Repatriation Taxes*

Chadwick C. Curtis†
University of Richmond

Julio Garín‡
Claremont McKenna College

M. Saif Mehkari§
University of Richmond

This Draft: July 2017

PRELIMINARY AND INCOMPLETE: PLEASE, DO NOT DISTRIBUTE

Abstract

How do firms respond to news that alters expectations of a future change in taxes U.S. based firms pay on profits remitted from abroad – repatriation taxes? We present a dynamic framework of a multinational firm to address these questions and quantify the impact of news of repatriation tax changes whose outcome and time of resolution is uncertain. Firms respond in anticipation to future repatriation tax reductions by contracting domestic activity and accumulating foreign assets untaxed by the U.S. government. We find that a protracted process of delibaration of a proposal that reduced repatriation tax rates, while increasing the value of the firm as soon as it is presented – due to lower expected future tax obligations – impacts negatively on tax revenues. The lengthier the deliberation process, the larger the tax revenue losses associated with the tax reform. We find that the impact on real variables depends crucially on the ability of the firm to access financial markets. By altering the relative price of holding assets abroad, news of a possible repatriation tax reduction can be thought as an implicit tax on repatriating funds during the news period and we calculate it for a set of scenarios.

JEL Classification: F23, H25, E6.

Keywords: Cash Holding, Liquidity, Corporate Tax, Tax Reform.

*We are grateful to David Agrawal, David Garraty, Erik Johnson, Marios Karabarbounis, Rob Lester, Johannes Voget, Dave Wildasin, and seminar participants at Bowdoin College, the University of Alabama, University of Kentucky, University of Mississippi, University of Richmond, the Virginia Association of Economists Meeting, the International Trade and Finance Association Meeting, Southern Economic Association Meetings, the 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."

†E-mail address: ccurtis2@richmond.edu.

‡E-mail address: jgarin@cmc.edu.

§E-mail address: smehkari@richmond.edu.

1 Introduction

U.S. based corporations hold over $2.2 trillion in assets abroad, up 4-fold from the mid-2000s. Many lawmakers would like these assets to be repatriated to the U.S. and used toward new investment and job creation. Consequently, in recent years there have been active discussions around lowering repatriation taxes – taxes U.S. based firms pay on profits remitted from abroad. The underlying premise behind lowering repatriation tax rates is that it will encourage firms to repatriate assets held abroad, thereby stimulating U.S. employment and investment. With various repatriation tax reform proposals being introduced to Congress, this policy debate has been thrust to the forefront. Will such tax reforms lead to an increase in repatriated assets? If so, will this stimulate employment and investment? What are the tax revenue costs to the government? More importantly, how are these costs and benefits influenced by a protracted legislative deliberation and uncertainty surrounding both the final outcome as well as the time of resolution of the proposed policy? Motivated by the most recent episode of U.S. repatriation tax changes and current policy discussions, the goal of this paper is to answer these questions and quantify their effects.

We present a dynamic framework to understand firm-level responses and tax revenue consequences from changes and expectations of changes in repatriation tax policy. Our approach is novel in that we not only quantify the effects at and after the policy change, but also capture the effects of news of future policy changes. Conceptually, we consider news as any information that alters the likelihood of future repatriation tax changes such as a policy proposal, the deliberation of the policy, or the legislative lag. We find that even before the actual policy change occurs, news of a 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, a fall in U.S. government tax revenue. As a result, policy evaluations that do not account for a firm's anticipation of future repatriation tax change, will overstate the amount of income repatriated from aboard as well as its effect on labor and capital, and understate the loss in tax revenue. Additionally, we show that firm-level investment and employment responses to repatriation tax policy changes depend on a firm's ability to access external credit. Specifically, the response of U.S. production activity to news of a repatriation tax change is small if cost of obtaining credit is low. Finally, since 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 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."

Given the policy implications of a repatriation tax reform, an additional contribution of our paper is that we use our framework to evaluate the firm-level effects and tax consequences of current repatriation tax proposals. These policies are drawn from proposals to permanently change the taxation of U.S. multinationals put forth by congressional members and past and current presidential administrations.[1] For each policy, we find that news, arising from anticipation of tax

[1]Specifically, the reforms we consider contain tax changes from proposals put forward in *A Better Way* (or *The Blueprint*) authored by chairman of the House Ways and Means Committee Kevin Brady and the Speaker of the

reform, is important for understanding the impacts of the policy change.

Our model consists of a firm that is incorporated in the U.S. but operates and holds 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, holdings of liquid financial assets, and the amount of debt to carry in the U.S.. Across geographies, profits originating from abroad 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 firm's decisions within and across geographies.

Our baseline experiment studies the effects of a one-time repatriation tax rate reduction – a 'tax holiday' – 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 allotted a one-time temporary repatriation tax rate reduction on repatriated assets in 2005. During the news period – the time between the reception of the news and resolution of the policy – the firm reduces the rate of repatriations from abroad and accumulates foreign assets to maximize its tax savings during the tax holiday. This reduced flow of assets into the U.S. leads to a 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 pay U.S. shareholders, reduce its debt, and increase production. Consequently, our analysis indicates that a policy evaluation that does not account for the news period overestimates the benefits of reducing repatriation tax rates, by overstating gains to domestic production activity and transfers from abroad, and underestimates its costs, by understating tax revenue losses.

We show that news acts as an implicit tax on repatriating foreign earnings during the news period by altering the intertemporal cost of repatriating foreign assets until the resolution of the policy. From the firm's perspective, news has both an income effect – higher expected disposable income induces firms to repatriate for dividend payments – and a substitution effect – repatriating funds today is relatively more expensive than in the future. We find that the substitution effect dominates: the firm scales back shareholder payouts and accumulate assets overseas in anticipation of future repatriation tax savings.

Given that news impacts the firm's intertemporal tradeoffs, its adjustments to domestic production and capital/labor usage from news and changes in repatriation tax rates crucially depends on the relative cost of substituting debt for repatriated profits. If the relative cost of borrowing is low – as is the case of many large multinational firms – a firm's U.S. operations can issue debt to operate close to its efficient scale independently of its flow of income from abroad. As a result, during the news period the firm issues debt to finance domestic production and make dividend payments while simultaneously accumulating assets abroad. At the implementation of the repatriation tax

House Paul Ryan in 2016, President Obama's White House Budgets for 2015, 2016, and 2017, and President Trump's White House Budget for 2018.

reduction, the low cost of debt mutes the response of domestic production and capital/labor inputs as the influx of foreign liquidity is primarily channeled to shareholder payouts and repaying debt accumulated during the news period. On the other hand, production for firms with more costly access to credit markets is closely linked to their ability to access foreign liquidity as they are more dependent on internal funds to support production activities. For these firms, the contraction of repatriations during the news period corresponds with a much larger contraction in its U.S. production, and the influx of foreign income at the time of the policy change leads to an expansion of domestic activity.

Since the enactment of the AJCA, bills have been introduced to congress nearly every year calling for temporary and permanent reductions in repatriation tax rates.[2] 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 are unsure *when* it will occur, they steadily accumulate foreign asset holdings over a long time horizon. If the proposal's intent is to attract offshore assets held by U.S. firms, the discussions themselves induce firms to further accumulate these assets while awaiting the resolution of the policy.

To provide external validation of our framework and establish a basis for assessing counterfactual policy, we compare our model predictions from a tax holiday with evaluations of the AJCA in the literature. We find that our model captures the key empirical findings surrounding the AJCA. We thus exploit our framework to evaluate the impact of leading repatriation tax reform proposals. In particular, we consider two proposals. The first is a permanent elimination of repatriation taxes (a territorial tax system). The second is a permanent reduction in U.S. corporate income tax rates. Currently, repatriation tax rates are set as the difference between U.S. and foreign income tax rates of the firm. As the top U.S. marginal corporate income tax rate is the highest in the OECD, a reduction in U.S. corporate income tax rates indirectly lead to a fall in repatriation tax rates. For both of these policy proposals, we find that the long-run costs in terms of tax revenue are large, while the gains in employment and investment are relatively low. Again, when firms are able to substitute debt for repatriated income, a firm's domestic operations are able to operate close to their efficient scale regardless of repatriation tax rates. As a result, a fall in repatriation tax rates have a relatively small impact on the scale of a firm's operations, but rather leads to a tax windfall for shareholders at the expense of U.S. tax revenue.

To the best of our knowledge this paper presents the first quantitative framework to jointly capture the dynamic impacts of repatriation tax reform and the anticipation, or news effects, of such reforms. 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

[2] In 2015 alone, five such bills were introduced to Congress.

the relationship between firm-level cash holding and repatriation tax rates in Gu (2016). In an influential paper, Hartman (1985) argues that if tax rates on multinational were constant, repatriation taxes would have no impact on the repatriation decisions of mature firms because these taxes are 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.[3] 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 et al. (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 captures the salient features found in these empirical studies.[4]

Our paper follows the large literature on fiscal policy news shocks such as House and Shapiro (2006), Yang (2005), Leeper et al. (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 rich 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, 2012) and Stokey (2016). While Stokey (2016) shows that a model with tax uncertainty can generate an investment boom after the resolution of the policy, our framework generates similar dynamics but that behavior crucially depends on the firm's ability to access to credit markets. In her theory, firms may reduce investment in new projects and accumulate liquid assets as a 'wait-and-see' policy until the uncertainty is settled. Although Stokey (2016) is not a quantitative study, relative to her findings, in our model access to credit markets dampens the investment effects from news and a policy change. In the news period, firms finance domestic operations with external financing while simultaneously accumulating liquid assets abroad.

2 Model Economy

In this section, we present a dynamic model to both capture and understand the effects of changes in repatriation tax policy. The model economy consists of a multinational firm – owned by households – and a government that levies taxes from different sources. The multinational firm is incorporated in the U.S. but operates and holds assets both in the U.S. and overseas. It faces corporate income taxes in both jurisdictions and repatriation taxes on any income earned by its foreign operations 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.

[3] 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 (2016) for a model analyzing tax revenue estimates from U.S. inversion law changes.

[4] 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.

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 shareholders – who are infinitely lived. The firm's objective 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]

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 *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 within the context of the economy.

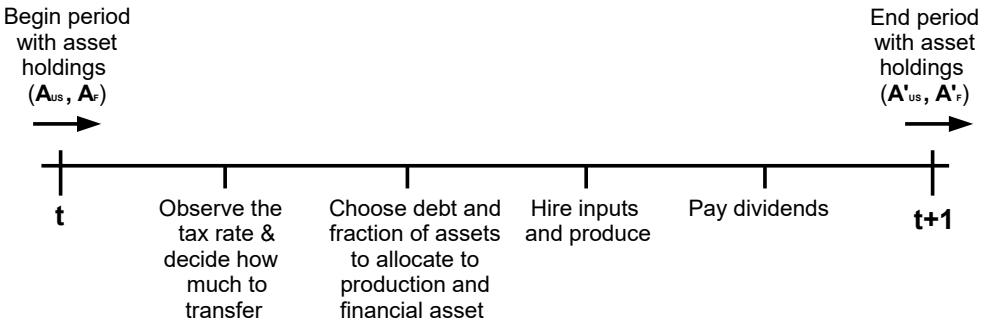

Figure 1: *Timeline of Events*

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 decides how to reallocate its portfolio by transferring assets between the location of its subsidiaries. The after-tax transfer assets held in the U.S., $\tilde{A}_{US}$, and abroad, $\tilde{A}_F$,

[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.

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 consist 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 will be introduced via 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 on 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 asset holding 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 returns net of corporate tax in the U.S.. In order words, following he debt decision, the firm faces a portfolio allocation problem. Formally, this intra-period decision can be expressed as

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

subject to:

[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 are not being modeled. These include special tax deductions, earnings stripping, transfer pricing, R&D credits, income loss deductions, etc. Second, the stochastic part induces firms to take expectations which convexifies the value function and facilitates the numerical solution of the model.

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

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.

Borrowing plays a central role in our model. As repatriation taxes impose frictions on cross-geography transfers, we allow firms to supplement U.S. assets by borrowing. 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]

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

where $\psi > 0$ is the elasticity parameter of debt – a debt elastic interest rate allows the firm to leverage its foreign asset holdings to reduce domestic debt costs.

The firm's foreign subsidiary faces a similar problem of optimally allocating assets to maximize gross returns net of the corporate taxes abroad:

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

subject to

$$\tilde{A}^P_F + \tilde{A}^B_F \leq \tilde{A}_F \quad (11)$$
$$\tilde{A}^P_F \geq 0 \quad (12)$$
$$\tilde{A}^B_F \geq 0 \quad (13)$$

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 financial 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

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

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).

$$Y_i = z_i K_i^{\alpha} L_i^{\eta} \tag{15}$$

$$\tilde{A}_i^P \geq wL_i + r^K K_i \tag{16}$$

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 nature of the assumed labor and capital market makes the profit maximization problem 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

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

subject to (1)–(16) and

$$d + A'_{US} \leq \Pi_{US} \tag{18}$$

$$A'_F \leq \Pi_F. \tag{19}$$

As we mentioned, news about future taxes are introduced through 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, τ'_R, is going to be lower. Uncertainty about future tax rates is captured by transition probabilities which depend on whether the focus is on uncertainty with respect of the time of the resolution, uncertainty regarding the timing of the implementation, or a combination of these. In Appendix A, we provide the reader with a detailed graphical depiction of the probability transitions associated with each one of the quantitative experiments performed in the paper.

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

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

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 with disciplining the parameters of 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

The time period is a quarter. 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.

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 13 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, $\mathbb{E}[\pi]$, 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.

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

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 2005 in affecting our calibration.

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,

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

Restricting the sample to firm-year entries with positive foreign sales, foreign taxes, and estimated repatriation tax, the average repatriation tax rate across time and firms 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 ÷ 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 impacting 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

[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.

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 assets minus debt is 0.334, and (3) the average number of employees is 22.7 (thousands).

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

3.2 Baseline Exercise

Our baseline experiment considers a tax holiday that reduces the repatriation tax 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 and it 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. Section 4.1 describes in detail the AJCA. In order to capture the main features of it, for our baseline exercise we reduce repatriation tax rates for one-period from $\tau^H = 0.131$ to $\tau_L = 0.0643$.[14]

In this exercise we assume that firms know 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 crucial to correctly quantifying the full effects of a tax holiday. In our subsequent discussion we refer to these policy lags, the periods between when the firm learns of the tax holiday and when it is implemented, as the news periods.

The solid lines in Figure 2 present the responses to news and implementation of a tax holiday for our baseline policy. Panel A gives the firm-level responses and panel B 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 firms receive 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

[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.

[14] 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.

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 firms cut back on repatriations from their foreign 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 also 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 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 stock price 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, in the news period, even though dividends are cut back they are still positive. When firms foresee 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. 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

Much of the current policy analysis focuses only on the effects of the policy at and after its enactment. For example, assessments of the AJCA such as Joint Committee on Taxation (2004)

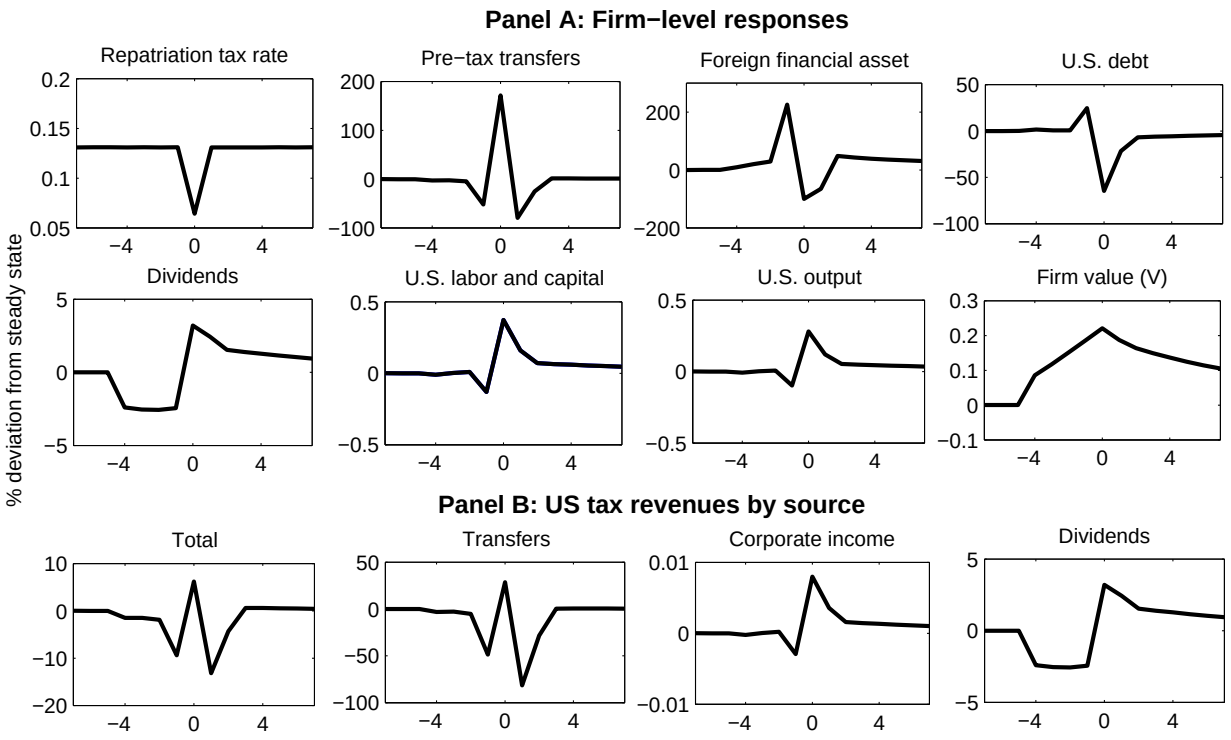

Figure 2: *Responses to Temporary reduction in repatriation taxes where news of tax reduction is 4 quarters in advance. Units are in percent deviation from initial steady state except for the repatriation tax rate.*

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 any 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 news periods should also 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 gain/losses to that variable relative to the steady state at the time of the news. For example, a cumulative value to tax revenues of -1 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 (news period=4). On net, transfers fall in the news period, rise during the tax holiday, and fall thereafter. If an assessment of the tax

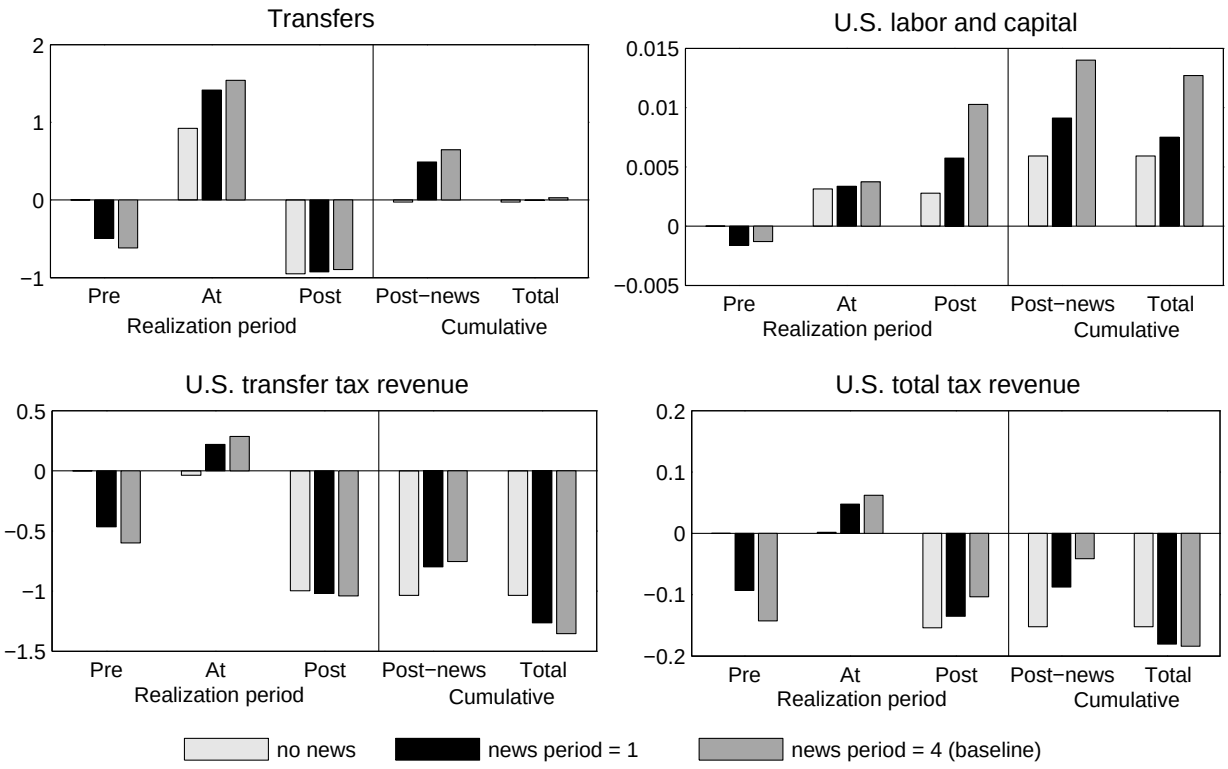

Figure 3: *Cumulative responses of transfers, U.S. capital and labor, U.S. transfer tax revenue, and total U.S. tax revenue to a tax holiday.*

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 are subdivided into 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.

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 that would have otherwise been repatriated 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 less overall the firm cumulatively

transfers back to the U.S. 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.

In summary, we find that it is very important to incorporate the news effect into policy analysis. From a policymaker's view, the key question, as was in the case of the AJCA, is can we enact a policy that stimulates domestic activity with a minimum loss to tax revenue? If news periods are not taken into account then the policymaker may overestimate the stimulative effects of the policy and underestimate the cost in terms of tax revenue losses.

3.4 Access to External Credit Markets

The enactment of a repatriation tax holiday may be 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" a firm's access to a large portion of its internal funds held abroad. A tax holiday thereby incentivizes firms to bring back these "locked-out" assets and use them to augment their productive activities. In this section we show that the magnitude of the response in a firm's productive activities, given by firm-level capital and labor, is highly dependent on the level of access a firm has to external credit.

Figure 4 shows the cumulative impacts from 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 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.

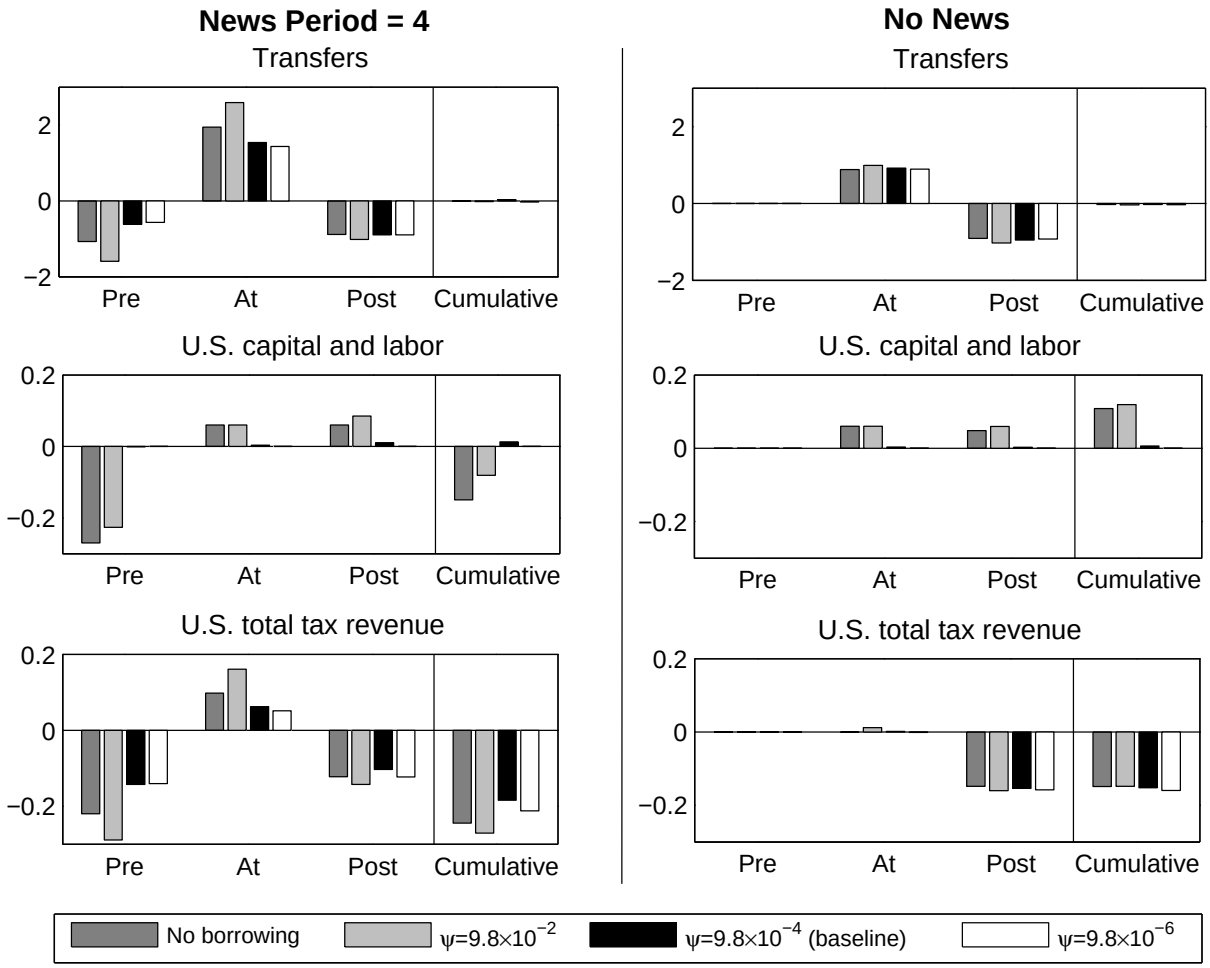

Figure 4: *Cumulative responses of transfers, U.S. capital and labor, and total U.S. tax revenue for variations in debt-elastic interest rate parameter ψ. In the left panel a tax holiday is announced 4 periods in advance and in the right panel it is immediately and unexpectedly implemented.*

Notes: The figures are subdivided into 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.

On the other hand, firms that have access to cheap borrowing also reduce transfers in order to take advantage of the tax holiday, but, because they can borrow to offset this fall in transfers during the news period, 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 credit-constraint firms 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 et al. 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) as a result 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 the theoretical literature, Stokey's (2016) model shows that tax uncertainty can generate an investment boon after the resolution of the uncertainty. In her model, a firm has projects that do not depreciate and investment in these projects is irreversible. 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, 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 firm develops the tabled projects and an upsurge in investment follows.

The characterization of the tax reform and economy in Stokey (2016) differs from our model, but we can generate the 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 relies 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 the repatriation tax reduction has 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 firms do not have access to external credit, the cumulative gains to U.S. capital and labor are positive. Since the policy change is unexpected, firms do not contract transfers and U.S. economic activity prior to the tax holiday but still increase their 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 firms have 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 firms face impediments to external credit market access, the tax revenue losses will also accompany losses in U.S. capital and labor use.

3.5 News and 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 a number of 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 has been put forth that this 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 in 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 do not show the periods at and after the tax reductions to highlight the run up of these 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

Let us first consider the case where firms are 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 to the same rate as the baseline, or the news does not materialize

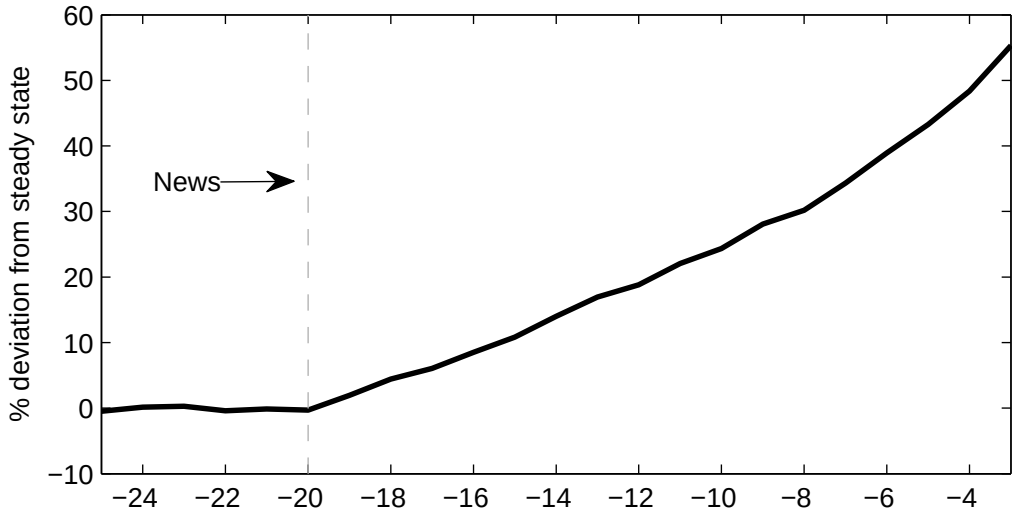

Figure 5: *Response to foreign bank assets to a temporary reduction in the repatriation tax rate when the date of implementation is uncertain.*

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.

and firms realize a tax holiday will not occur. In the following simulations, firms assign 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 doesn't 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 does disrupt 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 large 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

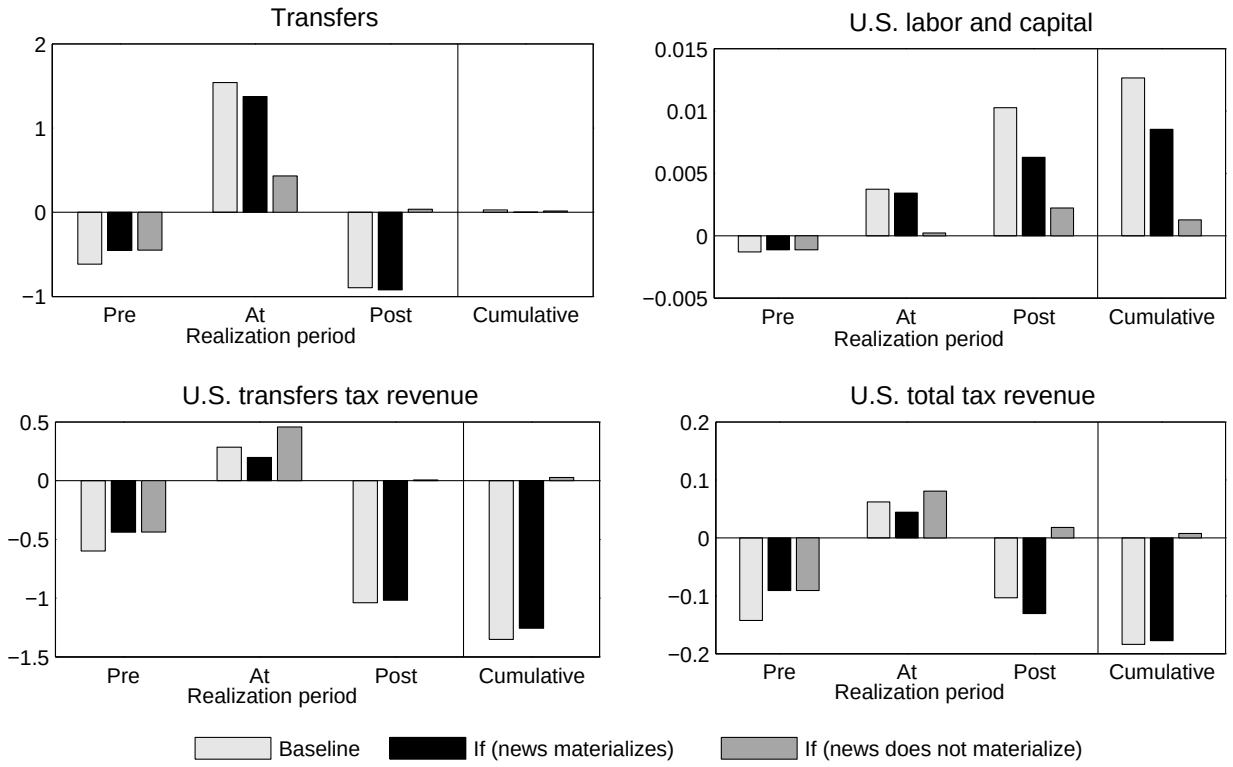

Figure 6: *Cumulative responses of transfers, U.S. capital and labor, U.S. tax revenue from transfers, and total U.S. tax revenue when there is a 50 percent probability of the tax holiday occurring in 4 quarters in advance of the news. The figure shows the cases when the tax holiday does materialize and when it does not materialize along with the baseline when the tax holiday occurs with certainty.*

Notes: The figures are subdivided into 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.

about tax holidays start, a policy maker who is primarily interested in stimulating the economy, would find it beneficial to implement the tax holiday vs. not implementing it.

3.6 Quantifying the Effects of News: the Shadow Tax

The richness of 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 single number 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.

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.

Table 2: Shadow Tax (in percent)

Panel A: Certainty when news materializes

News materializes in T quarters	$P(Tax\ Holiday)$	
	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	$P(Tax\ Holiday)$	
	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: The shadow tax as 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 firms know with certainty that a tax holiday will occur with a probability of 0.5 and 1 in exactly T periods. In panel B firms know that a tax holiday will occur with a probability of 0.5 and 1 at some period within T periods.

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 end 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, 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 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 making 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 as a laboratory in which to evaluate current tax policy proposals. We start by comparing our baseline results directly with previous findings from the literature that empirically evaluates the impact of the AJCA and provide a summary of this analysis in Appendix C.[15] The model is able to explain key empirical findings surrounding the AJCA. In doing so, we also present suggestive evidence that firms did indeed both anticipate and react to the tax holiday provision in the AJCA well before it was signed into law. This evidence lends support to the importance of accounting for the news periods in any analysis of repatriation tax policy changes.

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

[15] This literature, as it turns out, almost exclusively does not consider any anticipatory effects of tax policies.

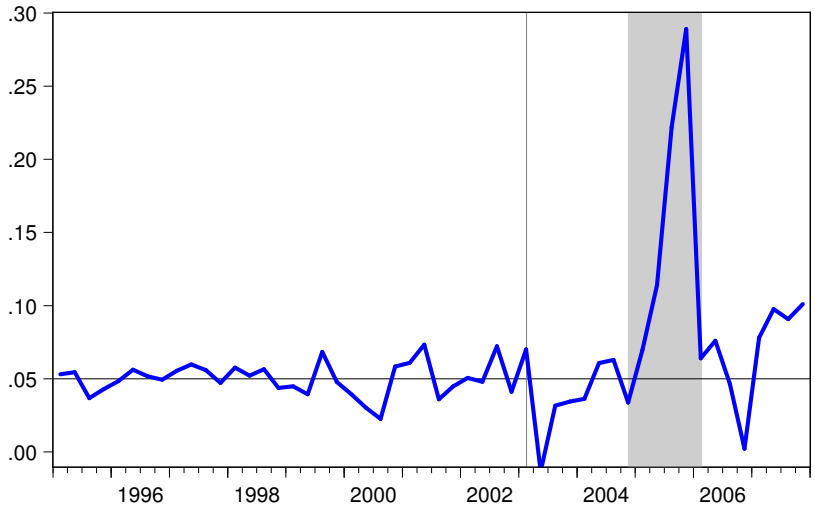

Figure 7: *Net Repatriated Dividends as Share of Corporate Profits.*

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

exceeded 10% prior to the enactment of the law, but reached 29% in the final quarter of the tax holiday before sharply falling below their average level just following the repatriation tax holiday.[16] As our baseline results show in Figure 2, the dynamics implied by our model are consistent with the data. Repatriated income rises 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 concentrated their repatriations to the tax holiday window leaving fewer assets to transfer in subsequent periods.

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 et al. (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.[17] 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 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 the number

[16]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).

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

of workers hired. That is, our model predicts that average short run impact of the AJCA tax holiday was less than an average of 0.1% more workers hired per quarter. Second, as discussed in Section 3.4, we find that the responsiveness of domestic capital and labor crucially depends on a firm's access to external credit markets. When a multinational firms is not credit constrained, it is able to operate at its profit maximizing scale independent of the amount of repatriated income. However, when 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 (Blouin and Krull 2009; Clemons and Kinney 2008; Dharmapala et al. 2011). 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 et al. 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 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 results. This is due to the fact that 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 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 [18]

[18] In addition, in Online Appendix F we quantitatively capture the steady state relationship between repatriation tax rates and liquid asset holding (financial assets in our model) found in Foley et al. (2007). As this relationship was not targeted in our calibration, it provides further external validity to our model.

4.1.1 News and the AJCA

Studies on the impacts of the AJCA have primarily focused on its impact at and after its enactment. The total effect of the policy 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.

Between passage of a bill through both houses of Congress and approval by the President, there is usually a lengthy period between when a law in introduced and when it is passed. This period was 5 months for the AJCA. This legislative policy lag is in addition to the one that may *de facto* occur given that many similar bills get introduced in the run-up to the actual final bill being introduced. In the case of the AJCA, there were a series of earlier bills beginning in 2003 that did not pass through congress but contained the tax holiday provisions that were later incorporated in the AJCA.[19] Thus, one can surmise 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 these bills did lead to anticipation of the tax holiday.[20] Oler et al. (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 for where to look for evidence regarding any anticipatory effect: to take advantage of a tax holiday, firms would 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

[19] 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.

[20] 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 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.

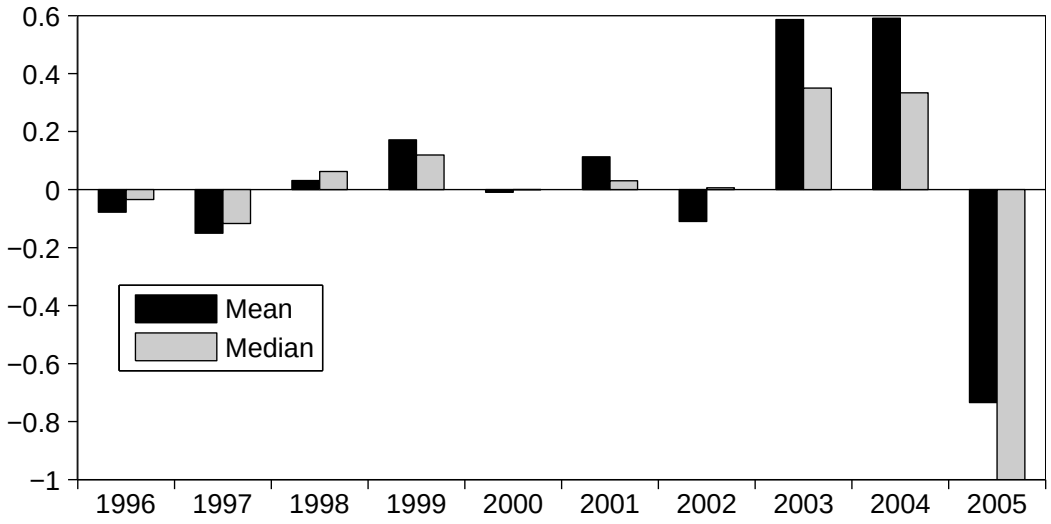

Figure 8: $\Delta\widetilde{PRE\ share}$ *1996-2005. Percentage point deviation of the share of foreign income retained abroad and untaxed by the US (PRE) relative to the average share from 1996-2002*

Notes: $\Delta\widetilde{PRE\ share}$ 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.

Reinvested Earnings (PRE); these are earnings that are claimed to be indefinitely held by foreign affiliates.[21] 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.

Figure 8 plots the across-firm mean and median percentage point deviation of $\Delta PRE\ share$ from its 1996-2002 average $\Delta PRE\ share$, $\Delta\widetilde{PRE\ share}$ (see Appendix B for detailed description of the data and construction of $\Delta\widetilde{PRE\ share}$). This gives a measure 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.

[21] 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.

4.2 Analysis of Proposed Tax Reforms

We next use our framework to analyze contemporary proposals to reform U.S. repatriation taxes. The reforms we consider contain tax changes from proposals put forward in *A Better Way* (or *The Blueprint*) authored by chairman of the House Ways and Means Committee Kevin Brady and the Speaker of the House Paul Ryan in 2016, President Obama's White House Budgets for 2015, 2016, and 2017, and President Trump's White House Budget for 2018.[22]

In contrast to the one-time tax holiday under the AJCA, many of the current proposals aim for a more permanent change in how the U.S. government taxes earnings repatriated from abroad. There are two major alternatives currently under consideration to permanently change repatriation tax laws. The first possibility is to alter the corporate income tax on all U.S. firms. Given that 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%, as proposed in *A Better Way*, then in 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 alternative is to not change the U.S. corporate income tax rate, but to directly alter the repatriation tax rate. A leading version of this proposal is to switch 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 corporate incomes taxes and when the change is moving to a territorial tax system. Similar to our baseline analysis we set the news period length to be 4, but now instead of a tax holiday, the policy change is a reduction of the corporate income tax to 20% (given by the solid line), as proposed in *A Better Way*, and a move to territorial tax system (given by the dashed line). Similar to our results from a tax holiday, the news periods do matter. In both cases firms reduce transfers in the news period in anticipation of the policy change, and thus, 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.

[22] In our framework, we do not model imports and exports of firms. For this reason, we do not model the destination approach to taxation included in *A Better Way*. In this proposal, U.S. operations do not include exports in its tax base, but U.S. operations are unable to deduct imports.

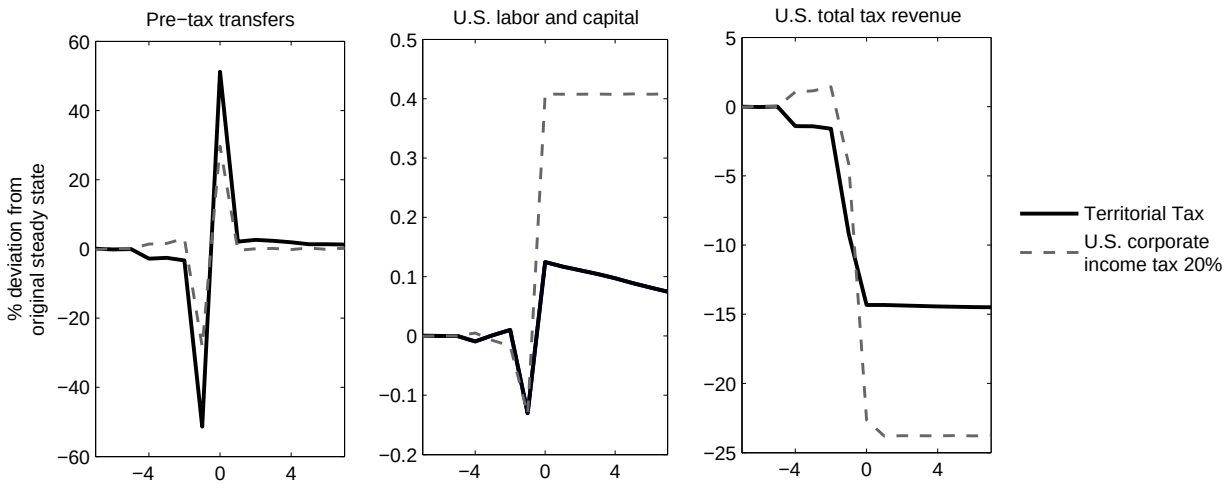

Figure 9: *Responses to permanent reduction in U.S. corporate income tax rate from 30.2% to 20% and change to territorial tax system.*

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%.

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.

Table 3: Percent change in steady state from policy changes in U.S. corporate income tax rates and implementation of territorial tax system

	Panel A: U.S. labor/capital		Panel B: U.S. tax revenue	
U.S. corporate income tax rate	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

Panels A and B of Table 3 shows how the steady state levels of U.S. labor/capital and U.S. tax revenue 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 also changed the corporate tax rate.

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 U.S. corporate income tax rates to 17.1%, which is the same rate as the foreign operations in our baseline calibration – will only lead to steady state gains in U.S. labor and capital of 1/2 of 1 percent. Again, because multinational firms have, arguably, a relatively easy access external financing, a reduction in U.S. corporate income and/or repatriation tax rates does not materially alter the firm's ability to operate close to their profit maximizing scale.

Looking next at the steady state U.S. tax revenue in Panel B, any reduction in tax rates leads to a sizable loss in tax revenue. For example, a reduction in U.S. corporate income tax rates 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 tax changes lead to marginal changes in U.S. capital and labor, and hence output, but have relatively large tax consequences for the U.S. government.

While abstracting from the potential efficiency gains associated with reducing distortionary taxes, these results point to a clear tradeoff between losses in tax revenue and gains to domestic activity. While tax revenue losses are quite substantial, steady state gains to labor and capital are only 1/2 of 1 percent relative to the initial steady state. 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 policy-makers, 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 $2.5 trillion dollars currently held abroad by U.S. firms. One proposal that recommends change to repatriation tax policy, but at the same time collects some tax revenue off the $2.5 trillion abroad, is to impose a one-time transition tax on assets held abroad at the time of a policy change. For example, *A Better Way* calls for a one-time, lump-sum tax on assets held abroad simultaneously with a permanent change in tax policy. Under this plan the transition tax will apply 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 temporary transition tax, as proposed in *A Better Way*. In our model, we apply a transition tax to all foreign assets A_F for one period only at the date of a change to a territorial tax system.[23] 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.

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

The transition tax in *A Better Way* calls for an 8.75% tax on all cash and cash-equivalent assets and 3.5% 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 $\tau_{TT} = 0.035$ on all foreign assets.

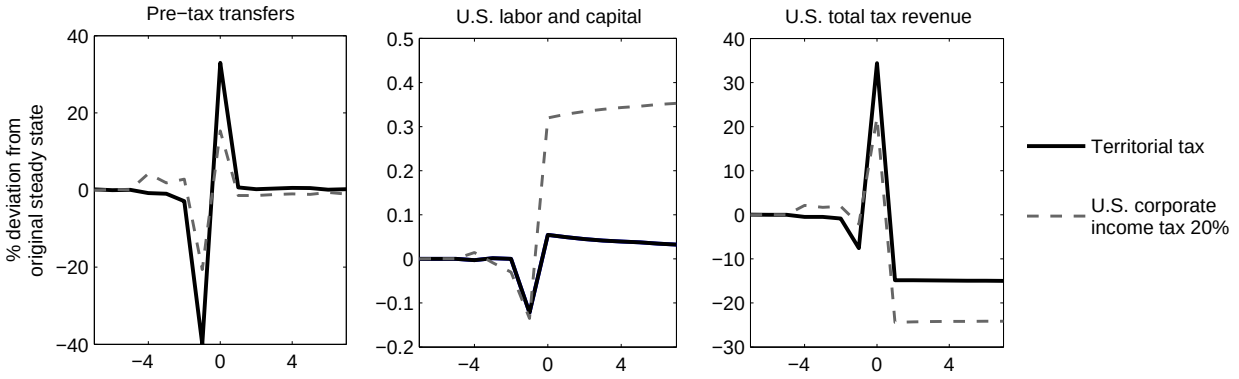

Figure 10: *Responses to permanent reduction in U.S. corporate income tax rate from 30.2% to 20% and change to territorial tax system both with a one-time transition tax of 3.5% on foreign assets at time of policy change.*

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%.

Figure 10 plots the responses to the implementation of a one-time transition tax combined with the switch to a territorial tax system and with 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 2 quarters worth of steady state tax revenue losses under the switch to a territorial tax system and make up for around 1 quarter 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.[24]

[24]In a previous version, we focused on the news effects of policy proposals from 2015-2016. These include uncertainty of if and/or when the policies may materialize using survey-based expectations of future tax reform. This analysis is presented in Online Appendix G.

5 Concluding Remarks

This paper develops a framework to understand how changes in tax policy on foreign income of U.S. multinational companies impacts firm-level behavior. We show that the news-period – the period between the announcement and implementation of the policy – is crucial for understanding the overall effects of international tax reform. In particular, we find that a policy evaluation that does not account for the news period overestimates the benefits of reducing repatriation tax rates, by overstating gains to domestic production activity and transfers from abroad, and understates its costs, by understating tax revenue losses. Additionally, the length of the news period, the uncertainty of *when* and *if* a tax change will occur, and a firm's access to external credit markets all have a significant effect on the impacts of a policy change.

References

Albring, S. M. (2006): "The Effects of the Cost of Foreign Internal Funds on the Probability that a Firm Issues Domestic Debt," *Journal of the American Taxation Association*, 28, 25–41.

Altshuler, R. and H. Grubert (2003): "Repatriation Taxes, Repatriation Strategies and Multinational Financial Policy," *Journal of Public Economics*, 87, 73–107.

Beaudry, P. and F. Portier (2007): "When can changes in expectations cause business cycle fluctuations in neo-classical settings?" *Journal of Economic Theory*, 135, 458–477.

Bloom, N. (2009): "The Impact of Uncertainty Shocks," *Econometrica*, 77, 623–685.

Blouin, J. and L. Krull (2009): "Bringing it home: A study of the incentives surrounding the repatriation of foreign earnings under the American Jobs Creation Act of 2004," *Journal of Accounting Research*, 47, 1027–1059.

Blouin, J., L. Krull, and L. Robinson (2014): "The Location, Composition, and Investment Implications of Permanently Reinvested Earnings," *Wharton Business School working paper*.

Brennan, T. J. (2010): "What happens after a holiday? Long-term effects of the repatriation provision of the AJCA," *Northwestern Journal of Law and Social Policy*, 5, 1.

Brumbaugh, D. (2003): "Tax exemption for repatriated foreign earnings: Proposals and analysis," Congressional Research Service, Library of Congress.

Clausing, K. A. (2005): "Tax holidays (and other escapes) in the American Jobs Creation Act," *National Tax Journal*, 331–346.

Clemons, R. and M. Kinney (2008): "An analysis of the tax holiday for repatriation under the jobs act," *Tax Notes*, 120.

Corporate Financing Week (2003): "Repatriation Bill Gathers Momentum," *October 27*.

De Waegenaere, A. and R. C. Sansing (2008): "Taxation of International Investment and Accounting Valuation," *Contemporary Accounting Research*, 25, 1045–1066.

Dharmapala, D., C. F. Foley, and K. J. Forbes (2011): "Watch what I do, not what I say: The unintended consequences of the Homeland Investment Act," *The Journal of Finance*, 66, 753–787.

Faulkender, M. and M. Petersen (2012): "Investment and capital constraints: repatriations under the American Jobs Creation Act," *Review of Financial Studies*, 25, 3351–3388.

Foley, C. F., J. C. Hartzell, S. Titman, and G. Twite (2007): "Why do firms hold so much cash? A tax-based explanation," *Journal of Financial Economics*, 86, 579–607.

Graham, J. R. (1996): "Proxies for the corporate marginal tax rate," *Journal of Financial Economics*, 42, 187–221.

Graham, J. R., M. Hanlon, T. Shevlin, et al. (2010): "Barriers To Mobility: The Lockout Effect Of US Taxation Of Worldwide Corporate Profits," *National Tax Journal*, 63, 1111–1144.

Gu, T. (2016): "US Multinationals and Cash Holdings," *Journal of Financial Economics, Forthcoming*.

Hartman, D. G. (1985): "Tax Policy and Foreign Direct Investment," *Journal of Public economics*, 26, 107–121.

House, C. L. and M. D. Shapiro (2006): "Phased-in tax cuts and economic activity," *The American Economic Review*, 96, 1835–1849.

Joint Committee on Taxation (2004): "Estimated Budget Effets of the Conference Agreement for H.R. 4520, The 'American Jobs Creation Act of 2004'," JCX-69-04, Joint Committee on Taxation, Washington D.C.

Judd, K. L. (1998): *Numerical Methods in Economics*, MIT press.

Kleinbard, E. D. and P. Driessen (2008): "A Revenue Estimate Case Study: The Repatriation Holiday Revisited," *Tax Notes*, 120.

Leeper, E. M., A. W. Richter, and T. B. Walker (2012): "Quantitative effects of fiscal foresight," *American Economic Journal: Economic Policy*, 4, 115–144.

Levin, C. and T. Coburn (2011): "Repatriating Offshore Funds: 2004 Tax Windfall for Select Multinationals," *United States Senate Permanent Subcommittee on Investigations*, 11.

Mertens, K. and M. O. Ravn (2011): "Understanding the Aggregate Effects of Anticipated and Unanticipated Tax Policy Shocks," *Review of Economic Dynamics*, 14, 27–54.

——— (2012): "Empirical Evidence on the Aggregate Effects of Anticipated and Unanticipated US Tax Policy Shocks," *American Economic Journal: Economic Policy*, 4, 145–181.

Oler, M., T. Shevlin, and R. Wilson (2007): "Examining investor expectations concerning tax savings on the repatriations of foreign earnings under the American Jobs Creation Act of 2004," *Journal of the American Taxation Association*, 29, 25–55.

Permanent Subcommittee on Investigations (2011): *Repatriating Offshore Funds: 2004 Tax Windfall for Select Multinationals*, U.S. Senate Committee on Homeland Security and Governmental Affairs, October 11.

Redmiles, M. (2008): "The One-Time Dividends Received Deduction," *IRS Statistics of Income Bulletin*, 27, 102–114.

Simpson, G. R. and R. Wells (2003): "Firms Accused of Using Shelters Lobby U.S. to Repatriate Funds," The Wall Street Journal, accessed June 20, 2016: http://www.wsj.com/articles/SB105329431199082400.

Stokey, N. L. (2016): "Wait-and-See: Investment Options Under Policy Uncertainty," *Review of Economic Dynamics*, 21, 246–265.

Sullivan, M. (2004): "Data show dramatic shift of profits to tax havens," *Tax Notes*, 13, 1190–1200.

The Tax Council and Ernst & Young (2016): "Tax Reform Business Barometer: Views on the Prospects for, and Key Aspects of, Federal Tax Reform," *January*.

van't Riet, M. and A. Lejour (2014): "Potential Benefits of Tax Inversion Remain (Huge): with the model and full country rankings," *CPB Netherlands Bureau for Economic Policy Analysis Backround Document*.

Yang, S.-C. S. (2005): "Quantifying Tax Effects Under Policy Foresight," *Journal of Monetary Economics*, 52, 1557–1568.

A Transition Probabilities for Experiments

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

A.1 Baseline

In the baseline simulations, the firm unexpectedly receives a tax news shock that notifies them there will be a one-period repatriation tax rate reduction 4 quarters in the future. Figure 11 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, repatriation tax rates return to the original steady state rates indefinitely.

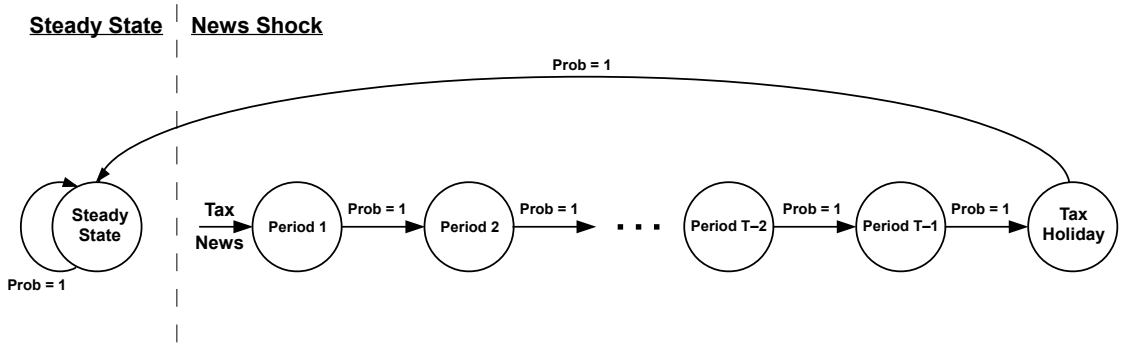

Figure 11: *Transition graph for baseline simulation, a tax holiday will occur in T periods from the arrival of the news.*

A.2 Uncertainty: When a Tax Holiday may Occur

Figure 12 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 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 1/7 probability of it occurring in the following period, and so on. Once the tax holiday occurs, repatriation tax rates return to the original steady-state rates indefinitely.

A.2.1 Uncertainty: If a Tax Holiday may Occur

Figure 13 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

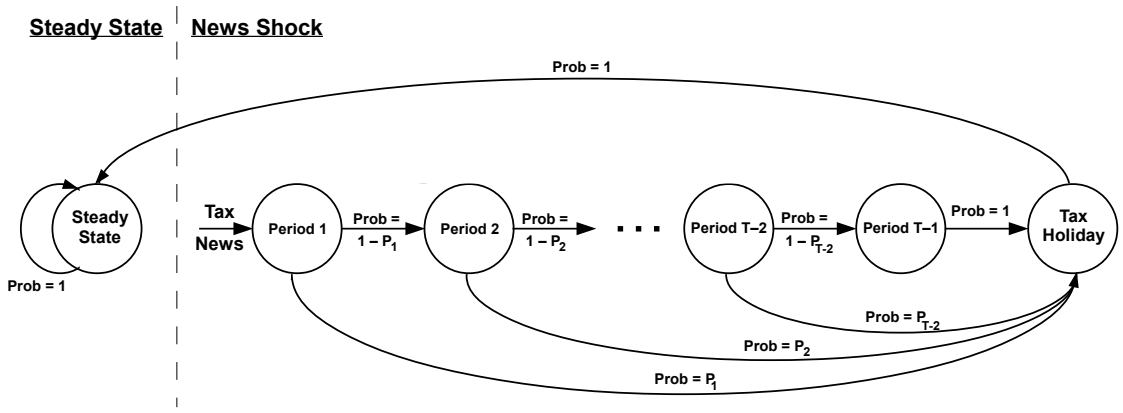

Figure 12: *Transition graph with uncertainty of when a tax holiday may occur between the arrival of the news and T periods from the arrival of the news*

$T-1$, 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 repatriation tax rates return to the original steady state rates indefinitely. If it does not occur, repatriation tax rates return to the original steady state rates indefinitely.

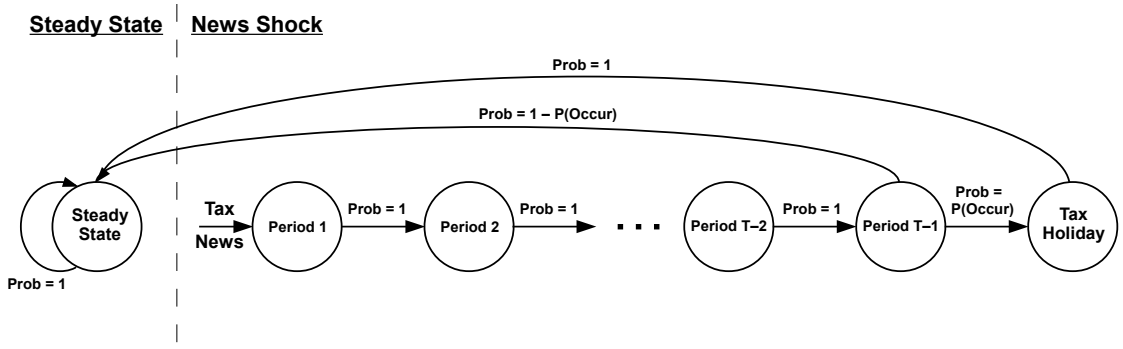

Figure 13: *Transition graph with uncertainty if a tax holiday may occur in T periods from the arrival of the news*

A.2.2 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 14 shows the general case for the transition graph for the simulations 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 ($P(Occur)$).

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 $P(Occur)$ 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 repatriation tax rates return to the original steady state rates indefinitely. If it does not occur, repatriation tax rates return to the original steady state rates indefinitely.

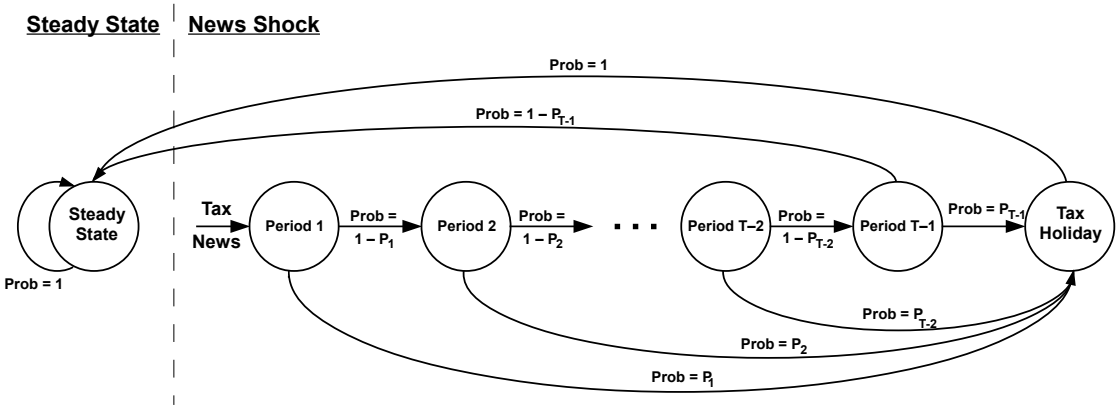

Figure 14: *transition graph with uncertainty if and when a tax holiday may occur between the arrival of the news and T periods from the arrival of the news*

A.3 Permanent Repatriation Tax Change

Figure 15 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. Firms unexpectedly receive 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 rates remain at this new level indefinitely.

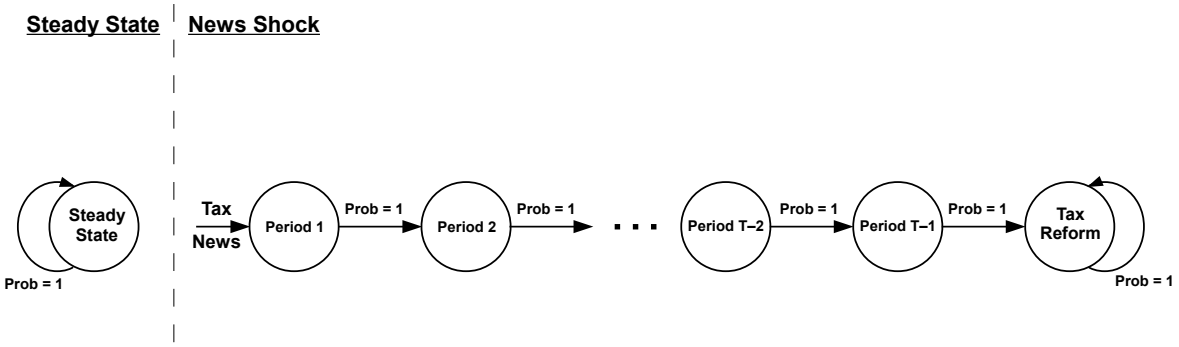

Figure 15: *Transition graph where a permanent change in tax policy will occur in T periods from the arrival of the news*

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 firm's 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 out 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 PRE. That is, the amount of a firms 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 firms' 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

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

where $\overline{\Delta PRE\ share}_{i,1996-2002}$ is the firm's average $\Delta PRE\ share$ from 1996-2002. $\Delta\widetilde{PRE\ share}_{i,t}$ 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.

C 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 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 4 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. Below, we discuss a subset of the comparisons from Table 4 in more detail. We also discuss comparisons between our model results and data surrounding the AJCA.

Table 4: 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 fall afterward for a net loss of U.S. tax revenue.
Employment and Investment (Financially Unconstrained): Faulkender and Petersen (2012), Dharmapala et al. (2011)	At/After	No significant change.	Short-term increase in both variables at a peak of 2/5 of 1 percent at the tax holiday.
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 et al. (2011), Clemons and Kinney (2008)	At/After	Increase in shareholder payouts (dividends and share repurchases). Dharmapala et al. (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 et al. (2011), Graham et al. (2010)	At/After	Graham 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 et al. (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.

Online Appendix - Not For Publication

This is a not-for-publication appendix which contains additional analysis of our framework. We start by presenting the solution method and then perform 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. We then finally expand on some current policy proposals by including uncertainty of if and/or when the policies may materialize using survey-based expectations of tax reform.

D Solution Method

As no closed form solution exists to the above 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. The code is available on request. Here we outline the solution method in three steps:

D.1 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

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

$$A_F^* = (\alpha+\eta) \left(\frac{z_F}{1+\bar{r}} \left(\frac{\eta}{w}\right)^{\eta} \left(\frac{\alpha}{r^k}\right)^{\alpha}\right)^{\frac{1}{1-\alpha-\eta}} \tag{20}$$

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 10000x10000 grid of $\tilde{A}_{US} \times \tilde{A}_F$ values. The solution at each of the 10000x10000 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

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

$$A^*_{US} = (\alpha+\eta)\left(\frac{z_{US}}{1+\bar{r}}\left(\frac{\eta}{w}\right)^{\eta}\left(\frac{\alpha}{r^k}\right)^{\alpha}\right)^{\frac{1}{1-\alpha-\eta}} \tag{21}$$

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.

D.2 Step 2:

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

For the value function iteration we define $V(A_{US}, A_F, \tau_i, \epsilon_k)$ on a 4-dimensional discrete grid and use a combination of linear and shape-preserving Schumacher quadratic splines to interpolate within the grid (see Judd (1998)). 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 in (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 1001 grid points along with

linear splines for each of the A_{US} and A_F dimensions.

D.3 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 1000 periods with the tax news arriving in period 800. We repeat this 1000 period simulation 100000 times keeping the tax news the same but allowing the idiosyncratic ϵ realization to vary. We then average across these 100000 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. For our impulse responses we label period 800 + N as time 0, the period of the expected news realization, where N = length of the new period.

E Sensitivity Analysis on σ

In this section, we perform sensitivity analysis on the coefficient of relative risk aversion σ in our utility function. Figure 16 shows the responses to news and 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 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 firms receive 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 ($\sigma = 0$).

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.

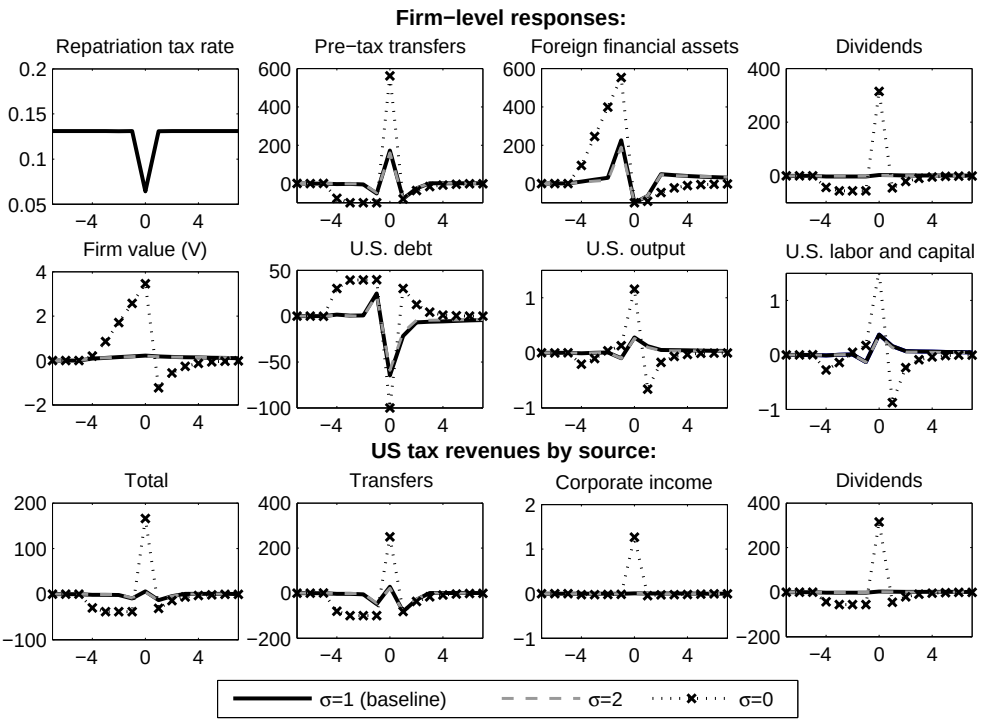

Figure 16: *Responses to Temporary reduction in repatriation taxes where news of tax reduction is 4 quarters in advance. Units are in percent deviation from initial steady state except for the repatriation tax rate. The figure plots the baseline ($\sigma = 1$, or log utility), $\sigma = 2$, and $\sigma = 0$ (linear utility).*

F 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 et al. (2007) find that the amount of consolidated liquid asset holdings by U.S. multinationals is growing in repatriation tax rates faced by the subsidiaries. Blouin et al. (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 Foley et al. (2007). Foley et al. 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 or Foley

et al.).

Within our model, we can use repatriation tax rates and liquid asset holdings as measured in Foley et al. to compare the quantitative relationships between these variables in the model as compared with their empirical estimates.[25] 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.[26] Figure 17 plots the level of $ln\left(\frac{Cash}{Net\ Assets}\right)$ from the model against the range of repatriation tax rate, which are normalized to zero by the mean level of liquid asset holdings. Consistent with the definition of liquid asset holding in Foley et al., "cash" in the model is total financial assets and net assets are total assets less financial assets. As a direct comparison with Foley et al., 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

[25] Foley et al. (2007) 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.

[26] 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 17, we hold U.S. and foreign tax rates constant and vary the repatriation tax rate.

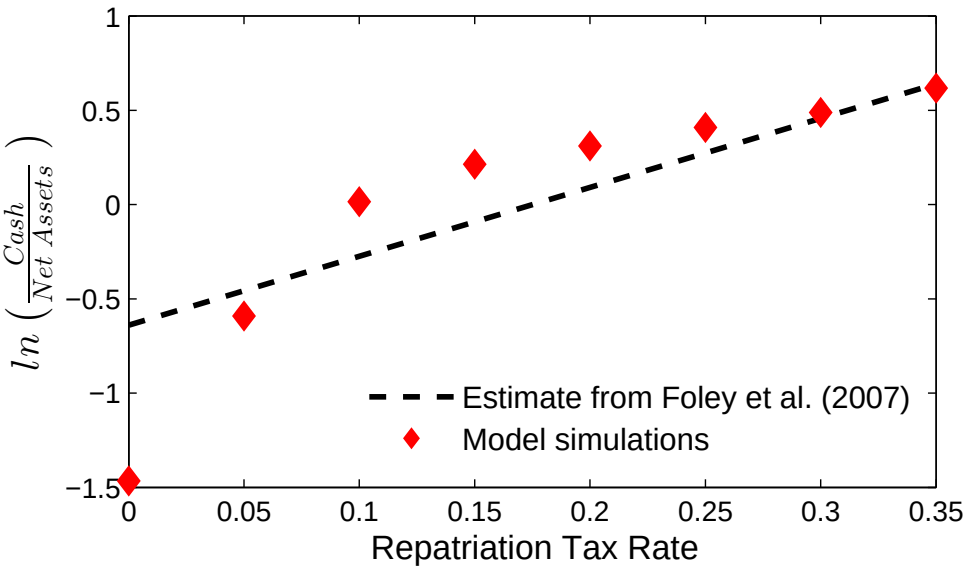

Figure 17: *The relationship between liquid asset holdings and repatriation tax rates. The scattered observations are from the model in steady-state and the slope coefficient of the line is the estimated relationship in Foley et al. (2007).*

Notes: In the model, "cash" is total bank assets (not including debt) and net assets are total assets less bank assets. In Foley et al. (2007), "cash" is liquid assets and short-term investments and net assets are total assets less cash. The estimate from Foley et al. is from Table 4, column 1 in their paper.

PRE for firms that face positive repatriation taxes.

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, firm's 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 taxes 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 indicates 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.

G Extension on Evaluating Current Policy Proposals

This section extends our analysis on current 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 of 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.

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 the 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.

G.1 Tax Reform Proposals

We consider key international provisions of two leading tax reform proposals. 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.[27] 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 domestic operations. 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

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

as replacing the foreign subsidiary's after tax profits as

$$(1-\tau_F-\tau_M)(K_F^{\alpha_F}L_F^{\eta_F}-w_F L_F-r_F^K K_F+r\tilde{A}_F^B). \tag{22}$$

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 (22).

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.

G.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.[28] 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 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."[29] 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.[30] 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 transition tax ($R1$), and Republican plan without transition tax ($R2$). The transition graph in Figure 18 summarizes the outcomes and probabilities associated with the realizations in the news period. The transition

[28] 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.

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

[30] 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.

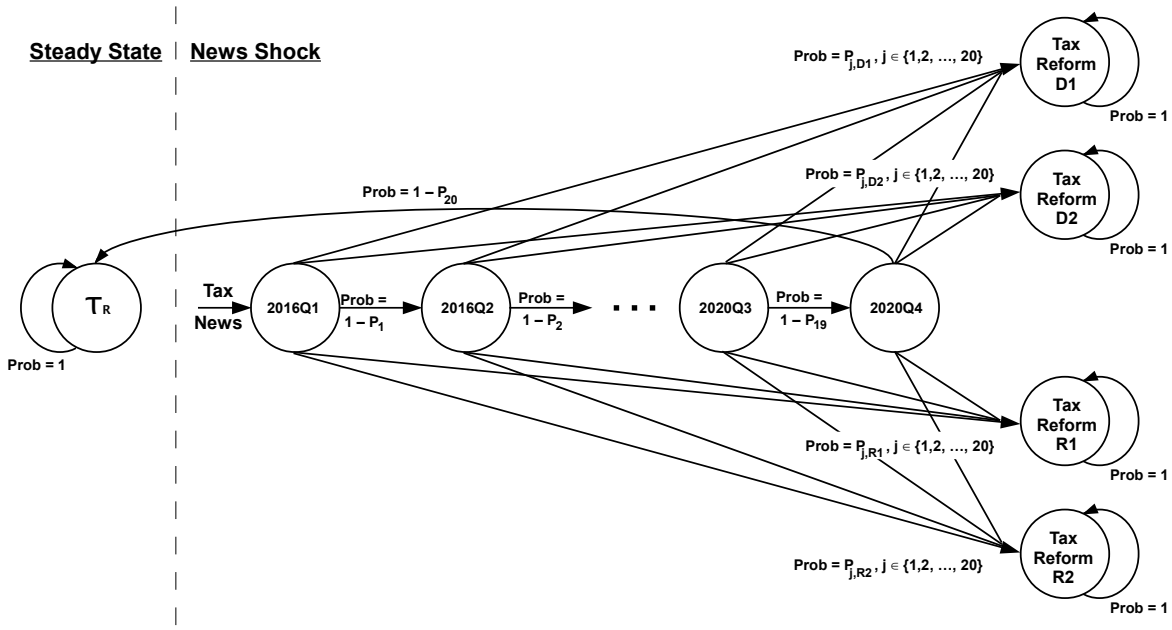

Figure 18: *Transition graph of news of policy reform: 2016Q1-2020Q4*

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.

Table 5: Potential policy changes: 2016Q1 to 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

matrix and probabilities of each state of Figure 18 occurring is shown below in Table 6. Table 5 summarize the tax changes in each proposal

G.3 Results

At 2016Q1, firm's receive news of a possible tax policy change. Figure 19 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

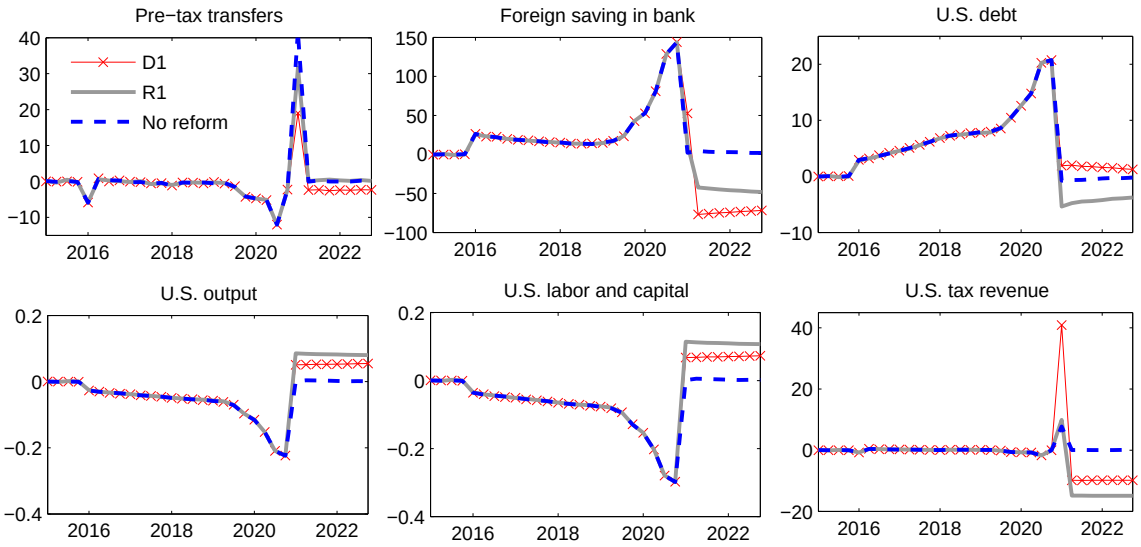

Figure 19: *Response to news and possible implementation of tax reform.*

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.

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.

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 20 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.

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 the lowest tax policies $R1$ 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.

According to the model, total labor and capital gains are highest under $R2$ if that policy is enacted promptly, equivalent to a lift-time gain of 7 percent above their initial quarterly steady-state levels, which on a quarterly stock basis is relatively small. 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 expectations 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 6 reports the transition matrix associated with the policy experiment given above and corresponds to the transition graph in Figure 18. 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.

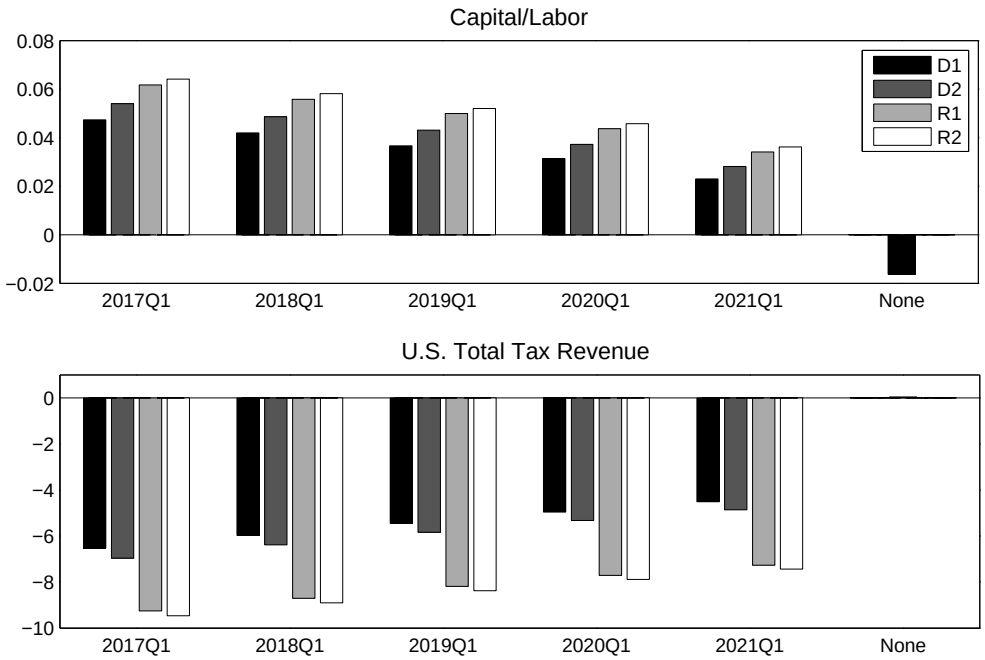

Figure 20: *Cumulative responses to policy outcomes by date of implementation and if there is no policy change.*

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.

Table 6: 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