The Macroeconomic Effects of Corporate Tax Reforms

Francesco Furno[†]

February 15, 2023

Abstract

This paper documents a dual response of the US economy to two major corporate tax cuts. The recent Tax Cuts and Jobs Act (TCJA-17) was followed by a large increase in payouts to shareholders, but not by major stimulus to investment and production. The Kennedy's tax cuts of the early 1960s, instead, were followed by a large increase in output and capital accumulation, but not in payouts to shareholder. To rationalize this duality, I extend a standard macroeconomic framework with a corporate tax code featuring two key elements: tax depreciation policy and the distinction between c-corporations and pass-through businesses. In the model, the stimulative effect of a tax rate cut on c-corporations is smaller the more tax depreciation policy is accelerated, and is diluted in the aggregate by the presence of pass-through businesses. Because of highly accelerated tax depreciation and a large pass-through share in 2017, the model predicts modest aggregate stimulus and large payout distributions as a result of the TCJA-17. At the same time, because of less accelerated tax depreciation and a lower pass-through share in the early 1960s, the theory predicts sizable stimulus and a small increase in payouts in response to the Kennedy's corporate tax cuts. Overall, the model-implied corporate tax multiplier for the Kennedy's tax cuts is four times as high as that for the TCJA-17, mainly due to pre-reform differences in tax depreciation policy.

JEL Codes: E06, H02, H06

Keywords: Corporate Tax, Macroeconomics, Tax Depreciation, Pass-Through Businesses

[†]Currently: Central Economics, Amazon Web Services (AWS). Previously: Department of Economics, New York University. Contact: francesco.furno@nyu.edu. This paper was completed prior to the author's employment by AWS. This paper is not sponsored or endorsed by, or associated with AWS or any of its subsidiaries or affiliates. The views, opinions and positions included in this paper are the author's own and do not reflect the views, opinions and positions of AWS.

I am grateful to my advisors Jaroslav Borovička, Jess Benhabib and Simon Gilchrist, and to Tim Christensen, Gian Luca Clementi, Francesco Daveri, Francesco Giavazzi, Stefano Rossi, Tom Sargent and Bàlint Szőke for their encouragement. I also thank Mark Gertler, François Gourio, Federico Kochen, Virgiliu Midrigan, Brandon Pecoraro, Diego Perez, and participants to the NYU Macro Lunch, the BFI's Macro-Financial Modeling Summer Session, the St. Louis FED, and the Chicago FED for their comments.

1 Introduction

This paper investigates the response of the US economy to the recent Tax Cuts and Jobs Act of 2017 (TCJA-17) and the Kennedy's corporate tax cuts of the early 1960s, and proposes a framework to think about the macroeconomic effects of corporate tax reforms. Both reforms featured a major corporate tax reduction component, but - as this paper documents - produced different effects on the economy. On the one hand, the TCJA-17 was followed by a large increase in payouts to shareholders, but not by a major stimulus to investment and production. On the other hand, the Kennedy's tax cuts of the 1960s were followed by a large increase in output and capital accumulation, but not in payouts to shareholders. Such a duality may appear puzzling. If one thinks of corporate taxes as a form of capital taxation, the lack of stimulus in the aftermath of the TCJA-17 is certainly surprising. If, instead, one thinks of corporate tax cuts as an improductive transfer to shareholders, the large boost to economic activity following the Kennedy's cuts is perplexing.

The conceptual framework proposed in this paper is able to rationalize this duality by leveraging two key elements of the tax code: tax depreciation policy and the distinction between c-corporations and pass-through businesses. Once embedded in a standard macroeconomic model and properly calibrated, these two features successfully reproduce the duality of responses documented empirically.

Before presenting the empirical evidence and the theoretical framework, it is useful to briefly review these two institutional elements. Tax depreciation policy defines the set of rules that businesses are required to follow to deduct investment from their tax base. The vast majority of corporate tax codes around the world do permit businesses to fully recover the cost of investment from their tax base, but only over time according to a tax depreciation schedule. As a result, differences in tax depreciation policies across space and time tend to boil down to how fast investment can be deducted. When investment is allowed to be deducted over a short period of time, the tax depreciation schedule is said to be 'accelerated', and recent empirical contributions from the public finance literature have documented the ability of accelerated tax depreciation policy to stimulate firms' investment.[1]

Pass-through businesses are the second institutional element of the analysis. In the US, only c-corporations are subject to corporate income taxation. All other legal forms of organization (s-corporations, partnerships, and sole-proprietorships) are 'pass-through', in the sense that their earnings are not subject to firm-level taxation and are 'passed through' to their owners. Over the last few decades, the share of economic activity taking place in pass-through businesses has risen

[1]For example, see Zwick and Mahon (2017), Ohrn (2018), and Ohrn (2019). From a theoretical perspective, the importance of tax depreciation policy is known at least since Smith (1963) and Hall and Jorgenson (1967).

substantially, reaching roughly 40% in 2017, compared to 25% in the early 1960s.[2]

To illustrate the duality of responses to the TCJA-17 and the Kennedy's tax cuts, I present several pieces of empirical evidence. To estimate the aggregate effect of the TCJA-17, I compare pre-reform professional forecasts with actual outcomes for several macroeconomic aggregates. This analysis extends the work done by Kopp et al. (2019) and, under the assumption that pre-reform forecasts do not incorporate an imminent tax reform, it recovers the causal effect of the reform. I then adopt the same strategy to analyze the response of c-corporations. The main challenge here is that neither actuals nor forecasts are available for c-corporations as a whole. To overcome this limitation, I aggregate firm-level forecasts from the IBES dataset and firm-level actuals from Compustat to construct an aggregate able to mimic economic activity for c-corporations. At an aggregate level, I document a small response of aggregate investment ($\approx$ +3% in 2018), output ($\approx$ +1% in 2018), and a dramatic loss of corporate tax revenues ($\approx$ −75% in 2018 excluding revenues from repatriated earnings). At the c-corporations level, I show a larger response of investment ($\approx$ +12% in 2018), and a very large increase in payouts to shareholders ($\approx$ +30% in 2018).

To ensure that these responses are indeed the result of the corporate tax reduction component of the TCJA-17 - as opposed to the response to other components of the TCJA-17 or to business cycle fluctuations - I compare the behavior of c-corporations and pass-through businesses using publicly available IRS data. This exercise confirms a sharp reallocation of economic activity from pass-through businesses to c-corporations, as one would expect were the response driven by the corporate tax provisions. Finally, I provide cross-sectional evidence on the mechanism by replicating the identification proposed in Zwick and Mahon (2017) to the TCJA-17.

I then gather empirical evidence on the Kennedy's tax cuts. The data is significantly sparser for this historical period, but it nonetheless suggests a large increase in investment and output driven both in the aggregate and for c-corporations, and a lack of increase in payouts to shareholders.

To rationalize these empirical results, I propose a theoretical mechanism that leverages tax depreciation policy and pass-through businesses and that can be embedded in a framework as simple as a neoclassical growth model with two sectors: a c-corporate sector subject to corporate taxation with an explicit tax depreciation schedule, and a pass-through sector not subject to corporate taxation.

In line with a canonical neoclassical model of firm investment, corporate tax changes affect the economy primarily through the investment decision of c-corporations, which depends not only by the tax rate but also by tax depreciation policy. Specifically, the possibility to deduct

[2]Several recent contributions have documented some of the implications and issues arising from this pass-through status. For example, see Cooper et al. (2016), Clarke and Kopczuk (2017), Chen et al. (2018), Smith et al. (2019), Barro and Wheaton (2020), Kopczuk and Zwick (2020), Bhandari and McGrattan (2021), Smith et al. (2022).

investment from the tax base (partially) counteracts the distortion introduced by the tax rate: the faster investment is deducted from the tax base, the higher the present value of the investment deductions, the smaller the distortion to the rate of return on investment (RoI) caused by the tax rate. As a result, when tax depreciation policy is very accelerated - as it was in 2017 - the RoI is almost unaffected by the corporate tax rate, and a rate reduction is not particularly expansionary. Put differently, accelerated tax depreciation reduces the marginal tax rate for any given statutory corporate tax rate.

On top of this, a statutory tax rate cut also entails reduced corporate tax liabilities. One of the key take-aways of this paper is that this reduction in the tax bill is not necessarily tied to the increase in the RoI described above. Put differently, a corporate tax reform could affect the marginal tax rate and the average tax rate differently.

How the tax savings from a statutory rate cut are used depends on how much the RoI increases in response to the cut. When pre-reform tax depreciation policy is very accelerated, the increase in the RoI is small and a large share of the tax-savings is distributed to the shareholders (either as dividends or as share repurchases) - which was the case for the TCJA-17. When pre-reform tax depreciation policy is not accelerated, instead, the increase in the RoI is sizable and the tax savings are primarily used for investment - which was the case for the Kennedy's tax cuts.

While this accounts for the response of the c-corporate sector, it is necessary to consider the pass-through sector to quantify what happens in the aggregate. Since a change to the corporate tax rate affects directly only c-corporations, the aggregate effect is diluted by the presence of pass-through businesses. To a rough approximation, if the pass-through share of economic activity is 50%, the aggregate effect of a corporate cut will be 50% smaller than the effect in the c-corporate sector. In fact, pass-through entities are not only excluded from the tax cut, but they are also put at a competitive disadvantage. This happens because they compete with c-corporations in the production of (imperfectly) substitutable goods, which further amplifies the shift of economic activity from pass-through businesses to c-corporations and may reduce the aggregate effect even more.[3]

Once calibrated to the tax code in 2017 and 1961, the baseline neoclassical model can rationalize these empirical findings. Specifically, thanks to a very accelerated tax depreciation schedule in 2017, the TCJA-17 did not significantly reduced the marginal tax rate for c-corporations, but sizably reduced the average tax rate. This resulted in limited stimulus to investment and an increase in payouts. On top of that, the aggregate stimulus was much smaller than the stimulus to c-corporations because of an all-time high share of pass-through activity in the US economy.

[3]C-corporations and pass-through businesses compete even in narrowly-defined industries of the US economy. As an illustrative example, IRS data from 2012 shows that 52.3% of economic activity in the "Apparel Manufacturing" industry (NAICS 315) took place in c-corporations, and the remaining 47.7% in pass-through businesses. Hence the assumption of imperfect substitutability between goods produced by the two sectors.

At the same time, because of less accelerated tax depreciation policy, the corporate reductions in the early 1960s significantly reduced the marginal tax rate, providing a boost to investment. Importantly, c-corporations did not distributed the tax savings to shareholders, but used them to accumulate capital. Finally, due to a smaller pass-through share, the model predicts that aggregate stimulus was closer to the stimulus in the c-corporate sector.

To quantify this duality, I compute the model-implied corporate tax multiplier for each tax reform and show that, for every dollar of lost corporate tax revenues, the Kennedy's tax cuts stimulated output roughly four times more than the TCJA-17, and that a large part of this difference can be attributed to differences in pre-reform tax depreciation policy.

The results in this paper may appear at odd with the approach - common in macroeconomics - of considering corporate taxation as a form of capital taxation. To clarify that they are not, I provide a formal mapping between corporate taxes and the familiar concept of a "capital tax". I show that a corporate tax is simply a different tax instrument from a capital tax, i.e. a tax on in the income attributable to the factor of production "capital". Both tax depreciation policy and pass-through businesses drive a wedge between corporate and capital taxes, which is why thinking of the TCJA-17 as a major reduction in the tax rate on the production factor capital may fail to rationalize its effects. I also provide additional results on the ability of corporate taxes to collect revenues, and show that standard macroeconomic approaches to model corporate taxes would fail to rationalize the empirical evidence.

Finally, I derive the analytic steady-state of the model and use it to characterize the distortions introduced by US corporate tax policy over the last few decades. This last exercise shows that US policy-makers have by now removed most of the distortions introduced by corporate taxes, but this also implies that they are running out of ammunition: further reductions of corporate tax rates are unlikely to provide strong stimulus to the economy.

1.1 Relation to the Literature

The main contribution of this paper is to document a duality of responses of the US economy to two major corporate tax reductions, and to propose a unified framework able to rationalize the joint response of a wide set of variables across these two episodes.[4] This is achieved by explicitly analyzing tax depreciation policy and pass-through businesses while keeping the economic environment as simple as possible, in order to illustrate the mechanisms at play transparently and to showcase the explanatory power of these two elements of the tax code.

[4]There are several policy papers that provide forecasts for the effect of major corporate tax reforms, but they are usually limited to the response of output and corporate tax revenues and do not quantify the importance of tax depreciation policy and pass-through businesses in shaping the effect of each reform. For assessments of the Tax Cuts and Jobs Act of 2017 see Tax Foundation (2017), Barro and Furman (2018), Mertens (2018), Gale et al. (2018), Auerbach (2018), Slemrod (2018).

Relative to the existing macroeconomic literature, the main contribution of this paper is to illustrate the qualitative and quantitative implications of considering both pass-through businesses and tax depreciation policy when studying the effects of a corporate tax reform.[5] The main advantage of leveraging these two elements of the tax code is that they are directly observable features of the tax code that have been widely analyzed by the public finance and the accounting literature.

While the intuition that the effect of a corporate tax rate cut on corporate investment depends on tax depreciation policy has been theorized by the public finance literature at least since Hall and Jorgenson (1967), this insight in isolation is not sufficient to pin down the macroeconomic response of the economy to a corporate tax reform. A general equilibrium modeling approach, instead, naturally provides restrictions on the comovement of a large set of variables of interest.

The paper also provides some novel empirical results. Following the TCJA-17, this paper documents a small impact on aggregate variables by extending and complementing Kopp et al. (2019), who focus on investment. It also construct a novel measure of overall c-corporate activity using firm-level data,and leverages publicly available IRS data - some of which have been manually digitalized - to document a shift of economic activity from pass-through businesses to c-corporations after a corporate tax reduction.

Finally, this paper provides two analytic results directly related to the capital taxation literature in macroeconomics. The first result is a mapping between corporate taxes and capital taxes, which shows that tax depreciation policy and pass-through businesses drive a wedge between these two tax instruments. As a result, thinking of corporate taxes as a form of capital taxation - as suggested for example in Lucas (1990), Atkeson et al. (1999), Mankiw et al. (2009) - could be misleading.

The second result is that - even in a frictionless environment - the corporate tax can efficiently collect positive tax revenues in the long-run.[6] This goes against a widespread belief that the corporate tax cannot collect revenues without distorting capital accumulation.

[5] Papers in macroeconomics that consider tax depreciation policy explicitly are Mertens and Ravn (2011), Winberry (2021), and Baley et al. (2022) . Sedlacek and Sterk (2019) consider full expensing of investment to study the TCJA-17, but otherwise restrict tax depreciation to economic depreciation. Papers that consider pass-through businesses and their importance for the aggregate effects of a corporate tax change are Meh (2008), Chen et al. (2018), Bhandari and McGrattan (2021) and Zeida (2021). In particular, Zeida (2021) studies the effects of the TCJA-17 focusing on the occupational choice between pass-through businesses and c-corporations. Examples of papers that study the macroeconomic effects of changes to the corporate tax rate ignoring pass-through businesses and restricting tax depreciation to economic depreciation are Conesa and Domínguez (2013), Erosa and González (2019), Conesa and Domínguez (2020), Chari et al. (2020). Acemoglu et al. (2020) suggest the alternative approach of calibrating a capital tax to the effective tax rate paid by corporations taking into account tax depreciation policy. By construction, this approach successfully recovers the tax wedge on the Euler Equation of the firm, but fails to measure cash-flows correctly and thus to rationalize the empirical evidence proposed.

[6] Abel (2007) makes the very same point suggesting that it is possible to collect tax revenues efficiently by subsidizing capital producers.

2 Empirical Evidence on the TCJA-17

This section presents evidence on the effects of the Tax Cuts and Jobs Act of 2017. I first examine aggregate and c-corporate variables by comparing their actual paths with pre-reform forecasts, and then look at reallocation of economic activity between c-corporations and pass-through businesses using tax returns. Finally, I replicate the identification proposed by Zwick and Mahon (2017) on the cross-section of Compustat firms to provide additional evidence on the impact of corporate taxation on investment.

A distinctive feature of the analysis is that it explicitly distinguishes between c-corporations - that pay corporate taxes - and pass-through businesses - that do not. Usually, data collection and analysis is organized around the distinction between corporations (c-corporations and s-corporations) and non-corporations (partnerships and sole-proprietorships). When studying corporate tax reforms, however, this categorization is problematic because c-corporations and s-corporations are aggregated together, but the latter do not pay corporate income taxes.

At the aggregate level, the evidence suggests small stimulus and a sharp reduction in corporate tax revenues. The response is larger at the c-corporate level, but the percentage increase in payouts to shareholders outweighs the percentage increase in investment, suggesting that a sizable portion of the tax-savings from the reform were distributed to shareholders. Finally, tax returns show a shift of economic activity from pass-through businesses to c-corporations.

2.1 The TCJA-17: Corporate Provisions

It is common for recent major US tax reforms to include provisions affecting a variety of tax instruments, and the Tax Cuts and Jobs Act of 2017 is no exception. For example, the reform included changes to individual income taxation, to the estate tax exemption, to the individual mandate penalty, to international tax rules, and introduced a deduction for pass-through income. Since corporate taxation is the main focus of this paper, I summarize the corporate provisions of the TCJA-17 in Table 1.

The two main corporate provisions introduced by the TCJA-17 are a permanent cut to the statutory corporate tax rate from 35% to 21% and a temporary five-year increase in bonus depreciation followed by a phase-out period for assets with an estimated life less than 20 years - i.e. fixed capital asset that are not buildings. These two provisions constitute the focus of the theoretical analysis carried out later in the paper. Another important provision reduces the ability of businesses to deduct interest payments on debt from their tax base, while the remaining provisions are aimed at re-organizing the tax code in an overall revenue-neutral fashion.[7]

[7]Bonus depreciation, together with the newly-introduced pass-through income deduction for the individual income tax, affect pass-through businesses as well. Goodman et al. (2021) document almost no response of pass-through

The Tax Cuts and Jobs Act was signed into law on December 22 2017, and the vast majority of its provisions became effective in January 2018.

Table 1: Corporate Tax Provisions in the TCJA-17

Provision	Static Revenue Change ($bln) 2018-2020
Corporate Tax Rate from 35% to 21%	−357.1
Bonus Depreciation Allowance from 50% to 100%	−93.6
Interest-Deduction Cap	+45.8
Small Business Reform (e.g. Section 179)	−34.6
Additional Changes to Deductions	+35.9
Changes to Loss Treatment	+27.5
AMT Repeal	−20.3
Changes for Insurances, Banks and Fin Instruments	+16.7
Changes to Business Credits	+2.1
Changes Accounting Methods	+5.6

Source: JCT Conference Report for H.R.1.
Notes: The numbers reported in the table are estimated using a "marginal" approach. The JCT estimates the effect of each provision by adding one after the other. So, for instance, the change in revenues due to the corporate tax rate reduction is estimated conditional on the repeal of the alternative minimum tax (ATM). As a result, the numbers above should be interpreted carefully due to interactions between different tax provisions.

2.2 Aggregate and C-Corporate Response

To assess the response of the US economy to the TCJA-17, I compare actual realizations of macroeconomic and c-corporate variables with pre-reform professional forecasts, and interpret the difference as the estimated effect of the reform.[8]

One issue with this approach is that the TCJA-17 is arguably not the only shock hitting the US economy in this period. To assess the potential impact of unforeseen shocks, I compute historical forecast errors and use them to construct confidence intervals for the forecasts. These forecast intervals are directly informative about the errors made by forecasters in the past and, to the extent that these errors reflect unanticipated shocks, the intervals do as well. Details on their construction can be found in subsection A.1.

Another important concern is that pre-reform forecasts might incorporate expectations of an imminent reform, thereby biasing the estimated effect. To assess the extent of anticipation effects in pre-reform forecasts, I first look at the probability of an imminent reform from betting markets

businesses to the pass-through income deduction, and pass-through businesses tend to be less capital-intensive then c-corporations. Thus, I abstract from these two pass-through provisions in my main theoretical analysis.

[8]The idea behind this exercise is the same as in Kopp et al. (2019) whose focus is on aggregate business investment.

data. Panel (a) of Figure 1 reports the probability of a corporate tax cut from the election of former President Trump to the passage of the TCJA-17.

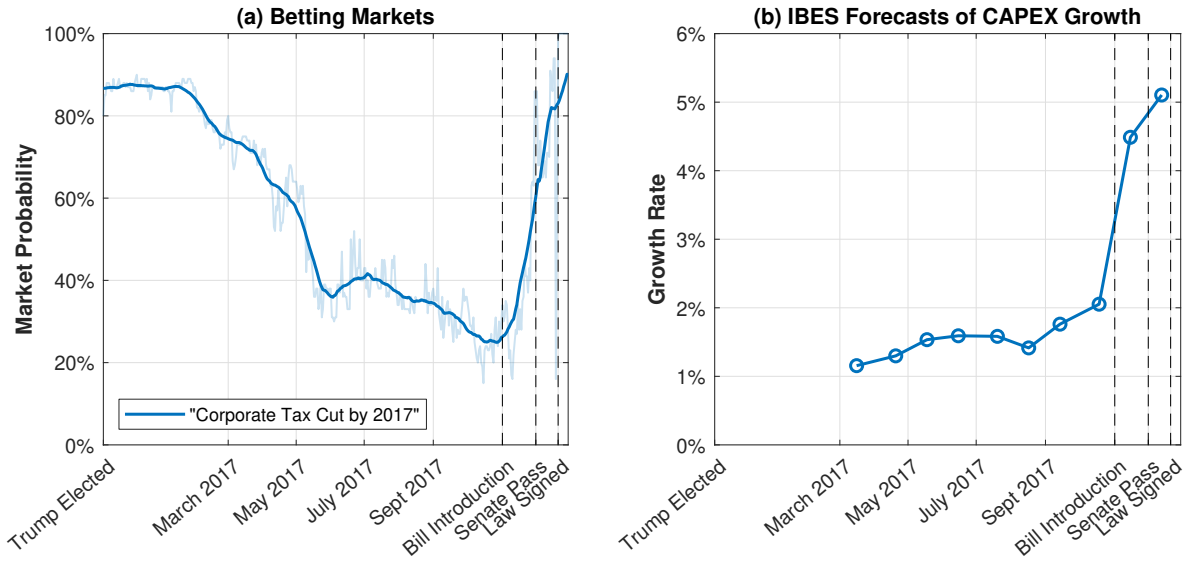

Figure 1: Perceptions of a Corporate Tax Reform before the TCJA-17
Source: IBES, PredictIt.

A corporate tax cut was perceived as almost certain in the first few months after the election, arguably as a reflection of electoral campaign promises. However, as months went by without any legislative action, the perceived probability decreased to around 30% in the summer of 2017. It then picked up once the first draft of the TCJA-17 reform bill was introduced into Congress in the Fall of 2017, and increased quickly as the bill passed congressional vote and eventually became law in December 2017.

Based on the probability from betting markets, it appears that forecasts made in the summer of 2017 are the least likely to incorporate anticipation effects. It is possible, however, that betting market participants' beliefs differ systematically from those of professional forecasters. To mitigate this concern, I examine the dynamic evolution of professional forecasts from IBES in Panel (b) of Figure 1. The plot reports the evolution over time of forecasts of capital expenditure growth for 2018. The series exhibits a strong correlation with betting market probabilities, which suggests a similar evolution of beliefs among betting market participants and professional forecasters.

While it is not possible to completely rule out anticipation effects in pre-reform forecasts, it is important to realize that there was no official draft of the reform before the Fall of 2017, and thus no clear indication of the magnitude and composition of a possible policy intervention. This consideration further mitigates concerns of anticipation effects.

2.2.1 Macroeconomic Aggregates

Forecasts for macroeconomic aggregates come from the Survey of Professional Forecasters (SPF) and are compared to their NIPA counterparts - except for corporate tax revenues where both actuals and forecasts come from the Update to the Budget and Economic Outlook produced by the Congressional Budget Office (CBO). The results are reported in Figure 2.

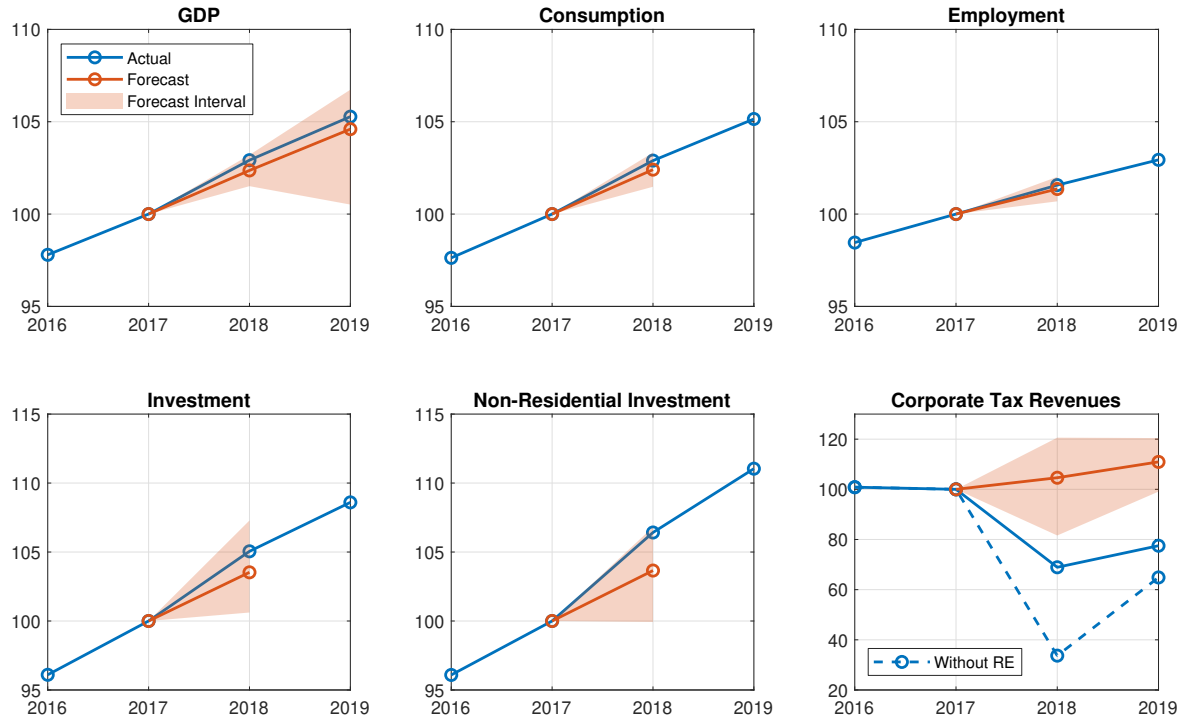

Figure 2: Response of Macroeconomic Aggregates to the TCJA-17

Notes: GDP, consumption, investment and non-residential investment are in real terms. "Forecast" refers to the median forecast in the SPF, and the point forecast made by the CBO. The series "Without RE" shows corporate tax revenues adjusted to remove the effect of earnings repatriation - the details of the adjustment procedure are in subsection A.3. All values are normalized to 100 in 2017.

The figure shows small stimulus - a couple of percentage points at best - to output, consumption, employment, and investment. Interestingly, the response of non-residential investment appears larger than that of investment, which is consistent with the idea that the macroeconomic response is driven by the investment decision of the productive sector.

The loss of corporate tax revenues, instead, is dramatic - especially when they are adjusted to filter out the effect of earnings repatriation by multinational companies. Since the theoretical framework in this paper features a closed-economy and abstracts from cross-border operations, it is important to have an empirical counterpart that can be used to assess the predictive power of the theory.

2.2.2 C-Corporations

Unfortunately, actuals and forecasts for the c-corporate sector are not readily available. The proposed solution is to aggregate firm-level data from IBES and Compustat and construct measures of economic activity in the c-corporate sector from the micro data. The IBES database contains professional forecasts for large c-corporations. Similarly, Compustat contains detailed information for a large sample of c-corporations.

Since Compustat contains information on a large number of c-corporations but not forecasts, my strategy is to first compare actuals with pre-reform forecasts using the IBES dataset, and then compare actuals between IBES and Compustat to assess the representativeness of the IBES sample.

The procedure to construct forecasts and actuals for the c-corporate sector in the IBES database is the following. Consider a given variable of interest y at a generic time t. The forecast of y_{t+h} at time t for the c-corporate sector is given by

$$\hat{y}_{t+h|t} = \sum_{f \in \mathcal{F}} \hat{y}^f_{t+h|t}$$

where $\hat{y}^f_{t+h|t}$ is the median h-step ahead forecast for c-corporation f. Similarly, the realization of y_t for the c-corporate sector is given by

$$y_t = \sum_{f \in \mathcal{F}} y^f_t$$

where y^f_t is the actual realization of variable y at time t for c-corporation f. The key aspect of the exercise is the selection of the set $\mathcal{F}$. I select $\mathcal{F}$ to include firms for which forecasts and actual realizations are available for all the years and all the variables considered. This ensures comparability of the c-corporate aggregates across years, and removes attrition bias (caused by firms leaving the sample) and selection bias (caused by firms entering the sample). The results are reported in Figure 3.

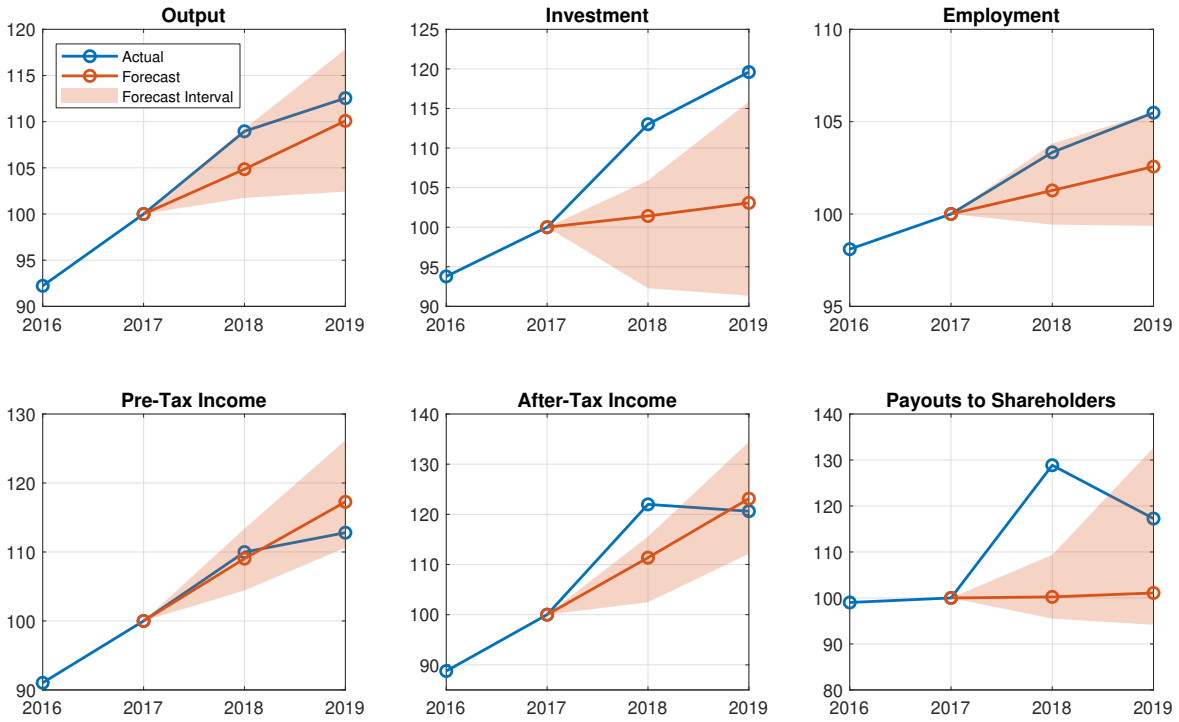

Figure 3: Response of C-Corporations to the TCJA-17

Notes: Perfectly-balanced panel of ≈ 800 firms accounting for ≈ 25% of non-residential investment and ≈ 15% of employment. Data on employment and share repuchases come from Compustat and their forecasts are constructed by extrapolating their 2-year growth rate. The disaggregated results for dividends and share repurchases are reported in Figure A1.

The stimulus to output, investment and employment is larger for the c-corporate sector than for the aggregate economy. In particular, the response of investment in 2018 exceeds pre-reform forecasts by more than 10%, which is consistent with the idea that the investment decision of c-corporations plays a key role.

It is also useful to compare the response of pre-tax income, measured by EBITDA, and after-tax income, measured by net income. While pre-tax income in 2018 is in line with forecasts, after-tax income exceeds forecasts because of the reduction in tax-liabilities due to the TCJA-17. Furthermore, the large response of payouts to shareholders - measured as the sum of dividends and share buybacks - suggests that a big share of those tax-savings were transferred to owners of c-corporations.

Since the IBES sample is skewed towards large c-corporations, I then compare it to a larger sample from Compustat, and the results are reported in Figure 4. The response of c-corporations in the Compustat sample is similar to the IBES sample. Overall, the IBES sample covers 25% of aggregate business investment and 15% of aggregate employment, while the Compustat sample covers 50% and 30%, respectively. In the rest of the paper, I consider the IBES sample representative of the population of c-corporations.

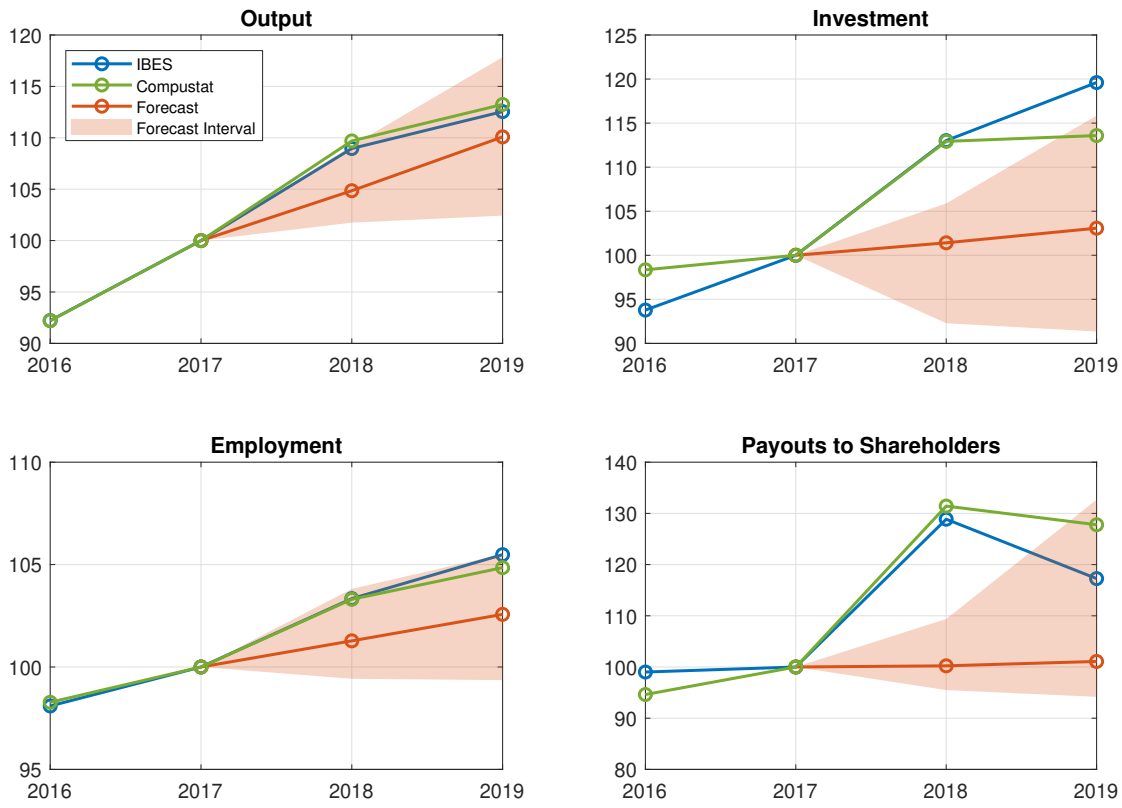

Figure 4: Response of C-Corporations to the TCJA-17: IBES vs Compustat

Notes: IBES comprises a perfectly-balanced panel of ≈ 800 firms accounting for ≈ 25% of non-residential investment and ≈ 15% of employment.Compustat comprises a perfectly-balanced panel of ≈ 5000 firms accounting for ≈ 50% of non-residential investment and ≈ 30% of employment.

2.3 C-Corporations vs Pass-Through Businesses

Businesses in the US can choose to operate under one of four major legal forms of organization: sole-proprietorship, partnership, s-corporation and c-corporation. There are several differences between them, but what matters for this paper is how each legal form is taxed. The first three forms of organization are pass-through for tax purposes: the business is not taxed directly, but its income is passed through to the owners who are taxed at the individual income level. C-corporations, instead, are taxed directly with the corporate income tax.[9]

2.3.1 The Size of the Pass-Through Sector

Panel (a) of Figure 5 offers a decomposition of US economic activity in 2017 by legal form of organization. In 2017, approximately 40% of US economic activity was carried out by pass-through businesses and was not subject to corporate income taxation. Also, 25% of economic activity in

[9]Owners of c-corporations are also taxed through the dividend tax once corporate income is distributed, and through the capital-gains tax if they realize a capital gain thanks thanks to a share price increase.

the corporate sector was not subject to corporate taxation.

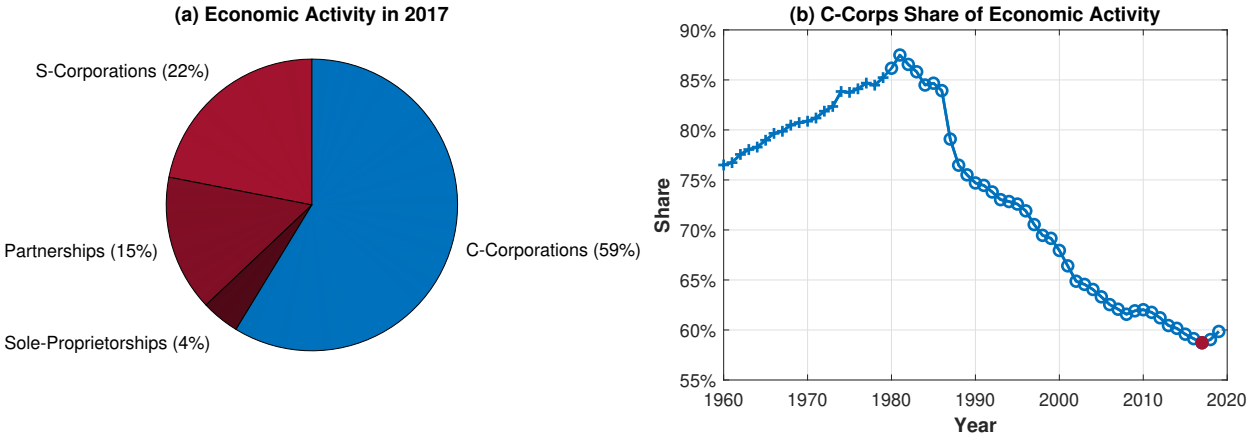

Figure 5: The Size and Evolution of the Pass-Through Sector

Notes: Economic activity is measured by "Business Receipts" from publicly available aggregated tax returns from IRS SOI. Data before 1980 have been manually collected from scanned version of SOI's Business Income Tax Return Reports and Corporation Income Tax Return Reports.

Panel (b) of Figure 5 shows the evolution of the share of economic activity that is subject to corporate income taxation since the early 1960s. There are two clear trends. The first one is the steady increase in pass-through economic activity since the tax reforms of the 1980s. The second one is the rise of c-corporations in the two decades before.[10]

2.3.2 Reallocation from Pass-Throughs to C-Corporations

I turn to publicly available business tax returns from the IRS to assess the response of c-corporations and pass-through businesses to the TCJA-17. The results are displayed in Figure 6.

The top row compares the response of output, investment and income reported by individuals for c-corporations and pass-through businesses, while the bottom row reports the share of c-corporate activity for each of these variables. Tax returns suggest an expansion of the c-corporate sector relative to the pass-through sector in response to the TCJA-17, and this is especially clear when one looks at the share of activity happening in the c-corporate sector. The decline in the years before the reform is consistent with the 'secular rise' of pass-through businesses, but the trend is reversed in 2018 after the TCJA-17.

[10]While the dynamic evolution of the pass-through sector reflects intriguing technological, legal and tax considerations, a satisfactory analysis of this phenomenon is beyond the scope of the analysis. What this paper emphasizes is that, at any point in time, the aggregate impact of a corporate tax reform depends on the share of economic activity taking place in the pass-through sector, and this shares has experienced large fluctuations over the last decades.

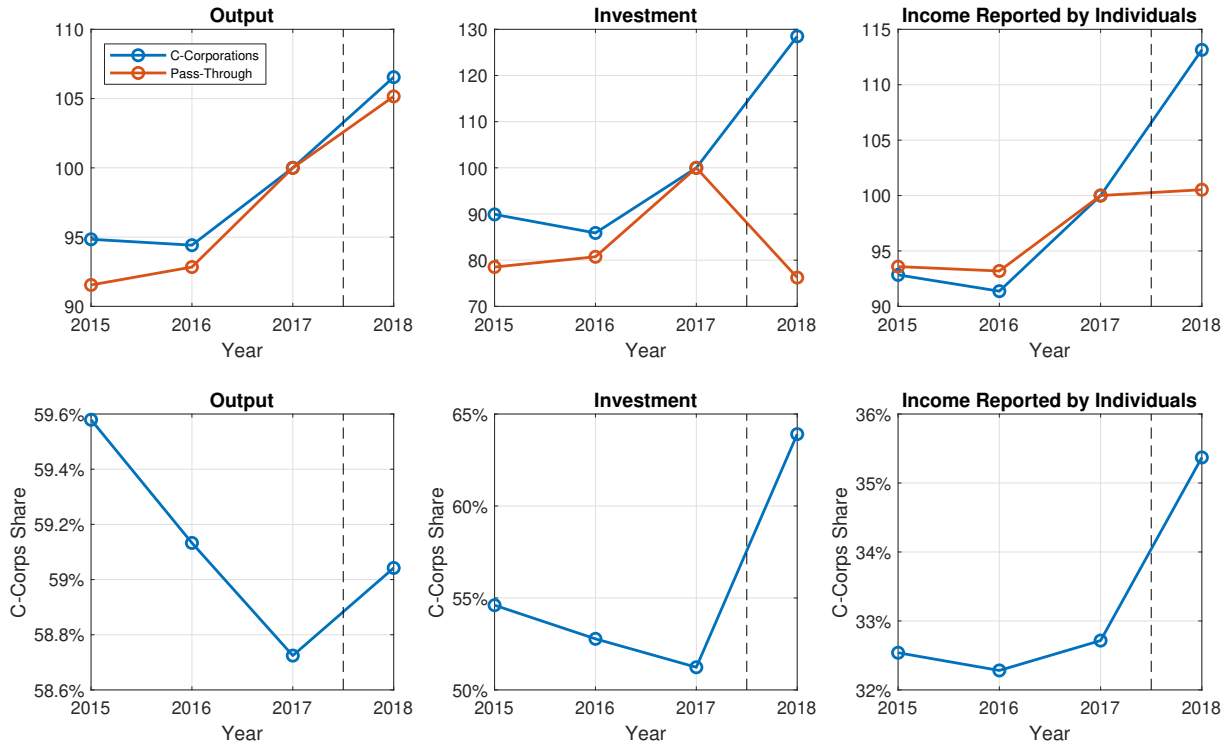

Figure 6: The Shift of Economic Activity from Pass-Through Businesses to C-Corporations

Notes: All values are computed from publicly available IRS SOI aggregated tax returns. "Output" is measured by "Business Receipts". "Investment", which is not available for sole-proprietorships, is measured by capital expenditure and is computed as "Depreciable Assets" in year t minus year $t-1$ plus "Depreciation" in year t. "Income Reported by Individuals" defined as the sum of "Ordinary Dividends" and "Qualified Dividends" for c-corporations, and as the sum of "Business or Profession Net Income" and "Partnership and S-Corporation Net Income" for pass-through businesses.

2.4 Cross-Sectional Evidence

To provide evidence on the effect on investment of the corporate provisions of the TCJA-17, I exploit the cross-section of c-corporations in Compustat and the identification strategy proposed by Zwick and Mahon (2017). In particular, I estimate the differential investment response to differential changes in corporate taxes across 4-digit NAICS industries by estimating the following panel regression:

$$\log(i_{t,f,s}) = \alpha_t + \mu_s + \beta \cdot \omega_{t,s} + \delta' X_{t,s,f} + \varepsilon_{t,f,s}$$

where f is the firm index, $X_{t,s,f}$ is a vector of firm-level controls, α_t and μ_s are fixed effects, and $\omega_{t,s}$ is the "corporate tax wedge" that will be introduced in the theoretical framework in subsection 4.2. This wedge is a measure of the effective marginal tax rate on new investment and is given by:

$$\omega_{t,s} = \frac{1 - \tau_t^{\pi}}{1 - \lambda_{t,s}^{\pi} \tau_t^{\pi}}$$

where τ_t^π is the statutory corporate tax rate in year t and $\lambda_{t,s}^\pi$ is the present discounted value of the representative tax depreciation schedule in sector s in year t. The latter is computed as follows:

$$\lambda_{t,s}^\pi = b_t^\pi + (1 - b_t^\pi)\lambda_s^\pi$$

where b_t^π is bonus depreciation in year t, and λ_s^π is the present discounted value of the representative MACRS tax depreciation schedules for sector s from Zwick and Mahon (2017). Both bonus depreciation (b_t^π) and the discounted value of the tax depreciation schedule ($\lambda_{t,s}^\pi$) refer to fixed assets with an estimated life less than 20 years. The main results are summarized in Table 2.

Table 2: Cross-Sectional Investment Response to the TCJA-17

	(1)	(2)	(3)	(4)	(5)
$\omega_{t,s}$	4.007***	8.175***	6.956***	6.180***	6.180**
	(0.434)	(0.743)	(2.023)	(2.097)	(2.880)
Firm FE	Y	N	N	N	N
NAICS FE	N	Y	Y	Y	Y
Year FE	N	N	Y	Y	Y
SE Clustering	Firm	NAICS	NAICS	NAICS	Firm
Controls	N	N	N	Y	Y
Obs	32,802	33,551	33,551	33,190	33,190

Notes: Clustered standard errors in parenthesis. $^*p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Controls include cash, sales, and assets. Sample spans 2014-2020.

The estimates suggest a robust and precise positive effect of an increase in the corporate tax wedge - i.e. a reduction in the marginal effective tax rate - on investment. The specification with controls, sectoral and time fixed-effects suggests that a (relative) reduction in the marginal effective tax rate produces a (relative) increase in investment by roughly 6%. This magnitude is in line with the evidence on c-corporations in subsubsection 2.2.2. In subsection 4.4, the TCJA-17 is assumed to lead to a reduction in the marginal effective corporate tax rate of around 2.8%, which multiplied by the point estimate in columns (4-5) yields an increase in investment by about 17%.

Overall, this cross-sectional evidence provides further support to the idea that the response of c-corporations' investment was an important driver of the TCJA-17, and to the theoretical mechanism that will be illustrated in subsection 4.2.

3 Empirical Evidence on the Kennedy's Tax Cuts

The Kennedy's tax cuts were legislated and implemented between 1962 and 1965. The Revenue Act of 1962 introduced a 7% investment tax credit for businesses and, in the same year, the IRS also issued a new set of more accelerated tax depreciation guidelines. Both provisions were implemented in 1962. The Revenue Act of 1964 then reduced the top individual tax rate from 91% to 70%, reduced individual tax rates across brackets, created the standard deduction, and reduced the corporate tax rate from 52% to 48%. The corporate tax rate reduction was implemented in 1964 and 1965. I follow Romer and Romer (2010) in classifying them as debt-financed.[11]

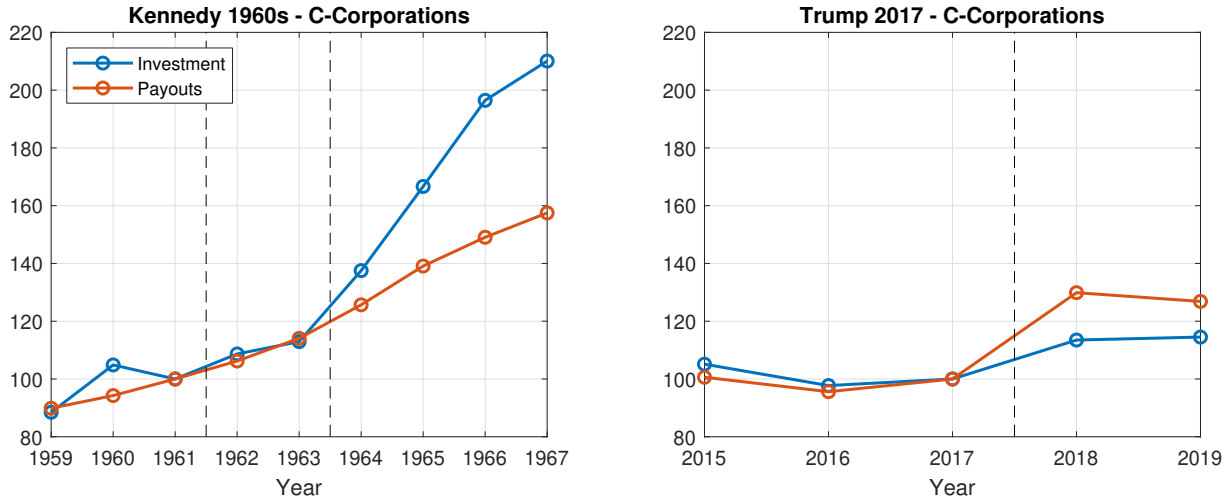

Figure 7: Investment and Payouts for Kennedy's and Trump's Reforms

Notes: Data for c-corporations come from Compustat. For the Kennedy's tax cuts, a perfectly-balanced sample of ≈ 600 c-corporations accounts for ≈ 35% of business investment. For the TCJA-17, a perfectly-balanced sample of ≈ 4000 c-corporations accounts for ≈ 40% of business investment. Share repurchases are included in payouts for TCJA-17, but not for the tax cuts of the 1960s since they were considered a form of market manipulation and largely illegal until 1982. Values are normalized to 100 in 1961 on the left panel and to 100 in 2017 on the right panel.

While it is difficult to obtain estimates of the effects of the Kennedy's tax cuts due to data availability, the time series of investment and payouts to shareholders reported in Figure 7 reveal an interesting pattern. The increase in payouts to shareholders outweighs the increase in investment after the recent TCJA-17, but not after the Kennedy's tax cuts. After the latter, payouts do not appear to deviate much from the existing trend, unlike investment which exhibits a clear acceleration. The increase in capital formation is gigantic: c-corporations' capital expenditure doubled between 1963 and 1967.

It possible, however, that the acceleration of economic activity after the Kennedy's cuts was not due to the corporate tax provisions. Figure 8 mitigates this concern by showing the response of output for c-corporations and pass-through businesses before and after the reform.

[11] Romer and Romer (2010) also classify these provisions as "exogenous", since they were motivated by the desire to increase the long-rung growth rate of the economy. For additional details on the Kennedy's tax cuts see Greenberg et al. (2016).

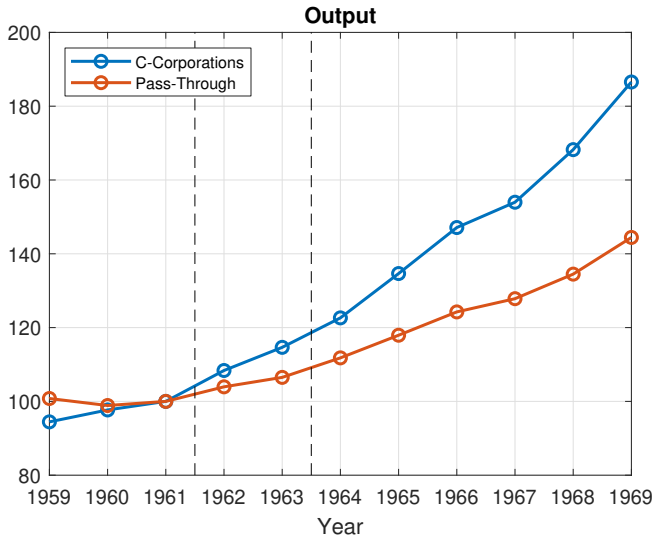

Figure 8: C-Corporations vs Pass-Throughs in 1960

Notes: All values are computed from the publicly available IRS SOI aggregated tax returns. "Output" is measured by "Business Receipts". Values are normalized to 100 in 1961.

The figure displays a stronger acceleration of output for c-corporations relative to pass-through businesses after 1961, consistently with the idea that the Kennedy's cuts provided relatively more stimulus to the c-corporate sector.

4 Theoretical Framework

This section introduces the theoretical framework and documents its ability to explain the empirical evidence presented so far. To illustrate the main mechanism, I introduce a frictionless "baseline model", which is a two-sector neoclassical growth model augmented with tax policy. Despite its simplicity, the model can forecast the qualitative response of macroeconomic and c-corporate variables to the TCJA-17. I then enrich the baseline model to improve its quantitative fit, and use this "extended model" to assess the relative importance of the TCJA-17's two main corporate tax provisions: the tax rate cut and bonus depreciation.

4.1 Baseline Model

The model economy is deterministic and populated by a productive sector, a representative household, and a government. The productive sector is further divided into a representative c-corporate sector and a representative pass-through sector. The former is subject to corporate income taxation and distributes its after-tax cash-flows to its shareholders. The latter is not directly subject to taxation, and its cash-flows are 'passed-through' to its shareholders. In the rest of the paper, variables relating to the pass-through sector will be denoted with a tilde.

The representative household solves the following optimization problem:

$$\max_{\{\hat{c}_t, c_t, \tilde{c}_t, S_{t+1}, \tilde{S}_{t+1}, l_t, \tilde{l}_t\}} \quad \sum_{t=0}^{+\infty} \beta^t \frac{\hat{c}_t^{1-\sigma}}{1-\sigma}$$

$$s.t. \quad \hat{c}_t = c_t^{\gamma} \cdot \tilde{c}_t^{1-\gamma}$$

$$c_t + p_t \tilde{c}_t + \Delta S_{t+1} P_t + \Delta \tilde{S}_{t+1} \tilde{P}_t = (1 - \tau^{II}) \cdot \left[w_t l_t + p_t \tilde{w}_t \tilde{l}_t + S_t d_t + \tilde{S}_t \tilde{d}_t \right] + \text{Transfer}_t$$

$$l_t + \tilde{l}_t = 1, \quad l_t = l, \quad \tilde{l}_t = \tilde{l}$$

$$\Lambda_{t+j,t} \equiv \beta^j \cdot \frac{u'(\hat{c}_{t+j})}{u'(\hat{c}_t)} \cdot \frac{\partial \hat{c}_{t+j} / \partial c_{t+j}}{\partial \hat{c}_t / \partial c_t}$$

where c_t is consumption of goods from c-corporations, $\tilde{c}_t$ is consumption of goods from pass-through businesses, and $\hat{c}_t$ is a consumption bundle constructed using a Cobb-Douglas aggregator. The good produced by the c-corporate sector is the numeraire, and p_t is the (relative) price of the good produced by pass-through businesses. The household supplies labor inelastically to each sector, and receives wages equal to w_t and $p_t \tilde{w}_t$ each period. She also invests in shares of each sector, that trade at prices P_t and $\tilde{P}_t$.[12] Ownership of the productive sector entitles the household to dividends d_t from c-corporations, and pass-through income $\tilde{d}_t$ from pass-through businesses. Finally, the household pays individual income taxes and receives transfers from the government.

[12] In equilibrium, the supply of each type of shares will be fixed and normalized to one.

For simplicity, I assume that there is a uniform individual income tax rate τ^{II} on labor income, dividends and pass-through income.[13] Finally, the household's intertemporal marginal rate of substitution $\Lambda_{t,t+j}$ will be used by the productive sector when making intertemporal decisions.

To better understand how corporate tax reforms affect the economy, I impose as much symmetry as possible between c-corporations and pass-through businesses. Each sector accumulates its own representative capital stock through investment, hires labor competitively, and produces a final good using a constant return-to-scale technology. However, only c-corporations pay corporate income taxes.

C-Corporations

$$\max_{\{d_t,\pi_t,T_t^{\pi},TB_t^{\pi},Y_t,l_t,k_{t+1},i_t\}} \sum_{t=0}^{+\infty} \Lambda_{0,t} d_t$$

$$\begin{aligned} s.t. \quad d_t &= \pi_t - T_t^{\pi} \\ \pi_t &= Y_t - w_t l_t - i_t \\ k_{t+1} &= (1-\delta)k_t + i_t \\ Y_t &= k_t^{\alpha} \cdot l_t^{1-\alpha} \\ T_t^{\pi} &= \tau^{\pi} \cdot TB_t^{\pi} \\ TB_t^{\pi} &= Y_t - w_t l_t - ID_t^{\pi} \end{aligned}$$

Pass-Through Businesses

$$\max_{\{\tilde{d}_t,\tilde{\pi}_t,\tilde{Y}_t,\tilde{l}_t,\tilde{k}_{t+1},\tilde{i}_t\}} \sum_{t=0}^{+\infty} \Lambda_{0,t} \tilde{d}_t$$

$$\begin{aligned} s.t. \quad \tilde{d}_t &= \tilde{\pi}_t \\ \tilde{\pi}_t &= p_t \cdot \left(\tilde{Y}_t - \tilde{w}_t \tilde{l}_t - \tilde{i}_t\right) \\ \tilde{k}_{t+1} &= (1-\tilde{\delta})\tilde{k}_t + \tilde{i}_t \\ \tilde{Y}_t &= \tilde{k}_t^{\tilde{\alpha}} \cdot l_t^{1-\tilde{\alpha}} \end{aligned}$$

Corporate income taxes T_t^{π} are computed by multiplying the corporate income tax base TB_t^{π} by the statutory corporate income tax rate τ^{π}. The corporate income tax base differs from corporate cash-flows because investment is usually not treated as an expense, but is deducted according to a tax depreciation schedule.[14] As a result, a fraction of present and past investment is deducted from the tax base each period, and this represents the investment deduction ID_t^{π} allowed by the tax code.

In general, the investment deduction for a generic period t is given by:

$$ID_t^{\pi} = \sum_{j=0}^{+\infty} \delta_j^{\pi} \cdot i_{t-j}$$

where the policy parameters $\{\delta_j^{\pi}\}_{j=0}^{+\infty}$ represent the percentage of investment from j periods ago

[13] In practice, dividends are taxed at a preferential rate, there are numerous deductions and exemptions, and there are tax brackets. Since my main theoretical experiments will involve changing the corporate tax rate while leaving the individual income tax rate unchanged, a uniform individual income tax rate will preserve my main conclusions.

[14] In reality, firms use a mix of capital assets to produce their final goods, and each asset category is potentially subject to a different tax depreciation schedule. Therefore, the capital stock in the model should be interpreted as a representative non-building business capital, and the tax depreciation schedule as a representative tax depreciation schedule for that capital.

that can be deducted from the tax base. Investment is eventually deducted from the tax base in full, so that the policy parameters sum up to one. To improve tractability and build intuition, I approximate the tax depreciation schedule using a declining-balance tax depreciation schedule, which permits the aggregation of all non-depreciated past investment into an auxiliary variable k_t^π.[15] The investment deduction can then be rewritten as

$$\begin{aligned} ID_t^\pi &= \delta^\pi \cdot (i_t + k_t^\pi) \\ \text{where} \quad k_{t+1}^\pi &= (1 - \delta^\pi) \cdot (i_t + k_t^\pi) \end{aligned}$$

The auxiliary variable k_t^π represents the stock of past investment that has not been depreciated for tax purposes yet, and δ^π is now the only policy parameter summarizing the tax depreciation schedule, where $\delta_j^\pi = \delta^\pi \cdot (1 - \delta^\pi)^j$. In this way, the corporate tax code is fully summarized by the pair (τ^π, δ^π).

To close the model, I introduce a government that collects tax revenues that can go into wasteful spending or into transfers to the representative household:

$$\begin{aligned} T_t &= T_t^\pi + T_t^{II} \\ G_t &= \theta \cdot T_t \\ \text{Transfer}_t &= (1 - \theta) \cdot T_t \end{aligned}$$

where T_t^{II} are individual income tax revenues, T_t are total tax revenues, and G_t is wasteful spending. The parameter $\theta \in [0, 1]$ determines the share of tax revenues that go into wasteful spending. When $\theta = 0$, all tax revenues are distributed back to the representative household. Finally, aggregate output and aggregate investment are defined as:

$$\begin{aligned} \hat{Y}_t &= Y_t + p_t \tilde{Y}_t \\ \hat{i}_t &= i_t + p_t \tilde{i}_t. \end{aligned}$$

4.2 The Investment Decision and the Tax Bill of C-Corporations

In the baseline model, the investment decision of the c-corporate sector is driven by the following Euler Equation:

[15] Winberry (2021) adopts the same approximation. In Furno (2021), I show that the error due to this approximation is negligible in standard economic environments.

$$1 = \Lambda_{t,t+1}\left[\underbrace{\frac{1-\lambda^{\pi}_{t+1}\tau^{\pi}}{1-\lambda^{\pi}_{t}\tau^{\pi}}}_{\approx 1}\cdot(1-\delta) + \underbrace{\frac{1-\tau^{\pi}}{1-\lambda^{\pi}_{t}\tau^{\pi}}}_{\text{“Corporate Tax Wedge”}}\cdot MPK_{t+1}\right]$$

$$\text{where} \quad \lambda^{\pi}_{t} = \underbrace{\sum_{j=0}^{+\infty}\Lambda_{t,t+j}\cdot\left[(1-\delta^{\pi})^{j}\cdot\delta^{\pi}\right]}_{\text{PDV of tax depreciation schedule}}$$

The distortion to the investment decision introduced by the corporate tax code shows up in the form of a wedge, that I label as the “corporate tax wedge”. This wedge is jointly determined by the statutory tax rate and the present discounted value of the tax depreciation schedule. This result mirrors Hall and Jorgenson (1967), and can be thought of as an extension to general equilibrium thereof.[16]

A higher value of δ^{π} reflects a more accelerated tax depreciation policy, which in turn implies that both λ^{π}_{t} and the corporate tax wedge are closer to one. As a result, even when the statutory tax rate is high, the distortions to the investment decision can be small if tax depreciation policy is highly accelerated.

The tax rate and tax depreciation policy also determine the tax bill of c-corporations:

$$T^{\pi}_{t} = \tau^{\pi}\cdot\left[Y_t - w_t l_t - \sum_{j=0}^{+\infty}\delta^{\pi}\cdot(1-\delta^{\pi})^{j}\cdot i_{t-j}\right]$$

However, changes to the corporate tax code do not affect the investment decision and the tax bill in the same way. It is possible - and this is key to understand the TCJA-17 - to conceive a corporate tax reform that leaves the corporate tax wedge almost unchanged, while producing a big change to the corporate tax bill.

4.3 Calibration to the US Economy before the TCJA-17

I calibrate the model to the US economy in 2017, just before the TCJA-17. Several parameters - such as the discount rate, the household’s IES, economic depreciation and the labor share - are standard. I calibrate labor supply and the exponents of the Cobb-Douglas consumption aggregator to match the relative size of the c-corporate and pass-through sectors.

[16] This happens because the baseline model is a neoclassical model. In general, when the economic environment is enriched with frictions, it is not possible to summarize the distortions to the investment decision in such a clear-cut way.

Table 3: Calibration of the Baseline Model

Parameter	Value	Notes
β	0.94	Rate of time preferences
σ	1	IES
$\delta = \tilde{\delta}$	0.10	Physical depreciation rate
$\alpha = \tilde{\alpha}$	0.35	Labor share (= 0.65)
l	0.575	C-Corps share of salaries and wages
γ	0.575	C-Corps share of business receipts
τ^{π}	0.35	Statutory Corporate Tax Rate
δ^{π}	0.4823	Tax Depreciation Rate
τ^{II}	0.135	Average effective tax rate
θ	0	Mimic a debt-financed tax cut

The tax code is calibrated as follows. The corporate tax rate is set equal to the statutory corporate tax rate. The tax depreciation rate δ^{π} is set in such a way that it matches the present discounted value of a representative tax depreciation schedule computed using the same methodology proposed in Zwick and Mahon (2017). This present discounted value averages tax depreciation schedules for different types of capital assets, and includes the 50% bonus depreciation that was in place in 2017 - see subsection B.1 for the details. The individual income tax rate is set equal to the average effective tax rate computed from publicly available individual income tax returns from the IRS. Finally, in order to mimic a debt-financed tax cut, I assume that all tax revenues are transferred back to the representative household by setting $\theta = 0$.

Table 4 shows that the calibrated model's deterministic steady-state is able to reproduce four important empirical moments: corporate profits, dividends, corporate tax revenues and individual income tax revenues as a share of GDP. These moments are not explicitly targeted by the calibration, but the model can match them well because the way the variables are defined in the model is a good approximation of what happens in practice.

Table 4: Fit of Key Untargeted Moments

Moment	Model (SS)	Data
π/Y	0.08	0.10
d/Y	0.05	0.05
T^{π}/Y	0.03	0.02
T^{II}/Y	0.10	0.08

Notes: Model (SS) refers to the deterministic steady-state of the model. Data comes from NIPA and span the period 2012-2017. Corporate profit and dividends in the NIPA refer to both c-corporations and s-corporations, thus slightly over-estimating the value for c-corporations alone.

Matching these four untargeted moments ensures that the size of the corporate sector and of the government's tax collection in the model is representative of the US economy before the TCJA-17.

4.4 The TCJA-17: Model vs Data

The Tax Cuts and Jobs Act of 2017 is simulated by starting from the calibration in Table 3 and introducing an unanticipated permanent change to the following policy parameters:

- A permanent reduction in the corporate tax rate τ^{π} from 35% to 21%.
- A permanent increase in the tax depreciation rate δ^{π} from 0.4823 to 0.8305.

The change to the tax depreciation rate increases the present discounted value of the representative tax depreciation schedule in steady-state from $\approx$ 0.94 to $\approx$ 0.99.[17] While the TCJA-17 increased bonus depreciation only temporarily, US policy-makers have repeatedly extended expiring bonus depreciation over the last couple of decades. It is not unreasonable to believe that bonus depreciation will be extended upon expiration, which justifies the assumption of a permanent change. Importantly, since the increase in bonus depreciation only applies to new investment, I introduce auxiliary variables to distinguish between old and new investment for tax purposes - see subsection B.2 for details.

Since the empirical evidence on the TCJA-17 is not directly targeted, the exercise should be thought of as an out-of-sample forecasting exercise. The results from the model are presented and compared to the empirical evidence in Figure 9. The first column describes the response estimated in the data, and the second column the response from the model. The first row focuses on macroeconomic aggregates, and the second on c-corporate ones.

[17] I allow for 90% bonus depreciation, instead of 100%, to take into account the fact that the TCJA-17 placed some restrictions on asset eligibility - see subsection B.1 for the details. The main results are almost unchanged if I assume 100% bonus depreciation instead.

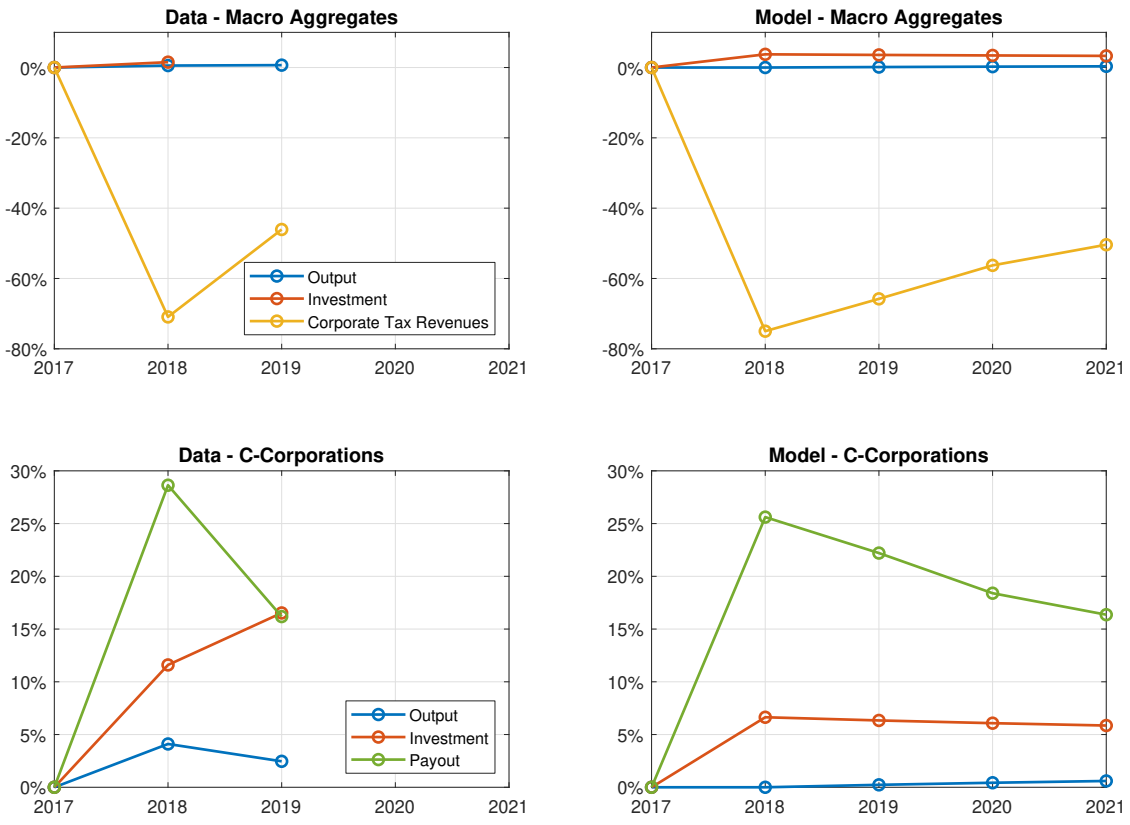

Figure 9: The TCJA-17: Model vs Data

Notes: Empirical moments are computed as the difference between the actual realizations and the pre-reform forecasts from section 2. The empirical response of corporate tax revenues is adjusted to eliminate the effect of profit repatriation. The results from the model are robust to changes in the intertemporal elasticity of substitution σ, the capital share α, and to the introduction of additional deductions presents in the corporate tax code.

The model successfully forecasts the relative responses of aggregate and c-corporate variables estimated in the data. At the aggregate level, the model predicts a small response of output and investment, and a large fall in corporate tax revenues. Moreover, the response of investment is larger than that of output. At the c-corporate level, the model predicts an increase in payouts to shareholders larger than investment - in line with the data. Again, the response of investment is larger than that of output.

The intuition behind what happens can be broken down into two pieces. The first piece clarifies the response of c-corporations. Because of highly accelerated tax depreciation policy before the TCJA-17, the pre-reform corporate tax wedge was close to one (≈ 0.97 under the proposed calibration). As a result, the ability of the reform to further remove distortions was very limited in the first place, and ended up providing little stimulus to c-corporate investment. At the same time, the tax-savings due to the reform were large, and c-corporations found themselves with a sizable amount of additional cash. Given their limited desire to increase investment, they distributed a big share of this extra cash to their shareholders.

The second piece of intuition helps understand the even smaller response at the aggregate

level. On the one hand, given a large share of pass-through businesses, the corporate provisions in the TCJA-17 applied to only 60% of the productive sector (measured in terms of economic activity). On the other hand, the remaining 40% was not only not stimulated, but was in fact put at a competitive disadvantage relative to prior the reform, which produced a shift of economic activity from pass-through businesses to c-corporations. Overall, this resulted in further dilution of the aggregate stimulus.

4.4.1 Improving Fit: An Extended Model

The baseline model can forecast the overall pattern of macroeconomic and c-corporate responses, but is not able to offer a good quantitative fit for the response of some of the variables. In particular, Figure 10 shows that the response of output and investment for c-corporations is smaller than in the data. This is partly due to the assumption of exogenous labor supply - which reduces the ability of c-corporations to respond to the stimulus by hiring more workers - and partly due to inelastic capital supply in the short-term.

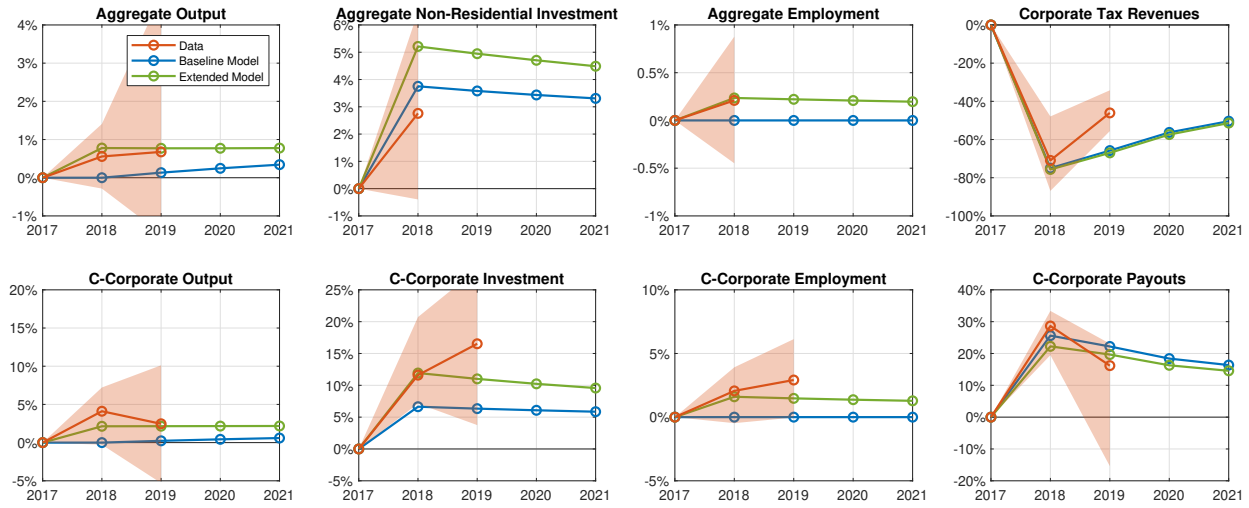

Figure 10: Quantitative Fit of the Baseline and Extended Model

To improve the fit of the model, I alter it in three ways. First, I endogenize labor supply and assume it is mobile across the two sectors. Second, I assume a more general CES consumption aggregator for the representative household. Third, I assume variable capital utilization. The additional parameters are calibrated in a standard way and the details can be found in subsection B.3. The "extended model" response is given by the green lines in Figure 10.

Endogenous labor supply that can move across the two sectors facilitates re-allocation of economic activity across sectors. Similarly, a CES consumption bundle allows household's spending to shift towards the goods produced by c-corporations - which are now relatively cheaper. Finally,

variable capital utilization amplifies the response of c-corporate output as it gives an additional margin of adjustment to the c-corporate sector.

Variable capital utilization interacts with corporate taxation in an interesting way. Since higher capital utilization accelerates the economic depreciation of capital, firms trade-off the marginal benefit of higher production with the marginal cost of replenishing the capital stock. By reducing the cost of capital, the TCJA-17 incentivizes higher capital utilization. Ottonello (2021) documents a large counter-cyclical share of idle productive capital, which is consistent with the proposed variable capital utilization mechanism.

4.4.2 Decomposing the TCJA-17: Tax Rate Cut vs Bonus Depreciation

I use the "extended model" to perform a counterfactual assessment of the importance of each of the two main corporate provisions in the TCJA-17, and the results for c-corporate investment and corporate tax revenues are reported in Figure 11.

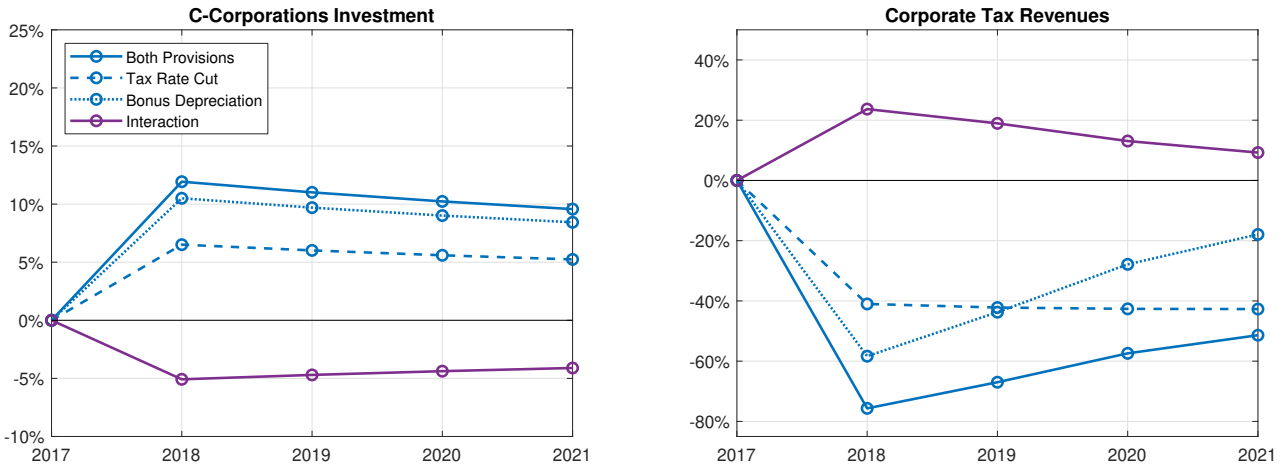

Figure 11: Decomposing the TCJA-17: Tax Rate Cut vs Bonus Depreciation

First, the expansionary effect of each provision on the investment of c-corporations is similar, as both are aimed at removing distortions to the investment decision.

Second, the interaction between these two provisions is negative. A cut to the corporate tax rate is more expansionary when the present discounted value of the tax depreciation schedule is lower. Similarly, the effect of bonus depreciation is larger when the tax rate is higher. By reducing the tax rate while accelerating the depreciation schedule, the two provisions partially offset each other.

Third, the effect of these two provisions on corporate tax revenues is similar on impact, but is different in the long-run. A reduction of the tax rate produces a permanent loss of corporate tax revenues. An acceleration of the tax depreciation schedule, instead, results in a transitory one.

4.5 TCJA-17 vs Kennedy's Tax Cuts

This section compares the recent Trump's TCJA-17 with the Kennedy's corporate tax cuts of the early 1960s through the lens of the theoretical framework proposed in the previous section.

4.6 Model-Implied Corporate Tax Multipliers

I use the "extended model" to assess the effects of each reform on GDP, aggregate investment and payouts to shareholders. By construction, the counterfactual experiment explains different macroeconomic outcomes through pre-existing differences in the corporate tax code, in the size of the pass-through sector, and in the composition of the policy intervention. As a result, the exercise abstracts from differences in the economic environment - such as changes to market structure and technological change - and focuses on the differential effects caused by the tax code and the pass-through sector.

The TCJA-17 is simulated in the same way as before. The Kennedy's corporate tax cuts are simulated as follow. I start from the calibration for 2017 and adjust the corporate tax rate, the tax depreciation rate, and the weights of the CES consumption aggregator to match corporate tax policy and the pass-through share in 1961. I then simulate the Kennedy's tax cuts as unanticipated permanent changes to the following policy parameters:

- A permanent reduction in the corporate tax rate τ^{π} from 52% to 48%.
- A permanent increase in the tax depreciation rate δ^{π} from 0.10 to 0.1857.

As for the TCJA-17, the new tax depreciation rate applies only to new investment and further details can be found in subsection B.2.

The results are reported in Figure 12. In response to the Kennedy's tax cuts, the model predicts a large increase in GDP and investment, and a small effect on payouts to shareholders: the opposite of Trump's Tax Cuts and Jobs Act. Similarly, the corporate tax multiplier for Kennedy's tax cuts is around 2.5 for GDP, 1.85 for investment, and close to zero for payouts to shareholders. For the TCJA-17, the multiplier is around 0.6 for each variable. For every dollar of lost corporate tax revenues, the Kennedy's corporate tax cuts stimulated GDP four times more than the TCJA-17.

The intuition behind these results is the following. In the early 1960s, the corporate tax rate was high and tax depreciation policy was not accelerated as it was mimicking economic depreciation. As a result, the corporate tax wedge was well below one (around 0.72) before the reform. The Kennedy's tax cuts increased the wedge significantly (to around 0.84), thus providing strong stimulus to the investment of c-corporations. Moreover, since around 75% of economic activity was taking place in the c-corporate sector, the aggregate effect was less diluted than in 2017.

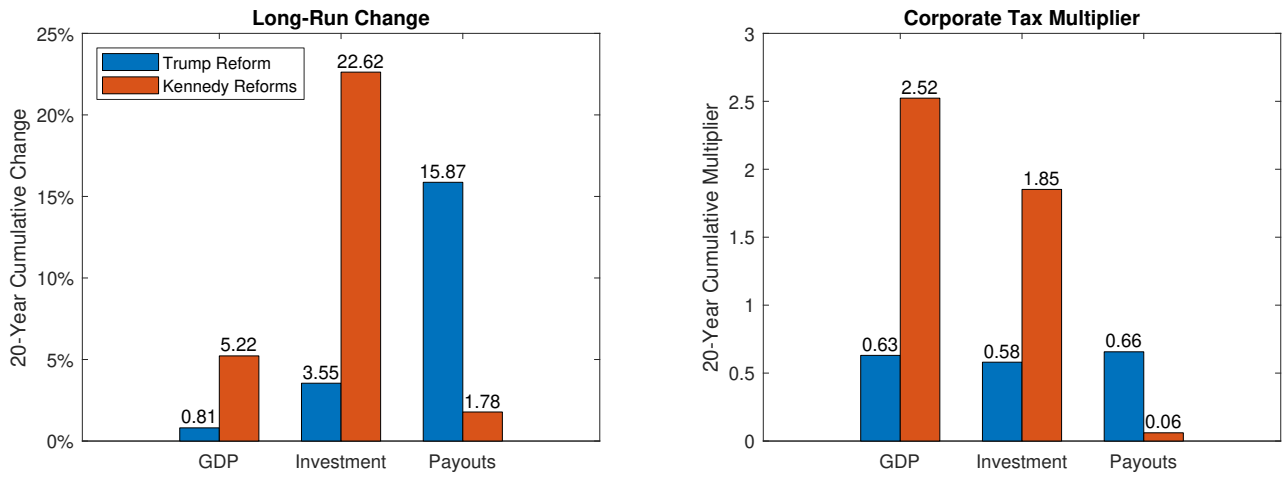

Figure 12: The TCJA-17 vs Kennedy's Corporate Tax Cuts

Notes: The long-run change is computed as the 20-year cumulative deviation from the steady-state, obtained by summing the level of each variable for 20 years after the reform and dividing it by its counterpart in the absence of the reform. The corporate tax multiplier is computed as the cumulative change in the level of each variable and divided by the cumulative change in corporate tax revenues.

To better understand how each factor (i.e. tax rate, tax depreciation, pass-through share, policy intervention) contributed to the outcomes reported in Figure 12, I perform another counterfactual experiment. First, I control for differences in policy interventions by simulating the exact same reform in both 1961 and 2017: an unanticipated permanent reduction in the corporate tax rate by 10%. Then, I start from the calibration for 2017 and simulate the reform after changing one of the tax rate, tax depreciation rate and pass-through share at a time. So, for example, I take the calibration for 2017, set the tax depreciation rate equal to that in 1961, and simulate the reform. I repeat the same for the tax rate and the pass-through share. The results are reported in Figure 13.

The exercise shows that differences in tax depreciation policy between the early 1960s and 2017 account for most of the difference in the macroeconomic response to the reform. Looking at long-run changes, differences in pre-reform corporate tax rates and in the pre-reform share of pass-through businesses contribute similarly to the difference between the two reforms. The interaction between these three factors, instead, can be assessed by looking at the difference between the first and the second vertical bar for each variable. For example, under the 1961 calibration, the long-run investment response is +14.24%, while the response under the 2017 calibration with each factor introduced at a time is only +8.39%, which implies an interaction effect of +5.85%.

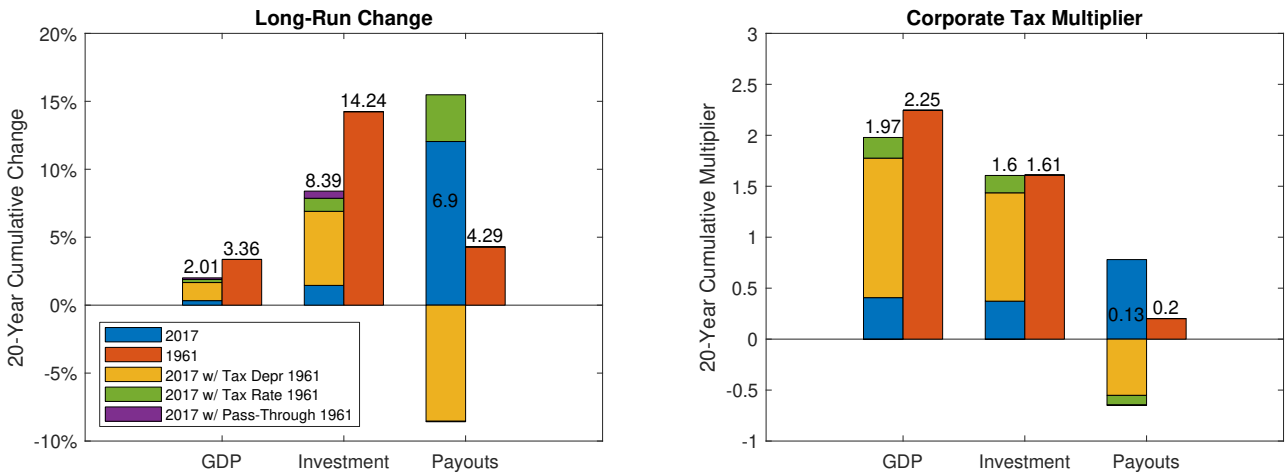

Figure 13: Understanding the Difference between the TCJA-17 and Kennedy's Reforms

The corporate tax multiplier features smaller interaction effects and seems unaffected by the size of the pass-through sector. This happens because a smaller pass-through sector implies larger aggregate stimulus after a corporate tax cut, but also a larger loss of corporate tax revenues - since a larger share of the economy receives the tax cut. These two effects almost perfectly offset each other in this specific experiment.

5 Relation to the Macroeconomics Literature

This section relates the results in this paper to the broader macroeconomics literature. Since it is common in macroeconomics to think about corporate taxation as a form of capital taxation, I first provide a formal mapping between capital taxes and corporate taxes. Corporate taxes and capital taxes are simply two different tax instruments, and this explains why a large corporate tax reduction may fail to provide a large stimulus to production and capital accumulation.

Second, I show how common macroeconomics approaches to model corporate taxes compare when trying to predict the effects of the TCJA-17. I show that abstracting from either pass-through businesses or tax depreciation policy generates a response of investment and of payouts to shareholders that is inconsistent with the data.

5.1 Corporate Taxes vs Capital Taxes

It is insightful to relate the corporate tax proposed in this paper with the familiar concept of a "capital income tax", i.e. a tax imposed on the income produced by the productive factor "capital". Under a constant return-to-scale (CRS) technology, it is possible to unambiguously define capital income using Euler Theorem. Aggregate output can be expressed as:

$$\begin{aligned}\hat{Y}_t =& Y_t + p_t \tilde{Y}_t \\ =& MPK_t k_t + MPL_t l_t + p_t \cdot \left(M\tilde{P}K_t \tilde{k}_t + M\tilde{P}L_t \tilde{l}_t \right) \\ =& \underbrace{MPK_t k_t + p_t M\tilde{P}K_t \tilde{k}_t}_{\text{capital income}} + \underbrace{MPL_t l_t + p_t M\tilde{P}L_t \tilde{l}_t}_{\text{labor income}}.\end{aligned}$$

The best way to compare corporate taxes and capital taxes is to compare their tax bases. The corporate tax base is given by:

$$TB_t^\pi = Y_t - w_t l_t - ID_t^\pi.$$

With a competitive labor market one has that $w_t = MPL_t$, and by Euler Theorem $Y_t - MPL_t l_t = MPK_t k_t$. As a result, the corporate tax base can be expressed as

$$TB_t^\pi = \begin{cases} MPK_t k_t & \text{if } \delta^\pi = 0 \\ MPK_t k_t - \sum_{j=0}^{+\infty} \delta^\pi (1-\delta^\pi)^j i_{t-j} & \text{if } \delta^\pi \in (0,1) \\ MPK_t k_t - i_t & \text{if } \delta^\pi = 1. \end{cases}$$

In other words, corporate taxes are levied on the capital income produced by the c-corporate sector reduced by a deduction for present (and past) investment.

The capital income tax base (TB_t^K), instead, is given by

$$TB_t^K = MPK_t k_t + p_t \tilde{MPK}_t \tilde{k}_t.$$

Notice that - as long as production is CRS and factor markets are competitive - capital taxes and corporate taxes are simply two different taxes levied on two different tax bases. The introduction of capital taxes in the model is more intuitive when the household accumulates the capital stock, and the introduction of corporate taxes is more intuitive when the productive sector accumulates the capital stock. Nonetheless, both can be introduced in the same economic environment following the approach above. To better see this point, subsection B.4 explicitly introduces capital and corporate taxes in the context of the baseline model of subsection 4.1.

The comparison between the corporate tax base and the capital tax base reveals two main points. First, corporate taxes feature an investment deduction shaped by tax depreciation policy that is absent for capital taxes. Second, capital taxes apply to the income generated by the productive capital in all sectors of the economy, including pass-through businesses, while corporate taxes are levied only on c-corporations.

When there is no pass-through sector in the economy (i.e. when $\gamma = 1$), the difference between capital taxes and corporate taxes boils down to the investment deduction.

5.1.1 Corporate Tax Revenues Collection

Under full-expensing of investment (i.e. $\delta^\pi = 1$) in a frictionless environment, the corporate tax wedge becomes one and the distortion to the Euler Equation for capital accumulation disappears. It is interesting to see whether the corporate tax can actually collect revenues in such a case. In light of the relation between corporate and capital taxes, this is fundamentally the same question asked in Abel (2007).

Proposition 1. *Capital tax revenues collection is positive. Corporate tax revenues collection can be positive, zero, or negative. More precisely:*

$$sign(T_t^\pi) = \begin{cases} > 0 & if \quad \frac{i_t}{Y_t} < \alpha \\ = 0 & if \quad \frac{i_t}{Y_t} = \alpha \\ < 0 & if \quad \frac{i_t}{Y_t} > \alpha \end{cases}$$

Proof. See subsubsection B.5.1 □

Proposition 2. *A corporate tax with full-expensing of investment collects positive tax revenues in steady-state, i.e.* $T_{ss}^\pi > 0$.

Proof. See subsubsection B.5.2 □

5.2 Alternative Approaches to Model Corporate Taxes

Existing research in macroeconomics does not explicitly model tax depreciation policy and pass-through businesses at the same time. In this section, I assess how alternative ways of modeling the corporate tax code compare when simulating the TCJA-17.

The most common approach is to ignore the pass-through sector and set tax depreciation equal to economic depreciation. Other two common approaches are to consider tax depreciation policy but to the ignore pass-through sector, or to consider the pass-through sector but restricting tax depreciation to economic depreciation.

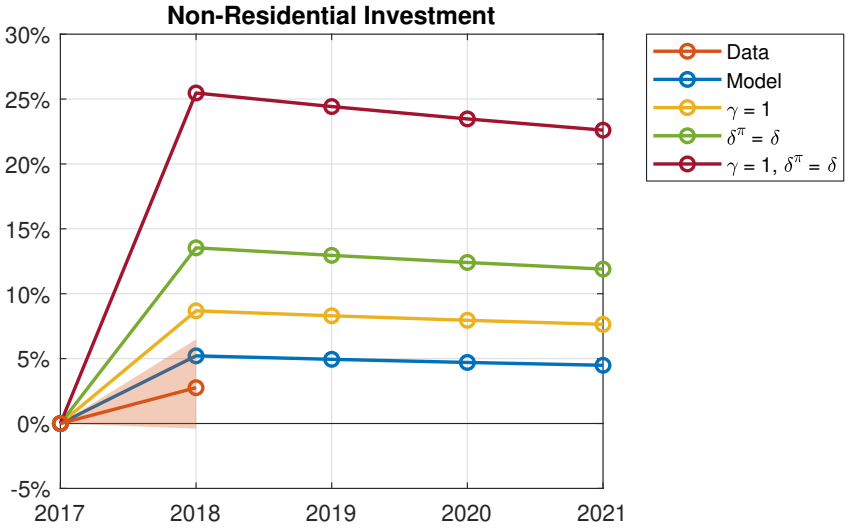

Figure 14: Investment Response to the TCJA-17: Alternative Modeling Approaches

I simulate all three using the "extended model", and Figure 14 summarizes the response of aggregate business investment.[18] The yellow line summarizes the response of the economy shutting down the pass-through sector by assuming $\gamma = 1$. The green line restricts tax depreciation to economic depreciation by setting $\delta^{\pi} = \delta$. The red line imposes both $\gamma = 1$ and $\delta^{\pi} = \delta$.

Abstracting from the pass-through sector (yellow line) assumes that the entire productive sector benefits from the corporate tax reduction, and increases the response of investment in the model by roughly 70%. Retaining the pass-through sector but forcing tax depreciation to equal economic depreciation (green line) overestimates the response of investment by a factor of 3. If $\delta^{\pi} = \delta$, the present discounted value of the tax depreciation schedule is low, and the corporate tax wedge introduces significant distortions to the investment decision of c-corporations. In this

[18] Whenever tax depreciation is restricted to economic depreciation (i.e. $\delta^{\pi} = \delta$), I simulate the TCJA-17 by only reducing the corporate tax rate.

case, a corporate tax rate reduction provides sizable stimulus to investment. Finally, ignoring the pass-through sector and imposing economic depreciation (red line) overestimates the response of investment by a factor of 5.

Restricting tax depreciation to economic depreciation corresponds to a very popular way to model the corporate tax base in macroeconomics. The corporate tax is usually modeled as

$$TB_t^{\pi} = Y_t - w_t l_t - \delta k_t$$

where δk_t is a deduction for 'capital depreciation'. In fact, this corresponds to a very specific tax depreciation policy. To see why, solve backwards the law of motion of capital accumulation

$$\delta k_t = \delta i_{t-1} + \delta(1-\delta) i_{t-2} + \delta(1-\delta)^2 i_{t-3} + \dots$$

and plug it back into the corporate tax base

$$TB_t^{\pi} = Y_t - w_t l_t - \sum_{j=1}^{+\infty} \delta(1-\delta)^{j-1} i_{t-j}$$

to see that tax depreciation equals economic depreciation with the caveat that the investment deduction can only be claimed one period after investment takes place.

5.2.1 The Marginal Effective Tax Rate Approach

A final alternative to model the corporate tax code is to abstract from tax depreciation policy and calibrate the corporate tax rate to a marginal effective tax rate which takes into account tax depreciation. I will label this as the "effective tax rate approach", and it is followed for example by Acemoglu et al. (2020). To implement it in my framework, I set $\delta^{\pi} = 0$ and $\tau^{\pi} = \tau^*$, where τ^* is the marginal effective tax rate which is computed as follows

$$\tau^* = 1 - \frac{1 - \tau^{\pi}}{1 - \lambda^{\pi} \tau^{\pi}}.$$

By construction, this marginal effective tax rate summarizes the "corporate tax wedge", and thus takes into account the effect of both tax depreciation policy and tax rate policy on the investment decision. Under my calibration, the marginal effective tax rates goes from 3.17% before the TCJA-17 down to 0.34% after it. The results are reported in Figure 15.

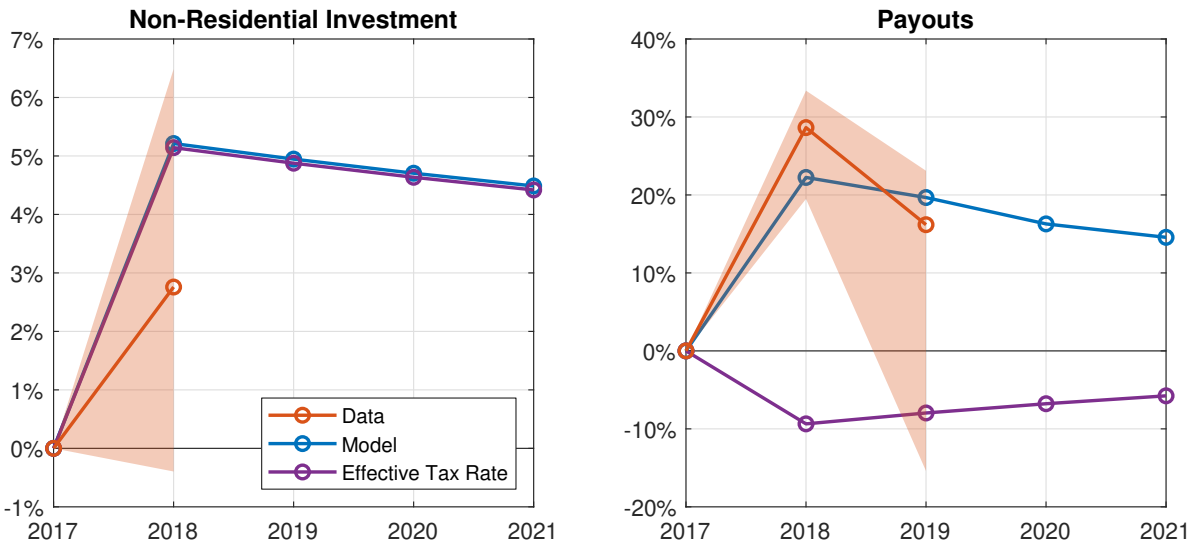

Figure 15: Comparison with the Effective Tax Rate Approach

The effective tax rate approach produces a response of investment that is almost identical to the one obtained when modeling tax depreciation policy explicitly. This is not surprising, since the effective tax rate summarizes the corporate tax wedge. However, the effective tax rate cannot correctly model the level of corporate tax revenues and, as a result, fails to anticipate the response of payouts to shareholders observed in the data.

6 Corporate Tax Policy over Time

This section leverages the deterministic steady-state of the model to analyze the evolution of corporate tax policy in the US over the last few decades. To obtain these results, I start from the "baseline model" and assume away pass-through businesses (i.e. $\gamma = l = 1$) and individual income taxes ($\tau^{II} = 0$). Under these restrictions, I recover a neoclassical growth model featuring a corporate tax levied on the entire productive sector.

It is then possible to solve analytically for the deterministic steady-state of the model and express it as a function of its 'undistorted' counterpart, i.e. the deterministic steady-state in the absence of corporate taxation (i.e. when $\tau^{\pi} = 0$). Long-run output (Y_{ss}) can be expressed as

$$Y_{ss} = Y^*_{ss} \cdot \omega_{ss}^{\frac{\alpha}{1-\alpha}}$$
$$\text{where} \quad \omega_{ss} = \frac{1-\tau^{\pi}}{1-\lambda^{\pi}_{ss}\tau^{\pi}} \quad \text{and} \quad \lambda^{\pi}_{ss} = \frac{\delta^{\pi}(1+\rho)}{\rho+\delta^{\pi}}$$

Undistorted long-run output is given by Y^*_{ss}, and ω_{ss} is the corporate tax wedge in steady-state. Notice that λ^{π}_{ss} is the present discounted value of the tax depreciation schedule in steady-state.

In this frictionless environment, distortions to production are summarized by the corporate tax wedge - properly adjusted for capital intensity α. Interestingly, corporate tax revenues and payouts to shareholders depend on the tax code in a more complicated way:

$$T^{\pi}_{ss} = \pi^*_{ss} \cdot \tau^{\pi} \cdot \left[\omega^{\frac{\alpha}{1-\alpha}} \cdot (1 + \frac{\delta}{\rho} \cdot (1-\omega))\right]$$
$$d_{ss} = \pi^*_{ss} \cdot (1-\tau^{\pi}) \cdot \left[\omega^{\frac{\alpha}{1-\alpha}} \cdot (1 + \frac{\delta}{\rho} \cdot (1-\omega))\right]$$

and this duality further clarifies that the corporate tax code can differentially affect incentives and cash-flows, in line with what pointed out in subsection 4.2 and subsection 5.1.

For convenience, I then define the following measure of long-run distortions to output

$$\text{Distortion}_{ss} = 1 - \frac{Y_{ss}}{Y^*_{ss}}$$

and represent it in the corporate tax policy space in Figure 16. The figure displays a contour map of 'isodistortions' for each combination of the corporate tax rate (τ^{π}) and the present discounted value of the tax depreciation schedule (λ^{π}_{ss}). Red dots representing the corporate tax code in different years are superimposed to assess the evolution of corporate tax distortions over time.

The spirit of the exercise is to assess the level of distortions to GDP introduced by the corporate tax code using the deterministic steady-state of the model. The figure reveals a steady elimination of distortions by US policy-makers over time, captured by the movement towards the south-east

corner of the map. For example, output was roughly 16% lower than its undistorted counterpart before the Kennedy's tax cuts, but only 1.7% lower before the TCJA-17. This improvement have been achieved through several rounds of statutory tax rate cuts, changes to tax depreciation rules, and repeated use of bonus depreciation over the decades.

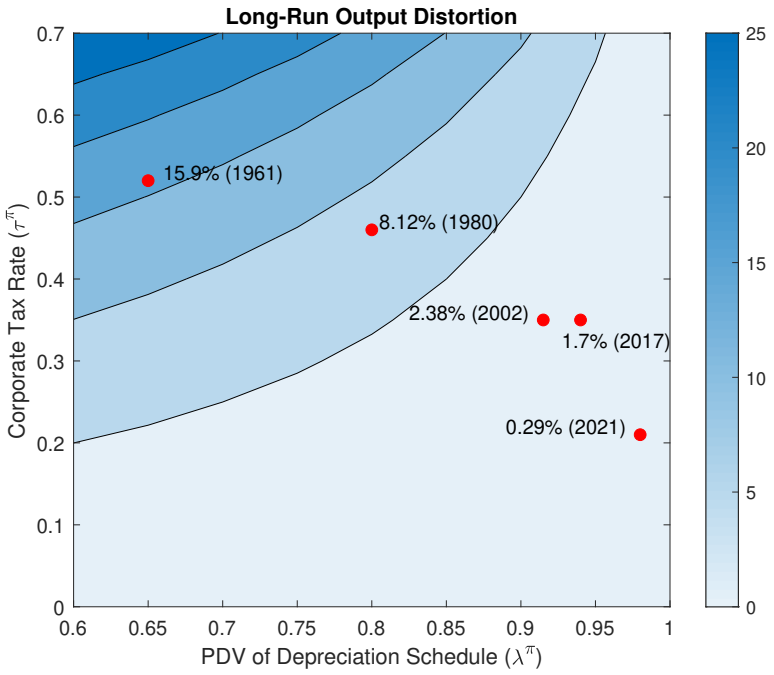

Figure 16: Corporate Tax Distortions over Time

Notes: Values for 1961 and 1980 are computed from Cummins et al. (1994). Values for 2002, 2017 and 2021 are computed from Zwick and Mahon (2017). The only two parameters used are $\beta = 0.94$ and $\alpha = 0.35$.

While the numbers reported in the figure should be taken with a grain of salt, they teach two important lessons. On the one hand, corporate tax policy has become less distortionary over time. On the other hand, policy-makers are now running short of ammunition. Given that the current level of distortions is almost zero, further reductions of the statutory corporate tax rate and/or acceleration of the tax depreciation schedule will produce little stimulus to the US economy.

7 Conclusions

This paper has focused on tax depreciation policy and the distinction between c-corporations and pass-through businesses to understand the effects of two major corporate tax reforms in the US. While the proposed theoretical framework is intendedly stylized in order to make the transmission mechanism as transparent and robust as possible, it can be enriched along several dimensions. For example, two candidates are the introduction of sectoral heterogeneity and the analysis of corporate debt and of the interest-payment deduction. Preliminary results suggest that these two extensions do not alter the overall predictions of the model, but they do allow the theory to generate additional implications for different sectors or for corporate leverage. This could be of interest on its own, or could be used to discipline the theory further by exploiting empirical evidence from the cross-section of firms or of industries.

References

Abel, A. B. (2007): "Optimal capital income taxation," .

Acemoglu, D., A. Manera, and P. Restrepo (2020): "Does the US tax code favor automation?" Tech. rep., National Bureau of Economic Research.

Atkeson, A., V. V. Chari, P. J. Kehoe, et al. (1999): "Taxing capital income: a bad idea," *Federal Reserve Bank of Minneapolis Quarterly Review*, 23, 3–18.

Auerbach, A. J. (2018): "Measuring the effects of corporate tax cuts," *Journal of Economic Perspectives*, 32, 97–120.

Baley, I., A. Blanco, et al. (2022): "The Macroeconomics of Partial Irreversibility," Tech. rep.

Barro, R. J. and J. Furman (2018): "Macroeconomic effects of the 2017 tax reform," *Brookings papers on economic activity*, 2018, 257–345.

Barro, R. J. and B. Wheaton (2020): "Taxes, incorporation, and productivity," *Tax Policy and the Economy*, 34, 91–111.

Basu, S. and M. S. Kimball (1997): "Cyclical productivity with unobserved input variation," .

Bhandari, A. and E. R. McGrattan (2021): "Sweat equity in US private business," *The Quarterly Journal of Economics*, 136, 727–781.

Chari, V. V., J. P. Nicolini, and P. Teles (2020): "Optimal capital taxation revisited," *Journal of Monetary Economics*, 116, 147–165.

Chen, D., S. Qi, and D. Schlagenhauf (2018): "Corporate income tax, legal form of organization, and employment," *American Economic Journal: Macroeconomics*, 10, 270–304.

Clarke, C. and W. Kopczuk (2017): "Business income and business taxation in the United States since the 1950s," *Tax Policy and the Economy*, 31, 121–159.

Conesa, J. C. and B. Domínguez (2013): "Intangible investment and Ramsey capital taxation," *Journal of Monetary Economics*, 60, 983–995.

——— (2020): "Capital taxes and redistribution: the role of management time and tax deductible investment," *Review of Economic Dynamics*, 37, 156–172.

Cooper, M., J. McClelland, J. Pearce, R. Prisinzano, J. Sullivan, D. Yagan, O. Zidar, and E. Zwick (2016): "Business in the United States: Who Owns It, and How Much Tax Do They Pay?" *Tax Policy and the Economy*, 30, 91–128.

Cummins, J. G., K. A. Hassett, R. G. Hubbard, R. E. Hall, and R. J. Caballero (1994): "A reconsideration of investment behavior using tax reforms as natural experiments," *Brookings papers on economic activity*, 1994, 1–74.

Erosa, A. and B. González (2019): "Taxation and the life cycle of firms," *Journal of Monetary Economics*.

Furno, F. (2021): "Tax Depreciation Schedules: Facts and Modeling," Tech. rep.

Gale, W., H. Gelfond, A. Krupkin, M. J. Mazur, and E. Toder (2018): "A preliminary assessment of the Tax Cuts and Jobs Act of 2017," *National Tax Journal*, 71, 589–612.

Goodman, L., K. Lim, B. Sacerdote, and A. Whitten (2021): "How Do Business Owners Respond to a Tax Cut? Examining the 199A Deduction for Pass-through Firms," Tech. rep., National Bureau of Economic Research.

Greenberg, S., J. Olson, and S. J. Entin (2016): "Modeling the Economic Effects of Past Tax Bills," *Tax Foundation, Fiscal Fact*, 527.

Hall, R. E. and D. W. Jorgenson (1967): "Tax policy and investment behavior," *The American Economic Review*, 57, 391–414.

King, R. G. and S. T. Rebelo (1999): "Resuscitating real business cycles," *Handbook of macroeconomics*, 1, 927–1007.

Kopczuk, W. and E. Zwick (2020): "Business incomes at the top," *Journal of Economic Perspectives*, 34, 27–51.

Kopp, E., M. D. Leigh, S. Mursula, and S. Tambunlertchai (2019): *US investment since the Tax Cuts and Jobs Act of 2017*, International Monetary Fund.

Lucas, R. E. (1990): "Supply-Side Economics: An Analytical Review," *Oxford Economic Papers*, 42, 293–316.

Mankiw, N. G., M. Weinzierl, and D. Yagan (2009): "Optimal taxation in theory and practice," *Journal of Economic Perspectives*, 23, 147–74.

Meh, C. A. (2008): "Business risk, credit constraints, and corporate taxation," *Journal of Economic Dynamics and control*, 32, 2971–3008.

Mertens, K. (2018): "The near term growth impact of the tax cuts and jobs act," .

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.

Ohrn, E. (2018): "The Effect of corporate taxation on investment and financial policy: evidence from the DPAD," *American Economic Journal: Economic Policy*, 10, 272–301.

——— (2019): "The effect of tax incentives on US manufacturing: Evidence from state accelerated depreciation policies," *Journal of Public Economics*, 180, 104084.

Ottonello, P. (2021): "Capital unemployment," Tech. rep.

Romer, C. D. and D. H. Romer (2010): "The macroeconomic effects of tax changes: estimates based on a new measure of fiscal shocks," *American Economic Review*, 100, 763–801.

Sedlacek, P. and V. Sterk (2019): "Reviving american entrepreneurship? tax reform and business dynamism," *Journal of Monetary Economics*, 105, 94–108.

Slemrod, J. (2018): "Is this tax reform, or just confusion?" *Journal of Economic Perspectives*, 32, 73–96.

Smith, M., D. Yagan, O. Zidar, and E. Zwick (2019): "Capitalists in the Twenty-first Century," *The Quarterly Journal of Economics*, 134, 1675–1745.

——— (2022): "The rise of pass-throughs and the decline of the labor share," *American Economic Review: Insights*, 4, 323–340.

Smith, V. L. (1963): "Tax depreciation policy and investment theory," *International Economic Review*, 4, 80–91.

Smolyansky, M., G. Suarez, and A. Tabova (2019): "US Corporations' Repatriation of Offshore Profits: Evidence from 2018," *FEDS Notes*, 06.

Tax Foundation, S. (2017): "Preliminary Details and Analysis of the Tax Cuts and Jobs Act," *Tax Foundation, Special Report*, 241.

Winberry, T. (2021): "Lumpy investment, business cycles, and stimulus policy," *American Economic Review*, 111, 364–96.

Zeida, T. H. (2021): "The Tax Cuts and Jobs Act (TCJA): A quantitative evaluation of key provisions," *Review of Economic Dynamics*.

Zwick, E. and J. Mahon (2017): "Tax policy and heterogeneous investment behavior," *American Economic Review*, 107, 217–48.

Appendix

A Empirics Details

A.1 Forecast Intervals

Consider a certain variable y at a generic time t. Let $\hat{y}_{t+h|t}$ be the point forecast of y_{t+h} at time t. Given a sample of point forecasts $\{\hat{y}_{t+h|t}\}$ and actual realizations $\{y_{t+h}\}$, I compute the h-step ahead forecast errors as

$$e_t^h = y_{t+h} - \hat{y}_{t+h|t}$$

and center them by subtracting the sample mean $\bar{e}^h$

$$\tilde{e}_t^h = e_t^h - \bar{e}^h.$$

I then estimate a non-parametric distribution $\hat{G}(\tilde{e}_t^h)$ using a normal kernel with bandwith parameter equal to 0.5, and select the percentiles g_l^h and g_u^h that leave a 68% central mass. The resulting forecast interval is given by

$$[\hat{y}_{t+h|t} + g_l^h, \quad \hat{y}_{t+h|t} + g_u^h]$$

and could be asymmetric. The forecast errors are computed over the period 2011-2018 for the SPF and the CBO, and over the period 2011-2017 for IBES.

A.2 Dividends vs Share Repurchases around the TCJA-17

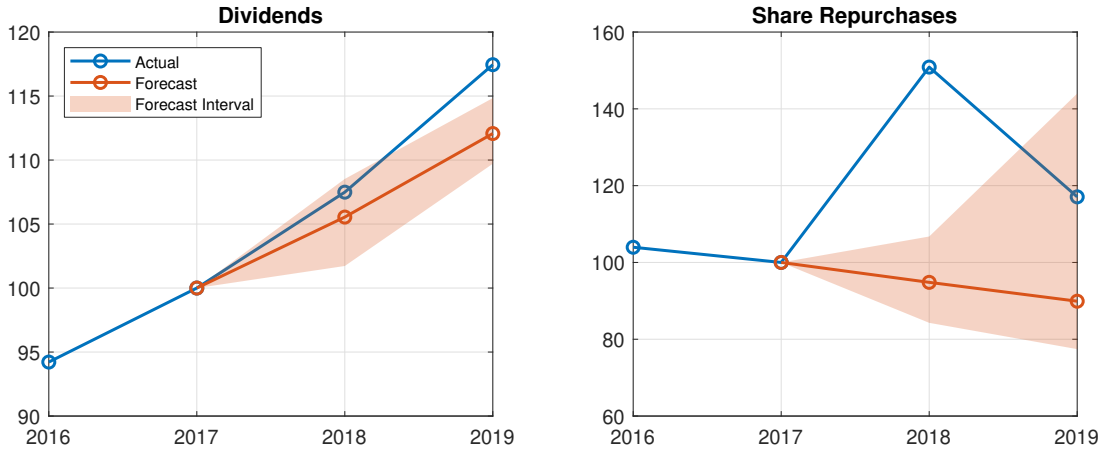

Figure A1: Decomposition of the Payouts Response to TCJA-17

A.3 Corporate Tax Revenues and Repatriated Earnings

When comparing the model's predictions with the empirical evidence, I adjust corporate tax revenues to remove taxes paid on repatriated earnings. I follow Smolyansky et al. (2019) to measure earnings repatriated by corporations, which are reported in Figure A2.

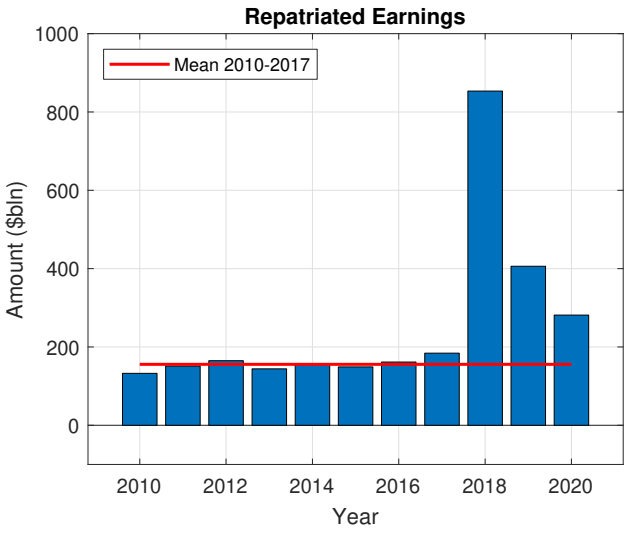

Figure A2: Repatriated Earnings during 2010-2020

The adjustment to corporate tax revenues attempts to remove the revenues collected upon repatriation. This requires to first estimate repatriated earnings caused by the TCJA-17, and then to estimate the tax revenues collection upon them.

Let RE_t be repatriated earnings at time t. I compute repatriated earnings that exceed historical levels by subtracting the mean over the period 2010-2017 to estimate repatriated earnings caused by the TCJA-17:

$$\hat{RE}_t = \begin{cases} 0 & t \leq 2017 \\ RE_t - \sum_{j=2010}^{2017} RE_j & t > 2017 \end{cases}$$

The TCJA-17 introduced a repatriation tax on repatriated earnings of 15.5% on cash and cash equivalents and of 8% on earnings not held in cash or cash equivalents. Since I do not observe the composition of repatriated earnings, I assume that repatriation occurs mainly through cash and cash equivalents and assume a tax rate of 15%. Adjusted corporate-tax revenues are then computed as

$$\tilde{T}_t^{\pi} = T_t^{\pi} - \hat{RE}_t.$$

The results are summarized in Figure A3.

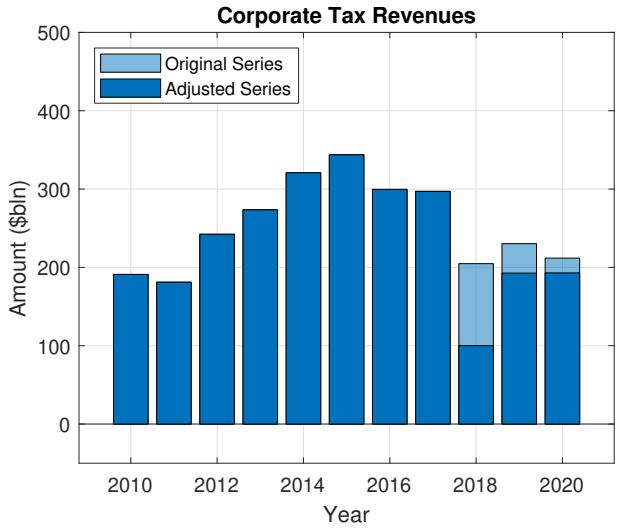

Figure A3: Corporate Tax Revenues during 2010-2020

B Modeling Details

B.1 Calibration of the Tax Depreciation Schedule

To calibrate the tax depreciation schedule I choose the policy parameter δ^{π} so that the present discounted value (PDV) of the tax depreciation schedule in the steady-state of the model matches an empirical counterpart from the existing literature.
Given a discount rate β, the PDV of the tax depreciation schedule in steady-state is given by

$$\text{PDV} = \sum_{j=0}^{+\infty} \beta^j \cdot \delta^{\pi} \cdot (1-\delta^{\pi})^j = \frac{\delta^{\pi}}{1-\beta\cdot(1-\delta^{\pi})}$$

The tax depreciation rate δ^{π} that produces a given PDV in steady-state is given by

$$\delta^{\pi} = \frac{\rho \cdot \text{PDV}}{1+\rho-\text{PDV}} \quad \text{where} \quad \rho \equiv \frac{1-\beta}{\beta}$$

TCJA-17

To calibrate δ^{π} in 2017, I build on Zwick and Mahon (2017). I start from their cross-sectoral average of the investment-weighted PDV of MACRS depreciation rules. They estimate a PDV for this object of 0.879. I then add an existing 50% bonus depreciation and compute the new PDV as follows:

$$0.50 + (1-0.50) \times 0.879 = 0.939$$

The associated δ^{π} is equal to 0.4823.
To calibrate the new value of δ^{π} after the TCJA-17, I increase bonus depreciation from 50% to 90%. This implies a PDV increase from 0.9395 to 0.9879, and a new value of $\delta^{\pi} = 0.8305$.

Kennedy's Tax Cuts

To calibrate tax depreciation policy before and after the Kennedy's tax cuts I follow Cummins et al. (1994). They estimate a PDV of the tax depreciation schedule for equipment of 0.647 in 1960.[1] This is almost the PDV under economic depreciation, so I set $\delta^{\pi} = \delta = 0.10$.
After the tax cuts, they estimate a PDV of the depreciation schedule equal to 0.726 in 1965, which is accompanied by an investment tax credit equal to 0.0657. The investment tax credit can be introduced by simply increasing the PDV of the tax depreciation schedule, which becomes 0.7917. The associated tax depreciation rate is $\delta^{\pi} = 0.1857$.

[1] In their paper, the definition of PDV of depreciation deductions scales the PDV of the tax depreciation schedule by the statutory tax rate. For instance, they report a value of 0.3366 for 1960, which becomes 0.647 after dividing by a statutory tax rate equal to 0.52.

B.2 Simulating Bonus Depreciation on New Investment

To capture the fact that bonus depreciation applies to new investment - as opposed to past investment not depreciated yet - I introduce auxiliary variables. Let $\delta^{\pi,B}$ and $k_t^{\pi,B}$ be the tax depreciation rate and the stock of un-depreciated investment before the reform. Let $\delta^{\pi,A}$ and $k_t^{\pi,A}$ be the same variables after the reform. Finally, let D_t^A take value equal to one after the reform and equal to zero before.

I then rewrite the investment deduction as follows

$$ID_t^{\pi} = \delta^{\pi,B} \cdot \left[(1 - D_t^A) \cdot i_t + k_t^{\pi,B} \right] + \delta^{\pi,A} \cdot \left[D_t^A \cdot i_t + k_t^{\pi,A} \right]$$

where

$$k_{t+1}^{\pi,B} = (1 - \delta^{\pi,B}) \cdot \left[(1 - D_t^A) \cdot i_t + k_t^{\pi,B} \right]$$
$$k_{t+1}^{\pi,A} = (1 - \delta^{\pi,A}) \cdot \left[D_t^A \cdot i_t + k_t^{\pi,A} \right]$$

This modeling strategy ensures that - after the reform - past investment that has not been depreciated yet can still be depreciated using the old depreciation schedule, while new investment is depreciated using the new depreciation schedule.

B.3 Extended Model Details

The 'extended model' starts from the 'baseline model' and introduces: 1) endogeneous labor supply that is mobile across sectors; 2) a CES consumption aggregator; 3) variable capital utilization in the c-corporate sector.

The representative household solves the following optimization problem:

$$\max \quad \sum_{t=0}^{+\infty} \beta^t \left[\frac{\hat{c}_t^{1-\sigma}}{1-\sigma} - \frac{\hat{l}_t^{1+\phi}}{1+\phi} \right]$$

$$s.t. \quad \hat{c}_t = \left(\eta \cdot c_t^{\epsilon} + (1-\eta) \cdot \tilde{c}_t^{\epsilon} \right)^{\frac{1}{\epsilon}}$$

$$\hat{l}_t = l_t + \tilde{l}_t$$

$$c_t + p_t \tilde{c}_t + \Delta S_{t+1} P_t + \Delta \tilde{S}_{t+1} \tilde{P}_t = (1-\tau^{II}) \cdot \left[w_t \hat{l}_t + S_t d_t + \tilde{S}_t \tilde{d}_t \right] + \text{Transfer}_t$$

$$\Lambda_{t+j,t} \equiv \beta^j \cdot \frac{u'(\hat{c}_{t+j})}{u'(\hat{c}_t)} \cdot \frac{\partial \hat{c}_{t+j} / \partial c_{t+j}}{\partial \hat{c}_t / \partial c_t}$$

The productive sector solves the following optimization problems:

C-Corporations

$$\max \quad \sum_{t=0}^{+\infty} \Lambda_{0,t} d_t$$

$$s.t. \quad d_t = \pi_t - T_t^{\pi}$$

$$\pi_t = Y_t - w_t l_t - i_t$$

$$k_{t+1} = (1 - \delta(u_t)) \cdot k_t + i_t$$

$$\delta(u_t) = \delta_0 + \delta_1 (u_t - 1) + \frac{\delta_2}{2} (u_t - 1)^2$$

$$Y_t = (u_t \cdot k_t)^{\alpha} \cdot l_t^{1-\alpha}$$

$$T_t^{\pi} = \tau^{\pi} \cdot TB_t^{\pi}$$

$$TB_t^{\pi} = Y_t - w_t l_t - ID_t^{\pi}$$

Pass-Through Businesses

$$\max \quad \sum_{t=0}^{+\infty} \Lambda_{0,t} \tilde{d}_t$$

$$s.t. \quad \tilde{d}_t = \tilde{\pi}_t$$

$$\tilde{\pi}_t = p_t \cdot \left(\tilde{Y}_t - w_t \tilde{l}_t - \tilde{i}_t \right)$$

$$\tilde{k}_{t+1} = (1 - \tilde{\delta}) \tilde{k}_t + \tilde{i}_t$$

$$\tilde{Y}_t = \tilde{k}_t^{\tilde{\alpha}} \cdot l_t^{1-\tilde{\alpha}}$$

The government collects revenues and channels them into wasteful spending and transfers:

$$T_t = T_t^{\pi} + T_t^{II}$$

$$G_t = \theta \cdot T_t$$

$$\text{Transfer}_t = (1-\theta) \cdot T_t$$

The new parameters introduced are ϕ, δ_0, δ_1, δ_2, η and ϵ. I set $\phi = 4$, which implies a Frisch

elasticity of 0.25. The steady-state economic depreciation for c-corporations is given by $\delta_0 = 0.10$ since I set $\delta_1 = \frac{1}{\beta} - (1 - \delta_0) = 0.1638$. The parameter δ_2 is set equal to 0.10 to target a steady-state elasticity of depreciation to utilization of approximately 0.60, which is basically the mid-point between the values in Basu and Kimball (1997) and King and Rebelo (1999).

I set $\epsilon = 0.33$ to target an elasticity of substitution between the goods produced by the two sectors of approximately 1.5%. This implies some substitutability between the two varieties. Given ϵ, I use η to calibrate the target the relative size of c-corporations. I set $\eta = 0.55$ for the TCJA-17, and $\eta = 0.70$ for the Kennedy's tax cuts.

B.4 An Equivalent Decentralization

B.4.1 Capital Taxes in the Baseline Model

To understand how to introduce capital taxes in the baseline model presented in subsection 4.1, start from the capital tax base and apply Euler Theorem:

$$\begin{aligned} TB_t^K =& MPK_t k_t + p_t \tilde{MPK}_t \tilde{k}_t \\ =& Y_t - w_t l_t + p_t \cdot \left(\tilde{Y}_t - \tilde{w}_t \tilde{l}_t \right). \end{aligned}$$

This implies that capital taxes can be levied by imposing a tax on operating income (i.e. revenues minus wages) on both the c-corporate sector and the pass-through sector.

B.4.2 An Alternative Decentralization of the Baseline Model

Since it is not immediate to see that a tax on the operating income of both sectors is equivalent to taxing capital income in the economy, I introduce explicitly capital taxes in an equivalent - but more familiar - decentralization of the model where the household accumulates the capital stock. For clarify of exposition and without loss of generality, let's assume away individual income taxation (i.e. $\tau^{II} = 0$). The representative household's problem is now given by

$$\max \quad \sum_{t=0}^{+\infty} \beta^t \frac{\hat{c}_t^{1-\sigma}}{1-\sigma}$$

$$s.t. \quad \hat{c}_t = c_t^{\gamma} \cdot \tilde{c}_t^{1-\gamma}$$

$$c_t + p_t \tilde{c}_t + k_{t+1} + p_t \tilde{k}_{t+1} = w_t l_t + p_t \tilde{w}_t \tilde{l}_t + k_t (1 - \delta + R_t) + p_t \tilde{k}_t (1 - \tilde{\delta} + \tilde{R}_t) + \pi_t + \tilde{\pi}_t - T_t^K + \text{Transfer}_t$$

$$l_t + \tilde{l}_t = 1, \quad l_t = l, \quad \tilde{l}_t = \tilde{l}$$

$$k_{t+1} = (1 - \delta) k_t + i_t$$

$$\tilde{k}_{t+1} = (1 - \tilde{\delta}) \tilde{k}_t + \tilde{i}_t$$

$$T_t^K = \tau^k \cdot \left(k_t R_t + p_t \tilde{k}_t \tilde{R}_t \right)$$

The representative household supplies labor and rents capital to the productive sector, and the factor markets are competitive. The productive sector's problem is given by:

C-Corporations

$$\max_{\{\pi_t, Y_t, k_t, l_t\}} \sum_{t=0}^{+\infty} \Lambda_{0,t} \pi_t$$
$$s.t. \quad \pi_t = Y_t - w_t l_t - R_t k_t$$
$$Y_t = k_t^{\alpha} \cdot l_t^{1-\alpha}$$

Pass-Through Businesses

$$\max_{\{\tilde{\pi}_t, \tilde{Y}_t, \tilde{k}_t, \tilde{l}_t\}} \sum_{t=0}^{+\infty} \Lambda_{0,t} \tilde{\pi}_t$$
$$s.t. \quad \tilde{\pi}_t = p_t \cdot \left(\tilde{Y}_t - \tilde{w}_t \tilde{l}_t - \tilde{R}_t \tilde{k}_t \right)$$
$$\tilde{Y}_t = \tilde{k}_t^{\tilde{\alpha}} \cdot l_t^{1-\tilde{\alpha}}$$

The government's behavior and aggregation are exactly as in subsection 4.1. This alternative decentralization is equivalent to the one in subsection 4.1 in the sense that the equilibrium law of motion of the system is the same. Since the factor markets are competitive, we have that $R_t = MPK_t$ and $\tilde{R}_t = M\tilde{P}K_t$. As a result, in equilibrium we have that capital taxes are equal to

$$T_t^K = \tau^k \cdot \left(MPK_t k_t + p_t \tilde{k}_t M\tilde{P}K_t \right)$$

and therefore the capital tax base is equal to

$$TB_t^K = MPK_t k_t + p_t M\tilde{P}K_t \tilde{k}_t.$$

It is also possible to introduce corporate taxes in this decentralization of the model. To do so, replace the capital tax T_t^K with a corporate tax T_t^{π} - still levied on the household - given by:

$$T_t^{\pi} = \tau^{\pi} \cdot \left(R_t k_t - \sum_{j=0}^{+\infty} \delta^{\pi} (1 - \delta^{\pi})^j i_{t-j} \right)$$

where δ^{π} is the tax depreciation rate. Given a competitive capital rental market and a competitive labor market we have that $R_t = MPK_t$ and that $w_t = MPL_t$. By applying Euler Theorem we can express corporate taxes as:

$$T_t^{\pi} = \tau^{\pi} \cdot \left(Y_t - w_t l_t - \sum_{j=0}^{+\infty} \delta^{\pi} (1 - \delta^{\pi})^j i_{t-j} \right).$$

B.5 Proofs of Corporate Tax Revenues Collection

B.5.1 Proof of Proposition 1

Let's first consider a capital tax. Capital tax revenues are given by

$$T_t^K = \tau^k \cdot \left(MPK_t k_t + p_t \tilde{k}_t M\tilde{P}K_t \right)$$

and, since $\tau^k > 0$, their sign is given by

$$sign(T_t^k) = sign(MPK_t k_t + p_t \tilde{k}_t M\tilde{P}K_t).$$

In a non-degenerate (or interior) equilibrium, one has that $k_t > 0$, $MPK_t > 0$, $\tilde{k}_t > 0$, $M\tilde{P}K_t > 0$, and $p_t > 0$. Therefore:

$$sign(T_t^k) > 0.$$

Let's now consider a corporate tax with full-expensing of investment. Corporate tax revenues are given by

$$T_t^\pi = \tau^\pi \cdot \left(MPK_t k_t - i_t \right)$$

and, since $\tau^\pi > 0$, their sign is given by

$$sign(T_t^\pi) = sign(MPK_t k_t - i_t).$$

Because of a Cobb-Douglas production function, one has that $MPK_t k_t = \alpha Y_t$. Therefore

$$\begin{aligned} sign(T_t^\pi) =& sign(\alpha Y_t - i_t) \\ =& sign\left(\alpha - \frac{i_t}{Y_t} \right) \end{aligned}$$

where the second equality follows from the fact that $Y_t > 0$. If $\alpha > \frac{i_t}{Y_t}$, corporate tax revenues collection is positive; if $\alpha < \frac{i_t}{Y_t}$, it is negative; if $\alpha = \frac{i_t}{Y_t}$, it is zero.

B.5.2 Proof of Proposition 2

Consider the corporate tax base in steady-state :

$$TB_{ss}^\pi = Y_{ss} - w_{ss} l_{ss} - ID_{ss}$$

and because of full-expensing we have $ID_{ss} = i_{ss}$. Apply Euler Theorem to get

$$TB^{\pi}_{ss} = MPK_{ss} \cdot k_{ss} - i_{ss}.$$

Since $i_{ss} = \delta k_{ss}$, the tax base can be rewritten as

$$TB^{\pi}_{ss} = k_{ss} \cdot (MPK_{ss} - \delta)$$

which implies that corporate tax revenues collection is positive if $MPK_{ss} - \delta > 0$. In steady-state, the Euler Equation for capital accumulation becomes

$$1 = \beta\Big[1 - \delta + MPK_{ss}\Big]$$

which implies that

$$MPK_{ss} - \delta = \frac{1}{\beta} - 1 \equiv \rho$$

where $\rho > 0$ is the rate of time preferences. Since $\rho > 0$, we have that

$$TB^{\pi}_{ss} > 0.$$