Repatriation Taxes*

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This Draft: September 24, 2018

Abstract

We present a model of a multinational firm to quantify the effects of policy changes to repatriation tax rates – taxes that firms pay on profits remitted from abroad. The framework captures the dynamic responses of the firm from the time a policy change is anticipated through its enactment, including its long-run effects. We find that failing to account for anticipatory behavior surrounding a reduction in repatriation tax rates overstates the amount of profits repatriated from abroad and underestimates tax revenue losses. We further show that policy changes have a relatively small impact on hiring and investment decisions if firms have relatively easy access to credit markets – as is the case for most multinational firms. Finally, by altering the relative price of holding assets abroad, news of a future reduction in repatriation tax rates acts as an implicit tax on repatriating funds today. We capture and quantify this "shadow tax."

JEL Classification: F23; H25; E60.

Keywords: Tax Reform, Repatriation Taxes, Asset Holding, Corporate Tax.

*We are grateful to David Agrawal, Juan Dubra, David Garraty, Erik Johnson, Marios Karabarbounis, Rob Lester, Johannes Voget, Dave Wildasin, Ahmed Rahman, Mike Pries, and seminar participants at Bowdoin College, Instituto de Economía-FCEA, Universidad Católica del Uruguay, UC Santa Cruz, University of Kentucky, University of Alabama, University of Mississippi, University of Notre Dame, University of Richmond, dECON-Facultad de Ciencias Sociales UDELAR, Virginia Association of Economists Meeting, International Trade and Finance Association Meeting, Southern Economic Association Meetings, Liberal Arts Macro Workshop, Asian Meetings of the Econometric Society, Georgetown Center for Economic Research Conference, and the North American Summer Meetings of the Econometric Society. The usual disclaimer applies. Previous versions of the paper were circulated as "Uncertain Taxes and the Quantitative Effects of Repatriation Tax Proposals."

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1 Introduction

The U.S. government collects taxes on the worldwide profits of U.S. based corporations. In addition to paying foreign taxes on profits earned abroad, corporations are often also subject to U.S. taxes once these profits are repatriated to the U.S. This is known as the repatriation tax. Many firms argue that these additional repatriation taxes deter them from repatriating foreign sourced income, and in recent years U.S. based corporations have steadily accumulated assets abroad. These foreign profits, as yet untaxed by the U.S. government, stand at over $2 trillion. This large accumulation of assets abroad has pushed changing repatriation tax policies high on the legislative agenda. Motivated by current policy discussions as well as past repatriation tax policy reforms, we build a dynamic model to quantify the effects of repatriation tax policy changes on firm-level variables and to understand the mechanisms driving those responses. Can proposed tax reforms lead to an increase in repatriated assets? Will these reforms stimulate employment and investment? What are the associated tax revenue costs? How are the costs and benefits of a reform influenced by protracted legislative deliberations and policy uncertainty? The goal of this paper is to shed light on these questions.

While the economic and tax revenue consequences of reforming repatriation tax policy are potentially large and involve a non-trivial dynamic aspect, the literature, for the most part, has abstracted from studying the dynamic behavior of the firm that accounts for expectations of changes in repatriation tax policy. To the best of our knowledge, this paper presents the first quantitative framework capturing the dynamic impacts of repatriation tax reform that includes the anticipation effects of such reforms.

We find that accounting for the anticipatory behavior of a firm, along with the responses after the policy change, is essential to fully understand the effects of repatriation tax policy changes. In our model, firms respond to news of a repatriation tax policy change in advance of the actual policy change. Conceptually, we consider news as any information that alters the likelihood of future repatriation tax changes such as a policy proposal, the deliberation of a policy, or the legislative lag. Receiving news of a potential future reduction in repatriation tax rates leads to a reduction of repatriated income from abroad, an accumulation of foreign assets untaxed by the U.S. government, and a fall in U.S. government tax revenue. At the enactment of a repatriation tax policy change, firms repatriate back the assets withheld during this *news period* – the period between the arrival of news and the policy change. As in our baseline experiment modeled after the temporary repatriation tax reduction in 2004-2005, firms additionally bring forward the repatriation of assets that were planned to be remitted at a future date to the time of the policy change, causing repatriations to once

again fall after the implementation of the policy. As a result, policy evaluations that do not account for a firm's anticipation of lower future repatriation tax rates overstate the amount of income repatriated from abroad and the effects on labor and capital while they understate the losses in tax revenue.

One of the primary motivations for reforming repatriation tax policy is to incentivize firms to repatriate assets to the U.S., thereby stimulating domestic employment and investment. We find that the effects of a reduction in the repatriation tax rate on U.S. employment and investment crucially depend on the firm's ability to access external credit markets. When the cost of accessing credit is high, the firm is more dependent on internal funds to support production activities. For such a firm, a contraction in repatriations during the news period corresponds with a large contraction in its U.S. production, and the influx of foreign income at the time of the policy change leads to a sizable expansion of domestic activity. Since most multinational firms are large and relatively unconstrained in their access to credit, our analysis indicates that a repatriation tax rate reduction has a relatively minor impact on domestic employment and investment. Firms that are not credit constrained are able to operate close to their optimal scale independent of whether or not they access their foreign assets. Thus, while a policy change may result in a large inflow of foreign assets, this change in asset flows does not affect production but primarily affects the firm's debt position and shareholder payouts.

An additional contribution of our paper is that we use our framework to evaluate the firm-level effects and tax consequences of a number of current repatriation tax reform proposals, including those from the *Tax Cut and Jobs Act* introduced in November 2017.[1] Currently, repatriation tax rates are set as the difference between the U.S. and foreign income tax rate of the firm. As the top U.S. marginal corporate income tax rate is the highest in the OECD, these proposals consider permanently reducing the taxation of U.S. multinationals. We study the effects of eliminating repatriation taxes (a territorial tax system), a reduction in the U.S. corporate income tax rate, and combining any policy change with a deemed repatriation tax – a retroactive tax on assets held abroad which have not been taxed by the U.S. government at the time of the policy change. We find that each of these policies generates relatively small gains to domestic employment and investment and reduces long-run tax revenues. Again, when firms are able to easily substitute debt for repatriated income, their domestic operations are able to operate close to their efficient scale regardless of repatriation tax rates.

Our model consists of a firm that is incorporated in the U.S. but operates and holds

[1] Other than *Tax Cut and Jobs Act*, these reforms include aspects from proposals put forward in President Obama's White House Budgets for 2015, 2016, and 2017, and President Trump's White House Budget for 2018.

assets both domestically and abroad with the objective of maximizing dividend streams paid to U.S. shareholders. Within each country, the firm decides on the levels of capital and labor required for production, its holdings of liquid financial assets, and the amount of debt to carry in the U.S. Across geographies, profits originating from abroad that are repatriated back to its U.S. parent are subject to a repatriation tax levied by the U.S. government. Thus, repatriation taxes play a key role in the across-geography allocation decision. We use this framework to quantify the impact of repatriation tax changes on the firm's decisions within and across geographies.

Our baseline experiment studies the effects of a temporary repatriation tax rate reduction that is anticipated a year in advance of its implementation. While we consider a range of repatriation tax policies, this experiment is motivated and disciplined by the American Jobs Creation Act of 2004 (AJCA), which granted a one-time "tax holiday" on repatriated assets in 2005. In our model, during the news period the firm reduces the rate of repatriations from abroad and accumulates foreign assets to maximize its tax savings from the tax holiday. This reduced flow of assets into the U.S. leads to a small contraction in domestic production and losses in U.S. tax revenue. At the enactment of the policy, the accumulated foreign assets flow into the U.S.; the firm then uses the additional inflow of assets to primarily pay U.S. shareholders, and reduce its debt.

We show that during the period between when a proposal is presented and its (potential) approval, there is a change in the relative cost of repatriating funds. The period of deliberation can be thought of as a wedge that distorts the firm's decision relative to the status quo without these announcements. We capture and quantify this wedge, generated by the news itself, which we refer to as a "shadow tax." By altering the intertemporal cost of repatriating foreign assets, news of a future tax reduction has both an income effect – higher expected future disposable income induces the firm to repatriate income for dividend payments today – and a substitution effect – repatriating funds today is relatively more expensive than in the future.

Since the enactment of the AJCA, bills have been introduced to congress nearly every year calling for temporary and/or permanent reductions in repatriation tax rates. To study the effects of changes in expectations about repatriation tax reforms that these discussions may introduce, we additionally model news with uncertainty surrounding *when* and *if* a repatriation tax change will occur. We show that uncertainty in the timing of the policy change generates a 'wait-and-see' effect. If the firm deems that future repatriation tax reform is likely but they are unsure *when* it will occur, they steadily accumulate foreign asset holdings, which can persist over a long time horizon. Even though the intent of the many proposals is to attract offshore assets held by U.S. firms, the discussions of such proposals

have the opposite effect of inducing firms to further accumulate assets abroad while they await a resolution of policy.

An innovation of our dynamic analysis is the inclusion of the anticipation, or new effects, of repatriation tax reform. In this regard, we complement models analyzing the impacts of repatriation taxes such as the static analysis of repatriation/investment decisions from an uncertain arrival of a tax holiday of De Waegenaere and Sansing (2008), Altshuler and Grubert (2003)'s theory of tradeoffs between investment and repatriation decisions of multinational corporations, and the structural model of the relationship between firm-level cash holding and repatriation tax rates in Gu (2017). In an influential paper, Hartman (1985) argues that if tax rates on multinational firms were constant across time, the level of repatriation tax rates would have no impact on the repatriation decisions of mature firms because these taxes would be unavoidable. In our model, in the absence of an actual policy change a reduction in repatriations and an increase in the stock of foreign asset holdings only occurs if firms expect a future repatriation tax reduction.[2]

Our contribution can also be viewed as a counterpart to the empirical literature looking at the effects of repatriation tax policy change from the AJCA such as Dharmapala, Foley, and Forbes (2011), Blouin and Krull (2009) and Faulkender and Petersen (2012). As external validation of our model, we find that our policy experiments of a one-time repatriation tax reduction capture the salient features found in these empirical studies.[3]

Our paper follows the large literature on fiscal policy news shocks such as House and Shapiro (2006), Yang (2005), Leeper, Richter, and Walker (2012), and Beaudry and Portier (2007). We investigate a specific fiscal policy shock – repatriation tax changes – and evaluate the tax revenue consequences and firm-level responses to the shock across a set of variables. In this regard, our analysis is closest to the news and uncertainty of future tax policy studied in Mertens and Ravn (2011) and Stokey (2016). Stokey (2016) presents a model with tax uncertainty that can generate an investment boom after the resolution of the policy. In that environment, firms reduce investment in new projects and accumulate liquid assets as a 'wait-and-see' policy until the uncertainty is settled. We differ from Stokey (2016) in two ways. First, ours is a quantitative study. This allows us to map some objects in our framework to the data. Second, we allow for firms to access financial markets. Our framework generates similar dynamics to Stokey (2016) but that behavior crucially depends

[2]Following this literature, we abstract from corporate inversions. We only consider the dynamic effects of repatriation tax changes rather than long-term decisions of corporate headquarter relocation that may, arguably, arise from repatriation tax policy. See Gu (2017) for a model analyzing tax revenue estimates from U.S. inversion law changes.

[3]Further, to support our modeling strategy of accounting for policy news, we provide empirical and narrative evidence suggesting that firms received and responded to information on the passage of the AJCA prior to its introduction in Congress.

on the firm's ability to access credit markets. In our model, allowing the firm to access external and internal financing dampens the investment effects of news of a policy change. Specifically, in the news period, the firm finances domestic operations with external financing while simultaneously accumulating liquid assets abroad.

In the DSGE model of Mertens and Ravn (2011), the economy experiences a contraction of output and investment in anticipation of a tax cut and then an expansion of these variables once the tax cut is implemented, regardless of whether it was anticipated or not. Whereas firms in Mertens and Ravn (2011) adjust domestic inputs in response to a tax cut, our focus on international firms provides an additional margin of adjustment. In our benchmark model, responses to output and investment to either an anticipated or unanticipated reduction in the repatriation tax rate are small due to the firm's ability to borrow and alter asset flows between domestic and foreign operations. This is consistent with the investment dynamics found in the empirical literature of the most recent U.S. repatriation tax change under the AJCA (Dharmapala, Foley, and Forbes 2011; Faulkender and Petersen, 2012).

2 Model Economy

In this section, we present a dynamic model to capture the effects of changes in repatriation tax policy. The model economy consists of a multinational firm that is owned by households and a government that levies taxes on various income sources. The multinational firm is incorporated in the U.S. but operates and holds assets both in the U.S. and overseas. The firm faces corporate income taxes in both jurisdictions and repatriation taxes on any income earned by its foreign operations that are remitted back to the U.S. Thus, a key decision for the firm consists of a portfolio choice problem of optimally allocating assets between its U.S. and its foreign subsidiary. Since our focus is primarily on how a firm internally reallocates its assets in response to repatriation tax changes, we do not model the debt vs. equity choice for external financing. Instead, we assume that the firm only has direct access to one type of external financing – debt.[4]

2.1 Firm

The multinational firm's objective is to maximize the present discounted value of the stream of utility from dividend payments, d_t, to its infinitely lived shareholders. The firm's objective

[4]Furthermore, we focus on firms that *already* operate across geographies and focus instead on changes in the scale of cross-border production activities.

function is

$$\mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t U((1-\tau_d)d_t) \right]$$

where τ_d is the capital gains tax on dividends, $U(\cdot)$ is the flow utility derived from the after-tax dividend payments with $U'(\cdot) > 0$, $U''(\cdot) \leq 0$, and β is the subjective discount factor.[5]

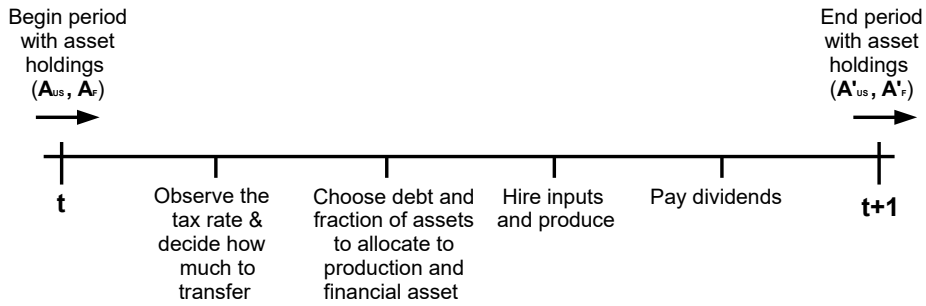

Figure 1: *Timeline of Events*

The firm begins each period with some of its assets held in the U.S., A_{US}, and some abroad, A_F. *Within* each period, the firm sequentially makes the following four decisions illustrated in Figure 1: *i*) First, the firm observes the current and expected future time-path of the repatriation tax rate and decides how many assets, T, to transfer between its U.S. and foreign operations; *ii*) next, the firm decides its debt position and, within each geographical location, chooses how to allocate assets between production and financial assets; *iii*) the firm then decides how the assets allocated to production within each geography will be used to hire labor and rent physical capital; and finally *iv*), the firm determines the portion of its gross returns to be devoted to dividend payments, d. After paying dividends, any remaining gross returns in the U.S. and overseas are carried over as assets (A'_{US} and A'_F, respectively) into the next period. We continue by formally introducing these decisions.

Cross-Geography Asset Allocation Decision

The firm enters each period with asset holdings in the U.S. and abroad. It observes the repatriation tax rate, τ_R, and then decides how to reallocate its global asset portfolio by transferring assets between the locations of its subsidiaries. The assets held in the U.S. after

[5]The curvature in the utility function is important as it generates a motive to smooth dividend payments over time rather than an erratic stream of payments. We could alternatively generate smooth dividends by having risk-neutral investors who are subject to dividend adjustment costs.

transfers, $\tilde{A}_{US}$, and abroad, $\tilde{A}_F$, are given by

$$\tilde{A}_{US} = \begin{cases} A_{US} + (1 - \tau_R)T & \text{if } T \geq 0 \\ A_{US} - |T| & \text{if } T < 0 \end{cases} \tag{1}$$

and

$$\tilde{A}_F = \begin{cases} A_F - T & \text{if } T \geq 0 \\ A_F + |T| & \text{if } T < 0. \end{cases} \tag{2}$$

If the reallocation causes assets to be moved from overseas to the U.S. ($T > 0$), the firm must pay repatriation taxes which result in a net transfer of $(1 - \tau_R)T$. However, if the transfer is from the U.S. to overseas ($T < 0$), there are no repatriation taxes and the full amount T is transferred abroad.[6]

The repatriation tax rate consists of two components and it is given by

$$\tau_R = \tau + \epsilon \tag{3}$$

where τ is the repatriation tax rate set by the U.S. government and ϵ is a stochastic component measuring firm-level idiosyncrasies that may impact the tax rate.[7] Under current policy, the repatriation tax rate is the U.S. corporate income tax rate less tax credits for taxes paid to the foreign country on overseas earnings. News about future taxes are introduced via altering expectations about future values of τ_R. We describe this when discussing the dynamic aspect of the firm decision.

Within-Geography Asset Allocation Decision

Once the cross-geography assets have been allocated, within each geography the firm decides how to allocate its assets between productive activities and holding them as financial assets. We also allow for the possibility that the firm can supplement its U.S. based assets by taking on debt. Hence, the U.S. operations of the firm are faced with the problem of deciding how much debt, D_{US}, to take on, and then how to allocates its debt-augmented U.S. based assets to production, $\tilde{A}^P_{US}$, and financial holdings, $\tilde{A}^B_{US}$, all with an aim of maximizing

[6] This one-sided repatriation tax friction is consistent with: i) on average U.S. corporate tax rates are higher than those abroad, and thus tax credits from overseas leave transfers from the U.S. untaxed, and 2) many countries have a territorial tax system whereby income earned abroad by domestic firms are not subject to domestic taxes.

[7] Including firm-level idiosyncratic components serves two objectives. First, there exist many firm-specific idiosyncrasies with respect to the repatriation tax rate that we do not model. These include special tax deductions, earnings stripping, transfer pricing, R&D credits, income loss deductions, etc. Second, the stochastic part induces the firm to take expectations which convexifies the value function and facilitates the numerical solution of the model.

returns net of corporate tax. In other words, following the debt decision, the firm faces a portfolio allocation problem. Formally, this intra-period decision is

$$\Pi_{US} = \max_{\tilde{A}^P_{US}, \tilde{A}^B_{US}, D_{US}} \left\{ R^P(\tilde{A}^P_{US}) + [1 + (1 - \tau_{US})r] \, \tilde{A}^B_{US} - (1 + r^D) D_{US} \right\} \tag{4}$$

subject to:

$$\begin{aligned} \tilde{A}^P_{US} + \tilde{A}^B_{US} &\leq \tilde{A}_{US} + D_{US} && (5) \\ \tilde{A}^P_{US} &\geq 0 && (6) \\ \tilde{A}^B_{US} &\geq 0 && (7) \\ D_{US} &\geq 0. && (8) \end{aligned}$$

The first term in Equation (4) gives the post-tax returns from assets allocated to production; the second term is the after-tax returns to financial assets, with r as the interest rate and τ_{US} as the U.S. corporate income tax rate; and the last term gives the firm's debt payments. We assume that the firm's interest rate on borrowed funds, r^D, is a function of its global debt-asset ratio, $D_{US}/(\tilde{A}_{US} + \tilde{A}_F)$[8]

$$r^D = r + \psi \left[\exp\left(\frac{D_{US}}{\tilde{A}_{US} + \tilde{A}_F} \right) - 1 \right] \tag{9}$$

where $\psi > 0$ is the elasticity parameter of debt. This debt elastic interest rate allows the firm to leverage its total (U.S. plus foreign) asset holdings to reduce domestic debt costs.

The firm's foreign subsidiary faces a nearly identical problem of allocating assets to maximize gross returns net of the corporate taxes abroad. The only difference is, for clarity in the analysis, we assume the firm cannot take on foreign debt, i.e., the debt decision of our model firm is confined to the U.S.

The foreign intra-period decision is

$$\Pi_F = \max_{\tilde{A}^P_F, \tilde{A}^B_F} \left\{ R^P(\tilde{A}^P_F) + [1 + (1 - \tau_F)r] \, \tilde{A}^B_F \right\} \tag{10}$$

subject to

[8]To ensure there is no arbitrage opportunity, we assume that when $D_{US} > 0$, $r < r^D$. In this way, the firm always faces a debt-elastic interest rate of borrowing that is higher than the returns it gets on financial assets. This condition also implies that in any given period the firm will never both borrow and invest in financial assets in the U.S. (i.e. one of $\tilde{A}^B_{US}$ and D_{US} will be zero every period).

$$\tilde{A}_F^P + \tilde{A}_F^B \leq \tilde{A}_F \tag{11}$$
$$\tilde{A}_F^P \geq 0 \tag{12}$$
$$\tilde{A}_F^B \geq 0 \tag{13}$$

where the variables are defined similarly as before, but with F subscripts denoting the decision of the foreign subsidiary.

Production Decisions

Within each geographical location, the firm uses the assets it allocates to production to hire labor, L, and rent capital, K. The firm's aim is to maximize the profits of its production units

$$R^P(\tilde{A}_i^P) = \max_{K_i, L_i} \left\{ (1 - \tau_i) \left[Y_i - wL_i - r^K K_i \right] + \tilde{A}_i^P \right\} \tag{14}$$

subject to:

$$Y_i = z_i K_i^\alpha L_i^\eta \tag{15}$$
$$\tilde{A}_i^P \geq wL_i + r^K K_i \tag{16}$$

where $i = \{US, F\}$, τ_i is the country-specific corporate income tax rate, and Y_i denotes output. The parameters z_i, α, and η represent the level of technology, capital share in production, and labor share in production, respectively. Finally, w is the constant wage rate and $r^K = r + \delta$ is the capital rental rate with depreciation rate δ.[9]

Dividend Decision

While the production-side profit maximization problem is a static one, the dividend decision is dynamic. The multinational firm's ultimate objective is to maximize the present value of the stream of utility derived from dividend payments to its shareholders. Consistent with U.S. regulations, all dividend payments by domestically based corporations must be paid through the U.S. parent company. The recursive representation of the firm's problem is given as

$$V\left(A_{US}, A_F, \tau, \epsilon\right) = \max_{A'_{US}, A'_F, T} \left\{ U((1 - \tau_d)d) + \beta \mathbb{E} V\left(A'_{US}, A'_F, \tau', \epsilon'\right) \right\} \tag{17}$$

[9]The assumption of constant input prices greatly simplifies our analysis. Including positively-sloped labor supply curves as in Bloom (2009) would dampen the labor responses which would not significantly change our main results.

subject to (1)–(16) and

$$d + A'_{US} \leq \Pi_{US} \tag{18}$$
$$A'_F \leq \Pi_F. \tag{19}$$

News about future taxes are introduced by altering expectations about future repatriation tax rates, τ_R. For instance, in the baseline exercise the firm receives a news that with probability one in four periods the new repatriation tax rate is going to be lower. Uncertainty about future tax rates is captured by altering transition probabilities. Appendix A provides detailed graphical depictions of the probability transitions associated with each one of the quantitative experiments.

2.2 U.S. Government

The U.S. government collects tax revenue and sets a repatriation tax policy. All tax rates and policies are exogenous to the model. U.S. tax revenue is collected from three different sources: the repatriation tax, TR_{REP}, corporate income tax, TR_{COR}, and dividend tax, TR_{DIV}. These are given as

$$\begin{aligned} TR_{REP} &= \tau_R T \\ TR_{CORP} &= \tau_{US}[Y_{US} - wL_{US} - r^K K_{US}] + \tau_{US} r \tilde{A}^B_{US} \\ TR_{DIV} &= \tau_d d \end{aligned}$$

with the total U.S. tax revenue being the sum of these three components. In this way, when repatriation taxes change our model is not only able to account for the direct effect on government revenue through TR_{REP}, but it is also able to account for the indirect effects by measuring changes in TR_{CORP} and TR_{DIV}.

Our analysis considers a range of different repatriation tax policy paths including expected and unexpected tax rate changes and various alternative characterizations. We explain these policies along with the results in the next section.

3 Quantitative analysis

This section presents our baseline exercise. We start by disciplining the parameters of the model and then study the effects of a one-time reduction in repatriation tax rates – a tax holiday – where the firm receives news of the policy change in advance.

3.1 Calibration

We set the parameter values by targeting moments of various economic aggregates, country specific tax rates, and firm-level data. The calibration characterizes the model in its stochastic steady state where the time period is one quarter.

There are 15 model parameters. We set the functional form of preferences as log utility and set the subjective discount factor to 0.986.[10] Of the remaining parameters, we set 10 to be consistent with various features of the data and 3 are jointly calibrated. These parameter values are reported in Table 1. For simplicity, we set the common firm-level parameters to be the same across the two countries. Since the ratio of labor to capital share in U.S. data is approximately 2, the labor share, η, is set at 0.5, while the capital share, α, is set at 0.25 to match an average marginal cost markup of 33 percent.

The real interest rate on financial assets is set to match the quarterly real interest rate on the 10 year U.S. T-bond for the period 2000Q1–2014Q4, $r = 0.0045$ (0.018 annually). We calculate this as $r = \frac{1+i^{T-bond}}{1+\mathbb{E}[\pi]} - 1$ where expected inflation rate, $\mathbb{E}[\pi]$, is the average inflation in the previous 4 quarters based on the PCE core price index. The capital rental rate is set as the real interest rate plus depreciation. Letting depreciation $\delta = 0.02$, $r^K = r + \delta = 0.0245$. The tax on dividends τ_d is set to 0.175. The U.S. capital gains tax is 0.2 for the highest tax bracket and 0.15 for the next bracket. Assuming shares are evenly split between these two groups, we use the midpoint at 0.175.

The remaining model parameters are set to match firm-level data. The firm-level data is constructed by merging the marginal tax rate data from Graham (1996) with the *Compustat Industrial Database*.[11] We restrict our sample to the 2006–2013 period to avoid the tax policy changes from the AJCA in affecting our calibration. We further restrict our sample to firm-year entries with positive foreign sales and that pay foreign taxes.

For a firm i at time t we calculate the repatriation tax rate in the firm-level dataset as the difference between the marginal U.S. tax rate and the average foreign corporate income tax rate.[12] That is,

$$Repatriation\ Tax\ Rate_{i,t} = \left\{ US\ Marginal\ Tax_{i,t} - \frac{Foreign\ Income\ Tax_{i,t}}{Foreign\ Pretax\ Income_{i,t}} \right\}.$$

[10] In the Online Appendix we perform sensitivity analysis on σ, including the case with linear utility ($\sigma = 0$).

[11] The marginal tax rates are calculated after accounting for interest deductions and accounts for the dynamics of the tax code such as net operating loss carry forwards and back, alternative minimum taxes, and investment tax credits.

[12] We argue this is an appropriate measure of the repatriation tax because the U.S. tax obligations are determined by the worldwide averaging of the foreign tax rate. It is also important to note that this may not necessarily be the repatriation tax rate firms effectively pay (they may choose to not repatriate any income, for example), but an estimate of the tax rate they would pay if they were to repatriate foreign income.

The average repatriation tax rate in our sample is $\tau = 0.131$. This value is similar to van't Riet and Lejour (2014) who estimate the U.S. repatriation tax rate to be between 14.6 and 16.7 percent. Further, splitting up the components of the repatriation tax rate, we have the average U.S. marginal tax as $\tau_{US} = 0.302$ and the mean foreign corporate income tax rate as $\tau_F = 0.171$.

Table 1: Parameter Values

Parameter	Value	Description	Motivation
η	0.5	Labor share in production	Labor $\div$ capital share of output ≈ 2
α	0.25	Capital share in production	and markup = 0.33
w	0.488	Wage	Firm level data
r	0.0045	Real interest rate on financial assets	Real 10 year U.S. T-bond rate 2000Q1–2014Q4
r^K	0.0245	Capital rental rate	$r^K = r + \delta$ ($\delta = 0.02$)
ψ	0.00098	Borrowing interest rate elasticity	Firm-level data
$\frac{z_F}{z_{US}}$	1.043	Relative productivity	Firm-level data
τ_{US}	0.302	U.S. corporate income tax rate	Firm-level data
τ_F	0.171	Foreign corporate income tax rate	Firm-level data
τ	0.131	Repatriation tax rate	Firm-level data
τ_D	0.175	Capital gains tax	U.S. capital gains tax rates
ϵ	$\sim \mathcal{U}(-0.032, 0.032)$	Idiosyncratic repatriation tax shock	Bounds from firm-level data

Repatriation tax rates by firms in our sample are quite variable from one year to the next. This may be due to various idiosyncrasies such as tax deductions from losses, various tax credits, changes in a firm's marginal tax bracket, and other factors affecting tax rates. We capture such idiosyncrasies in our model with the stochastic variable ϵ. To parameterize the distribution of ϵ, we first assume it to be uniformly distributed. We then calculate the difference of the 2^{nd} highest and 2^{nd} lowest repatriation tax rate for the 2006–2013 period and divide it by each firm's average repatriation tax rate in this interval.[13] The median value across firms is 0.489. This gives the bounds on ϵ of ± 0.032 ($0.064/0.131 = 0.489$). Formally, $\tau_R = 0.131 + \epsilon$ with $\epsilon \sim \mathcal{U}(-0.032, 0.032)$.

Finally, we jointly calibrate our remaining three parameters. We normalize the technology level in the U.S. to $z_{US} = 1$, and then estimate $\{z_F, \psi, w\}$ in order to match three moments in our firm-level data: (1) the average share of foreign sales is 0.53, (2) the mean ratio of debt to net assets minus debt is 0.334, and (3) the average number of employees is 22.7 (thousands).

[13] In this calculation, we require each firm to have 8 continuous observations. We do not use the highest and lowest observations to avoid outliers in our calculations which may occur, for example, from deductions if firms incur losses or face extraordinary tax obligations.

Because of the importance in capturing the non-linearities of the firm problem, we rely on global solution methods. The Online Appendix discusses the solution method in detail.

3.2 Baseline Exercise

Our baseline experiment considers a tax holiday that reduces the repatriation tax rate faced by the multinational firm for one period from a steady state level of τ^H to τ^L. We further assume that firms receive news of the tax holiday T periods in advance of its enactment. This choice for the baseline tax policy is motivated by the *American Jobs Creation Act of 2004* (AJCA), which represents the most recent example of a repatriation tax change implemented by the U.S. Government. The AJCA contained several tax incentives, one of which was a one-time allowance for firms to bring back assets from abroad at a reduced repatriation tax rate.[14] For our baseline exercise, consistent with the AJCA, we reduce repatriation tax rates for one-period from $\tau^H = 0.131$ to $\tau^L = 0.0643$.[15]

In this exercise, the firm knows with certainty that a tax holiday will occur 4 periods in advance of the actual tax holiday occurring, i.e. $T = 4$. Such policy lags are typical for fiscal policy changes and, as we explain in the next subsection, it is crucial to quantifying the full effects of a tax holiday. In our subsequent discussion, we refer to these policy lags– the periods between when the firm begins anticipating a future tax holiday and when it is implemented–as the news periods.

The solid lines in Figure 2 present the responses to news of and implementation of a tax holiday per our baseline policy. Panel A gives the firm-level responses and panel B gives the responses for the U.S. government's tax revenue. The units are percentage deviations from the original stochastic steady state with the exception of the repatriation tax rate graph, which shows the actual time-path for the repatriation tax rate. The tax holiday is implemented at period 0 and the firm receives news of it 4 quarters in advance (period -4).

It is most instructive to discuss our results by dividing the effects of our baseline repatriation tax holiday into three separate sub-intervals: the news period (pre-realization, from periods -4 to -1), the period of the tax holiday (at-realization, period 0), and the periods thereafter (post-realization, period 1 onwards). On receiving news about an imminent future tax holiday, during the news period the firm cuts back on repatriations from their foreign

[14] Section 4.1 describes in detail the AJCA.

[15] Under the AJCA, firms were allowed a maximum tax rate on overseas earnings of 5.25 percent on 85 percent of repatriated funds. The remaining 15 percent of funds faced their 'normal' repatriation tax rate, 0.131. The average repatriation tax rate on our model firms in the tax holiday is thus $0.85 \times 0.0525 + 0.15 \times 0.131 = 0.0643$. Kleinbard and Driessen (2008) note that additional tax credits toward the effective tax rate on funds receiving tax breaks under the AJCA was 3.65 percent rather than 5.25 percent. Since we do not explicitly model additional foreign tax credits, we use the 5.25 percent rate in our calculation.

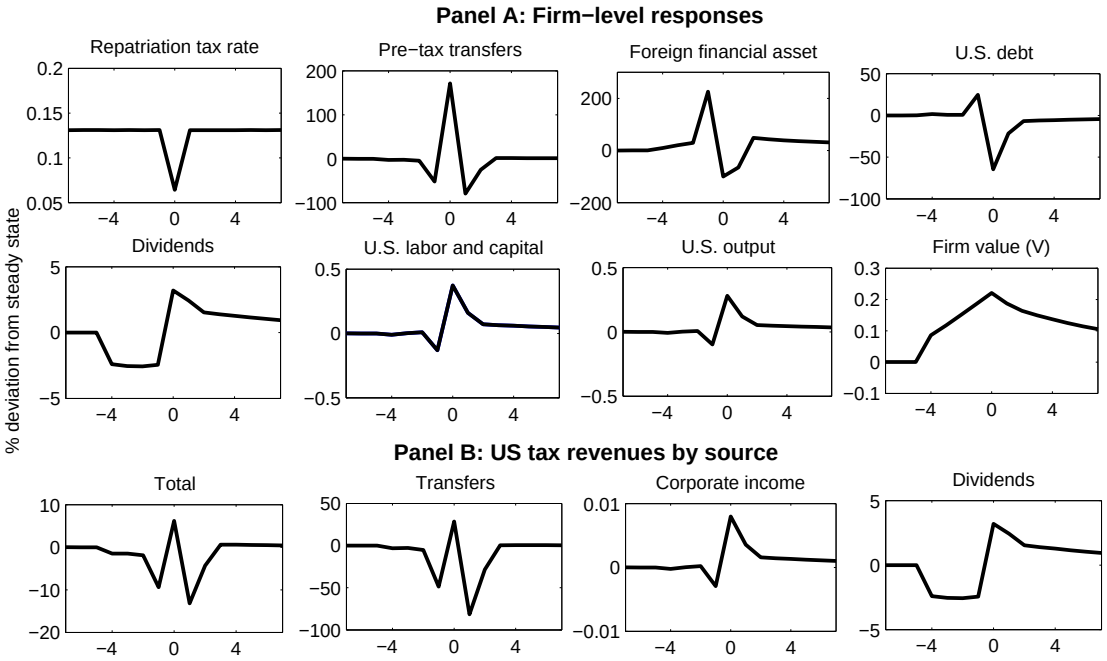

Figure 2: *Responses to an Announced Temporary Reduction in Repatriation Taxes*

Notes: News of tax reduction is received 4 quarters in advance. Except for the repatriation tax rate, units are in percent deviation from initial steady state.

subsidiary as they await more favorable repatriation tax rates. This leads to an accumulation of financial assets abroad. In the U.S., the firm compensates for this reduction in transfers by issuing debt. However, since borrowing is not costless, the U.S. operations are unable to fully make up for the entire fall in assets and thus have to cut back on dividend payments and assets devoted to production. The fall in U.S. capital and labor is quite small at approximately 1/10 of 1 percent.

In the period of implementation, the firm takes advantage of the one-time tax holiday and transfers a large amount of foreign assets to the U.S. The amount transferred assets contains not only the financial assets the firm accumulated abroad during the news period, but to take maximum benefit of the tax holiday the firm also brings forward planned future transfers to the period of implementation. The U.S. operations then use this large inflow of funds from abroad to pay higher dividends, reduce debt, and increase production.

After the tax holiday period, the firm reduces transfers and reaccumulates assets abroad toward returning to their steady state level. In the U.S., the firm uses the large influx of assets from the tax holiday period to temporarily sustain higher dividend payments, higher production, and reduce debt.

Next, with respect to share value and dividend payments, the announcement of a tax holiday signals a lower tax obligation in the future, which causes an instant increase in firm

value at the time of the news. The value of the firm continues to rise within the news period up to the realization period, after which it slowly returns to steady state as the tax-savings from the tax holiday are slowly paid out as dividends. Further, during the news period, even though dividends are cut back they are still positive. When the firm foresees a future tax reduction, they accumulate foreign financial assets while simultaneously issuing domestic debt to smooth out dividend payments. This behavior is consistent with the observation that several companies (Apple Inc., Ford Motor Co., Caterpillar Inc., for instance) have recently relied on bond issuance to finance dividend payments while simultaneously amassing large sums untaxed assets abroad.

On the U.S. government side, in Panel B, the collection of tax revenues on transfers, corporate income, and dividends mirror the transition path of their respective tax sources.[16] The responses of tax revenues from corporate income and dividends are small relative to that of transfers. Since the firm uses debt to smooth out U.S. production and dividend payments, the magnitude of the impact from transfers is the primary force governing the changes in total tax revenues behavior in the model.

3.3 News Effects

Current policy analysis generally focuses on the effects of a repatriation tax policy change only at and after its enactment. For example, assessments of the AJCA such as Joint Committee on Taxation (2004) estimated the tax holiday provision in the AJCA would result in $2.8 billion in revenue gains during the holiday and over $6 billion in losses over the next 9 years. The news period was not included in the assessment of the AJCA. In this section, we show that the responses in the news period are large and to ensure an accurate assessment of any policy change the entire dynamics surrounding the policy change should be taken into account.

In Figure 3 we report the total cumulative responses of a tax holiday for several variables of interest. Each plot also subdivides the cumulative responses into three sub-periods: pre-realization, at-realization, post-realization. Additionally, as comparison we also report just the post-news cumulative response (the sum of the at-realization and post-realization responses). As mentioned before, much of the current policy analysis focuses only on the post-news cumulative responses. For the figure, the units are quarterly gains/losses to that variable relative to the steady state at the time of the news. For example, a cumulative value

[16] Our model does not incorporate profit shifting – attributing U.S. value added to foreign affiliates – for tax purposes (see Guvenen et al. (2017)). If our model included opportunities for profit shifting, profit shifting could increase if firms anticipate a repatriation tax rate reduction. While this would not affect real variables, it would amplify the responses to tax revenues.

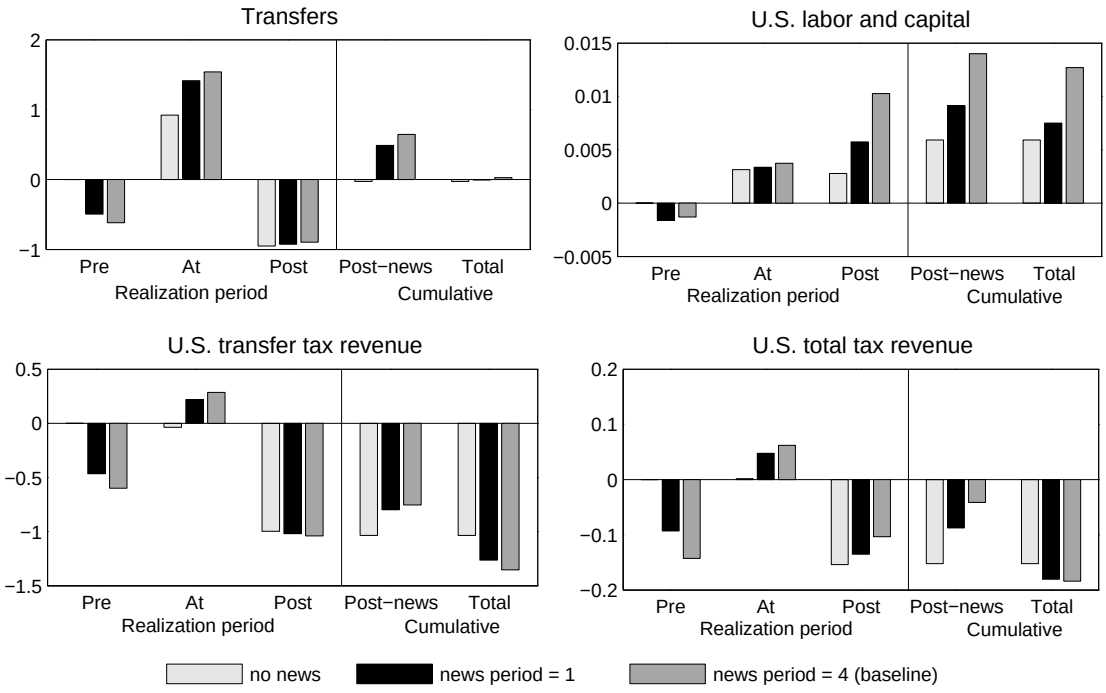

Figure 3: *Cumulative Responses to a Tax Holiday*

Notes: The cumulative effects are shown news periods for when there is no news period and when the news period is 1 and 4 quarters long. The figures subdivide the cumulative responses in the three realization periods: Pre-realization, At-realization, and Post-realization. This also shows the Post-news cumulative (sum of At- and Post-realization periods) and the total response (sum of all subperiods). Units are quarterly gain/losses to that variable relative to the steady state at the time of the news.

of -1 to tax revenues indicates that total tax revenue losses are equal to 1 quarter's worth of steady state tax revenues. We further show the results for three simulations differing in the length of the news period: when there is no news period and when the news period is 1 and 4 quarters long.

Consider first the cumulative impacts in the baseline case, i.e. news period is equal to 4. On net, transfers fall in the news period, rise during the tax holiday, and fall thereafter. If an assessment of the tax holiday on transfers only considers the total effects at and after its implementation, the value of transfers from abroad in the model are a net gain of over 60 percent of the quarterly steady state transfers. When all periods are taken into account, including the news period, cumulative transfers are negligible: the policy change merely shifts the timing of transfers, which would have been repatriated anyway, to the time of the tax holiday.

In the baseline case, there are cumulative gains to U.S. capital and labor. The total gains to these variables are 1.3 percent of their quarterly steady state levels. If the news period is not taken into account, these gains are overstated by 10 percent. On the government side, there are net losses to U.S. tax revenues. When including the news period, total U.S. tax

revenue losses are more than 4 times larger than when the news period is not accounted for. Again, the tax costs to the U.S. government from the tax holiday provision in the AJCA estimated by the Joint Committee on Taxation (2004) was a net loss of $3.2 billion. Within the context of the model, if firms anticipated the tax holiday, these estimates would understate the true tax revenue costs of the act.

Furthermore, we find that the longer the news period the larger the losses to U.S. tax revenue. A longer news period allows the firm to take maximum advantage of the tax holiday by holding back a large amount of assets during the news period and then repatriating a large amount during the tax holiday. This larger repatriation in turn leads to an overall larger cumulative gain in the U.S. capital and labor, but at the same time also leads to a larger revenue loss by the government. Thus, there is a tradeoff between the length of advanced notice and policy outcomes: a longer news period leads to higher cumulative gains to employment but at the expense of larger tax revenue losses – although it should be noted that the gains for labor and capital are quantitatively small while the losses in U.S. tax revenue are relatively large. Put differently, if news periods are not taken into account, the policymaker may overestimate the stimulative effects of the policy and underestimate the costs in terms of tax revenue losses.

3.4 Access to External Credit Markets

The enactment of a repatriation tax holiday is often motivated as a policy to stimulate U.S. investment and employment. The underlying premise of this argument is that the high tax cost of repatriation discourages firms from repatriating assets held abroad, effectively "locking out" their access to a large portion of its internal funds held abroad. A tax holiday is hypothesized to free up the "locked out" assets held abroad, allowing them to bring these foreign assets back to the U.S. to increase the scale of their domestic productive activities. In this section we show that the magnitude of the response in a firm's production activities, given by firm-level capital and labor, is highly dependent on the level of access they have to external credit.

Figure 4 shows the cumulative impacts of a one-period tax holiday under various parameterizations of the debt elastic interest rate parameter ψ. We interpret ψ as the ease of access to domestic credit markets. The left panel documents the cumulative effects when the policy is announced 4 periods in advance while the right reports the net responses when the tax holiday is immediately and unexpectedly implemented (no news period). Each figure subdivides the responses into the pre-realization, at-realization, and the post-realization periods. The cumulative response is the sum of the three sub-periods. Again, the units are

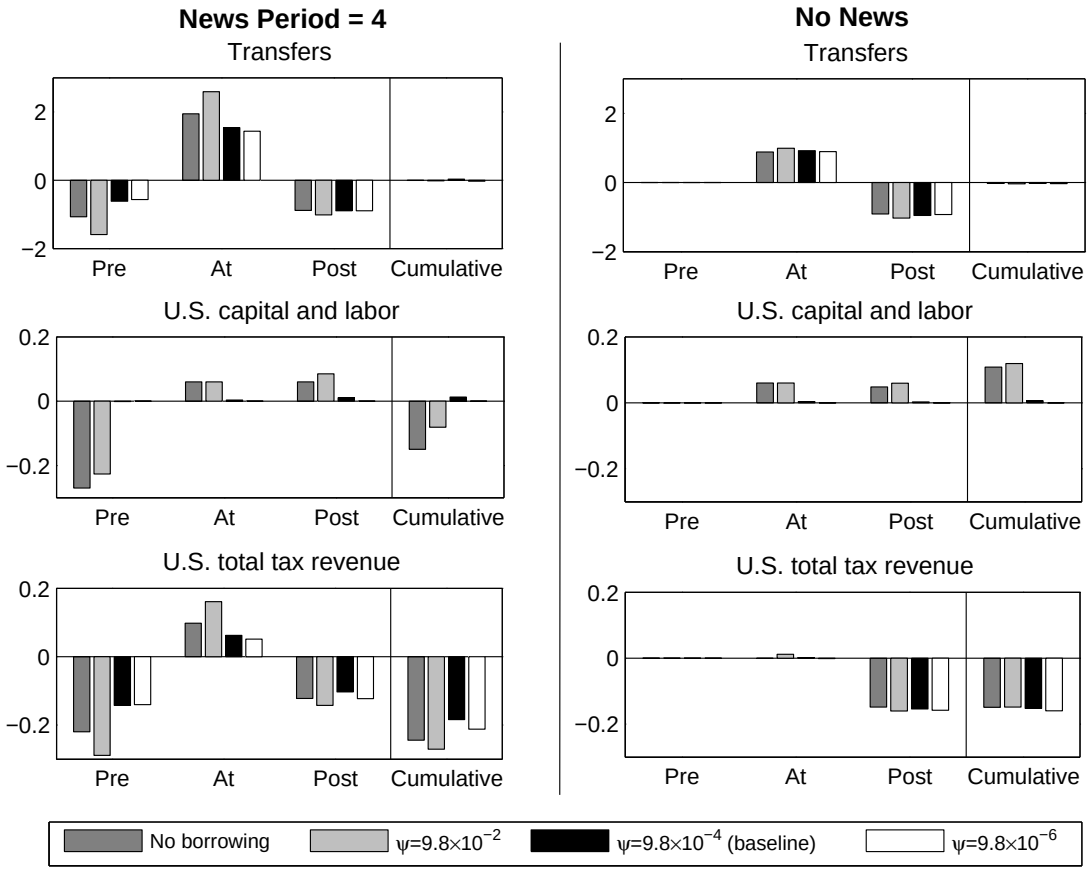

Figure 4: *Cumulative Responses for Variations in Debt-Elastic Interest Rate Parameter, ψ*

Notes: In the left panel a tax holiday is announced 4 periods in advance and in the right panel it is immediately and unexpectedly implemented. The figures subdivide the cumulative responses in the three realization periods: Pre-realization, At-realization, and Post-realization. The cumulative response is the sum of all subperiods. Units are quarterly gain/losses to that variable relative to the initial steady state.

in quarterly gains/losses of that variable relative to the steady state. As in the baseline, the temporary tax holiday reduces τ from 0.131 to 0.0642.

We focus first on the left panel where, identical to our baseline model, the firm receives news 4 periods in advance of the tax holiday. When the firm cannot access credit markets or the cost of borrowing is high, it relies heavily on internal funds and thus marginal value of an additional dollar in tax saving from the upcoming tax holiday is high. Consequently, during the news period a credit constrained firm aggressively cuts back transfers so as to be able to take the maximum benefits of the tax holiday. This aggressive curtailing of transfers, in combination with the lack of access to cheap credit, causes U.S. labor and capital to fall substantially during the news period. On the other hand, a firm that has access to less costly borrowing also reduce transfers in order to take advantage of the tax holiday. However, because they can borrow to offset this fall in transfers, there is little net effect on

U.S. labor and capital for these firms during the news period. In the presence of easy access to credit, the ability to smooth production activities by borrowing to offset fluctuations in asset holdings further results in negligible responses for non-credit constraint firms during the at- and post-news period. In comparison, there are large fluctuations in labor and capital for a credit-constrained firm at and after the tax holiday. These results show how a firm's access to credit is an important determinant of the magnitude of the effect of repatriation tax holidays on U.S. labor and capital.

The labor and capital responses from our baseline model follow the empirical literature of the AJCA. The majority of the firms receiving tax benefits from the act were not financially constrained and therefore did not alter the scale of their U.S. operations (Dharmapala, Foley, and Forbes 2011; Faulkender and Petersen 2012). Our baseline results reinforce these findings. However, Faulkender and Petersen find that a subset of firms that were financially constrained at the time of the AJCA did increase investment (but not employment) because of the act. When analyzing the periods at and after the tax holiday, our model likewise predicts that financially constrained firms increase capital use after the holiday.

In general, our analysis shows why that the ability of a firm to borrow can be very important when to understand the effects of future policy changes. For instance, in Stokey's (2016) model shows that tax uncertainty can generate an investment boon after the resolution of the uncertainty. In her model, firms cannot borrow but can accumulate liquid assets. In the main exercise, a tax reform on revenue is announced that will be implemented at a known future date, but the size of the tax rate change is uncertain. At the announcement of this future change, firms reduce investment in new projects and accumulate liquid assets as a "wait and see" policy until the uncertainty is resolved. When the tax reform is implemented, the firms develop the tabled projects and an upsurge in investment follows. Even though the exact characterization of the tax reform and economy in Stokey (2016) differs from our model, we can generate similar investment dynamics. In our model, however, a reduction in domestic capital usage in the news period and an upswing at the implementation of the tax holiday crucially depends on restricting a firm's access to credit markets. When firms can freely access external credit, the domestic operations are already operating close to their optimal scale and any repatriation tax rate reduction, or news surrounding such tax changes, have a negligible impact on domestic production.

Moving next to the right panel, when the tax holiday is immediately and unexpectedly implemented, a different picture emerges. If firm does not have access to external credit, the cumulative gains to U.S. capital and labor are positive. Since the policy change is unexpected, the firm does not contract transfers and U.S. economic activity prior to the tax holiday but still increase its capital and labor use once the holiday is implemented. When

ψ is very low, there are essentially no changes in these variables compared to the case with news.

In summary, we find that a tax holiday will only lead to a meaningful increase in U.S. capital and labor if a firm has sufficient barriers accessing credit markets *and* if the policy is unexpectedly implemented. However, if a policy change is anticipated, at best a tax holiday will result in small gains in U.S. capital and labor along with tax revenue losses. At worse, if a firm faces impediments to external credit market access, the tax revenue losses will also accompany losses in U.S. capital and labor use.

3.5 Policy Uncertainty

Our baseline simulations operated under the assumption that the firm knew with certainty that a repatriation tax holiday was going to occur at a known future date. However, in reality the legislative process is ripe with uncertainty – firms are regularly uncertain about both if and when a policy being discussed will be passed. For example, for a number of years now various proposals for changing repatriation tax laws have been floated in Washington, however, there is no clear indication of when and if such proposals will be made into law. In this section, we investigate the impacts of a tax holiday when there is uncertainty about both if and when the tax holiday will occur.

3.5.1 When a Tax Holiday will Happen

Since the AJCA, firms have steadily increased foreign holdings of assets untaxed by the U.S. government. The tax holiday under the AJCA was penned as a one-time event, but its use as a stimulus measure may indicate to firms that repatriation tax changes are a viable tool for policymakers to use again (Clausing, 2005). A hypothesis that has been put forth is that the current accumulation of foreign assets is due to expectations of another tax reduction at some point in the future (Levin and Coburn 2011; Brennan 2010). Our model concurs with this hypothesis. We find if the firm believes a tax holiday will occur but are uncertain about *when* it will occur, this leads to a steady accumulation of assets abroad by the firm.

Suppose the model firm receives news of a repatriation tax rate reduction that will happen with an unknown arrival date between the time of the news and a given time T in the future. Further, let us assume that in each time period, the firm assigns an equal probability that the tax change will occur in each remaining period through period T. We set $T = 20$ and in Figure 5 plot the foreign financial asset holdings during the news period. The size of the tax rate reduction is the same as in the baseline. In these simulations, we arbitrarily let the implementation of the tax reform to occur 18 quarters after receiving the news ($t = -2$). We

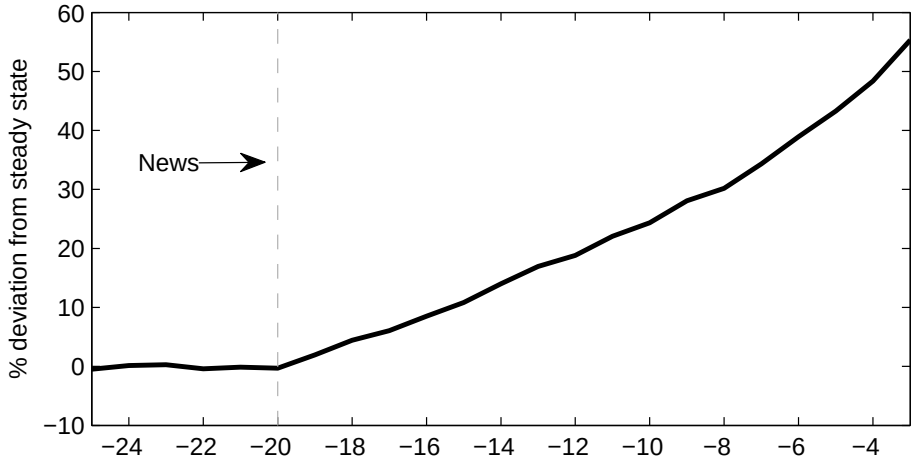

Figure 5: *Response to Foreign Bank Assets to a Temporary Reduction in the Repatriation Tax Rate When Date of Implementation is Uncertain*

Notes: The firm receives news that a tax holiday will occur in the next 20 quarters but are unsure of the arrival date. The tax holiday is arbitrarily chosen to occur after 18 periods. The expectations in the timing of the tax holiday are uniform across all remaining periods if the tax holiday has not yet occurred. The figure shows up to two periods before the tax holiday occurs to highlight the accumulation of foreign financial assets prior to the holiday.

do not show the periods at and after the tax reductions to highlight the run up of foreign assets in the news periods.

At the time of the news, the firm gradually begins accumulating foreign financial assets. After 17 quarters, these asset holdings are 55 percent higher than their steady state level. Since the timing of the policy change is unknown, the firm accrues these assets to take advantage of tax gains that will occur once the tax holiday is implemented in the future.

Our model suggests that the conjecture that firms have been accumulating assets abroad in anticipation of a future tax holiday has merit. As shown above, when firms believe that a future tax holiday is imminent – even if they are unaware of the timing – they will start accumulating assets abroad. This result is further interesting because it shows that at least part of the current asset buildup abroad may not be related to a high steady state repatriation tax rate, but maybe the direct result of discussions and a consequent belief by firms that a tax holiday is on the offing in the near future.

3.5.2 If a Tax Holiday May Happen

Next, let us consider the case where the firm is unsure *if* a tax holiday will occur. In this example, the firm receives news that in 4 quarters a one-period repatriation tax reduction might occur. After 4 quarters of receiving the news, two outcomes are possible: the news materializes whereby the repatriation tax rate is reduced as in the baseline, or the news does not materialize and the firm realizes a tax holiday will not occur. In the following

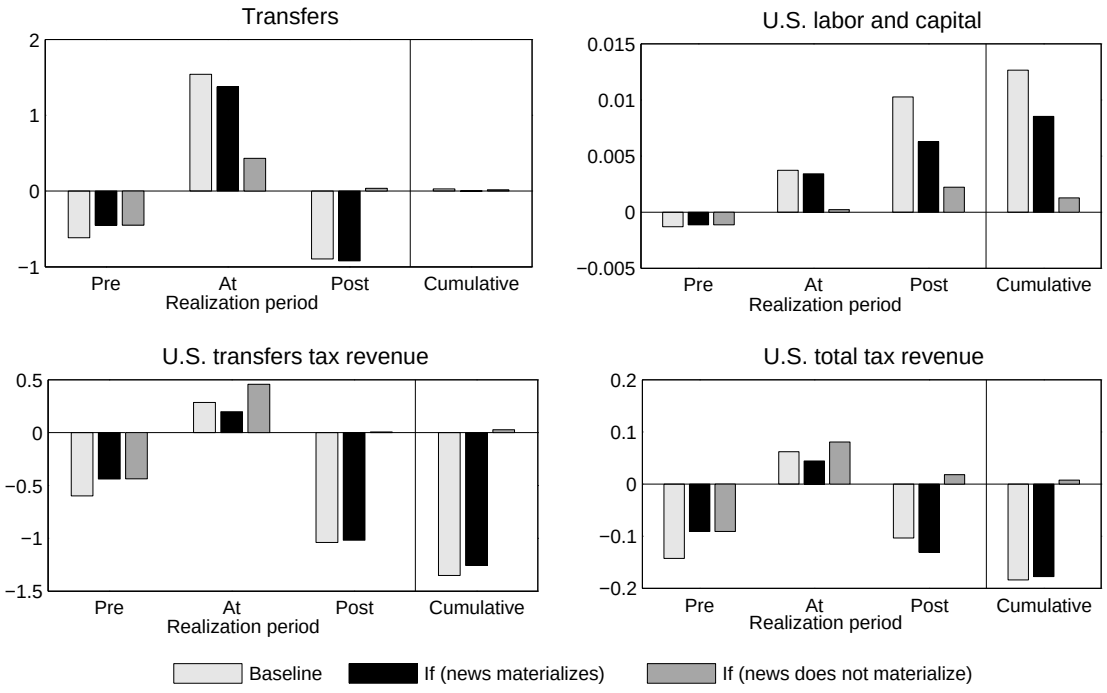

Figure 6: *Cumulative Responses When There is a 50 Percent Probability of the Tax Holiday Occurring in 4 Quarters in Advance of the News*

Notes: The figure shows the cases when the tax holiday does materialize and when it does not materialize along with the baseline when the tax holiday occurs with certainty. The figures subdivide the cumulative responses in the three realization periods: Pre-realization, At-realization, and Post-realization. The cumulative response is the sum of all sub-periods. Units are quarterly gain/losses to that variable relative to the initial steady state.

simulations, the firm assigns a 50/50 likelihood of either outcome occurring.

Figure 6 shows the cumulative responses in each sub-period – pre, at, and post realization – and the sum of all periods. The cases of uncertainty of *if* the tax holiday will occur (and if it does or not happen) are compared against the baseline where the tax holiday occurs with certainty. In the news period, the responses to all variables follow the baseline but are slightly dampened as the firm takes into account the possibility a tax holiday may not occur. If the news materializes, the firm repatriates additional funds by transferring assets that would otherwise be repatriated in future periods to the time of the tax holiday. In contrast, when the tax holiday does not occur the firm has no such motive. Instead, they only repatriate the funds they accumulated in the news period and the level of transfers quickly returns to their initial steady state. Thus, the tax revenue losses in the news period are almost exactly offset by the gains when the firm realizes the tax holiday is not coming. Overall, if the firm anticipates the possibility of a future tax holiday and it does not occur, the cumulative effects are negligible. However, the mere prospect of a repatriation tax holiday disrupts the timing of firm-level decisions and U.S. tax revenue.

Even though the cumulative effects for the case where the tax holiday does not occur

are negligible, they do differ from the case where the tax holiday does occur. In particular, if the tax holiday does occur the labor and capital responses are higher, although they do come at the cost of a larger tax revenue loss. This difference in the outcomes between the case where the tax holiday does occur and does not occur has the potential to generate a self-fulfilling prophecy. Once discussion about tax holidays start, a policy maker who is primarily interested in stimulating the economy, would find it beneficial to implement the tax holiday versus not implementing it.

3.6 Quantifying News and Uncertainty Effects: the Shadow Tax

Our framework lets us study the effect of repatriation tax changes on a number of firm-level variables. It also lets us construct a succinct measure of the quantitative impacts of news of a tax policy change. By holding assets back and not repatriating during the news period the firm can take maximum advantage of the tax holiday. Thus, news of a possible repatriation tax reduction actually generates an implicit tax – or shadow tax – on repatriating funds during the news period. In our model, we can measure this shadow tax as the subsidy rate the government will have to pay the firm in the period of receiving the news to encourage them to not hold back transfers in this period, and keep transfers at the original steady state level. That is, how much would the U.S. government have to subsidize transfers by to induce the firm to keep their level of transfers unchanged in response to news of a tax holiday?

We calculate the shadow tax under various scenarios and show that this implicit tax depends on both the length of the news period and the degree of certainty of *if* and/or *when* a tax holiday will occur. In panel A of Table 2, the firm receives news of a one-time repatriation tax holiday that *may* occur in exactly T quarters from the news. We consider two cases: one in which there is a 50 percent probability the tax holiday will happen and the other where the tax holiday will happen with certainty. If the tax holiday is implemented, the repatriation tax rate reduction is the same as the baseline.

Our shadow tax measure quantifies the degree to which news of a repatriation tax reduction induces firms to accumulate foreign assets. It is growing in the likelihood of the passage of a tax holiday and shrinking in the time until the realization of the news. The motive to increase foreign asset holding by reducing transfers at the time of the news is higher when the passage of the tax holiday is likely and when firms have less time to amass these assets in preparation for the possible tax holiday.

Table 2: Shadow Tax

Panel A: Certainty when news materializes

News materializes in T quarters	$P(if\ tax\ holiday)$ 0.5	1
$T = 1$	3.39	6.81
$T = 2$	0.34	0.65
$T = 3$	0.12	0.47
$T = 4$	0.10	0.42

Panel B: Uncertainty when news materializes

News materializes within T quarters	$P(if\ tax\ holiday)$ 0.5	1
$T = 1$	3.39	6.81
$T = 2$	2.01	3.69
$T = 3$	1.37	2.59
$T = 4$	1.10	2.06

Notes: Units are in percent. The shadow tax is the subsidized rate on a firm's repatriations at the time they receive news of a potential tax holiday that would keep transfers constant at their original steady state level in that period. In panel A the firm knows with certainty that a tax holiday will occur with a probability of 0.5 and 1 in exactly T periods. In panel B, the firm knows that a tax holiday will occur with a probability of 0.5 and 1 at some period within T periods.

When the tax holiday will occur with certainty in 1 quarter ($P = 1$ and $T = 1$), the shadow tax is 6.81 percent. In comparison, the repatriation tax reduction during the holiday is $13.1 - 6.42 = 6.68$ percent. That is, the shadow tax is even larger than the actual repatriation tax rate reduction. From the firm's perspective, it is more beneficial for them to receive news of the tax holiday than to have it immediately implemented. The advanced notice allows the firm to accumulate foreign assets and optimally maximize its use of tax breaks from the holiday.

Turning next to panel B of Table 2, the firm receives news of a one-time repatriation tax holiday that may occur with an unknown arrival date between the time of the news and T quarters from the news. At each time period, the firm assigns an equal probability that the tax change will occur in each of the remaining periods. We consider two cases, one where there is a 50/50 chance the tax holiday will occur and one where the tax holiday will occur with certainty. If $T = 1$, the exercises in panels A and B are identical. Comparing pairwise with panel A for $T > 1$, the shadow tax with uncertainty in when the news will materialize is always larger than the case with certainty. When there is certainty that the arrival date is more than one quarter out, the firm can wait to accumulate foreign assets right before the tax holiday. On the other hand, when the firm is uncertain when the news will materialize, the motive of the firm to accumulate foreign assets at the time of the news is larger as they prepare for the chance the tax holiday may occur at any time.

In summary, news of a potential tax change is akin to levying an additional tax on repatriated earnings in the periods leading up to the possible policy change. Our model shows that, conditional on the probability that a repatriation tax holiday will occur, uncertainty

in the timing of when the tax holiday may be implemented increases the shadow tax on repatriated foreign earnings. More generally, if discussions or proposals in congress alter the probability distribution of the legal environment, then the news itself may act as an implicit tax, with uncertainty about when the actual policy change will occur increasing this implicit tax.

4 Policy Analysis

In this section, we use our model framework to analyze historic and future repatriation tax policy changes. For historic tax policy changes, we consider the American Jobs Creation Act (AJCA) of 2004, and for future changes we study leading proposals currently being discussed the rounds in Washington. The former of these exercises is important as it helps provide external validation for our model. The exercises around current proposals add to the current discourse on repatriation tax policies in the U.S.

4.1 The American Jobs Creation Act

Our baseline calibration was informed by the actual tax rate reduction from the AJCA, leading to a natural benchmark from which to judge the validity of our framework. We start by comparing our baseline results directly with the main findings from the empirical literature that evaluates the impact of the AJCA.[17] Our model is able to explain key empirical findings surrounding the AJCA. We also present suggestive evidence that firms both anticipated and reacted to the tax holiday provision in the AJCA well before it was signed into law. Furthermore, the effects of policy lasted for several quarters after the end of the tax holiday. This evidence lends support to the importance of accounting for the full dynamics in any analysis of repatriation tax policy reform.

It is estimated that under the AJCA tax holiday approximately $312 billion of qualified earnings were repatriated to the U.S. (Redmiles, 2008). Figure 7 shows the timeline of net repatriated dividends from foreign subsidiaries to U.S. based parent companies as a share of total corporate profits for the periods before, during, and after the passing of the AJCA. The shaded area is the effective period of the tax holiday and the horizontal line - at roughly 5% – is the average prior to the enactment of the AJCA. Net repatriated dividends as a share of corporate profits had never exceeded 10% prior to the enactment of the law, but reached 29% in the final quarter of the tax holiday before sharply falling below its average

[17] A summary of this literature is in the Online Appendix. This literature, surprisingly, almost generally does not consider the anticipatory effects of repatriation tax policy changes.

level just following the repatriation tax holiday.[18] As our baseline results show in Figure 2, the W-shape in repatriations beginning before the policy change generated by model is consistent with the data. Transfers rise sharply at the tax holiday before falling below its long-run average at the conclusion of the tax holiday. Knowing that the tax holiday is a one-time event, firms concentrate their repatriations to the tax holiday window leaving fewer assets to transfer in subsequent periods.

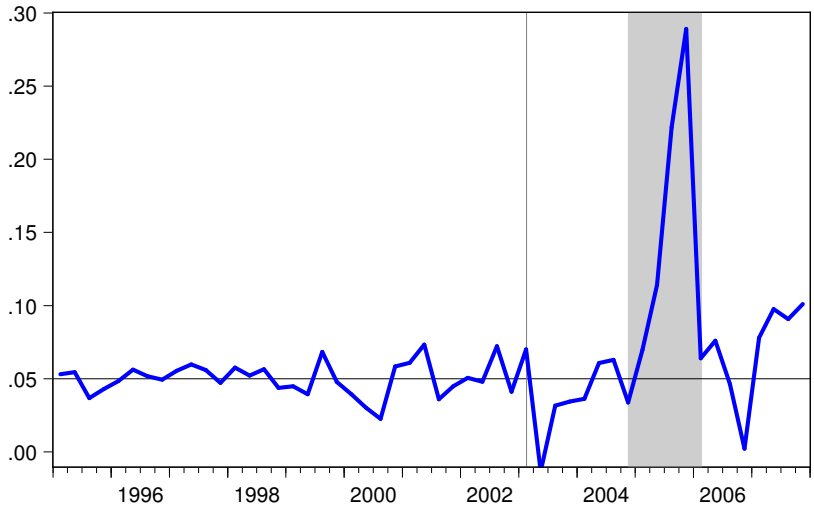

Figure 7: *Transfers: Net Repatriations as Share of Corporate Profits*

Notes: Constructed using Flow of Funds reported by the Board of Governors of the Federal Reserve Bank.

Despite the influx of liquidity during the tax holiday, the general consensus in the literature is that the AJCA's objective of stimulating employment and investment were not met. Dharmapala, Foley, and Forbes (2011) found that repatriations had no significant impact on U.S. investment or employment, as did Clemons and Kinney (2008) with regards to investment. Faulkender and Petersen (2012) echo these findings and show that financially unconstrained firms, which repatriated 73% of all qualified funds, did not alter domestic employment or investment. However, they also document that, unlike the financially unconstrained firms, the financially constrained firms did increase investment, but still not employment, in response to the act.[19] Our model is consistent with these findings. First, as seen in Figure 3, our model predicts that irrespective of whether we focus on just the

[18]The fall in repatriations after the tax holiday was anticipated by policy makers. The Joint Committee on Taxation predicted firms would shift repatriated earnings they would otherwise have repatriated in future years to the tax-holiday period to get more favorable rates (Kleinbard and Driessen, 2008).

[19]Further, of the top 15 repatriating corporations, 10 actually reported a decrease in U.S. jobs from 2004-2007 (Permanent Subcommittee on Investigations 2011).

post-news period or the full effect with the pre-news period, the impact of a tax holiday on capital and unemployment is very small. Over the first ten quarters, counted from the period of the news, the impact of the tax holiday per our model was a cumulative increase of less than 1% in labor. In other words, our model predicts that average short run impact of the AJCA tax holiday was less than an average of 0.1% more labor hired per quarter. Second, as discussed in Section 3.4, we find that similar to Dharmapala, Foley, and Forbes (2011) the responsiveness of domestic capital and labor crucially depends on a firm's access to external credit markets. When a multinational firm is not credit constrained, it is able to operate at its profit maximizing scale independent of the amount of repatriated income. However, if a firm is constrained in its access to credit, asset inflows and outflows from its foreign operations have an effect on its ability to hire and rent U.S. capital.

Next, under the AJCA, funds receiving tax breaks were prohibited from being used for shareholder payouts (dividends and share buybacks). However, many studies have found that the tax holiday was, in fact, associated with an increase in payments to shareholders.[20] In addition, in an evaluation of the proposed tax holiday released a year prior to the AJCA, a Congressional Research Service report noted that due to the fungibility of internal funds, firms could channel the repatriated funds from a tax holiday to investment while switching domestic funds to shareholder payouts (Brumbaugh, 2003). Dharmapala, Foley, and Forbes (2011) estimate that a $1 increase in repatriation during the AJCA tax holiday corresponded with a $0.60–$0.92 increase in shareholder payouts. Consistent with these empirical studies, our baseline simulations in Figure 2 show that following a tax holiday dividends rise and remain higher than average for many years to come. Back of the envelope calculations using our baseline simulation further reveal that for our model the increase relative to steady state in after-tax transfers is roughly equal to the increase in dividend payments. Thus, in our model the entirety of the tax savings during the tax holiday is eventually reimbursed to shareholders.

Finally, on net, a Joint Committee on Taxation (2004) report anticipated that the tax holiday provisions from the AJCA would lead to tax losses over a 10 year period. The report anticipated tax revenue gains during the tax holiday window with subsequent losses over the following years. Consistent with this report, our model results show that a tax holiday would lead to a cumulative fall in tax revenue. Interestingly, however, our results show that at the time of the tax holiday tax revenues increase, which is again consistent with the report. This is because even though taxes are lower during the tax holiday, the increase in repatriated funds is enough to offset this effect, leading to higher overall tax revenues. We find that

[20] See for instance, Blouin and Krull (2009); Clemons and Kinney (2008); or Dharmapala, Foley, and Forbes (2011).

the loss in tax revenue is actually driven solely by the reduction in repatriations both in the news periods and after the actual tax holiday.

Our model, even though not constructed to explain the AJCA, is able to match a number of features of the data and empirical results surrounding the AJCA. This provides confidence to evaluate current policy proposals through the lens of our model.[21]

4.1.1 News and the AJCA

Studies on the impacts of the AJCA have primarily focused on its impact only at and after its enactment. However, we argue that to correctly quantify the effects of the AJCA, one must also account for any anticipatory effects that may have occurred, i.e. the impacts during the news period. We now present suggestive evidence that the tax holiday under the AJCA was not unexpected and that firms did indeed alter their behavior significantly in anticipation of the act.

There is often a lag between when a firm starts forming a belief that a policy change is likely to occur and when the actual policy change occurs. There is usually a relatively long legislative lag between when a law is introduced and when it is passed by both houses of Congress, approved by the President, and then implemented. This is in addition to the fact that long before the final bill is introduced there are many similar bills that are introduced but never passed or even voted on. In the case of the AJCA, there were a series of earlier bills beginning in February 2003 that did not pass through congress but contained the tax holiday provisions that were later incorporated in the AJCA.[22] Thus, one can safely conjecture that firms, with some level of certainty, did anticipate at least as early as February 2003 that a tax holiday was on the horizon.

In the time leading up to the AJCA, there is evidence that earlier bills did lead to anticipation of the tax holiday. For example, in 2003 Lehman Brothers' tax accounting analyst Robert Wilkens indicated that legislation allowing companies to repatriate foreign earnings was "gaining momentum" and was likely to be passed into law in early 2004 (Corporate Financing Week 2003). Other examples of anticipation of the tax holiday include Simpson and

[21] In addition, in the Online Appendix we quantitatively capture the steady state relationship between repatriation tax rates and liquid asset holding (financial assets in our model) found in Foley, Hartzell, Titman, and Twite (2007). As we did not target this relationship in our calibration, it provides further external validity to our model.

[22] Lobbying efforts had long called for tax breaks on repatriated income, but the call for a tax holiday gained legitimacy in February 2003 with the introduction of the *Homeland Investment Act of 2003* to the House of Representatives, the *Invest in America Act of 2003* presented to the House in March, and the *Invest in the USA Act of 2003* introduced in the Senate in the same month. These bills included similar provisions for the tax holiday included in the AJCA of 2004. Under the AJCA of 2004, 85 percent of repatriated earnings would qualify for tax exemptions, the same as in the *Invest in the USA Act of 2003*. A later bill introduced in November 2003, *The American Jobs Creation Act of 2003*, also contained similar language.

Wells (2003) who discuss firms' lobbying efforts for a tax holiday in 2003 citing provisions that would eventually be enacted in the AJCA and Sullivan (2004) who question if foreign income shifting in the years leading up through 2002 are related to tax holiday proposals in congress. Oler, Shevlin, and Wilson (2007) find that in 2003, well before the introduction and passage of the AJCA but when a future tax holiday seemed likely, stock prices had started reflecting potential tax savings from a tax holiday. This is a result that is mimicked by our model; stock prices rise in the news period in anticipation of a future tax holiday (see Figure 2).

Intuitively, our model can inform us of where to look for evidence regarding anticipatory effects: to take advantage of a tax holiday, we expect firms to reduce transfers and accumulate assets abroad to maximize tax savings. Prior to the AJCA, we find such a drop in aggregate transfers and increases in firm-level accumulation of assets abroad. Returning to Figure 7, we see that net repatriated dividends fell sharply in early 2003. The vertical line in 2003Q1 in Figure 7 marks the time the first bill leading up to the AJCA was introduced (the *Homeland Investment Act of 2003*). The following quarter, net repatriated dividends went negative, the only such instance in the sample period. If firms curtailed transfers from abroad in anticipation of the AJCA, this would result in an accumulation of income held abroad. We next rely on firm-level data to investigate the holdings of these assets leading up to the AJCA.

Firms can avoid paying U.S. taxes on foreign income by declaring these assets as Permanently Reinvested Earnings (PRE); these are earnings that are claimed to be indefinitely held by foreign affiliates.[23] To illustrate the accumulation of PRE leading up to the AJCA, we collected the disclosed PRE from 10-K filings for firms that received tax breaks on over $500 million under the AJCA. Our sample contains 58 firms that repatriated 57% of the estimated $312 billion repatriated under the act. To measure a firm's annual accumulation of PRE, we define $\Delta PRE\ share$ as the dollar change in PRE for a firm divided by its net foreign income in that year (pre-tax foreign income minus foreign income taxes). This gives the implied share of net foreign income designated as PRE that year.[24]

[23] There is no deferred tax liability on PRE as firms declare these assets will not return to the U.S., although under the AJCA these assets were permitted to be repatriated with the reduced tax rate.

[24] See Appendix B for a detailed description of the data.

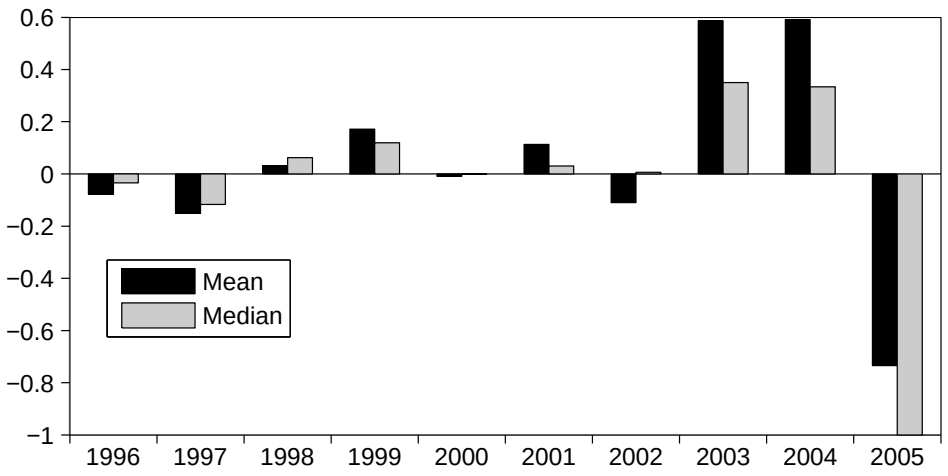

Figure 8: $\Delta\widetilde{PRE\ share}$ *1996–2005*

Notes: The figure shows the percentage point deviation of the share of foreign income retained abroad and untaxed by the US (PRE) relative to the average share from the period 1996–2002. $\Delta\widetilde{PRE\ share}$ is defined as $(\Delta PRE\ share)/(\overline{\Delta PRE\ share})_{1996-2002} - 1$ where $\Delta PRE\ share$ is the implied share of after tax foreign income designated as PRE and $\overline{\Delta PRE\ share}$ is the average $\Delta PRE\ share$ from 1996-2002. Details on the sample and construction of $\Delta\widetilde{PRE\ share}$ is found in Appendix B.

Figure 8 plots the across-firm mean and median percentage point deviation of $\Delta PRE\ share$ from its 1996-2002 average $\Delta PRE\ share$, $\Delta\widetilde{PRE\ share}$. This gives a measure of how firms' accumulation of PRE changed before versus after 2003, the year the precursor bills leading up to the AJCA were first introduced. Prior to 2003, $\Delta\widetilde{PRE\ share}$ was relatively stable. From 2002-2003 and 2003-2004, this measure of changes in foreign asset holdings by U.S. firms increases sharply relative to its long-run average. In 2004-2005, $\Delta\widetilde{PRE\ share}$ substantially declined as firms ran down their holdings of PRE by repatriating a large share of these assets during the tax holiday. We note that the sharp increase in the accumulation of PRE in 2002-2003 occurred before the AJCA was officially introduced and enacted. This is once again suggestive that firms anticipated the tax holiday and acted on this anticipation by changing the amount of assets held overseas leading up to the AJCA.

4.2 Analysis of Proposed Tax Reforms

We next use our framework to analyze current U.S. repatriation tax reform proposals. The reforms we consider contain tax changes from proposals put forward in the *Tax Cut and Jobs Act* (henceforth the TCJA17 to clearly distinguish this acronym from the AJCA) introduced in the U.S. House of Representatives in November of 2017, President Obama's White House Budgets for 2015, 2016, and 2017, and President Trump's White House Budget for 2018.

In contrast to the one-time tax holiday under the AJCA, these proposals aim for a

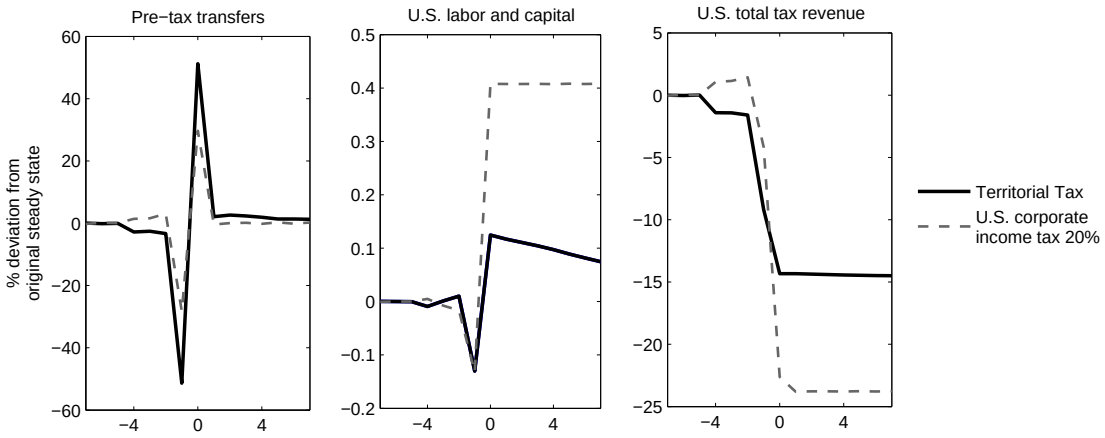

Figure 9: *Responses to a Permanent Reduction in U.S. Corporate Income Tax Rate and Change to a Territorial Tax System*

Notes: The firm receives news 4 periods in advance of the tax policy change. With the reduction in U.S. corporate income tax rates, τ_{US} is permanently reduced from 30.2% to 20%. This also reduces the repatriation tax rate τ from 13.1% to 2.9%. Under the change to a transition tax rate, the repatriation tax rate τ is reduced from 13.1% to 0%.

permanent change in how the U.S. government taxes earnings repatriated from abroad. The first possibility is to alter the corporate income tax on all U.S. firms. Given that the repatriation tax rate is the difference between the U.S. corporate tax rate and the corporate tax rate abroad (bound below at 0), a change in the U.S. corporate tax rate will automatically also alter the repatriation tax rate. For example, if the highest marginal U.S. corporate rate was capped at 20%, then per our baseline repatriation tax rate calculation we would expect the average repatriation tax rate to fall to 2.9% from the current 13.1% (ie. τ=20%-17.1%).

The second possibility is directly altering the repatriation tax rate by switching to a territorial tax system where the repatriation tax rate is set at 0%. In this scenario, the firm is responsible for paying corporate income taxes both in the U.S. and abroad, but income earned abroad would not face additional U.S. taxes upon repatriation.

In Figure 9 we plot out the impulse responses for a subset of our variables both for when the policy change is a permanent reduction in the U.S. corporate income tax rate to 20% (solid line) and when the change is moving to a territorial tax system (dashed line). As in our baseline experiment, we set the news period length to be 4. Similar to our results from a tax holiday, the news periods do matter. In both cases, firms significantly reduce transfers in the news period in anticipation of the policy change, and, as before, it is prudent for policymakers to take these news effects into account as they calculate the costs and benefits of permanently changing repatriation tax policies.

In addition to taking into account the news effects, it is also important in the case of permanent policy changes to consider their long term effects. The reason for this is that

whereas temporary policies do not alter the long term steady state, a permanent change in the repatriation tax policy will permanently change the steady state levels of tax revenue and capital/labor in the economy. We document these permanent changes in Table 3 as calculated from our model.

Panels A and B of Table 3 show how the steady state levels of U.S. labor/capital and U.S. tax revenues change under different corporate income tax rates. The first row in each panel documents the long run effects of the policy change if only the corporate income tax rate is altered. In these cases, the repatriation tax rate is reduced by the same amount as the U.S. corporate income tax change. The second column in each panel documents what would happen in the long run if the U.S. both went to a territorial tax system and simultaneously changed the corporate tax rate. As a reference point, the TCJA17 proposes reducing the top U.S. corporate income tax rate to 20% along with a move to a territorial tax system (second entry of row 2, column 2 of Panels A and B).

Table 3: Long-Run Effects

U.S. corporate income tax rate	Panel A: U.S. labor/capital		Panel B: U.S. tax revenue	
	No territorial	w/territorial	No territorial	w/territorial
30.2% (orig. steady state)	0.0	0.0	0.0	-15.1
20%	0.4	0.4	-23.8	-27.1
17.1% (equal to foreign)	0.5	0.5	-30.5	-30.5

Notes: The table presents the percent change in steady-state values from policy changes in U.S. corporate income tax rates and implementation of territorial tax system.

With both a reduction in corporate income taxes and a switch to a territorial tax system, U.S. gains to labor and capital are about the same. Even at the extreme, a reduction of the U.S. corporate income tax rate to 17.1%, which is the same rate as the foreign corporate income tax rate, only leads to steady state gains in U.S. labor and capital of 1/2 of 1 percent. Again, because multinational firms have, arguably, relatively easy access to external financing, a reduction in U.S. corporate income and/or repatriation tax rates does not materially alter its ability to operate close to their profit maximizing scale.

Looking next at steady state U.S. tax revenues in Panel B, any reduction in tax rates leads to a sizable loss in tax revenue. For example, a reduction in the U.S. corporate income tax rate to 20% combined with a switch to a territorial tax system results in tax revenue losses of 27% per quarter relative to the original steady state. Taken together, within our

model these policy changes lead to marginal changes in U.S. capital and labor, and hence output, and have relatively large tax consequences for the U.S. government.

While abstracting from the potential efficiency gains associated with reducing distortionary taxes, our results point to a clear tradeoff between losses in tax revenue and gains to domestic activity. We note that these results are not representative of comprehensive tax reform which may provide tax revenues from other sources, but rather only isolate the impacts of specific policy changes on U.S. based multinationals. For example, many policymakers, even though they all may not fully appreciate the magnitude of the news effect, do worry about transitioning to any system that does not tax the over $2 trillion dollars currently held abroad by U.S. firms that are yet to be taxed by the U.S. government. One proposal that recommends changes to repatriation tax policy, but at the same time collects some tax revenue off these foreign asset holdings, is to impose a one-time deemed repatriation tax on assets held abroad at the time of a policy change. For example, the TCJA17 calls for a one-time, lump-sum tax on assets held abroad simultaneous with a permanent change in repatriation tax policy. Under this plan, this deemed repatriation tax applies to all Permanently Reinvested Earnings (PRE) since the enactment of the *Tax Reform Act of 1986*. Once paid, the plan allows firms to repatriate taxes back to the U.S. at no additional tax cost.

We next study the dynamic effects of a deemed repatriation tax using measures proposed in the TCJA17. In our model, we apply a deemed repatriation tax to all foreign assets A_F for one period only at the date of a change to a territorial tax system.[25] At this period, Equation (2) is changed to

$$\tilde{A}_F = \begin{cases} (1-\tau_{TT})A_F - T & \text{if } T \geq 0 \\ (1-\tau_{TT})A_F + |T| & \text{if } T < 0 \end{cases}$$

where τ_{TT} is the transition tax rate.

The transition tax in the TCJA17 calls for a 12% tax on all cash and cash-equivalent assets and 5% on remaining reinvested earnings. Given the fungibility of internal funds, the taxation of liquid assets in this proposal may be problematic. That is, in practice it may be difficult to say whether a particular dollar in foreign financial assets is from earnings untaxed by the U.S. or another source. For this reason, in the model we set the transition tax to be $\tau_{TT} = 0.05$ on all foreign assets.[26]

Figure 10 plots the responses to the implementation of a one-time deemed repatriation tax

[25] In practice, any assets transferred from the U.S. parent company to foreign operations would be exempt from this tax. In our calibration, the U.S. operations never transfer assets to the foreign operations and thus

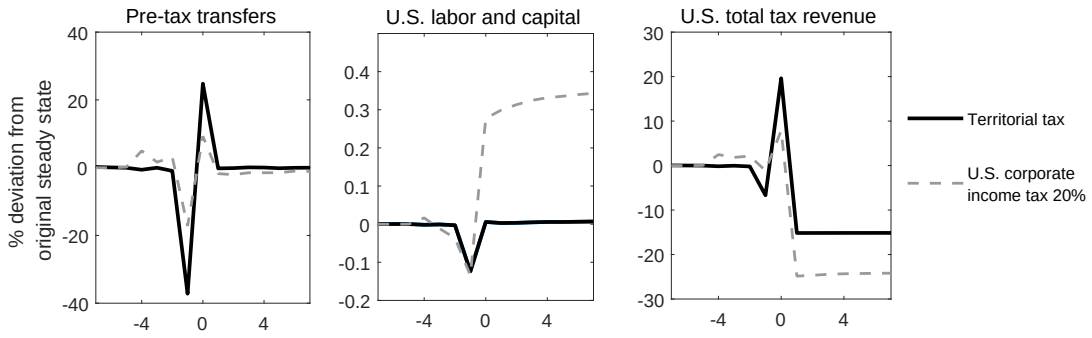

Figure 10: *Responses to a Permanent Reduction in U.S. Corporate Income Tax Rate and Change to Territorial Tax System with a deemed repatriation tax of 5%*

Notes: The firm receives news 4 periods in advance of the tax policy change. At the implementation of the policies, the firm is charged a one-time deemed repatriation tax of 5% on all foreign assets. With the reduction in U.S. corporate income tax rates, τ_{US} is permanently reduced from 30.2% to 20%. This also reduces the repatriation tax rate τ from 13.1% to 2.9%. Under the change to a territorial tax, the repatriation tax rate τ is reduced from 13.1% to 0%.

combined with the switch to a territorial tax system and a reduction of the U.S. corporate income tax to 20%. Again, in both cases firm receive news 4 quarters in advance of the policy changes. The responses to transfers and U.S. labor and capital are similar to the cases without the transition tax (see Figure 9) with two main differences. First, the transition tax partially reduces the incentive to accumulate assets abroad during the news period, and thus there is a smaller reduction in transfers during the news period. Second, at the period of the policy change, U.S. tax revenues spike from the one-period transition tax on foreign assets. Overall, the transition tax revenue gains make up for approximately 1.5 quarters worth of steady state tax revenue losses under the switch to a territorial tax system and make up for less than 1/2 quarters worth of steady state tax revenue losses under the reduction in the U.S. corporate income tax rate. While in the short-run the transition tax results in sizable tax revenues for the U.S. government, these tax revenue gains are dwarfed by the long-run losses from the tax rate reductions.[27]

all foreign assets A_F are assets that have yet to be taxed by the U.S. government.

[26]There is also a question of whether the deemed repatriation tax will be permitted under U.S. law as it retroactively taxes assets not previously subject to U.S. taxation. The U.S. Supreme Court has allowed certain retroactive taxes to be applied but only if the retroactive period is modest and "required by the practicalities of producing national legislation (*United States v. Darusmont*(1981), 449 U.S. 292, 296-297)."

[27]In a previous version, we focused on the news effects of policy proposals from 2015-2020. These include uncertainty of *if* and/or *when* the policies may materialize using survey-based expectations of future tax reform. This analysis is presented now in the Online Appendix.

5 Conclusion

This paper presents a model of a multinational firm to understand how changes in repatriation tax policy impact firm-level behavior. We discipline our framework with both aggregate and firm-level data and use the American Jobs Creation Act of 2004 to test its external validity. Our analysis serves to highlight the importance of understanding the dynamics around, and timeliness in, resolving repatriation tax policy.

We find that a policy evaluation that does not account for firm-level behavior before the policy change overestimates the benefits of reducing repatriation tax rates – by overstating both the gains to domestic production activity and the amount of assets transferred from abroad – and underestimates its costs by understating tax revenue losses. Additionally, the length of the news period and policy uncertainty of *when* and *if* a tax change will occur all have significant effects on the impact of a policy change. Furthermore, we show that a firm's access to external financing plays an important role in determining the impact of repatriation tax changes on domestic activity. Firms that have low costs of accessing external credit markets can operate at their efficient scale independent of access to foreign funds, and are thus not materially affected by changes in the repatriation tax rate. In other words, the less credit constrained the firm is, the more muted the responses of real variables are to both expected and realized changes in repatriation taxes.

In recent years, lawmakers have actively discussed policies to lower repatriation tax rates. A widely stated aim of these reforms is to encourage U.S. based firms to repatriate foreign asset holdings. News of a potential reduction in repatriation tax rates, which may arise from policy discussions, generates a wedge that distorts the intertemporal cost of repatriating foreign assets. This wedge, or "shadow tax," on repatriating foreign earnings discourages firms to transfer income back to the US, thereby leading to an accumulation of assets abroad. The shadow tax is further magnified with uncertainty regarding the timing of the policy's resolution.

Even though lawmakers' goals may be to lower the repatriation tax rate to encourage the transfer of assets, expectations and uncertainty generated by their discussions can have the opposite effect by decreasing the incentives for firms to repatriate earnings until the resolution of the policy discussion. Although unexplored in this paper, it may be that revenue losses during this period are sufficiently large such that lawmakers have the incentive to implement a tax reduction. In other words, public discussions that indicate the intention of changing repatriation tax policy could be self-fulfilling.

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Appendix

A Transition Probabilities for Experiments

This appendix describes the firm's expectations of future policy from the period of receiving news through the resolution of the news.

A.1 Baseline

In the baseline simulations, the firm unexpectedly receives a tax news shock that notifies them that there will be a one-period repatriation tax rate reduction 4 quarters in the future. Figure A1 shows the transition graph for the general case when the time from the news to the tax holiday is T quarters. After the tax holiday, the repatriation tax rate returns to its original steady-state rate indefinitely.

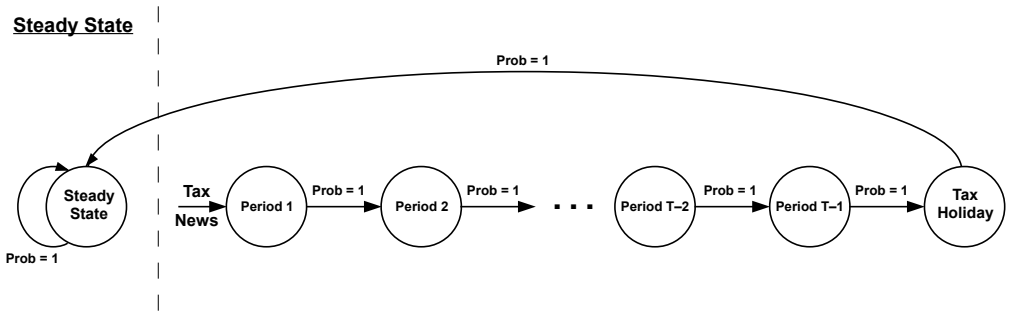

Figure A1: *Transition Graph for Baseline Simulation: Tax Holiday Occurring T Periods From the Arrival of the News*

A.2 Uncertainty: When a Tax Holiday May Occur

Figure A2 shows the transition graph for the case when firms receive news of a one-period temporary repatriation tax reduction that will occur at an unknown time between the arrival of the news and T periods from the arrival of the news. This corresponds to the simulations in Section 3.5.1. If the tax holiday has not occurred at a given period, the firm places an equal likelihood that the tax holiday will occur at any given future period. For example, if $T = 8$, then in the first period of the news firms place a $P_1 = 1/8$ probability that it will occur in the next period, and if it doesn't occur in the next period then in period 2 they place a $P_2 = 1/7$ probability of it occurring in the following period, and so on. Once the tax holiday occurs, the repatriation tax rate returns to its original steady-state rate indefinitely.

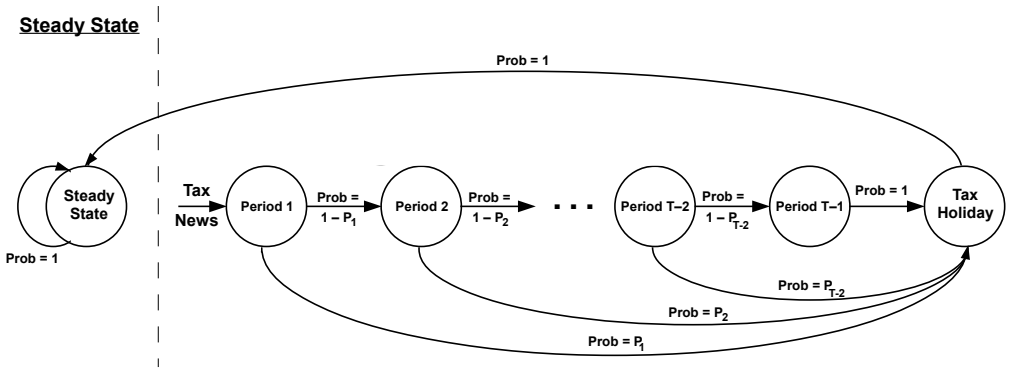

Figure A2: *Transition Graph With Uncertainty of When a Tax Holiday May Occur Between the Arrival of the News and T Periods Afterwards*

A.3 Uncertainty: If a Tax Holiday May Occur

Figure A3 shows the transition graph for the case when firms receive news of a one-period temporary repatriation tax reduction that may or may not occur T periods in the future. This corresponds to the simulations in Section 3.5.2. The firm unexpectedly receives a tax news shock that notifies them there *may* be a temporary repatriation tax rate reduction T quarters in the future. At time $T-1$, the firm knows that the tax news will be resolved with a probability of the tax holiday occurring as $P(Occur)$ and probability $1-P(Occur)$ that it will not occur. If the tax holiday does occur, the firm will receive a one-period repatriation tax reduction before the repatriation tax rate returns to the original steady-state rate indefinitely. If it does not occur, the repatriation tax rate returns to its original steady-state rate indefinitely.

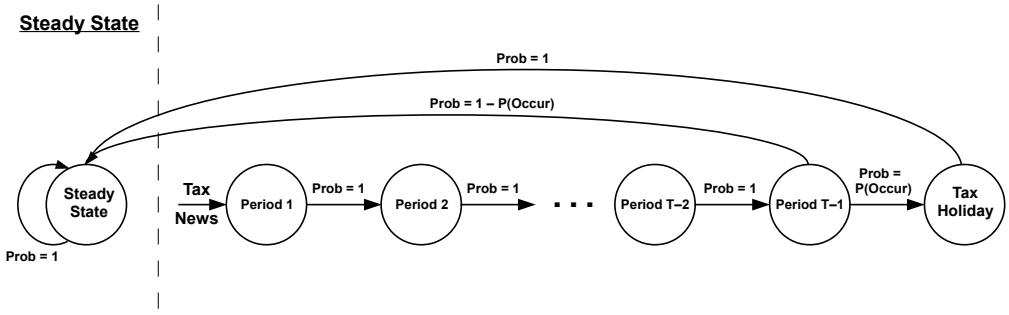

Figure A3: *Transition Graph With Uncertain Tax Holiday Occurring T Periods From Arrival of the News*

A.4 Uncertainty in If and When a Tax Holiday May Occur

Section 3.6 reports the shadow tax on repatriated earnings at the period the firm receives news of a possible repatriation tax holiday. Figure A4 shows the general case of the transition graph used in calculating these shadow taxes (ex. Column 1 of Panel B in Table 2). The firm receives news of a temporary repatriation tax reduction that may or may not occur between the arrival of the news and T periods from the arrival of the news. If the tax holiday has not occurred at a given period, the firm places an equal likelihood that the tax holiday may occur at any given future period. They additionally place a probability that the holiday will occur at all ($P(Occur) = P_{T-1}$). For example, if $T = 4$ and firms place a 50 percent probability a tax holiday will occur, then in the first period of the news firms place at $\frac{1}{4} \times 0.5$ probability it will occur in the next period and in each remaining period. At time $T - 1$, firms know that the tax news will be resolved with a probability of the tax holiday occurring as P_{T-1} and probability $1 - P_{T-1}$ that it will not occur. If the tax holiday does occur, the firm receives a one-period repatriation tax reduction before the repatriation tax rate returns to its original steady-state rate indefinitely. If it does not occur, the repatriation tax rate returns to its original steady-state rate indefinitely.

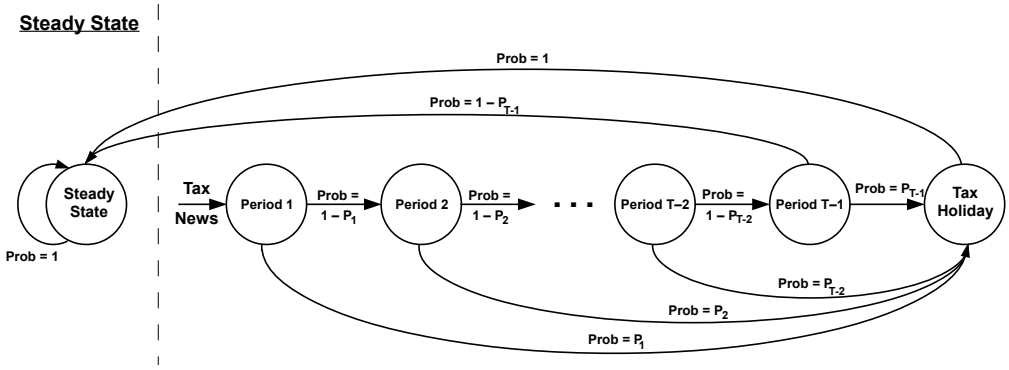

Figure A4: *Transition Graph With Uncertainty if and When a Tax Holiday May Occur Between Arrival of the News and T Periods Afterwards*

A.5 Permanent Repatriation Tax Change

Figure A5 shows the transition graph for the case of a permanent reduction in repatriation tax rates. This corresponds to the reductions in U.S. corporate income tax rates and change to a territorial tax system given in Section 4.2. The firm unexpectedly receives a tax news shock that notifies them there will be a permanent tax policy change T quarters in the future. Once the tax reform is implemented, the tax rate remains at this new level indefinitely.

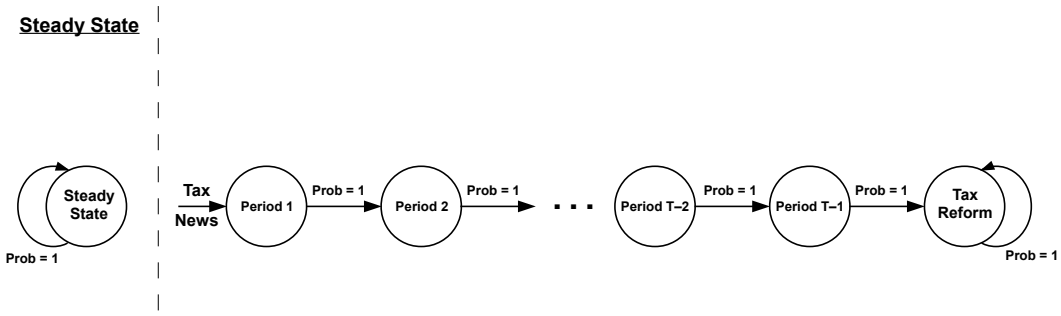

Figure A5: *Transition Graph Where a Permanent Change in Tax Policy Occurs T Periods From Arrival of the News*

B Data and Construction of $\Delta \widetilde{PRE\ share}$

This section describes the data and construction of $\Delta \widetilde{PRE\ share}$ shown in Figure 8. To illustrate the accumulation of PRE leading up to the AJCA, we hand collect the disclosed PRE from firms' 10-K filings with the SEC for those that received tax breaks on over $500 million under the AJCA. We choose $500 million dollars as the cutoff for repatriated earnings in order to correlate firms' PRE leading up to the AJCA. Under the AJCA firms could receive tax breaks on repatriated earnings of the larger of $500 million or the dollar amount of PRE. That is, the amount of a firm's PRE could be independent to the amount of tax breaks received if the repatriated money was less that $500 million. We then link our PRE data with foreign earnings data from the annual Compustat Industrial Database. We require firms in our sample to have a minimum of 5 PRE observations leading up to the AJCA. Our sample contains 58 firms which, as a group, represents 57% of the estimated $312 billion repatriated under the act.

PRE is a stock measure of all earnings held permanently abroad that are not subject to U.S. taxes. To measure a firm's annual accumulation of PRE, we define $\Delta PRE\ share_{i,t}$ as the dollar change in PRE for a firm i in time t divided by its net foreign income (pre-tax foreign income minus foreign income taxes). This gives the implied share of net foreign income designated as PRE that year. We restrict $\Delta PRE\ share$ to be between 0 and 1. If $\Delta PRE\ share > 1$, we set it equal to 1 (i.e. all of a firm's foreign income is assigned as PRE). If $\Delta PRE\ share < 0$ we let $\Delta PRE\ share = 0$ (i.e. none of a firm's income is assigned as PRE). Additionally, if net foreign income is negative and $\Delta PRE\ share < 0$, we set $\Delta PRE\ share = 0$.

We then measure how firms' accumulation of PRE changed before and after 2003. We pick 2003 as this is the year in which the precursor bills leading up to the AJCA were first

introduced. We do this by comparing a firm's $\Delta PRE\ share$ by its average $\Delta PRE\ share$ from 1996-2002. This is given by

$$\widetilde{\Delta PRE\ share}_{i,t} = \left(\Delta PRE\ share_{i,t} \Big/ \overline{\Delta PRE\ share}_{i,1996-2002} \right) - 1$$

where $\overline{\Delta PRE\ share}_{i,1996-2002}$ is the firm's average $\Delta PRE\ share$ from 1996-2002. $\widetilde{\Delta PRE\ share}_{i,t}$ gives the percentage point deviation of a firm's accumulation of PRE as a share of foreign income relative to its 1996-2002 average accumulation of PRE as a share of foreign income.

Online Appendix for "Repatriation Taxes" (Not For Publication)

This not-for-publication appendix contains additional analysis of our framework. We start by presenting the solution method in Section OA3. In Section OA4, we then present a comparison of the empirical findings in the literature of the AJCA with out model predictions. Section OA5 performs robustness exercises on the coefficient of relative risk aversion in our utility function. We then analyze the impacts of repatriation taxes in the steady state in Section OA6. Finally, in Section OA7 we expand on our analysis of policy proposals by including uncertainty of *if* and/or *when* the policies may materialize using survey-based expectations of tax reform.

OA3 Solution Method

As no closed form solution exists to the firm's problem we must solve it numerically. To solve and simulate this model economy we wrote custom Fortran code and used openMP to parallelize for speed gains. Here we outline the solution method in three steps:

Step 1:

To solve this model we first need to find solutions to $\Pi_{US}(\tilde{A}_{US}, \tilde{A}_F)$ and $\Pi_F(\tilde{A}_{US}, \tilde{A}_F)$. Whereas a closed form solution exists for $\Pi_F(\tilde{A}_{US}, \tilde{A}_F)$, no closed form solution exists for $\Pi_{US}(\tilde{A}_{US}, \tilde{A}_F)$. The closed-form solution to $\Pi_F(\tilde{A}_{US}, \tilde{A}_F)$ is as follows:

$$\Pi_F(\tilde{A}_{US}, \tilde{A}_F) = \begin{cases} \xi_{1,F}\tilde{A}_F^{\alpha+\eta} + \tau_F \tilde{A}_F & \text{if } \tilde{A}_F < A_F^* \\ \xi_{2,F} + [1 + (1-\tau_F)\bar{r}]\left(\tilde{A}_F - A_F^*\right) & \text{if } \tilde{A}_F \geq A_F^* \end{cases}$$

where

$$\xi_{1,F} = (1-\tau_F)\, z_F \left(\frac{\eta}{w}\right)^{\eta} \left(\frac{\alpha}{r^k}\right)^{\alpha} \left(\frac{1}{\alpha+\eta}\right)^{\alpha+\eta}$$

$$\xi_{2,F} = \{(1-\tau_F)(1-\alpha-\eta)(1+\bar{r}) + [1+(1-\tau_F)\bar{r}](\alpha+\eta)\} \left[\frac{z_F}{1+\bar{r}} \left(\frac{\eta}{w}\right)^{\eta} \left(\frac{\alpha}{r^k}\right)^{\alpha}\right]^{\frac{1}{1-\alpha-\eta}}$$

$$A_F^* = (\alpha+\eta)\left[\frac{z_F}{1+\bar{r}}\left(\frac{\eta}{w}\right)^{\eta}\left(\frac{\alpha}{r^k}\right)^{\alpha}\right]^{\frac{1}{1-\alpha-\eta}}. \tag{OA3.1}$$

For $\Pi_{US}(\tilde{A}_{US}, \tilde{A}_F)$ we construct a numerical solution. The numerical solution is represented by a 2-dimensional linear spline on a $10,000 \times 10,000$ grid of $\tilde{A}_{US} \times \tilde{A}_F$ values. The solution at each of the $10,000 \times 10,000$ grid points is constructed as follows:

$$\Pi_{US}(\tilde{A}_{US}, \tilde{A}_F) = \begin{cases} g(\tilde{A}_{US}, \tilde{A}_F) + \tau_{US}\tilde{A}_{US} & \text{if } \tilde{A}_{US} < A_{US}^* \\ \\ \xi_{2,US} + [1+(1-\tau_{US})\bar{r}]\left(\tilde{A}_{US} - A_{US}^*\right) & \text{if } \tilde{A}_{US} \geq A_{US}^* \end{cases}$$

where

$$\xi_{2,US} = \{(1-\tau_{US})(1-\alpha-\eta)(1+\bar{r}) + [1+(1-\tau_{US})\bar{r}](\alpha+\eta)\}\left[\frac{z_{US}}{1+\bar{r}}\left(\frac{\eta}{w}\right)^{\eta}\left(\frac{\alpha}{r^k}\right)^{\alpha}\right]^{\frac{1}{1-\alpha-\eta}}$$

$$A_{US}^* = (\alpha+\eta)\left[\frac{z_{US}}{1+\bar{r}}\left(\frac{\eta}{w}\right)^{\eta}\left(\frac{\alpha}{r^k}\right)^{\alpha}\right]^{\frac{1}{1-\alpha-\eta}}. \tag{OA3.2}$$

To solve for $g(\tilde{A}_{US}, \tilde{A}_F)$ at each grid point we first solve the following root finding problem in the optimal level of capital, K_{opt}:

$$\alpha z_{US}\left(\frac{r^k}{\alpha}\frac{\eta}{w}\right)^{\eta} K_{opt}^{\alpha+\eta-1} - (1+\bar{r})\,r^k + \left[\tilde{A}_{US} - (\alpha+\eta)\frac{r^k}{\alpha}K_{opt}\right]\frac{\psi}{1-\tau_{US}}\frac{r^k}{\tilde{A}_{US}+\tilde{A}_F}e^{\frac{(\alpha+\eta)\frac{r^k}{\alpha}K - \tilde{A}_{US}}{\tilde{A}_{US}+\tilde{A}_F}} = 0.$$

We then use the optimal level of capital to find,

$$g(\tilde{A}_{US}, \tilde{A}_F) = (1-\tau_{US})\left\{z_{US}\left(\frac{r^k}{\alpha}\frac{\eta}{w}\right)^{\eta} K_{opt}^{\alpha+\eta} + (1+\bar{r})\left[\tilde{A}_{US} - (\alpha+\eta)\frac{r^k}{\alpha}K_{opt}\right]\right\}.$$

The root finding problem in K is solved using bi-section search.

Step 2:

To solve for the policy functions $A'_{US}(A_{US}, A_F, \tau, \epsilon)$, $A'_F(A_{US}, A_F, \tau, \epsilon)$, and $T(A_{US}, A_F, \tau, \epsilon)$, we first solve for the value function, $V(A_{US}, A_F, \tau, \epsilon)$, using value function iteration and then use this value function to solve for the three policy functions.

For the value function iteration we define $V(A_{US}, A_F, \tau, \epsilon)$ on a 4-dimensional discrete

grid and use a combination of linear and shape-preserving Schumacher quadratic splines to interpolate within the grid.[28] For A_{US} we use 61 grid points and shape-preserving quadratic splines, for A_F we use 121 grid points and linear splines, ϵ is defined as a discrete uniform distribution on $N_\epsilon = 7$ grid points, and finally the grid points for τ depend on the structure of the policy being evaluated. For example, for our baseline model where the news occurs after N = 4 periods, τ is defined on $N_\epsilon = 6$ grid points that correspond to the 6 states of the economy – the pre- and post-policy steady-state state, a state each for the 4 news periods, and a state for the period is which the policy is implemented.

The value function iteration requires a maximization step. The three dimensional maximization step $\{A'_{US}, A'_F, T\}$ can be reduced to a maximization step in just two dimensions, $\{A'_{US}, T\}$. We numerically maximize over these two variables using two-dimensional Golden Section Search.

Having found the value function, we next find the policy functions. The policy functions, similar to the value function, are defined on a 4-dimensional discrete grid and use combination two-dimensional quadratic-linear splines to evaluate points that lie within the grid. The grid for the policy functions is much finer in the A_{US} and A_F dimensions. We use 1,001 grid points along with linear splines for each of the A_{US} and A_F dimensions.

Step 3:

Finally, we use the policy functions constructed in step 2 to simulate the economy. To construct the response of the economy to various policies we simulate the economy for 1,000 periods with the tax news arriving in period 800. We repeat this 1,000 period simulation 100,000 times keeping the tax news the same but allowing the idiosyncratic ϵ realization to vary. We then average across these 100,000 simulations. The resulting averaged simulation is relatively purified of the effect of the idiosyncratic ϵ shocks. We include 800 period before the tax news to allow the economy to settle into its stochastic steady state.

OA4 AJCA Literature and Model Comparison

In the early 2000's policymakers were concerned that U.S. tax laws were disincentivizing U.S. based multinationals from repatriating foreign income back to the U.S. They felt that if they could convince firms to repatriate more foreign income it would lead to greater investment and job creation in the U.S., thereby spurring further economic growth. Thus, in October 2004 they passed the AJCA which reduced the maximum repatriation tax rate on qualified

[28] See Judd (1998).

funds from 35 to 5.25 percent on 85 percent of repatriated earnings in a one-year window. Further, under the AJCA guidelines, firms were required to use any funds that received tax breaks from the act on U.S. employment, investment, research and development, and other uses related to job creation and retention.

There is a large empirical literature that aims to tease out the effects of the AJCA tax holiday on a number of firm-level and fiscal policy variables. Table OA1 summarizes the comparison between our model findings and this empirical literature. The table shows our model is remarkably consistent with the results documented in the empirical literature.

Table OA1: AJCA Literature and Model Predictions

Study	Period	Study Findings	Our Model Predictions
Transfers: Joint Committee on Taxation (2004)	At/After	Predicted transfers rise during at the AJCA and fall afterward	Transfers rise during the tax holiday and fall afterward.
U.S. Tax Revenue: Joint Committee on Taxation (2004)	At/After	An estimate of the budget impacts of the AJCA predicted rise in tax revenue at the AJCA and fall thereafter for a net loss in tax revenue.	Tax revenue rises during the tax holiday and falls afterward for a net loss of U.S. tax revenue.
Employment and Investment (Financially Unconstrained): Faulkender and Petersen (2012), Dharmapala, Foley, and Forbes (2011)	At/After	No significant change.	Negligible total response.
Employment and Investment (Financially Constrained): Faulkender and Petersen (2012)	At/After	Increase in investment and no change to employment.	Significant increase in both variables (see Section 3.4).
Shareholder Payouts: Blouin and Krull (2009), Dharmapala, Foley, and Forbes (2011), Clemons and Kinney (2008)	At/After	Increase in shareholder payouts (dividends and share repurchases). Dharmapala, Foley, and Forbes (2011) estimate a $1 increase in repatriation during the AJCA correspond to a $0.60 to $0.92 increase in shareholder payouts.	Increase in dividend payments approximately equaling the tax saving from holiday.
Debt Reduction: Faulkender and Petersen (2012), Dharmapala, Foley, and Forbes (2011), Graham, Hanlon, Shevlin et al. (2010)	At/After	Graham, Hanlon, Shevlin et al. (2010) finds firms with foreign sourced earnings reported paying down domestic debt as one of the most common uses of repatriated earnings using survey data from tax executives from these firms. The other papers find no impact of the AJCA on debt reduction.	Firms repay debt but the debt reduction is short lasting.
Firm Value: Oler, Shevlin, and Wilson (2007)	Pre	Stock value increased proportionately to the expected tax savings from the holiday. Increases occurred beginning in 2003 when the passage of the AJCA seemed likely, but the AJCA was not enacted until October 2004.	Increase in firm value V at the time of the news of the tax holiday.

Notes: This table summarizes the impacts from the AJCA of 2004 from the literature and compares it with our model findings. The second column reports the sub-periods of the analysis in the empirical literature in which the empirical studies focus on: Pre (news period) and At/After the enactment of the AJCA.

OA5 Sensitivity Analysis on σ

In this section, we perform sensitivity analysis on the coefficient of relative risk aversion σ in our utility function. Figure OA1 shows the responses to news and the implementation of our baseline tax holiday for simulations with different values of σ. The top panel gives the firm-level responses and the bottom gives the responses for the U.S. government tax revenue. The units are percentage deviations from the original stochastic steady state with the exception of the repatriation tax rate graph which shows the actual time-path for the repatriation tax rate. The tax holiday is implemented at period 0 and the firm receives news of it 4 quarters in advance (period -4). The repatriation tax rate reduction is the same as in the baseline. In our baseline simulation, we use log utility ($\sigma = 1$). Here we show the case with more curvature in the utility function ($\sigma = 2$) and with linear utility ($\sigma = 0$).

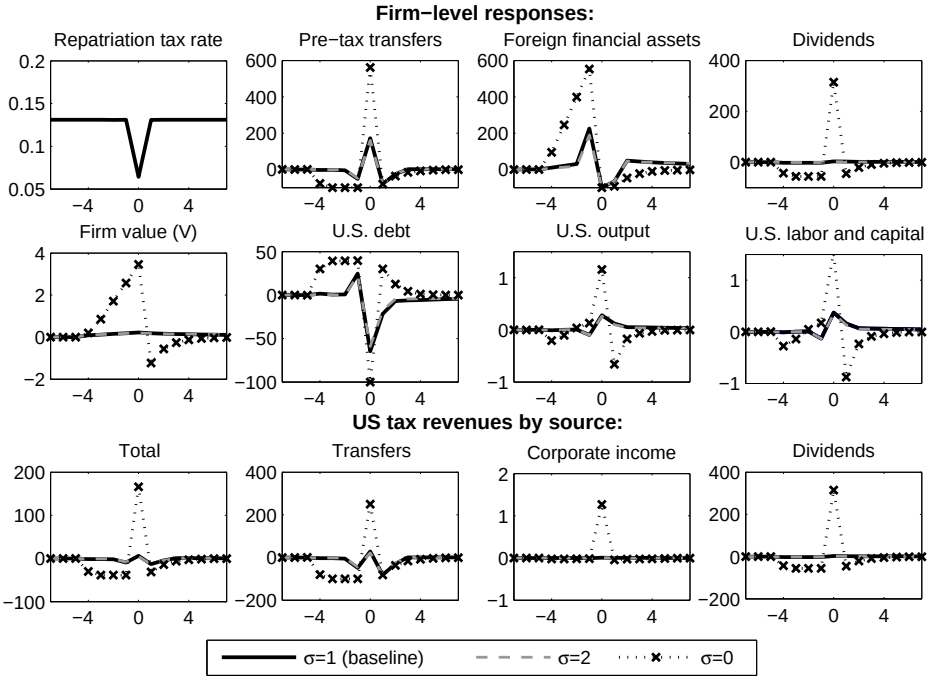

Figure OA1: *Responses to Temporary Reduction in Repatriation Taxes Where News of Reduction is Received 4 Quarters in Advance*

Notes: Except for the repatriation tax rate, units are in percent deviation from initial steady state. The figure plots the baseline, $\sigma = 1$, $\sigma = 2$, and $\sigma = 0$ (linear utility).

For all variables, the results for the baseline and with $\sigma = 2$ are quantitatively very close. The added curvature with $\sigma = 2$ does not change our results in any material way. When we consider the case with linear utility, the results differ quite substantially. Without curvature in the utility of dividends, the firm does not have a motive to smooth out dividend payments. Thus, there are wide swings in many variables at the announcement of the news.

For example, the firm cuts off dividend payments completely during the news period. The large swings in foreign transfers, dividend payments, and U.S. tax revenue are at odds with the variation of these variables for multinational firms in the data. In particular, with linear utility firms do not have an incentive to smooth dividends over time. We thus, incorporate curvature in out utility function.

OA6 The "Lockout Effect"

A main concern of policymakers who champion repatriation tax reform is the *lockout effect*. This is the argument that high repatriation tax rates induce firms to accumulate foreign earnings, particularly liquid assets, to avoid paying these taxes. Some studies have indeed shown repatriation taxes impact the level of multinational firms' liquid asset holdings and the composition of firms' asset portfolios. For example, Foley, Hartzell, Titman, and Twite (2007) (FHTT, henceforth) find that the amount of consolidated liquid asset holdings by U.S. multinationals is growing in repatriation tax rates faced by the subsidiaries. Blouin, Krull, and Robinson (2014) shows PRE held by subsidiaries in tax havens are disproportionately in liquid assets compared to assets in non-haven jurisdictions.

Our model quantitatively mirrors the relationship between a firm's liquid asset holdings and repatriation tax rates in FHTT. These authors use firm-level data on liquid asset holding along with confidential BEA data on foreign subsidiaries of U.S. multinationals in 4 benchmark surveys from 1982-1999 to estimate repatriation tax rates by firm. Their measure of liquid asset holdings is the natural log of consolidated liquid assets (referred to as "cash") divided by the firm's net assets (total assets less liquid assets), $ln\left(\frac{Cash}{Net\ Assets}\right)$. They regress liquid asset holdings on an estimate of repatriation tax rates and controls. The coefficient estimate on the repatriation tax rate in their linear regression is 3.66 and with a significance of 5% (see Table 4, Column 1 in FHTT).

We can use repatriation tax rates and liquid asset holdings as measured in FHTT to compare with this quantitative relationship in our model.[29] We do this comparison by varying the model's repatriation tax rate τ in the steady state from 0 to 0.35, the range of possible repatriation tax rates in the data.[30] Figure OA2 plots the level of $ln\left(\frac{Cash}{Net\ Assets}\right)$

[29]FHTT exploit subsidiary-level data to estimate a single repatriation tax rate by firm. They measure the repatriation tax rate by each subsidiary the same way we do in our model calibration. The contribution of each subsidiary in the firm's overall repatriation tax rate is weighed by the net property plant and equipment of each subsidiary.

[30]We note that repatriation tax rates in the data may increase (decrease) due to a higher (lower) U.S. corporate income tax rate faced by the firm, low (high) foreign taxes of the subsidiaries, or a combination of the two. For our repatriation tax rate in Figure OA2, we hold U.S. and foreign tax rates constant and vary the repatriation tax rate.

from the model against the range of repatriation tax rates, which are normalized to zero by the mean level of liquid asset holdings. Consistent with the definition of liquid asset holding in FHTT, "cash" in the model is total financial assets and net assets are total assets less financial assets. As a direct comparison with FHTT, the slope coefficient of the line in the figure is 3.66, the same as in their paper. The relationship between liquid asset holdings and repatriation tax rates in the model is non-linear, but it follows the empirical estimate of this relationship in the data. The slope coefficient of a linear regression of $ln\frac{Cash}{Net\ Assets}$ on the repatriation tax rate in the model is 5.10. Our model calibration did not target this relationship between repatriation tax rates and liquid asset holdings, so the success of the model in capturing this empirical relationship gives us confidence in the external validity of the model.

In our simulations, all of the financial asset holdings are held by the foreign subsidiary. While it is true that liquid asset holdings abroad are growing in the repatriation tax rate – suggesting a lockout effect – domestic output and labor and capital use are virtually unchanged across the various tax rates. Although the lockout effect relates foreign asset holdings to repatriation tax rates, the implicit connotation is that this has an effect on real economic activity. In our model, the interest rate on U.S. debt is decreasing in foreign asset holdings (see Equation (9)), so firms leverage these foreign assets to increase debt and keep domestic production at its optimal scale. This channel mitigates alterations in the U.S. production decisions due to repatriation taxes.

Higher repatriation tax rates in the model are therefore related to an increase in foreign financial assets and domestic debt. At the baseline repatriation tax rate in the model ($\tau = 0.131$), a 1 percentage point increase in the repatriation tax rate is associated with a 0.13 percent increase in foreign bank assets and a 0.19 percent increase in domestic debt. This relates to a theoretical prediction in Altshuler and Grubert (2003). In their model, a parent company of a multinational firm can increase its debt limit by borrowing against financial assets abroad. Under certain conditions, firms increase financial asset holdings as the tax rate in a low-tax affiliate decreases (thus a higher repatriation tax rate). Moreover, the positive relationship between foreign financial assets and domestic debt in our model provide some theoretical underpinnings for Albring (2006) who find the probability that U.S. multinational manufacturing firms use domestic debt is increasing in PRE for firms that face positive repatriation taxes.

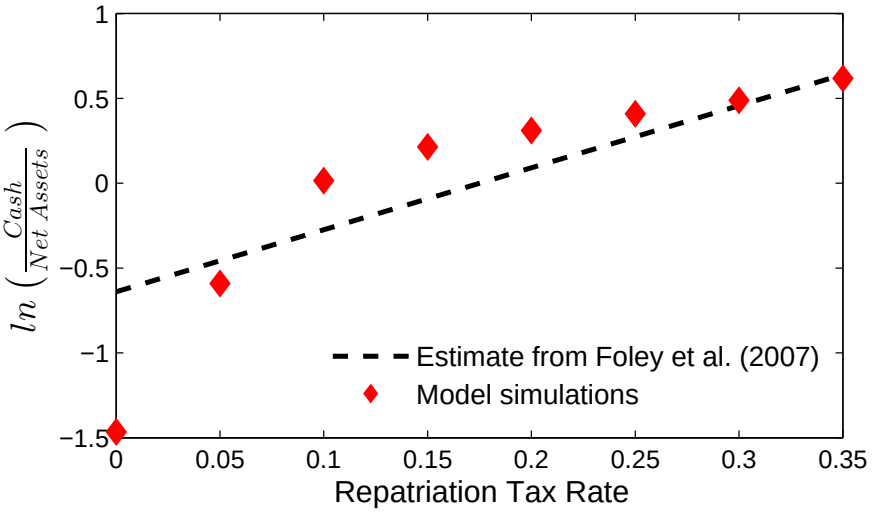

Figure OA2: *Relationship Between Liquid Asset Holdings and Repatriation Tax Rates*

Notes: The scattered observations are from the model's steady-state and the dashed line corresponds to the estimated relationship in Foley et al. (2007). In the model, "cash" is total bank assets (not including debt) and net assets are total assets less bank assets. In FHTT's paper, "cash" is liquid assets and short-term investments and net assets are total assets less cash and these estimates are taken from Table 4, Column 1, in their paper.

Within the model, foreign financial asset holdings are impacted by the repatriation tax rate which differs from Hartman's (1985) seminal paper. He showed that if tax rates are constant, repatriation taxes do not alter the decision of mature firms between reinvesting foreign earnings abroad or remitting them to their U.S. parent. This is because when repatriation taxes are inevitable, firms receive no additional benefit of deferring these tax payments. This result does not hold in our model for two reasons. First, the stochastic element in repatriation tax rates, ϵ, induces firms to accumulate foreign financial assets to await tax savings from a low realization of ϵ (therefore a low τ_R). When the underlying repatriation tax rate τ is high, the marginal utility of shareholder dividends also high. In this case, the marginal benefit of tax saving form a low realization of ϵ is likewise high, leading the firms to defer repatriations to await such a realization. Second, as mentioned above, in our model foreign asset holdings reduce domestic debt costs. Repatriation taxes thus induce firms to hold assets abroad up to the point the marginal returns on after-tax repatriations equals the marginal cost of debt.

The steady-state relationship between liquid asset holdings abroad and repatriation taxes along with the firm-level responses from news indicate an important link between repatriation taxes and foreign asset accumulation. For a given repatriation tax rate, firms have a steady-state level of foreign bank asset holdings. If there is no change in repatriation tax rates, they will not alter their holdings of these assets once they reach their steady-state target and all remaining foreign earnings will be repatriated to the U.S. In this environment, additional

accumulation of foreign assets will *only* occur if there are expectations of a future reduction in repatriation taxes.

OA7 Extension on Evaluating Current Policy Proposals

This section extends our analysis on international tax reform proposals. Our model allows us to study relatively complex belief structures about future policy. Here, we consider the case where there are two leading proposals; one proposed by Democrats and the other by Republicans. Firms receive news of possible tax reforms in the beginning of 2016 and there is uncertainty around the news in 3 dimensions. First, firms are unsure if a policy change will be enacted. Second, conditional on a policy being implemented, the arrival date of its implementation is unknown. Third, if a policy is enacted, firms are unsure ex-post if the Democratic or Republican proposal will be implemented. We characterize these rich expectations based on survey data from business tax professionals on the likelihood of and timing of tax reforms from 2016-2020. Although these are no longer the exact proposals being considered, our analysis is instructive as it provides a more comprehensive belief structure of expectations of tax reform.

The proposals we consider include comprehensive tax reforms that include, but are not exclusive to, changes in the taxation of foreign activity of U.S. multinationals. Our analysis strictly focuses on the international aspects of these proposals. We show that the responses to the reforms hinge on the length of time it takes for the policies to be resolved and if a proposal is implemented.

OA7.1 Tax Reform Proposals

We consider key international provisions of two tax reform proposals from 2016. The first is from the former *White House 2017 Budget* penned by the former Democratic presidential administration. The second is the 2016 House Republican Tax Reform Plan put forth by Republican House Speaker Paul Ryan, House Ways and Means Committee Chairman Kevin Brady, and others.[31] Although the plans may not have unanimous support among their respective parties, for simplicity we refer to the proposals as the Democratic and the Republican plan. The structure of both proposals are conceptually similar but differ on the size of the new tax rates. First, they both include provisions eliminating repatriation taxes all together. The White House proposal alternatively includes a direct tax on foreign profits of

[31] Officially titled is *A Better Way: Our Vision for a Confident America*.

domestic-based corporations. On the other hand, the House Republican Plan suggests a pure territorial tax system – a 100 percent tax exemption on all income of U.S. multinationals generated abroad. Second, both plans recommend a "transition tax" bridging the existing international tax regime to the new one. This is a one-time retroactive tax on the sum of foreign income held abroad untaxed by the U.S. government at the time of the implementation date. Once taxed, the plans allow these assets to be repatriated with no additional U.S. tax costs. We now detail the provisions and explain how these tax rules apply to the model.

Under the Democratic proposal, repatriation taxes would be abolished and replaced with a minimum tax of 19 percent on all foreign profits of U.S. based corporations. Firms would then be able to repatriate these profits at no additional tax. In the model, this provision is characterized as replacing the foreign subsidiary's after tax profits as

$$(1-\tau_F-\tau_M)(K_F^{\alpha_F}L_F^{\eta_F}-w_F L_F-r_F^K K_F+r\tilde{A}_F^B). \tag{OA7.1}$$

The stipulation is the total tax rate from the foreign country and the U.S. would be at least 19 percent. The minimum tax τ_M is thus given by

$$\begin{aligned}\tau_F+\tau_M=0.19 \quad if \quad \tau_F<0.19\\ \tau_M=0 \quad if \quad \tau_F\geq 0.19.\end{aligned}$$

From the data used to calibrate the model, the average foreign tax rate $\tau_F=0.171$, resulting in $\tau_M=0.019$. In the House Republican Plan, repatriation taxes would be eliminated and firms would face no additional taxes on foreign profits. This is equivalent to setting $\tau_M=0$ in equation (OA7.1).

Both proposal additionally include a transition tax on foreign assets yet to be taxed by the U.S. government. This applies to all deferred taxes on foreign profits and PRE since the enactment of the *Tax Reform Act of 1986*. In the model, the transition tax would be applied to all foreign assets A_F at the period of the tax reform minus the initial transfer from the U.S. parent to set up the foreign operation. Assuming the foreign operation was established at time $t=0$ and the tax reform is initiated at time $t=J$, then the assets facing the transition tax is

$$A_{F,J}-T_0=\sum_{t=0}^{J}\pi_{F,t}(1-\tau_F)-\sum_{t=1}^{J}T_t$$

where T_0 is the initial transfer from the firm's U.S. operations and π_F are the sum of pre-tax foreign income from operations and interest on bank assets. In the model, we assume the seed money from the U.S. T_0 is small relative to the total assets at time T. Thus, tax

revenues from the transition tax τ_{TT} is $\tau_{TT}A_{F,T}$.

Under the Democratic proposal, the transition tax rate is 0.14 with a 2/5 credit to foreign taxes paid. This transition tax, including foreign tax credit, is

$$\tau_{TT} = 0.14 - \tau_F \frac{2}{5}.$$

In the model, we use $\tau_F = 0.171$ which gives $\tau_{TT} = 0.0716$.

The Republican plan levies transition taxes of of 8.75 percent on cash and cash-equivalent assets and 3.5 percent on remaining reinvested earnings. There are no foreign tax credits. Given the fungibility of internal funds, the taxation of liquid assets in this proposal may be problematic. The total stock of untaxed assets by the U.S. is known by, say, whether a particular dollar in financial assets is from this stock or from another source may be difficult to ascertain. For this reason, in the model we set the transition tax to be $\tau_{TT} = 0.035$ for this proposal.

OA7.2 News and Expectations of Tax Reforms: 2016-2020

Our policy experiment simulates our model firm's response from news of a potential tax reform through its (possible) implementation. In contrast to our baseline simulation, these proposals involve a permanent change to repatriation tax policy. The expectations of if and when a policy change may occur follows the narrative approach drawn from a survey of approximately 100 U.S. tax executives and practitioners compiled by The Tax Council and Ernst & Young (2016). In the survey, respondents were asked about the likelihood and possible implementation year of U.S. federal tax reform in the 2016–2020 period. 82 percent of respondents believe there will be tax reform within these 5 years. We note that they do not report whether the reforms will include international tax changes.[32] However, we use these beliefs to form the model firm's expectations on international tax changes.

In the model, firm's receive news of a potential tax reform in 2016Q1 that may occur at any occur at any quarter from 2016Q1–2020Q4. If tax reform has not occurred at a given period, firms place an equal likelihood of reform occurring at any future period up to 2020Q4. Cumulatively, firms place an 82 percent probability that reform will occur and an 18 percent likelihood that they will not. If a tax reform does not occur by the end of 2020Q4, firms realize with certainty they will never happen.

At the time of the news, conditional on a reform being implemented, firms are unsure

[32] They do report expectations if there will be an international tax reform only and no domestic tax reform. The 82 percent figure indicates expectations of reforms that include only international reforms, international and domestic reforms, and only domestic reforms.

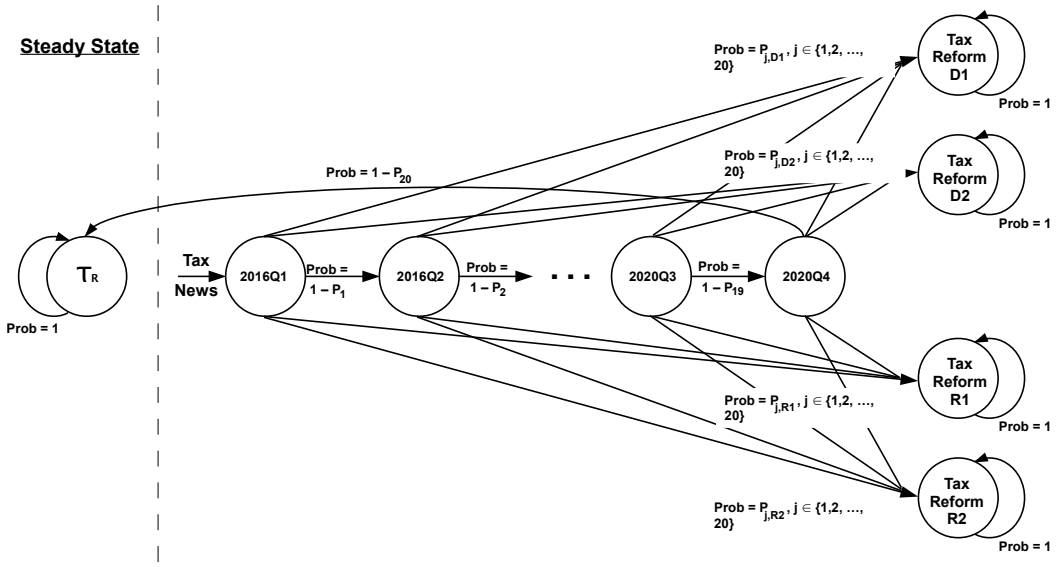

Figure OA3: *Transition Graph of News of Policy Reform: 2016Q1–2020Q4*

Notes: Firms unexpectedly receive news of a possible tax reform in 2016Q1. At any period, 5 outcomes are possible: 1 of 4 proposals D1, D2, R1, or R4 are enacted or there is no reform. If at the end of 2020Q4 no reform is implemented, the firm realizes with certainty that there will be no reforms. The probability $P_j = P_{j,D1} + P_{j,D2} + P_{j,R1} + P_{j,R2}$, $j \in \{1, 2, ...20\}$. The transition matrix is shown in Online Appendix OA1.6.

if it will be the Democratic or Republican plan. There is also a question of whether the transition tax proposals, as written, will be permitted under U.S. law. The U.S. Supreme Court has allowed certain retroactive taxes to be applied but only if the retroactive period is modest and "required by the practicalities of producing national legislation."[33] Since these proposals include taxing all foreign earnings accumulated since 1986 yet to be taxed by the U.S. government, from a legal standpoint it is not clear if the retroactive period is of "modest" length. Taking this into consideration, conditional on a reform occurring we assign the following probabilities for each proposal. If reforms occur, there is a 50/50 likelihood will be the Democratic or Republican plan.[34] Within each proposal, it is not certain that the transition tax will be upheld if passed. We simply assign an equal likelihood that the reform will include the proposal or not. In either case, the repatriation tax will fall to 0 and firms will face a minimum tax on foreign earnings if the Democratic proposal is passed or a pure territorial tax if the Republican plan is implemented. In sum, conditional on a reform occurring there is a 25 percent chance assigned to each outcome: Democratic proposal with transition tax ($D1$), Democratic proposal without transition tax ($D2$), Republican plan with

[33] *United States v. Darusmont*(1981), 449 U.S. 292, 296-297.

[34] With Republicans holding both houses of congress and the presidential administration as of 2017, it may be more likely that a Republican tax reform may be implemented. Even so, ascertaining the exact probability weights assigned to each plan is beyond the scope of this analysis, so we simply assign 50/50 weight to each plan.

Table OA2: Potential Policy Changes: 2016Q1–2020Q4

Democrat	D1	D2	Republican	R1	R2
Territorial ($\tau = 0.00$)	✓	✓	Territorial ($\tau = 0.00$)	✓	✓
Transition Tax ($\tau_{TT} = 0.0716$)	✓		Transition Tax ($\tau_{TT} = 0.035$)		✓
Minimum Tax ($\tau_M = 0.019$)	✓	✓			
Prob. enactment conditional on any policy change	0.25	0.25	Prob. enactment conditional on any policy change	0.25	0.25

transition tax ($R1$), and Republican plan without transition tax ($R2$). The transition graph in Figure OA3 summarizes the outcomes and probabilities associated with the realizations in the news period. The transition matrix and probabilities of each state of Figure OA3 occurring is shown below in Table OA3. Table OA2 summarize the tax changes in each proposal

OA7.3 Results

At 2016Q1, firms receive news of a possible tax policy change. Figure OA4 presents 3 selected outcomes of the policy experiment: 1) enactment of the Democratic proposal including the transition tax ($D1$), 2) implementation of the Republican plan including the transition tax, and 3) no reforms occur. Although the reform can occur at any period in the 2016Q1–2020Q4 interval, in this figure we let the outcome be decided in 2020Q4 to highlight the role of the news period on firm-level behavior. The units are in percentage deviation of the initial steady-state of that variable.

Across the 3 cases, when firms receive news of potential reforms transfers from the foreign subsidiary fall initially as firms increase their foreign financial asset holdings. The level of these assets remains relatively constant until mid-2019 before accelerating. Two opposing forces govern the time-path of foreign financial assets in the news period. On one hand, foreign assets are subject to a transition tax if either $D1$ or $R1$ is enacted which leads firms to curtail their foreign asset accumulation. On the other hand, if one of the policies that do not include the transition tax is implemented ($D2$ or $R2$), firms will receive large tax saving on the accumulated assets. During the final 6 quarters of the news period, the latter effect is stronger.

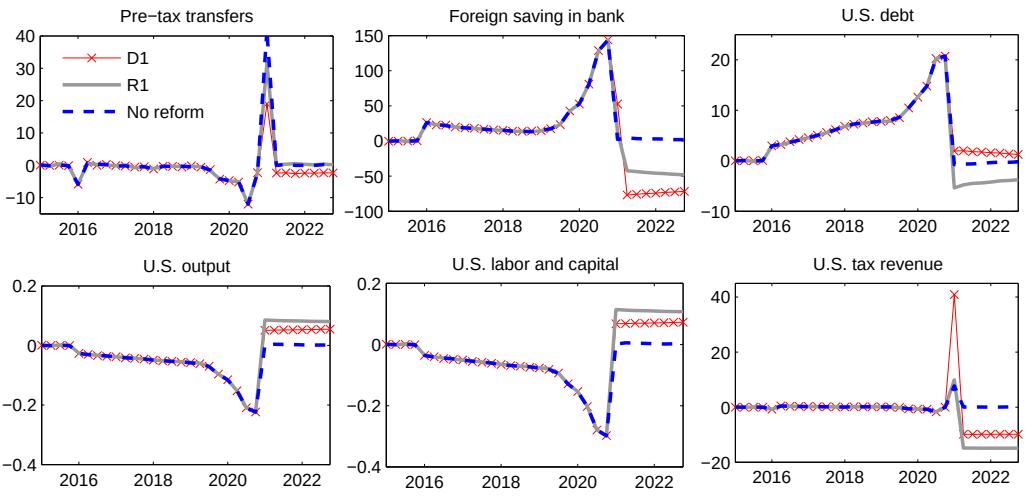

Figure OA4: *Response to News and Possible Implementation of Tax Reform*

Notes: Firms receive news of a potential reform in 2016Q1 that may occur in any period between 2016Q1 and 2020Q4. There are 5 possible outcomes: D1, D2, R1, or R2 is passed or there is no policy change. In this figure we let the realization occur in 2020Q4 and show the cases if D1 and R1 is passed and when there is not policy change.

If no reform is enacted, the sum of accumulated foreign financial assets in the news period is immediately repatriated in full when firms realize this outcome. If reform $D1$ or $R1$ is passed, transfers rise at the enactment of the policy and the new steady-state foreign financial asset holdings are permanently lower.

Throughout the news period, U.S. debt rises and U.S. output and labor and capital use decline. Firms smooth their shareholder payments by issuing debt and liquidating productive assets as they await the resolution of the news. If $R1$ is enacted, U.S. output and factor input use is permanently higher and U.S. debt is permanently lower than in $D1$. Since the marginal product of inputs in the domestic operations are a function of interest rates, the decline in debt, and hence lower interest rate, under R1 induces firms to expand their domestic activity.

The transition tax adds a sizable one-time boon in U.S. tax revenue, particularly if $D1$ is enacted. After the policy change, under both $D1$ and $R1$, tax revenues are permanently lower than in the initial steady-state. In sum, there are permanent modest gains to domestic activity if a policy is enacted, but it comes at the cost of lost tax revenue.

Figure OA5 summarizes some of the domestic costs and benefits of the policies. It shows the present discounted value of cumulative quarterly gains and losses relative to the initial steady-state to U.S. capital, labor, and tax revenue for the 5 possible outcomes: $D1$, $D2$, $R1$, or $R2$ is implemented or there is no policy change. These outcomes are then subdivided by the implementation date, if any.

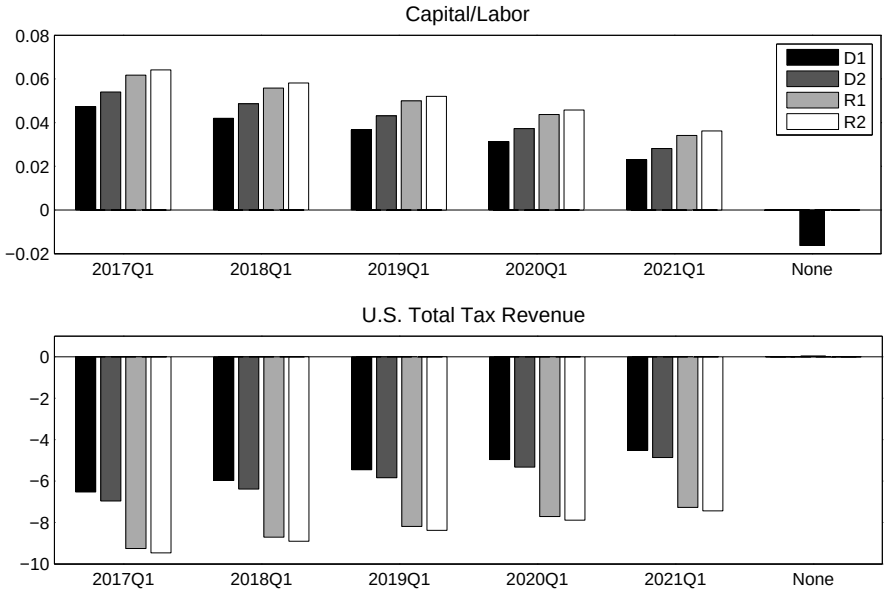

Figure OA5: *Cumulative Responses to Policy Outcomes by Date of Implementation and if There is no Policy Change*

Notes: Units are in the present discounted value of quarterly gain/losses to that variable relative to the steady state at the time of the news. Firms receive news of a potential reform in 2016Q1 that may occur in any period between 2016Q1 and 2020Q4. There are 5 possible outcomes: D1, D2, R1, or R2 is passed or there is no policy change. The date is when the policy is implemented.

Cumulative gains to U.S. labor and capital are increasing with policies that feature the lowest tax burdens. Recall tax rate are highest under the White House proposal $D1$ and lowest for the House Republican Plan not including the transition tax $R2$. Conversely, cumulative U.S. tax revenue losses are largest for policies featuring the lowest tax rates, $R1$ and $R2$. For each policy, when the news period is longer labor and capital gains are shrinking as are tax revenue losses. The longer the news period, the more news and policy uncertainty leads firms to curtail domestic activity. At the same time, if any of the 4 policies are implemented there are perpetual losses to U.S. tax revenues. Thus, the longer the news period is, the longer U.S. tax revenues remain relatively high before the tax cuts from the policies shrink the tax base.

Total labor and capital gains are highest under $R2$ if that policy is enacted promptly, equivalent to a life-time gain of 7 percent above their initial quarterly steady-state levels. These gains are then diminishing if the policy change is drawn out. On the other hand, U.S. tax revenues for policy $R2$ suffer a loss of 9.5 quarters worth of initial steady-state revenues if enacted in 2017Q1. If at the end of 2020Q4 no policy is implemented, there are cumulative losses of nearly 2 percent to domestic labor and capital use and little change in total tax revenues.

The model quantifies the impacts of actual tax reform proposals using realistic expecta-

tions of the credibility of reforms. We show that the timing of a future policy change may be equally important for understanding its effects as the actual policies when accounting for firms' expectations. It is ultimately up to the policymaker to decide if the gains outweigh the costs of implementing a policy. What the model is clear on, however, is if a policymaker deems the resolution of a policy will be unlikely after years of deliberation, it is in the economy's best interest for them to cease further discussions as soon as possible. This will assure firms there will be no policy change and, in the process, halt losses to domestic activity from the policy uncertainty.

Repatriation Tax Reform 2016–2020

Table OA3 reports the transition matrix associated with the policy experiment given above and corresponds to the transition graph in Figure OA3. After firms receive news of a possible tax reform with an uncertain arrival date, if a policy is enacted it will be 1 of 4 possibilities: D1, D2, R1, or R2. Conditional on reform, there is a 1/4 probability it will be any one of the proposals. Further, firms believe there is a 0.82 probability reform will occur over the 2016Q1–2020Q4 interval. Letting $P_p = \frac{1}{4} \times 0.82$, the transition matrix is shown in full below.

Table OA3: Transition Matrix of Policy Experiment

	ss	2016$Q1$	2016$Q2$	2016$Q3$	...	2020$Q3$	2020$Q4$	$D1$	$D2$	$R1$	$R2$
ss	1	0	0	0	$\dots$	0	0	0	0	0	0
2016$Q1$	0	0	$1-4\times P_p\times\frac{1}{20}$	0	$\dots$	0	0	$P_p\times\frac{1}{20}$	$P_p\times\frac{1}{20}$	$P_p\times\frac{1}{20}$	$P_p\times\frac{1}{20}$
2016$Q2$	0	0	0	$1-4\times P_p\times\frac{1}{19}$	$\dots$	0	0	$P_p\times\frac{1}{19}$	$P_p\times\frac{1}{19}$	$P_p\times\frac{1}{19}$	$P_p\times\frac{1}{19}$
2016$Q3$	0	0	0	0	$\dots$	0	0	$P_p\times\frac{1}{18}$	$P_p\times\frac{1}{18}$	$P_p\times\frac{1}{18}$	$P_p\times\frac{1}{18}$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\ddots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
2020$Q3$	0	0	0	0	$\dots$	0	$1-4\times P_p\times\frac{1}{2}$	$P_p\times\frac{1}{2}$	$P_p\times\frac{1}{2}$	$P_p\times\frac{1}{2}$	$P_p\times\frac{1}{2}$
2020$Q4$	$1-4\times P_p$	0	0	0	$\dots$	0	0	P_p	P_p	P_p	P_p
$D1$	0	0	0	0	$\dots$	0	0	1	0	0	0
$D2$	0	0	0	0	$\dots$	0	0	0	1	0	0
$R1$	0	0	0	0	$\dots$	0	0	0	0	1	0
$R2$	0	0	0	0	$\dots$	0	0	0	0	0	1