 1990–2010, inclusive. 1990 is the first year for which data are available from Execucomp. 2010 is last year for which BEA’s microdata have been finalized at the time of writing.

The model parameters used in the benchmark specification are shown in Table I. First, we choose parameters for the discount rate $r$ consistent with the existing literature. We set the foreign corporate income tax rate $\tau_F$ to 11.2%, the median\textsuperscript{6} effective rate observed in

\textsuperscript{5}These data are collected for the purpose of producing publicly available aggregate statistics on the activities of multinational enterprises.

\textsuperscript{6}To satisfy confidentiality requirements, we do not report the true median, as it corresponds to a value reported by a respondent. Instead, we report the average of the inner five observations.
our sample, and the US corporate income tax rate to 20.9% using a similar approach. This estimated US corporate income tax rate likely understates the marginal tax rate that these firms face, and we therefore consider alternative rates as part of our analysis.

Second, we choose the production parameters such that the moments from the model-simulated data approximate their empirical counterparts in the BEA data on the foreign subsidiaries of US multinationals. Specifically, we attempt to match the means, standard deviations, and serial correlations of the investment rate and profitability, as well as the frequency of negative earnings. These seven moments help to identify the parameters of the profitability process $Z_t$ (specifically, persistence $\rho$, volatility $\sigma$, and returns to scale $\alpha$), the fixed costs of production $f$, the adjustment cost parameter $\phi$, and the depreciation rate $\delta$.

We calculate the investment rate as the ratio of capital expenditures to lagged gross property, plant, and equipment. Profitability is the ratio of taxable income to total assets. Taxable income is the sum of net income and foreign taxes paid. We winsorize the investment rate and profitability (and all variables constructed from the data) at the 2.5% and 97.5% thresholds of their empirical distributions to mitigate the influence of outliers.

Finally, we choose parameters for the manager’s compensation using data from Execucomp. For this sample of CEOs, the average equity ownership is 2.0%, and the ratio of bonus to operating income is 0.1%. We use these values for the ownership and bonus parameters $\theta$ and $b$, respectively. For the resource diversion parameter, $s$, which we cannot directly observe, we use the estimates from Nikolov and Whited (2014) for the sample of large firms: $1000 \times s = 0.04$. This corresponds to an ability of the manager to expropriate 0.4 basis points of cash and profits each period. Given we are unable to directly estimate this parameter using the identification approach of Nikolov and Whited (2014) due to data limitations (we do not have market prices for foreign subsidiaries), we explore different values for this parameter to quantify its importance and for robustness.

The basic moments from the benchmark calibration of the model, along with their empirical counterparts, are shown in Table II. The model does well to match the investment and profitability moments in the data.
4. Trading off repatriation, cash, and investment

When the foreign subsidiary generates a dollar of earnings, it has three options as to how to use this source of funds: invest in operations in the foreign country, invest in financial assets (i.e. hold as overseas cash), or immediately repatriate and pay US corporate income tax. Investment in capital exhibits decreasing returns to scale. Therefore, investment in capital will occur up until the point at which the marginal benefit of a dollar of capital is equal to the marginal value of a marginal dollar inside the foreign subsidiary. This marginal dollar inside the foreign subsidiary can then either be immediately repatriated or held as cash until tax reform occurs. Without costly financing, the marginal values of both options are constant. For a given set of parameters, the firm will choose to always repatriate or always hold cash until tax reform occurs. We first discuss the decision to repatriate and the value of holding cash, followed by discussing the capital investment decision.

4.1. Repatriation and the value of cash

The value of immediately repatriating a dollar of earnings, for the manager, is

\[
\left(1 - \frac{\tau_{US} - \tau_{F}}{1 - \tau_{F}}\right) \theta. \tag{28}
\]

This value is declining in the spread between the US and foreign tax rates. Alternatively, the manager can hold cash inside the foreign subsidiary until tax reform occurs. The present value of holding a dollar inside the foreign subsidiary is

\[
\gamma + \theta \eta \tag{29}
\]

where \(\gamma\) is the expected present value of the manager’s resource diversion given in Eq. (21) and \(\eta\) is the expected present value for shareholders of a dollar held inside the foreign subsidiary until tax reform given in Eq. (19). When Eq. (28) exceeds Eq. (29), the manager prefers to repatriate immediately. This is condition (24).

To understand the trade off between immediate repatriation and holding cash, we begin by exploring the shareholder value of holding cash. Figure 1 plots the expected present
value of a dollar of earnings (after foreign tax) by varying parameter values in the model. All other parameter values are held at their benchmark values reported in Table I. Panel A varies the probability of the tax reform, $\lambda$, shown for three different US tax rates. The expected present value of a dollar held as cash is weakly increasing in $\lambda$, as the expected time until tax reform is decreasing in the arrival intensity. The value is decreasing in the US tax rate because a high US tax rate increases the tax cost of holding cash. For sufficiently low value of $\lambda$, the manager decides to immediately repatriate which can be seen as the flat regions of the plot.

Panel B varies the tax reform repatriation cost, $\tau_R$. Recall that the repatriation cost conditional on reform, $\tau_R$, is the rate over and above the foreign tax credit, where $\tau_R = 0$ corresponds to the foreign tax credit fully offsetting any US taxes triggered by repatriation. At a low US tax rate of 15%, the manager always immediately repatriates and therefore the tax rate during tax reform is irrelevant. For higher US tax rates, higher repatriation rates lower the value of cash, where immediate repatriation occurring when the rate is sufficiently high. Panel C shows a similar pattern for varying the rate of return on investment. Because taxes on the return to financial assets are based on nominal values, higher nominal rates increase the tax costs of holding cash.

Holding cash inside the foreign subsidiary allows the manager to divert resources to create private value. The expected present value of this resource diversion is given by $\gamma$ in Eq. (21). Figure 2 plots the value of $\gamma$ for various parameter values. All other parameter values are held at their benchmark values.

Panel A shows the value of $\gamma$ for a range of US tax rates and for low, medium, and high resource diversion parameters. For low US tax rates, the manager immediately repatriates cash and therefore receives no value from diverting resources from the foreign subsidiary’s cash holdings. For higher US tax rates, the manager defers repatriations and receives a present value of resource diversion that is increasing in $s$. The magnitudes of $\gamma$ are quantitatively small in comparison to the manager’s share of the cash holdings through her stock ownership ($\theta \eta$).
Panel B reports the value of $\gamma$ for a range of tax reform arrival intensities $\lambda$ for low, medium, and high US tax rates. For low values of $\lambda$, the manager prefers to immediately repatriate and $\gamma$ is zero. When the probability of tax reform is sufficiently high, the manager prefers to wait for tax reform and holds cash inside the subsidiary, diverting resources each period. The time until tax reform decreases in $\lambda$, and therefore so does the manager’s expected present value of resource diversion, $\gamma$. Panel C shows the value for a range of US tax rates for low, medium, and high values for $\lambda$. Again, we see that immediate repatriation occurs at lower US tax rates when $\lambda$ is high. In addition, conditional on holding cash inside the foreign subsidiary, instead of immediately repatriating, the expected present value of resource diversion is significantly decreasing in $\lambda$.

The effect of the manager’s equity ownership is shown in Panel D. The higher the ownership, the less value the manager gets from resource diversion, $\gamma$, relative to her value of direct ownership of the cash holdings, $\theta\eta$. Therefore, immediate repatriation is less likely to occur when the manager’s equity ownership is low. Instead, the manager prefers to hold cash and divert resources.

Having explored the expected present value of holding cash until tax reform, as well as the present value of the manager’s resource diversion, we now turn to the decision of whether to immediately repatriate. Figure 3 explores how the decision to either immediately repatriate or defer repatriation varies with the model parameters. Immediate repatriation occurs when condition (24) is satisfied. Each panel shows the regions under which the manager chooses to defer repatriation until tax reform occurs (white) and to immediately repatriate and pay US corporate income taxes (gray) by varying the parameter values shown on the horizontal and vertical axes. The model parameters not shown on the axes are held at the benchmark values given in Table I.

Panel A shows the repatriation decision as a function of the US and foreign tax rates. A higher spread between the US and foreign tax rates generates a higher cost of immediate repatriation, seen in the left hand side of expression (24). The tax cost of holding cash inside the foreign subsidiary is also increasing in the spread in the tax rates, which can be seen
in the expression for $\eta$ given in Eq. (19). Together, the manager repatriates only when the spread between the US and foreign rates are small, shown in the lower right hand corner.

The effect of the manager’s personal value of resource diversion from holding cash in the foreign subsidiary, $\gamma$, is quantitatively small at the benchmark level of equity holding. This can be seen in Panel B which shows the repatriation decision for different US tax rates and diversion parameter $s$. The manager’s value of holding cash, $\gamma$, is increasing in $s$, and the present value of holding cash until repatriation, $\eta$, is decreasing in $s$. The latter effect dominates, causing immediate repatriation to be increasing in $s$. However, the quantities are sufficiently small at reasonable resource diversion parameter values that the positive slope is not perceptible.

Panel C shows the repatriation decision for different levels of the US tax rate and the probability of tax reform, $\lambda$. Immediate repatriation is decreasing in the US tax rate, as this corresponds to lower repatriation costs. Repatriation is also decreasing in the arrival intensity, as a higher $\lambda$ lowers the present value of tax costs the firm pays while waiting for tax reform.

Finally, Panel D varies the tax reform repatriation cost, $\tau_R$, and the probability of tax reform, $\lambda$. A higher repatriation cost $\tau_R$ means that the expected costs of waiting to repatriate are increasing, making immediate repatriation relatively more attractive. This interacts with the tax reform arrival intensity $\lambda$, which has the same effect as described in Panel C. Deferral is most attractive when reform is likely to happen and repatriation costs conditional on reform are low.

4.2. The capital investment decision

The previous subsection describes the firm’s decision over whether to immediately repatriate or hold as cash an extra dollar that is not being spent on physical capital. This decision, given by condition (24), is independent of the firm’s state and amounts to minimizing the tax costs of disgorging a marginal dollar of earnings. However, this tax cost associated with holding or paying out cash changes the opportunity costs of physical capital
investment the firm faces. In particular, the tax costs of holding or paying out cash makes physical capital look relatively cheap.

To see this, consider a simplifies version of the model with no agency conflicts and no cash holdings. Instead, the value of a dollar of earnings inside the firm is worth $\xi < 1$ due to immediate or expected tax costs. Then the firm’s dividend, before tax costs, is

$$d_t \equiv (1 - \tau_F)(Z_t K_t^\alpha - \delta K_t - f) + \delta K_t - I_t - \Phi(K_{t+1}, K_t) + \beta \mathbb{E}[V(K_{t+1}, Z_{t+1})|Z_t]$$

With repatriation costs, the dividend is

$$d_t = \begin{cases} d_t & \text{if } d_t \leq 0, \\ \xi d_t & \text{if } d_t > 0. \end{cases} \quad (30)$$

Firm value is

$$V(K_t, Z_t) = \max_{K_{t+1}} \{d_t + \beta \mathbb{E}[V(K_{t+1}, Z_{t+1})|Z_t]\}.$$ 

(31)

To find the optimal capital choice, we take the first order condition:

$$\frac{\partial d_t}{\partial K_{t+1}} + \beta \mathbb{E} \left[ \frac{\partial V(K_{t+1}, Z_{t+1})}{\partial K_{t+1}} \bigg| Z_t \right] = 0. \quad (32)$$

For the region where $d_t > 0$, the firm is paying the tax costs and $d_t = \xi \tilde{d}_t$. The FOC becomes

$$\beta \mathbb{E} \left[ \frac{\partial V(K_{t+1}, Z_{t+1})}{\partial K_{t+1}} \bigg| Z_t \right] = \xi \left( 1 + \frac{\partial \Phi(K_{t+1}, K_t)}{\partial K_{t+1}} \right). \quad (33)$$

Note that when we have no worldwide taxation or tax holding costs, $\xi = 1$ and we have the usual investment FOC. With $\xi < 1$, all else equal, this has the effect of lowering the opportunity cost of investment, causing the firm to choose higher investment. Separately, changes in taxes affect the expected value of a marginal unit of capital (the left hand side). Generally, changes in tax rates or the tax system will affect both sides of the FOC, making it difficult to make general statements about the effect of taxes on the level of investment.

5. The effect of taxes and agency conflicts on foreign investment

In this section we use the model to evaluate counterfactual tax policies. In particular, we show how the foreign subsidiary investment, profits, and taxes paid would change if the
US adopted a territorial system, eliminated deferral of unrepatriated earnings, or reduced the US tax rate. We then examine the effect of agency conflicts in shaping the firm’s foreign investment decision.

5.1. Policy experiment: territorial tax system

Using the calibrated model, we conduct a policy experiment to study how firm investment, cash holdings, profits, and taxes paid would change under a territorial corporate tax system. In Table III, we compare the results obtained in the benchmark model with a worldwide tax system to a counterfactual case in which the US adopts a territorial tax system. Each column of the table corresponds to a configuration of three model parameters: $\lambda$ (the arrival probability of a tax reform), $\tau_R$ (the tax rate on repatriation), and $\tau_{US}$ (the US corporate tax rate). For each of these parameter configurations, represented by a different column in the table, we solve and simulate the model, holding the other parameters fixed at the values reported in Table I. We do this for two cases: the benchmark worldwide tax system and a counterfactual case with a territorial tax system.

In Table III, we report the difference, as a percentage, of the average moment in the simulated data of the worldwide system relative to that for the territorial system. The first row of the table reports the firm’s average capital stock, $K$. For the case of the first column, we see that the firm optimally chooses a capital stock that is, on average, approximately 4.9% percent higher in the worldwide system than what it would choose under a territorial system. We see this pattern holds generally as the values in the first row are positive across all columns of the table, meaning the firm chooses a higher capital stock at its foreign subsidiary in a worldwide system compared to a territorial regime. With the assumption of decreasing returns to capital, this results in a lower marginal product of capital in the worldwide system, which is indicated by the negative values in the second row of the table.

The final row of Table III presents the firm’s average instantaneous return resulting from a tax reform arrival with a change from a worldwide to territorial system. The reported values are the percentage increase in the firm’s non-cash asset value, averaged across simulations.
As one would expect, this instantaneous return is higher when the arrival is less anticipated (lower $\lambda$) and when the US corporate rate and repatriation tax rates are higher.

In Figures 4 and 5 we graphically show the difference in firm policies and taxes in a worldwide relative to territorial system as functions of different underlying parameters. With these comparative statics, all other parameter values are held fixed at the benchmark values reported in Table I. Figure 4 plots the firm’s choice of capital, its marginal product of capital, and the return from a tax reform of changing from a worldwide to territorial tax system. In each panel, we plot a value in the worldwide system, averaged across model simulations, relative to its counterpart average across simulations in a territorial tax system. Panels A and B plot the firm’s choice of capital in a worldwide relative to territorial tax system as functions of the repatriation tax rate ($\tau_R$) and US tax rate ($\tau_{US}$), respectively. We see that the firm optimally chooses a larger average capital stock in the worldwide tax system and this is increasing in $\tau_R$ and $\tau_{US}$. With a higher value of $\tau_R$, the firm’s cash will be subject to a higher tax rate upon reform. This makes holding unrepatriated earnings as cash a less attractive option. The result is capital investment becomes relatively more attractive as $\tau_R$ increases. Similarly, with a higher value of $\tau_{US}$, the after-tax return on the subsidiary’s cash is lower. With decreasing returns to scale in capital, the firm’s higher capital stock translates to a lower marginal product of capital, as illustrated in Panels C and D of Figure 4. Finally, Panels E and F of Figure 4 show that the firm’s return from a tax reform is increasing in both the US tax rate and the repatriation tax rate imposed on the cash held at the date of reform.

In Figure 5 we plot comparative statics for effective tax rates and tax revenues in a worldwide relative to territorial system. The top row of the figure shows the effective US tax rate faced by the foreign subsidiary in a worldwide system relative to a territorial system as a function of the repatriation tax rate on reform ($\tau_R$) and the US corporate tax rate ($\tau_{US}$). We also plot the foreign tax revenue (Panels C and D) and total global tax revenue (Panels E and F) as functions of the repatriation tax rate on reform ($\tau_R$) and the US corporate tax rate ($\tau_{US}$).
5.2. Reducing the US tax rate and eliminating deferral

Table IV shows the effect of eliminating the deferral of the tax liability on unrepatriated earnings (Panel A) and, separately, the effect of reducing the US corporate tax rate to 15% (Panel B). Each column of the table again corresponds to a configuration of three parameters: $\lambda$, $\tau_R$, $\tau_{US}$. In each panel, we report the difference, in percent, under this counterfactual tax regime (elimination of deferral or a lower US rate) relative to counterpart values in the benchmark tax system. The top row of Panel A shows that the foreign subsidiary chooses a lower capital stock on average in a tax code with no option to defer unrepatriated earnings. Removing the deferral option effectively increases the tax rate on subsidiary profits. This decreases the after-tax return on capital at the foreign subsidiary, leading the firm to invest less. This also leads to lower average revenues and profits at the foreign subsidiary. As a result, the foreign corporate tax revenue is lower, though in most cases the US corporate tax revenue from the subsidiary is higher and this latter effect is larger in magnitude as the global tax revenue is higher when deferral is eliminated.

In Panel B of Table IV we consider a counterfactual case of a lower US corporate tax rate equal to 15%. Again, all values are reported as percentage differences relative to the benchmark tax system. In the case of a lower US tax rate, the foreign subsidiary faces a higher after-tax return on its cash holdings. Consequently, with unrepatriated earnings, this makes investing in financial assets relatively more attractive than in the benchmark case. Investing in physical capital thus looks relatively less attractive and the firm chooses a lower average capital stock in the case of $\tau_{US} = 15\%$, compared to the benchmark value of 20.9%. With lower capital in the case of $\tau_{US} = 15\%$, we see higher MPK and lower revenues and profits at the foreign subsidiary.

In Table V we evaluate a tax change in which the US corporate rate is lowered to the empirical average foreign rate in our sample of 11.2%. We see qualitatively similar results here compared to those in Panel B of Table IV, where $\tau_{US}$ was reduced to 15%. In particular, we see that the firm choose a lower average capital stock compared to the benchmark case. Additionally, when the foreign tax rate is equal to the US rate, the firm faces no additional
US tax on foreign income. Consequently, the US corporate tax revenue collected from the foreign subsidiary profits go to zero, which is shown by the -100% change in all columns of Table V.

5.3. The effect of agency conflicts

The manager makes investment, savings, and repatriation decisions. In order to better understand how the manager’s private incentives affect the firm’s policy, we adjust the agency conflicts away from benchmark and report the change in model outcomes. Table VI reports the percent change, relative to the benchmark, in the capital stock, marginal product of capital, profits, firm size, and tax collections for the cases of no agency, no resource diversion, and no bonus compensation. Each column reports values for a different combination of benchmark parameters for the probability of tax reform \( \lambda \), the repatriation tax rate conditional on tax reform \( \tau_R \), and the US tax rate faced by the US parent.

Panel A shows reports the percent change relative to the benchmark for the case of no agency \((s = 0, b = 0, \theta = 1)\). The change, in all columns, is relatively modest: capital changes between 1.07% and -0.43%. The change in US tax revenue is more significant: in the benchmark case in column 1, US tax revenue declines 2.51% despite only a 0.54% decrease in profits.

Panels B and C of Table VI decompose the effects of agency conflicts into the resource diversion and bonus compensation components. The resource diversion component makes cash holdings more valuable for the manager. Therefore, shutting down this channel \((s = 0)\), shown in Panel B, results in an increase in the capital of 1.87% in the benchmark case (column 1), and as much as 3.64% in the high US tax case (column 4). In contrast, bonus compensation encourages the manager to invest in capital. Eliminating bonus compensation \((b = 0)\), shown in Panel C, results in a decrease in capital of 2.65% in the benchmark case, and similarly for other cases. These two incentives work in opposite directions, resulting in a combined small effect of agency conflicts on firm investment. In addition, these results indicate that most of the distortion in foreign investment is a result of the tax incentives
rather than agency conflicts.

Figure 6 shows comparative statics on the capital stock with respect to the resource diversion, s, bonus compensation, b, and equity holdings, θ, parameters. The other parameters are held at their benchmark values. All values are reported relative to the case with no agency conflicts (s = 0, b = 0, θ = 1).

Panel A shows that the capital stock is declining, almost linearly, in the resource diversion parameter s. As the manager’s ability to divert resources increases, holding cash looks relatively more favorable relative to capital and capital investment declines. In contrast, higher bonus compensation b makes output and profits relatively more valuable to the manager, and higher investment in capital occurs, shown in Panel B. Panel C shows that equity ownership θ works to align the manager’s incentives with the shareholders, and the capital distortion becomes small for large values of θ. With lower equity ownership, the bonus compensation effect dominates resulting in investment significantly higher than that preferred by the shareholder.

These figures demonstrate that while the investment distortions due to agency conflicts are relatively small for the average firm, they can be significantly larger for firms with low equity ownership and high bonus compensation. In addition, resource diversion, while costly to the shareholder, can work to offset the investment distortion caused by these other agency frictions.

6. Conclusion

Using an investment model of U.S. multinationals’ foreign operations, we find that the worldwide tax system induces significantly greater foreign investment. This holds even in the absence of financing frictions and agency conflicts. In addition, we find that tax incentives to encourage repatriation of foreign earnings may instead have the unintended consequence of increasing foreign investment.

We also consider the revenue implications of the U.S. moving from a worldwide to a territorial tax system. Under the baseline parameterization, foreign corporate tax revenue
would be impacted minimally. In contrast, global corporate tax revenue would fall by 59%-88% of firm value. At the same time, firm value would increase by 2%-3%.

Our results inform the ongoing debate on reforming the U.S. tax code. Switching from a worldwide to a territorial tax system would have substantial repercussions for the real foreign operations of U.S. multinational firms. However, the reform’s impact would operate primarily through the reduction in the effective tax rate the firms pay, not the avoidance of agency costs due to diminished cash holdings abroad.
References


Table I: **Benchmark model parameters**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\rho$</td>
<td>Persistence in profitability</td>
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</tr>
<tr>
<td>$\sigma$</td>
<td>Volatility of profitability</td>
<td>0.40</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>Returns to scale</td>
<td>0.6</td>
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<tr>
<td>$\delta$</td>
<td>Depreciation rate</td>
<td>0.12</td>
</tr>
<tr>
<td>$f$</td>
<td>Fixed costs</td>
<td>0.025</td>
</tr>
<tr>
<td>$\phi$</td>
<td>Adjustment costs</td>
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<tr>
<td>$r$</td>
<td>Discount rate</td>
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<tr>
<td>$\tau_F$</td>
<td>Foreign tax rate</td>
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</tr>
<tr>
<td>$\tau_{US}$</td>
<td>US tax rate on domestic earnings</td>
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<tr>
<td>$\lambda$</td>
<td>Tax reform arrival probability</td>
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<tr>
<td>$\theta$</td>
<td>Manager equity ownership</td>
<td>0.02</td>
</tr>
<tr>
<td>$100 \times b$</td>
<td>Bonus to operating income ratio</td>
<td>0.1</td>
</tr>
<tr>
<td>$1000 \times s$</td>
<td>Manager resource diversion</td>
<td>0.04</td>
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The table presents benchmark parameter values used in the model. Values are reported at an annual frequency, where applicable. For more details on the calibration, see Section 3.

Table II: **Model moments**

<table>
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<tr>
<th>Moment</th>
<th>Data</th>
<th>Model</th>
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<tr>
<td>Investment rate, mean</td>
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<td>0.14</td>
</tr>
<tr>
<td>Investment rate, standard deviation</td>
<td>0.19</td>
<td>0.20</td>
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<tr>
<td>Investment rate, serial correlation</td>
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<td>0.36</td>
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<tr>
<td>Profitability, mean</td>
<td>0.10</td>
<td>0.09</td>
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<tr>
<td>Profitability, standard deviation</td>
<td>0.14</td>
<td>0.14</td>
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<tr>
<td>Profitability, serial correlation</td>
<td>0.58</td>
<td>0.57</td>
</tr>
<tr>
<td>Frequency of negative earnings</td>
<td>0.19</td>
<td>0.23</td>
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<tr>
<td>M/B, mean</td>
<td>—</td>
<td>2.93</td>
</tr>
<tr>
<td>M/B, standard deviation</td>
<td>—</td>
<td>0.79</td>
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</table>

The table presents moments from the empirical data and model-simulated data used to calibrate the model parameters reported in Table I. All values are at an annual frequency where applicable. See Section 3 for a description of the data and the calibration approach.
Table III: **Worldwide relative to a territorial tax system**

<table>
<thead>
<tr>
<th></th>
<th>λ 0.10</th>
<th>λ 0.10</th>
<th>λ 0.10</th>
<th>λ 0.10</th>
<th>λ 0.05</th>
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<tbody>
<tr>
<td>τ_{R}</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>τ_{US}</td>
<td>0.209</td>
<td>0.209</td>
<td>0.35</td>
<td>0.35</td>
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<table>
<thead>
<tr>
<th>Parameter</th>
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<tr>
<td>Capital stock (K)</td>
<td>4.86</td>
<td>10.36</td>
<td>11.46</td>
<td>20.27</td>
<td>3.14</td>
<td>12.99</td>
</tr>
<tr>
<td>MPK</td>
<td>-1.94</td>
<td>-3.83</td>
<td>-4.21</td>
<td>-6.95</td>
<td>-1.29</td>
<td>-4.69</td>
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<tr>
<td>Revenue</td>
<td>2.25</td>
<td>5.13</td>
<td>5.71</td>
<td>10.38</td>
<td>1.14</td>
<td>6.32</td>
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<tr>
<td>Profits</td>
<td>0.51</td>
<td>1.82</td>
<td>2.12</td>
<td>4.37</td>
<td>-0.41</td>
<td>2.01</td>
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<td>Firm size</td>
<td>-0.15</td>
<td>0.84</td>
<td>1.16</td>
<td>3.06</td>
<td>-3.77</td>
<td>-4.62</td>
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<tr>
<td>Foreign corporate tax revenue</td>
<td>0.50</td>
<td>1.79</td>
<td>2.09</td>
<td>4.29</td>
<td>-0.41</td>
<td>1.98</td>
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<td>Global corporate tax revenue</td>
<td>58.69</td>
<td>88.47</td>
<td>93.09</td>
<td>130.79</td>
<td>85.06</td>
<td>164.06</td>
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<tr>
<td>Firm return from reform</td>
<td>2.17</td>
<td>3.21</td>
<td>3.43</td>
<td>4.79</td>
<td>5.26</td>
<td>10.25</td>
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</table>

The table reports the percentage change in a value in the worldwide system relative to the territorial system. Each column corresponds to a configuration of three parameters: λ (the tax reform arrival probability), τ_{R} (tax rate on repatriation), and τ_{US} (US corporate tax rate). All other model parameters are kept fixed at the values reported in Table I. We solve and simulate the model under the both a worldwide tax system and a territorial tax system and compute averages from the model simulated data. We do this under the current US worldwide tax system as well as for a counterfactual case of a territorial tax system. Each element in the table reports the percent difference in the average value in the model simulated data under the worldwide system relative to its counterpart in a territorial system, with the exception of the last row. The last row, labeled “Firm return from reform,” reports the average instantaneous return on the firm’s non-cash assets, as a percentage, resulting from the tax reform of a switch from a worldwide to territorial tax system.
Table IV: Implications of tax policy changes under worldwide system

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<tr>
<th></th>
<th>(\lambda)</th>
<th>0.1</th>
<th>0.1</th>
<th>0.05</th>
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<th>0.1</th>
<th>0.1</th>
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<tr>
<td>(\tau_R)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.05</td>
<td>0.05</td>
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<tr>
<td>(\tau_{US})</td>
<td>0.209</td>
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<td>0.209</td>
<td>0.35</td>
<td>0.209</td>
<td>0.35</td>
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</tbody>
</table>

Panel A: No deferral

<p>| | | | | | | | |</p>
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</thead>
<tbody>
<tr>
<td>Capital stock (K)</td>
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<td>-30.16</td>
<td>-11.45</td>
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<td>-16.94</td>
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<td>MPK</td>
<td>5.38</td>
<td>15.48</td>
<td>4.60</td>
<td>15.56</td>
<td>8.12</td>
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<tr>
<td>US corporate tax revenue</td>
<td>36.73</td>
<td>103.95</td>
<td>-5.71</td>
<td>13.64</td>
<td>-4.23</td>
<td>46.15</td>
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</tr>
<tr>
<td>Global corporate tax revenue</td>
<td>9.09</td>
<td>41.88</td>
<td>-5.92</td>
<td>1.85</td>
<td>-5.81</td>
<td>16.75</td>
<td></td>
</tr>
</tbody>
</table>

Panel B: Reduced US corporate tax rate (\(\tau_{US} = 0.15\))

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
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<td>Capital stock (K)</td>
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<td>3.41</td>
<td>0.71</td>
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<td>2.53</td>
<td>5.73</td>
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<td>Revenue</td>
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<tr>
<td>Profits</td>
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<td>1.07</td>
<td>-0.93</td>
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<tr>
<td>Firm size</td>
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<td>2.69</td>
<td>3.65</td>
<td>-0.60</td>
<td>-2.91</td>
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<tr>
<td>US corporate tax revenue</td>
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<td>-61.77</td>
<td>-59.26</td>
<td>-78.46</td>
<td>-59.70</td>
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<tr>
<td>Foreign corporate tax revenue</td>
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<td>0.79</td>
<td>-1.30</td>
<td>-1.97</td>
<td>-4.87</td>
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</tbody>
</table>

The table reports changes in firm investment policy, size, and tax revenue arising from eliminating deferral of unrepatriated earnings (Panel A) and reducing the US corporate tax rate to 15% (Panel B). Each column corresponds to a different parameter configuration for \(\lambda\), \(\tau_R\), and \(\tau_{US}\). All other model parameters are fixed at the values reported in Table I. For each column, we solve the model and compute averages from the model simulated data. Each element in the table reports the percent difference in the model simulated average under the alternative tax code relative to the benchmark worldwide tax system.
Table V: **Equal US and foreign tax rates**

<table>
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<tr>
<th></th>
<th>$\lambda$</th>
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<tr>
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<tr>
<td>Capital stock (K)</td>
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<td>-9.93</td>
<td>-2.31</td>
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<tr>
<td>MPK</td>
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<td>4.21</td>
<td>1.83</td>
<td>2.73</td>
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<td>Revenue</td>
<td>-2.49</td>
<td>-5.29</td>
<td>0.18</td>
<td>-1.93</td>
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<tr>
<td>Profits</td>
<td>-0.68</td>
<td>-2.18</td>
<td>2.79</td>
<td>0.98</td>
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</tr>
<tr>
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<td>-100.00</td>
<td>-100.00</td>
<td>-100.00</td>
<td></td>
</tr>
<tr>
<td>Foreign corporate tax revenue</td>
<td>-2.38</td>
<td>-4.76</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Global corporate tax revenue</td>
<td>-37.88</td>
<td>-48.39</td>
<td>-46.05</td>
<td>-46.00</td>
<td></td>
</tr>
</tbody>
</table>

The table reports changes in firm investment policy, size, and tax revenue when the US and foreign corporate rates are both equal to 11.2%, the estimated average foreign rate in the data. Each column corresponds to a different parameter combination for $\lambda$ and $\tau_R$. The values reported in the table are the difference in percent of this alternative tax regime ($\tau_{US} = \tau_{F} = 0.112$) relative to the benchmark model where $\tau_{US} = 0.209$.
Table VI: The effect of agency conflicts

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<td>0.05</td>
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<tr>
<td>$\tau_R$</td>
<td>0.209</td>
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<td>0.35</td>
<td>0.209</td>
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<tr>
<td>$\tau_{US}$</td>
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<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.209</td>
<td>0.35</td>
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</table>

**Panel A: No agency conflicts**

<table>
<thead>
<tr>
<th></th>
<th>0.10</th>
<th>-0.18</th>
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<th>1.07</th>
<th>0.75</th>
<th>1.07</th>
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<tr>
<td>Capital stock (K)</td>
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<td>-0.85</td>
<td>0.02</td>
<td>0.82</td>
<td>0.22</td>
<td>0.68</td>
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<tr>
<td>Profits</td>
<td>-0.54</td>
<td>-1.83</td>
<td>0.32</td>
<td>0.82</td>
<td>-0.26</td>
<td>0.46</td>
</tr>
<tr>
<td>Firm size</td>
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<td>-0.04</td>
<td>0.12</td>
<td>0.62</td>
<td>0.42</td>
<td>0.58</td>
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<tr>
<td>US corporate tax revenue</td>
<td>-2.51</td>
<td>-2.68</td>
<td>-1.45</td>
<td>0.43</td>
<td>-1.17</td>
<td>0.01</td>
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<tr>
<td>Foreign corporate tax revenue</td>
<td>-0.48</td>
<td>-1.77</td>
<td>0.37</td>
<td>0.83</td>
<td>-0.21</td>
<td>0.48</td>
</tr>
<tr>
<td>Global corporate tax revenue</td>
<td>-1.23</td>
<td>-2.20</td>
<td>-0.47</td>
<td>0.58</td>
<td>-0.65</td>
<td>0.22</td>
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</table>

**Panel B: No resource diversion ($s = 0$)**

<table>
<thead>
<tr>
<th></th>
<th>1.87</th>
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<tbody>
<tr>
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<td>MPK</td>
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<td>-0.95</td>
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<td>-1.08</td>
<td>-0.94</td>
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<td>2.34</td>
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<tr>
<td>Profits</td>
<td>-0.02</td>
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<td>1.57</td>
<td>0.53</td>
<td>2.01</td>
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<tr>
<td>Firm size</td>
<td>0.68</td>
<td>0.92</td>
<td>1.58</td>
<td>1.44</td>
<td>1.03</td>
<td>1.44</td>
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<tr>
<td>US corporate tax revenue</td>
<td>-1.65</td>
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<td>0.81</td>
<td>1.01</td>
<td>-0.29</td>
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<tr>
<td>Foreign corporate tax revenue</td>
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<td>1.56</td>
<td>0.55</td>
<td>2.00</td>
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<tr>
<td>Global corporate tax revenue</td>
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<td>-0.03</td>
<td>1.82</td>
<td>1.22</td>
<td>0.17</td>
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</table>

**Panel C: No bonus compensation ($b = 0$)**

<table>
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<tr>
<th></th>
<th>-2.65</th>
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</thead>
<tbody>
<tr>
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<td>0.99</td>
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<td>1.29</td>
<td>0.94</td>
<td>0.57</td>
</tr>
<tr>
<td>MPK</td>
<td>-1.76</td>
<td>-1.50</td>
<td>-1.17</td>
<td>-0.96</td>
<td>-1.09</td>
<td>-1.87</td>
</tr>
<tr>
<td>Revenue</td>
<td>-1.46</td>
<td>-1.14</td>
<td>-0.43</td>
<td>0.23</td>
<td>-0.77</td>
<td>-1.89</td>
</tr>
<tr>
<td>Profits</td>
<td>-0.96</td>
<td>-0.79</td>
<td>-0.69</td>
<td>-0.71</td>
<td>-0.54</td>
<td>-0.96</td>
</tr>
<tr>
<td>Firm size</td>
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<td>-0.88</td>
<td>0.23</td>
<td>-0.97</td>
<td>-1.81</td>
</tr>
<tr>
<td>US corporate tax revenue</td>
<td>-1.41</td>
<td>-1.10</td>
<td>-0.39</td>
<td>0.22</td>
<td>-0.73</td>
<td>-1.85</td>
</tr>
<tr>
<td>Foreign corporate tax revenue</td>
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<td>-1.19</td>
<td>-0.61</td>
<td>0.22</td>
<td>-0.84</td>
<td>-1.83</td>
</tr>
</tbody>
</table>

The table reports values of alternative model specifications relative to the benchmark model values. Reported values are in percent relative to the benchmark. Panel A displays values for the model case in which agency conflicts are shut off ($\theta = 1, s = 0, b = 0$). Panel B shows the case in which the manager is unable to divert resources ($s = 0$), while manager equity ownership ($\theta$) and bonus ($b$) are kept at their benchmark values displayed in Table I. Panel C shows the case in which the manager has no bonus compensation ($b = 0$), while equity ownership and resource diversion are kept at the benchmark values in Table I. Each column corresponds to a configuration of $\lambda, \tau_R, \tau_{US}$ parameters. All other parameter values are held fixed at the values reported in Table I.
**Panel A**

![Graph showing the expected present value of a dollar of cash held inside the foreign subsidiary by varying the tax reform arrival intensity $\lambda$.](image)

**Panel B**

![Graph showing the expected present value of a dollar of cash held inside the foreign subsidiary by varying the repatriation tax rate $\tau_r$.](image)

**Panel C**

![Graph showing the expected present value of a dollar of cash held inside the foreign subsidiary by varying the interest rate $r$.](image)

Fig. 1. **Expected present value of a dollar of cash held inside the foreign subsidiary.** Each panel plots the expected present value of a marginal dollar of cash held inside the subsidiary by varying the tax reform arrival intensity $\lambda$ (Panel A), the repatriation tax rate on reform $\tau_R$ (Panel B), and the interest rate on cash $r$ (Panel C). Each plots shows the value of a dollar for three different US corporate tax rates, $\tau_{US}$. All other parameters are kept at their benchmark values given in Table I. The expected present value of a dollar is defined in Eq. (26). For Panel C, which varies $r$, the discount factor is kept consistent with $r$, specifically $\beta = 1/(1 + r)$. 

---

Note: The graphs and equations mentioned in the text are not fully transcribed here as they are visual representations in the document.
Fig. 2. Expected present value of the manager’s resource diversion of a marginal dollar of cash. Each panel plots the expected present value of the manager’s resource diversion of a marginal dollar of cash held inside the subsidiary. A single parameter is varied, shown on the horizontal axis, for three different values of another parameter corresponding to each of the three lines. All other parameters are held at their benchmark values given in Table I. The plotted value is equal to $\gamma$, defined in Eq. (21), when the manager chooses to defer repatriation until tax reform, and equal to zero when the manager chooses immediate repatriation. Immediate repatriation occurs when condition (24) is satisfied.
Fig. 3. **The decision to immediately repatriate or accumulate cash.** Each panel shows the regions of the parameter space, by varying the parameters shown on the axes, for which the firm defers repatriation (white) and repatriates immediately (gray). Immediate repatriation occurs when condition (24) is satisfied.
**Panel A: Capital stock**

Panel B: Capital stock

**Panel C: Marginal product of capital**

Panel D: Marginal product of capital

**Panel E: Return from tax reform**

Panel F: Return from tax reform

Fig. 4. **Distortions relative to a territorial system.** Panels A and B show the mean capital stock under the benchmark model relative to the territorial system, in percent, by varying the repatriation tax rate on reform $\tau_R$ (Panel A) and the US corporate income tax rate $\tau_{US}$ (Panel B). Panels C and C show the marginal product of capital by performing the same exercise. Panels E and F show the instantaneous return to the firm’s non-cash assets from moving to a territorial tax system, again by varying $\tau_R$ and $\tau_{US}$. In each case, all other parameters are held at their benchmark values given in Table I.
Fig. 5. US expected average effective tax rates on foreign earnings and tax collection relative to a territorial tax system. Panels A and B show the average effective US tax rate on a dollar of foreign earnings (after foreign taxes) by varying the repatriation tax rate $\tau_R$ (Panel A) and the US corporate income tax rate $\tau_{US}$ (Panel B). Panels C and D show the mean foreign tax revenue relative to the territorial system, in percent, by performing the same exercise. Panels E and F repeat the exercise, reporting the percent change in global (US plus foreign) tax revenue under the benchmark model relative to the territorial tax system. In each case, all other parameters are held at their benchmark values given in Table I.
Fig. 6. The effect of agency conflicts on investment. Each panel plots the mean capital stock under the benchmark model, with agency conflicts, relative to the case where agency conflicts are shut down (s = 0, b = 0, and θ = 1), in percent. Panels A, B and C show the effect of varying the resource diversion parameter s, the bonus compensation parameter b, and the manager’s equity ownership θ, respectively.