Online Appendix for

The Tax Cuts and Jobs Act (TCJA) : A Quantitative Evaluation of Key Provisions

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A Appendix

A.1 Labor efficiency units and productivity shock

I use the Panel Study of Income Dynamics (PSID) waves 1968-2011 and collect information on heads of households about annual labor income, age, annual hours worked, and sex. I include in the sample households whose head *i*) is between 20-64 *ii*) is a male *iii*) and works between 520 and 4368 hours annually[1] (Bakış et al. (2015)). Earnings are transformed into 2011 US dollars using the Consumer Price Index. For each age cohort, I compute per annum mean labor earnings and mean hours worked. Mean wages are calculated by simply dividing mean earnings by mean hours worked. The endowment of labor efficiency units is determined by dividing each cohort's average wage by the average wage of the selected sample. I use a cubic fit in age to smooth the wage-age profile while controlling for year dummies. The figure plots the underlying labor efficiency over the life-cycle.

Figure 1: Labor efficiency unit over the life-cycle

[1] I also tried an alternative maximal value of 5820 hours, as in Huggett et al. (2011); however, the results are not affected.

Below I report the first five values of labor productivity shocks η computed using an approximation of an AR(1) process after Tauchen (1986), as defined in section 2.2. For this, I set the persistence coefficient ρ and the residual variance σ_η^2 to 0.95 and 0.03, respectively(Storesletten et al. (2004)). I then add a calibrated awesome state to allow superstars workers in the model.

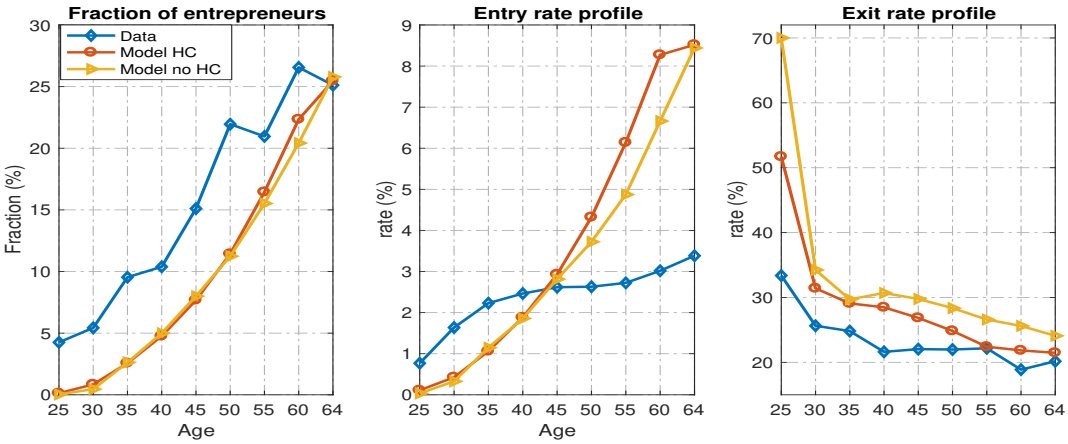
$$\eta = [0.2468, \quad 0.4473, \quad 0.77654, \quad 1.3097, \quad 2.93742, \quad 21.75]$$

$$\Gamma_\eta = \begin{pmatrix} 0.7376(1-0.003) & 0.2473(1-0.003) & 0.0150(1-0.003) & 0.0002(1-0.003) & 0.0000(1-0.003) & 0.003 \\ 0.1947(1-0.003) & 0.5555(1-0.003) & 0.2328(1-0.003) & 0.0169(1-0.003) & 0.0000(1-0.003) & 0.003 \\ 0.0113(1-0.003) & 0.2221(1-0.003) & 0.5333(1-0.003) & 0.2221(1-0.003) & 0.0113(1-0.003) & 0.003 \\ 0.0001(1-0.003) & 0.0169(1-0.003) & 0.2328(1-0.003) & 0.5555(1-0.003) & 0.1947(1-0.003) & 0.003 \\ 0.000(1-0.003) & 0.0002(1-0.003) & 0.0150(1-0.003) & 0.2473(1-0.003) & 0.7376(1-0.003) & 0.003 \\ 0.0000 & 0.0000 & 0.125 & 0.0000 & 0.0000 & 1-0.125 \end{pmatrix}$$

A.2 Entrepreneurial statistics by age in the benchmark

The figure below gives an overview of the non-targeted age profile of entrepreneurs' fraction, entry and exit rates in the data and two versions of the model (with and without entrepreneurial human capital). Overall, both models are consistent with the general trend in the data.

Figure 2: Entrepreneurship by age



Note: In all panels, red represents model with human capital (HC), yellow the model without human capital (no HC) and the blue indicates data. Data are from the PSID (1968-2011) and SCF (2010) where an entrepreneur is defined as self-employed and business owner. SCF is used to compute the cross-sectional share of entrepreneurs by age cohort. The longitudinal dimension of the PSID is exploited to compute entry and exit rates. Each dot represents a five-year bin average.

A.3 Main forces : General Equilibrium vs. Partial

This section sheds light on the main forces underlying the reaction of the different aggregates to the tax cuts implemented via the TCJA. The different provisions are assessed both in partial equilibrium where prices are kept to their benchmark values, and in general equilibrium with adjusting prices. In fact, partial equilibrium captures the direct effects of the tax policy. From the four tables below, one sees that the tax cuts and factor prices adjustment have opposite effects. While tax cuts provide more incentive for risk-taking activities in the business sector, giving rise to higher output and capital stock (positive effect), factor prices adjustments reduce these activities by making either investments or labor input costly for entrepreneurs, thereby reducing the aggregates (negative effect).

Table 1: Aggregate effects : 20%-business income deduction provision

		Deduction provision	
Variables	Benchmark	GE	PE
	Level	%Δ from benchmark	
Output	1.05	2.09	4.10
corporate	0.48	-2.34	-9.74
non corporate	0.57	5.80	15.71
Capital	2.73	5.24	10.32
corporate	1.76	2.20	6.30
non corporate	0.97	10.73	17. 60
labor	0.49	-0.63	-1.77
corporate	0.25	-4.60	-18.44
non corporate	0.24	3.38	15.60
Prices			
after-corp-tax interest rate(%)	2.23	-12.46	0.00
wage	1.30	+2.34	0.00
Corp. tax revenue/GDP (%)	1.59	1.39	1.63

GE stands for general equilibrium and PE for partial equilibrium. In the PE case, interest is kept constant to its benchmark value.

Table 2: Entrepreneurial statistics: 20% business income deduction provision

		Deduction provision	
Averages	Benchmark	GE	PE
% of entrepreneurs	7.10	7.37	8.35
entry rate(%)	2.62	2.70	3.10
exit rate(%)	20.9	20.50	20.51
tenure in entrepreneurship(yrs)	8.69	8.88	9.22
% of constrained E	25.40	25.45	26.12
asset	10.76	11.47	11.09
capital size	13.70	14.61	14.35
optimal capital size	15.74	16.74	15.37
profitability (%)	19.37	18.32	18.24
tax-to-profit ratio(%)	31.70	24.76	25.82
% of leveraged E (%)	93.55	93.42	94.06

Note: GE stands for general equilibrium and PE for partial equilibrium. In the PE case, prices are kept constant to their benchmark values. Optimal capital is capital invested when firm is unconstrained. Profitability is defined as the ratio of the operating profit to the amount of invested capital. Tax-to-profit is tax paid by a firm out of its profit. Leveraged entrepreneurs is the fraction of firms borrowing from the banking system and the constrained firms are defined as those hitting their borrowing constraint.

Table 3: Aggregate effects : Top marginal tax cut provision (from 39.6 $\rightarrow$ 37%)

		Deduction provision	
Variables	Benchmark	GE	PE
	Level	%Δ from benchmark	
Output	1.05	0.45	0.95
corporate	0.48	1.34	-0.90
non corporate	0.57	-0.29	2.50
Capital	2.73	1.90	2.87
corporate	1.76	1.99	2.39
non corporate	0.97	1.74	3.74
labor	0.49	0.18	-0.42
corporate	0.25	1.01	-4.19
non corporate	0.24	-0.66	3.50
Prices			
after-corp-tax interest rate(%)	2.33	-2.01	0.00
wage	1.30	+0.37	0.00
Corp. tax revenue/GDP (%)	1.59	1.58	1.62

Note: GE stands for general equilibrium and PE for partial equilibrium. In the PE case, prices are kept constant to their benchmark values.

Table 4: Entrepreneurial statistics : Top marginal tax cut provision (from 39.6 $\rightarrow$ 37%)

		top marg. tax cut's case	
Averages	Benchmark	GE	PE
% of entrepreneurs	7.10	6.93	7.11
entry rate(%)	2.62	2.55	2.63
exit rate(%)	20.9	20.9	20.87
tenure in entrepreneurship(yrs)	8.69	8.66	8.72
% of constrained E	25.40	24.98	25.14
asset	10.76	11.30	11.18
capital size	13.70	14.27	14.15
optimal capital size	15.74	16.51	15.37
profitability (%)	19.37	18.88	17.92
tax-to-profit ratio(%)	31.70	30.04	32.76
% of leveraged E (%)	93.55	93.03	93.31

Note: GE stands for general equilibrium and PE for partial equilibrium. In the PE case, prices are kept constant to their benchmark values. Optimal capital is capital invested when firm is unconstrained. Profitability is defined as the ratio of the operating profit to the amount of invested capital. Tax-to-profit is tax paid by a firm out of its profit. Leveraged entrepreneurs is the fraction of firms borrowing from the banking system and the constrained firms are defined as those hitting their borrowing constraint.

A.4 Sensitivity analysis wit positive correlation between work and entrepreneurial abilities

In the baseline considered in the main text, the two abilities are assumed independent as in Cagetti and De Nardi (2006). Nonetheless, I provide in this section a robustness check to analyze the effects of allowing for positive correlation between these two ability processes. I use their procedure: keep the marginal distributions and transition probabilities as in the baseline case. Assume that the two processes have a positive correlation: they use a given value of 0.4, but I use four possible values (0.25, 0.5, 0.75 and 0.95). All other parameters are as in the baseline economy, except for the discount factor β, which is recalibrated to obtain the same capital-to-output ratio as in the benchmark.

Next, I use in each value of the correlation $corr(\eta, z)$ the induced baseline to implement the three provisions of the TCJA. The results are summarized table below where $corr(\eta, z) = 0$ represents the initial benchmark with independent abilities, and the subsequent values stands for cases with positive correlation between the two abilities. Overall, the findings suggest that the conservative zero-correlation assumption is robust to the sensitivity analysis. The economic intuition is that in the presence of positive correlation between the two abilities, individuals with high work ability tend to have a lower outside option value of remaining in the nonentrepreneurial sector and consequently are less likely to become entrepreneurs.

Table 5: Aggregate effects in % change

	$corr(\eta, z)$				
	0	0.25	0.5	0.75	0.95
Output	2.65	2.51	2.45	2.49	2.41
Capital	7.60	7.19	7.09	7.08	6.98
Labor	-0.42	-0.12	-0.10	-0.14	-0.22
after-corp-tax interest rate	-5.46	-2.92	-4.39	-9.92	-4.71
wage	2.85	2.54	2.59	1.82	2.52
Fraction of entrepreneurs	1.97	-0.43	-0.58	-0.28	0.20
%E in top1 wealth	1.29	5.57	4.20	5.33	3.80
%E in top10 wealth	4.34	2.72	2.20	2.56	2.17
Wealth Gini	1.25	1.08	0.70	0.69	0.65
Income Gini	0.22	0.16	0.08	0.09	0.09

Note: Each column represents the percentage deviation between an economy with the implementation of the TCJA and its corresponding baseline. The first column indicates the benchmark in this paper where the two abilities are considered independent.

A.5 Some details about key provisions as written in the Law and sensibility analysis

In the tables below, I provide certain details about the provisions in the new tax bill. However, the information are still highly summarized since the tax code describes many aspects of each provision and also gives the conditions under which it can be applied.

Table 6: Tax Cuts and Job Act (TCJA): reform of 2017

Key provisions	All	Bus. deduction	Corp. cut	Top cut	Bonus depreciation
Deduction for pass-throughs' income: $\tau_d^{bench} = 0\% \rightarrow \tau_d^{new} = 20\%$	X	X			
Corporate tax cut: $\tau_c^{bench} = 29\% \rightarrow \tau_c^{new} = 21\%$	X		X		
Top marginal tax cut: $\tau_{\max}^{bench} = 39.6\% \rightarrow \tau_{\max}^{new} = 37\%$	X			X	
Bonus depreciation: $\varphi^{bench} = 1 \rightarrow \varphi^{new} = 1.2$	X				X

	Key provisions	Conditions
Businesses		
- Coprorations	New Flat tax rate of 21%	Permanent
- Pass-throughs	New 20-percent deduction for qualified business income	Temporary (2018-2025). Limits apply based on income and type of business. For instance, if your 2018 taxable income is below $315,000, if married filing jointly, or $157,500 for all other filing statuses, it doesn't matter, what type of business you are in. You will be able to deduct the lesser of: a) Twenty percent (20%) of your Qualified Business Income (QBI), or b) Twenty percent (20%) of your taxable income minus your net capital gains.
- All	New 100-percent bonus depreciation deduction for businesses	100% the first five years(2018-2022) before phasing out at 20% rate until 2026
Individuals	Reduction in marginal tax rates 10%, 15%, 25%, 28%, 33%, 35% and 39.6% to 10%, 12%, 22%, 24%, 32%, 35% and 37% There is also a reduction in the income brackets based on the filling status.	Temporary (2018-2025)

Source: Internal Revenue Service (IRS). More details at https://www.irs.gov/newsroom/tax-reform-guidance

In the new tax law, businesses are allowed to take advantage of a new accelerated depreciation or bonus depreciation. Since this provision is more prevalent in the corporate sector relative to pass-through entities, I then introduce the parameter $\varphi_c \geq 1$, which controls for the bonus depreciation rule. In the benchmark, its value is $\varphi_c = 1$, but the new tax bill allows 100% bonus depreciation (for new and used assets). Therefore, the reformed valued will be $\varphi_c > 1$ during the first five years(2018-2022) before phasing out at 20% rate each year until 2026. In 2027, this provision sunsets. In this section, I perform a robustness check of the effects of the key provisions of the TCJA accounting for bonus depreciation. To do so, I rely on the change of the value of the expensing rate used by Barro and Furman (2018). Indeed, the user the expensing rate takes account of literal expensing, depreciation allowances, and investment tax credits. They find that the expensing rate will change from 0.8 to 1 for corporate firms, which represents a 0.2 unit change. Therefore, I assume that the parameter of the bonus depreciation also changes from $\varphi_c = 1$ to $\varphi_c = 1.2$. The corporate firm then solves the following static problem, which generates the rental price for capital and labor inputs:
First order conditions give rise to

$$\max_{K_c, L_c > 0} (1 - \tau_c) \underbrace{(A_c F(K_c, L_c) - wL_c) - (1 - \tau_c \varphi_c)\delta K_c}_{operating\ profit} - rK_c \tag{1}$$

The marginal product of capital is given by

$$MPK = \frac{r}{1 - \tau_c} + \frac{(1 - \tau_c \varphi_c)\delta}{1 - \tau_c} \tag{2}$$

$\frac{\partial MPK}{\partial \varphi_c} < 0$: an increase in bonus depreciation for corporations reduces the user cost capital and this should increase the investment made by corporations. However, corporations problem is static in this framework, inducing the channel to transit through

households' savings. In fact, from equation (2), one can deduct that $\frac{\partial r}{\partial \varphi_c} > 0$. Therefore, the increase in bonus depreciation augments the renting cost for entrepreneurs, else being equal. Higher after-corprate tax return on corporate dividends makes saving attractive, and some households would prefer aquiring these dividends instead of running their own (risky) business. Accordingly, capital will move from pass-through sector toward the corporate sector: the last column of table 6 where the stylized bonus depreciation is applied in both sector show that the corporate capital increases by 3.4% while non-corporate capital decreases by the same proportion.

Moreover, I allow pass-through entities to take advantage of this depreciation by a faction φ_e. The amount $\varphi_e \delta k$ reduces the taxable income. From Barro and Furman, φ_e changes on average by 5% after the reform. I then consider that φ_e increase from $\varphi_e = 1$ (benchmark) to $\varphi_e = 1.05$. The profit function of an entrepreneur is as follows.

$$\pi(a, z, \kappa) = \max_{l \geq 0, k \leq \lambda a} z\kappa^{\theta}(k^{\alpha} l^{1-\alpha})^{\gamma} - \varphi_e \delta k - r(k - a) - wl \tag{3}$$

Moreover, I allow pass-through entities to take advantage of this depreciation by a faction φ_e. The amount $\varphi_e \delta k$ reduces the taxable income. From Barro and Furman, φ_e changes on average by 4% after the reform. I then consider that φ_e increase from $\varphi_e = 1$ (benchmark) to $\varphi_e = 1.05$. The profit function of an entrepreneur is as follows.

$$\pi(a, z, \kappa) = \max_{l \geq 0, k \leq \lambda a} z\kappa^{\theta}(k^{\alpha} l^{1-\alpha})^{\gamma} - \varphi_e \delta k - r(k - a) - wl \tag{4}$$

Furthermore, in the main text, I assumed that any pass-through owner is entitled to deduct the new 20% provision. Nonetheless, the tax code imposes some limits relative to the industry and the income level. Since my model does not have the industry margin, in this section I only consider a check on the income threshold. Let y and y^d be the gross income and the disposable income of an entrepreneur, respectively. The taxable income $y^{taxable}$ is given by:

$$y^{taxable} = \begin{cases} (1 - \tau_d) y \text{ if } y \leq y^{max} \\ y \text{ if } y > y^{max} \end{cases}$$

and the disposable income y^d using the progressive tax schedule is as follows:

$$y^d = \xi \min\{y_{top}, y^{taxable}\}^{1-\tau} + (1 - \tau_{\max}) \max\{0, y^{taxable} - y_{top}\} + \tau_d \cdot y \mathbb{1}_{\{\text{ if } y \leq y^{max}\}}$$

y^{max} represents the level of qualified business income above which households can no longer claim the new deduction provision. In 2017, this threshold is U.S. $315,000, or 3.6 times average household income. y_{top} is the income threshold beyond which the household starts paying the top marginal tax rate.

The results of accounting for the two previous provisions are provided in the table

below. A comparative analysis with table **??** in section **??** shows that their long-run effect is negative, since they dampen the changes in the level of the different aggregates. For instance, the output level increases by 1.51% when the three provisions are implemented while this rise is 2.65% if all entrepreneurs can claim the deduction. In fact, the new 20% deduction is no longer available for top entrepreneurs and since their saving rate is higher, the tax incentives are not totally unleashed, as in section **??**. Furthermore, when evaluated solely, the new bonus depreciation even generates a negative level change in capital and output. The intuition is as follows, the increase in depreciation allowances increases the after-corporate rate r, which makes capital expensive for entrepreneurs. For some entrepreneurs, it is optimal not to run a risky business, and the fraction of entrepreneurs drop by 3%. More capital is then transferred to the corporate sector through savings. But with the current parametrization, the production of the corporate sector is not enough to make up the forgone production of the pass-through sector. Consequently, this negative impact of the bonus depreciation on the non-corporate sector helps understand in this framework why the implementation of all provisions with bonus depreciation induces higher output level change than that without bonus depreciation. The size of the non-corporate sector is expected increase by 4% and 2% with bonus depreciation and without bonus depreciation, respectively.

Table 7: Aggregate effects of the TCJA in the long run

Variables	Benchmark	**All provisions with bonus depreciation**	**All provision without bonus depreciation**	**Bonus depreciation only**
	Level	% change from benchmark		
Output	1.05	1.51	1.81	-0.32
corporate	0.48	2.24	-0.48	3.35
non corporate	0.57	0.89	3.72	-3.42
Capital	2.73	4.21	4.70	-0.53
corporate	1.76	5.85	3.58	2.60
non corporate	0.97	1.21	6.74	-6.20
labor	0.49	-0.21	-0.45	0.38
corporate	0.25	-1.25	-4.25	2.00
non corporate	0.24	0.06	2.57	-6.20
Fraction of entrepreneurs	0.071	+1.92	+3.74	-2.57
Prices				
after-corp-tax interest rate	2.33	+1.39	-1.36	+2.05
wage	1.29	+1.70	+2.00	-0.46

"All provisions" in this paper means corporate income tax cut, top marginal tax cut and business income deduction for pass-through entities.

A.6 Model with government debt

To compare my results to that of the US federal agencies (JCT, CBO) as indicated in section **??**, I assume that the revenue neutrality should hold over the standard 10-years budget window. This is in line with the Reconciliation Act of the US Congress coupled with the Byrd Rule *" A provision is regarded as extraneous under the Byrd rule if : [...] it would increase the deficit for a fiscal year beyond the "budget window" covered by the reconciliation measure.* The current law as written does not satisfy exactly this requirement, therefore some provisions are made temporary to reduce the projected deficit by 2027. Even though I do not introduce a debt-financing possibility for this reform, I allow the government to run deficit during the budget window of 10 years without changing the parameter that preserves the year-to-year balanced budget.

To be more specific, let's consider the government budget

$$G + B = \tau_c \left(\frac{r}{1 - \tau_c} \right) K_c + \tau_s \sum_{j=1}^{J} \int_S g_j^c(s) d\phi_j + \sum_{j=1}^{J} \int_S [y_j - y_j^d] d\phi_j$$

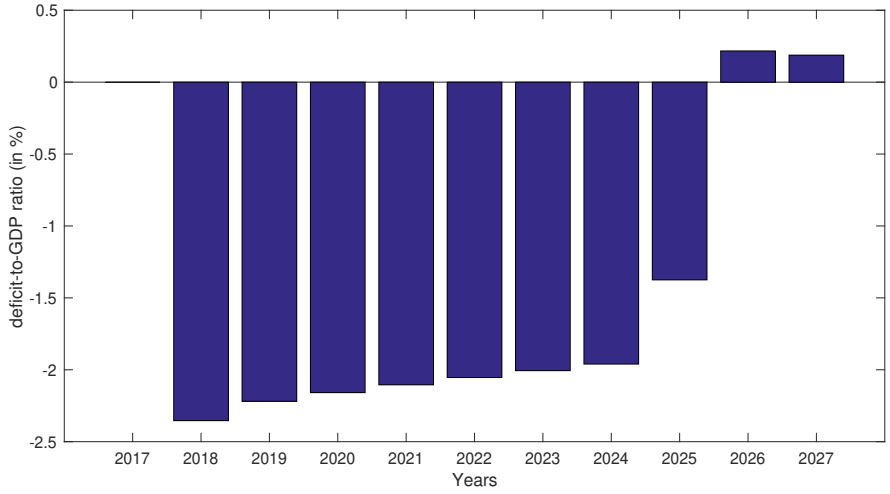
where $y_j^d = \xi \min\{y_{top}, y_j\}^{1-\tau} + (1 - \tau_{\max}) \max\{0, y_j - y_{top}\} + \tau_d \cdot y_j^e \mathbb{1}_{\{occup=entrepreneur\}}$ is the disposable income

$y_j = \mathbb{1}_{\{occup=worker\}} y_j^w + \mathbb{1}_{\{occup=entrepreneur\}} (1 - \tau_d) y_j^e + \mathbb{1}_{\{Retiree\}} y_j^r$ is the taxable income and τ_d is the deduction rate for entrepreneurs.

The tax system progressivity is captured by τ while the parameter ξ controls for the average level of taxation in the economy and it also allows one to balance the government's budget at equilibrium. A decrease in this parameter increases the tax revenues collected in the economy, and a rise relaxes the fiscal pressure on households. Therefore, over the first 8 years of the transition, ξ is kept at its pre-reform value, thereafter the parameter ξ is allowed to adjust to satisfy the revenue neutrality with the baseline. This is what I termed as *10-year revenue neutrality*. I start adjusting the parameter ξ at the end of the 8th year because some tax provisions are temporary, and one can consider that removing these incentives is akin to increasing the average fiscal pressure on households.

The figure below shows the prediction of the model about the change of the deficit-to-GDP ratio over the 10-year budget window. The average net budgetary effects of the TCJA (deficit/GDP) over the budget window is -1,58% in the current model. In its 2018 projections of the TCJA : *"Estimated Deficits and Debt under the Conference Agreement of H.R. 1."*, the CBO Congressional Budget Office forecasted the average deficit-to-GDP ratio to -0.6%. Table 13 in the main text also shows estimates provided by the JCT (-0.61%) and the PWBM (-0.83%).

Figure 3: Deficit-to-GDP ratio over the 10-year budget window



As a robustness check, I consider the debt-financing channel. Therefore, I recalibrate the model to the same moment targets as in the baseline without debt. I also require the model to match a debt-to-GDP ratio of 60%, which is the average ratio of the pre-2008 financial level (Kindermann and Krueger, 2014).

- At the steady state

  Government budget with debt:

$$G + B + r \cdot D = \tau_c \left(\frac{r}{1 - \tau_c} \right) K_c + \tau_s \sum_{j=1}^{J} \int_S g_j^c(s) d\phi_j + \sum_{j=1}^{J} \int_S [y_j - y_j^d] d\phi_j$$

  Capital market with debt (D_t)

$$\sum_{j=1}^{R-1} \int_S k_j(s) d\phi_j + K_c + D = \sum_{j=1}^{J} \int_S g_j^a(s) d\phi_j$$

  The following table compares the twos setups when the provisions are implemented in the long run. The results show that the consideration of the debt channel does not change significantly the expected effects of the tax reforms. The presence of the debt reduces the fiscal pressure on households to financing the tax cuts. But it reduces the capital available to the private sector, specifically when one considers a closed economy. For instance, given that in the current setup the corporate sector uses the residual capital to pin down prices in the economy, it can experience a decrease in its capital stock when government is levying more debt.

Table 8: Aggregate effects of the TCJA in the long run

Variables	**All provisions without debt**	**All provisions with debt**
	% change from benchmarks*	
Output	2.7	3.2
corporate	0.1	6.5
non corporate	4.7	1.5
Capital	7.6	7.87
corporate	5.8	-25.8
non corporate	10.8	9.1
labor	-0.4	-0.2
corporate	-2.6	2.7
non corporate	1.84	-2.1
Prices		
after-corp-tax interest rate	-5.6	-5.8
wage	+2.8	+3.7
Inequality		
Wealth Gini	1.33	1.21
After tax-income Gini	3.87	4.13
Debt-to-GDP ratio (%)	0.0	55
Corp. tax revenue/GDP (%)	1.59	1.06

"All provisions" in this paper means corporate income tax cut, top marginal tax cut and business income deduction for pass-through entities. " $*$% change from benchmarks" implies that each deviation is calculated using the corresponding benchmark. Indeed, the second column uses the zero-debt benchmark while the last colunm considers the baseline with debt. Variables under the dash-line are not in deviation.

- Along the transition path

  Government budget with debt during transition:

$$G + B + (1 + r_t) \cdot D_t = D_{t+1} + \tau_c \left(\frac{r}{1 - \tau_c} \right) K_{ct} + \tau_s \sum_{j=1}^{J} \int_S g^c_{jt}(s) d\phi_{jt} + \sum_{j=1}^{J} \int_S [y_{jt} - y^d_{jt}] d\phi_{jt}$$

  Capital market with debt (D)

$$\sum_{j=1}^{R-1} \int_S k_{jt}(s) d\phi_{jt} + K_{ct} + D_{t+1} = \sum_{j=1}^{J} \int_S g^a_{j(t+1)}(s) d\phi_{jt}$$

In the transition case, I assume as the Penn Wharton Budget Model (PWBM, 2019)

that 40% of the new debt induced by the tax cut is financed by foreigners, and the remaining 60% will be financed by the U.S. households through their savings. Therefore, this is a supplementary of capital for the U.S. domestic economy, which dampens relatively the increase in domestic interest rates. Table 23 shows the annual growth rate of some aggregates (output, capital and consumption) in percentage point when provisions are both made temporary and permanent. Overall, this table indicates that considering the debt-financing channel in my current framework induces a relatively higher output and consumption annual growth rate over the 10-years budget window. On the other hand, aggregate capital growth is relatively lower since a part of this capital is used to pay back the debt service.

Table 9: Annual growth rates in percentage point p.p. over 2018-2027

	TCJA with temporary provisions				TCJA with permanent provisions		
Variables	JCT	Barro and Furman'18	**Model without debt**	**Model with debt**	Barro and Furman'18	**Model without debt**	**Model with debt**
Output	0.07	0.04	0.19	0.34	0.13	0.22	0.36
Capital	0.09	-	0.5	0.44	-	0.58	0.53
Consumption	0.07	-	0.16	0.21	-	0.20	0.15
Deficit/GDP (not growth rate)	-0.61%	-0.60%	-1.58%	-3.10%	-0.80%	-2.11%	-3.04%

Note: Temporary provisions for individuals and pass-throughs are scheduled to expired by 2025. Therefore, for the scenario with sunset they will be active for the time period 2018-2025. Annual growth rate is the compound average annual growth rate over the 10-years budget window.

A.7 Comparison of elasticities with and without the legal form of organization (LFO) margin

This section intents to provide insights about the magnitude of the extensive margin that the current benchmark without LFO is potentially missing. Before doing this analysis, I present the underlying model that incorporate the possibility to choose the legal status of the firm. But for computational tractability reason, I use a version of the benchmark where the human capital channel is shut off.

A.7.1 Recursive formulation with choice of the legal form of organization (LFO)

This section describes a version of the model presented in the main text (section 2.4) where the choice of the legal form of organization is accounted for. For the sake of computational tractability due to the large dimensionality of the model, I abstract the channel of business experience accumulation.

Agent of age j maximizes the expected flow of utility as follows.

$$\mathbb{E}_0\left[\sum_{j=1}^{J}\beta^{j-1}u(c_j)\right] \tag{5}$$

where $u(c_j) = \frac{c_j^{1-\sigma}}{1-\sigma}$ where σ is the rate of relative risk aversion. An agent discounts future at rate $\beta \in (0,1)$.

Each period, an age-j individual starts with an initial wealth a, productivity η, and entrepreneurial ability z, and then chooses his current occupation. Workers earn income from labor and make consumption and savings decision. Entrepreneurs choose the working capital and labor input demand subject to the collateral constraint.

A.7.2 Agent's problem

a-Retiree's problem

After retirement, agents live off their savings and retirement benefits (b). Pensions are paid out to any retiree regardless of his/her pre-retirement occupation. The problem of a retired agent for ages $j \in \{R, R+1, \ldots, J\}$ is given by

$$v_j(a) = \max_{a'}\left\{u(c) + \beta v_{j+1}(a')\right\} \tag{Pret}$$

$$y_r = ra + b \tag{6}$$

$$(1+\tau_s)c + a' = \underbrace{\xi \min\{y_{top}, y_r\}^{1-\tau} + (1-\tau_{\max})\max\{0, y_r - y_{top}\}}_{disposable\ income} + a \tag{7}$$

$$a \geq 0 \tag{8}$$

$$v_{J+1}(a) = 0 \tag{9}$$

Thus, during the retirement, an agent just chooses his/her next period asset holdings. The parameter $\tau_{\max}$ is the top marginal tax rate that is applied as long as the agent's income reaches the top level, y_{top}. In the policy experiment's section, this parameter will be modified. To the extent that the agent's lifetime ends at J, equation 9 gives the one period ahead terminal utility, which is zero.

b-Working agent's problem

Before retirement, any agent in the economy has the following choice:

$$v_j(a,z,\eta) = \max\left\{v_j^w(a,z,\eta), v_j^p(a,z,\eta), v_j^c(a,z,\eta)\right\} \tag{10}$$

where $v_j^w(a,z,\eta)$ $v_j^p(a,z,\eta)$ and $v_j^c(a,z,\eta)$ are the value functions of worker and pass-through entrepreneur and C-corp. entrepreneur, respectively.

b1-Worker's problem

Conditional on being on the labor market, an age-j worker solves the following recursive problem by choosing his next savings and occupation.

$$v_j^w(a,z,\eta,\kappa) = \max_{a'} \left\{ u(c) + \beta \sum_{z',\eta'} \psi(z',\eta'|z,\eta) v_{j+1}(a',z',\eta') \right\} \tag{Pw}$$

subject to

$$y_w = w\eta\epsilon_j + ra \tag{11}$$

$$(1+\tau_s)c + a' = \underbrace{\xi \min\{y_{top}, y_w\}^{1-\tau} + (1-\tau_{\max}) \max\{0, y_w - y_{top}\}}_{disposable\ income} + a \tag{12}$$

$$a \geq 0, \quad j = 1,2,\ldots,R-1 \tag{13}$$

The expectation is taken with respect to the underlying Markovian productivity distribution $\psi(z',\eta'|z,\eta)$ for the two abilities with the assumption that they are not correlated.[2] The worker's income stems from the efficiency unit of labor per market wage.

The parameter $\tau_{\max}$ is the top marginal tax rate that is applied as long as the agent's income reaches the top level, y_{top} and will modified during the TCJA experiment.

b2-Entrepreneur's problem

There are now two types of entrepreneurs in the production sector: Pass-through entrepreneurs and C-corporation entrepreneurs. Overall, Pass-through entities have a fiscal advantage because they escape the double taxation imposed to C-corporations. On the other hand, C-corps are less constrained on the financial market ($\lambda_c > \lambda_p$).

b2.1-Pass-through entrepreneur's problem

The recursive problem of a pass-through entrepreneur is now stated as follows

$$v_j^p(a,z,\eta) = \max_{a'} \left\{ u(c) + \beta \sum_{z',\eta'} \psi(z',\eta'|z,\eta) v_{j+1}(a',z',\eta') \right\} \tag{Pb.P}$$

subject to (13) and

$$\pi_p(a,z) = \max_{l\geq 0,\, k \leq \lambda_p \cdot a} z(k^\alpha l^{1-\alpha})^\gamma - \delta k - r(k-a) - wl \tag{14}$$

$$y_p = \pi_p(a,z,\kappa) \tag{15}$$

$$(1+\tau_s)c + a' = \underbrace{\xi \min\{y_{top}, (1-\tau_d)y_p\}^{1-\tau} + (1-\tau_{\max}) \max\{0, y_p - y_{top}\} + \tau_d \cdot y_p}_{disposable\ income} + a \tag{16}$$

[2] This assumption is also made in Cagetti and De Nardi (2006). They compute a robustness check with correlated abilities but the results are not affected.

b2.2- C-corp. entrepreneur's problem

A C-corp entrepreneur recursively solve the following problem

$$v_j^c(a,z,\eta,\kappa) = \max_{a'} \left\{ u(c) + \beta \sum_{z',\eta'} \psi(z',\eta'|z,\eta) v_{j+1}(a',z',\eta') \right\} \tag{Pb.C}$$

subject to (13) and

$$\pi_c(a,z) = \max_{l\geq 0,\, k\leq \lambda_c \cdot a} z(k^\alpha l^{1-\alpha})^\gamma - \delta k - r(k-a) - wl \tag{17}$$

$$y_c = \pi_c(a,z) \tag{18}$$

$$(1+\tau_s)c + a' = \underbrace{\xi \min\{y_{top}, (1-\tau_c)y_c\}^{1-\tau} + (1-\tau_{\max}) \max\{0, (1-\tau_c)y_c - y_{top}\}}_{disposable\ income} + a \tag{19}$$

After paying the corporate income tax τ_c at the firm level ($(1-\tau_c)y_c$), the C-corp. entrepreneur also pays personal income tax using the same individual tax scheme as the pass-through entrepreneur. The parameter $\tau_{\max}$ in Eqs (16 and 19) is the top marginal tax rate that will be cut with the TCJA. Under the new tax reform, pass-through entrepreneurs will be able to claim τ_d% of their business income as deductions. This reduces their taxable income by $(1-\tau_d)y_p$ while increasing their disposable income by $\tau_d y_p$.

A.7.3 Equilibrium

At each point in time, individuals differ from one another with respect to age j and to state $s = (a,z,\eta,o)$ i.e. asset holdings a, entrepreneurial productivity z, work productivity η, and occupation $o \in \{W, P, C, Retiree\}$. Let $a \in \mathbb{A} = \mathbb{R}_+, z \in \mathbb{Z}, \eta \in \mathbb{H}, \kappa \in \mathbb{K}$ and $o \in \mathbb{O}$, and $\mathbb{S} = \mathbb{A} \times \mathbb{Z} \times \mathbb{H} \times \mathbb{O}$ the entire state space. Let $(\mathbb{S}, \mathcal{F}(\mathbb{S}), \phi j)$ be a space of probability, where $\mathcal{F}(\mathbb{S})$ is the Borel σ-algebra on $\mathbb{S}$: for each $\mathcal{B} \subset \mathcal{F}(\mathbb{S})$, $\phi_j(\mathcal{B})$ denotes the fraction of agents aged j that are in $\mathcal{B}$. Given the age j distribution ϕ_j, $Q_j(s,\mathcal{B})$ induces the age $j+1$ distribution ϕ_{j+1} as follows. The function $Q_j(s,\mathcal{B})$ determines the probability of an agent at age j and state s to transit to the set $\mathcal{B}$ at age $j+1$. The policy function for savings, consumption, entrepreneurial capital, and entrepreneurial labor is given by $g_j^a(s), g_j^c(s), k_j(s)$ and $l_j(s)$, respectively.

Definition . Given a tax structure $\{\tau_s, \tau_c, \tau_{max}, \xi, b\}$, a stationary recursive competitive equilibrium is a set of **functions** $\{v_j^w, v_j^p, v_j^c, v_j, g_j^a, g_j^c, k_j^p, k_j^c, l_j^p, l_j^c(s)\}_{j=1}^J$, and **prices** $\{\tilde{r}, w\}$ such that

(i) given prices, the functions solve the household problem in (10), (**??**), (**??**)and (**??**);

(ii) capital and labor markets clear :

$$\sum_{j=1}^{R-1} \int_{\mathbb{S}} \left[k_j^p(s) + k_j^c(s) \right] d\phi_j = \sum_{j=1}^{J} \int_{\mathbb{S}} g_j^a(s) d\phi_j$$

$$\sum_{j=1}^{R-1} \int_{\mathbb{S}} \left[l_j^p(s) + l_j^c(s) \right] d\phi_j = \sum_{j=1}^{R-1} \int_{\mathbb{S}} \epsilon_j \eta d\phi_j$$

(iii) given the decision rules, $\phi_j(s)$ follows the law of motion:

$$\phi_{j+1}(\mathcal{B}) = \int_{\mathbb{S}} Q_j(s, \mathcal{B}) d\phi_j, \forall \mathcal{B} \subset \mathcal{F}(\mathbb{S});$$

(iv) the government balances its budget:

$$G + B = \tau_s \sum_{j=1}^{J} \int_{\mathbb{S}} g_j^c(s) d\phi_j + \sum_{j=1}^{J} \int_{\mathbb{S}} [y_j - y_j^d] d\phi_j + \sum_{j=1}^{J} \int_{\mathbb{S}} [(1 - \tau_c) y_j^c - y_j^{cd}] d\phi_j + \tau_c \sum_{j=1}^{J} \int_{\mathbb{S}} y_j^c$$

where $y_j^d = \xi \min\{y_{top}, y_j\}^{1-\tau} + (1 - \tau_{\max}) \max\{0, y_j - y_{top}\} + \tau_d \cdot y_j^p \mathbb{1}_{\{occup=Pass-through\}}$
$y_j = \mathbb{1}_{\{occup=worker\}} y_j^w + \mathbb{1}_{\{occup=Pass-through\}} (1 - \tau_d) y_j^e + \mathbb{1}_{\{Retiree\}} y_j^r$
and τ_d is the deduction rate for entrepreneurs.

C-corp's disposable income: $y_j^{cd} = \xi \min\{y_{top}, (1 - \tau_c) y_j^c\}^{1-\tau} + (1 - \tau_{\max}) \max\{0, (1 - \tau_c) y_j^c - y_{top}\}$

A.7.4 Calibration

The parametrization of the model above is almost standard to that of the model without the LFO margin. To account for the financial advantage of C-corp versus Pass-through, I assume that λ_c is greater than λ_p, and this implies that C- corporations are less constrained than pass-through entities. Specifically, following Chen et al. (2018) who use the 2003 Survey of Small Business Finance data and find that only 12 percent of S corporations raised capital from an external source while this figure is 29.4 percent for C corporations. In cases where an S corporation had additional equity, only 6.0 percent raised capital from an external source. In contrast, 14.2 percent of small C corporations raised additional equity from external sources. They even conclude that certain C corporations are as much as eight times more likely to receive external equity financing

as pass-through firms. I targeted a middle value of 4. The current calibration provides $\lambda_c = 3.5 * \lambda_p$, where $\lambda_p = 1.5$.

Table 10: Targets: Data and Model

	Data	**Model**
Fraction of C corporation	0.230	0.233
Share of business income held by C-corp	0.44	0.41
C-corporation financial constraint (λ_c)	$4 * \lambda_p$	$3.5 * \lambda_p$
Employment percent of C corporations	0.490	0.420
Fraction of new entry of Pass-Through Firms	0.089	0.075
Fraction of new entry of C Corporation	0.022	0.014
Entrepreneurs' share of Total income	0.200	0.208
Wealth Gini	0.840	0.860
Percentage of wealth in top 1%	0.340	0.390
Percentage of wealth in top 10%	0.720	0.760
Income Gini	0.549	0.546

The following tables are a summary of some findings between different models/data the sensitivity of the LFO margin when taxes are changed. I report some elasticities of labor productivity and the average firm TFP.

Table 11: Comparison of elasticities I

	Share of C-corp
Dyrda and Pugsley (2018) stylized facts from the TRA86	
percentage point (pp) change	-5.5
pp change in corp. tax (23.9 $\rightarrow$ 28.2)	4.3
1 pp increase τ_c	1.3 pp decrease
Chen et al. (2018) with LFO	
1 pp decrease in τ_c (28.5 $\rightarrow$ 20)	1.2 pp increase
Goolsbee (2004) (Regressions results)	
1 pp decrease in τ_c	2.5 pp increase
Current baseline with LFO	
1 pp decrease in τ_c (29 $\rightarrow$ 21)	0.08 pp decrease
	Average labor productivity (Y/L)
Chen et al. (2018) with LFO	
% change in Y	1
% change in τ_c (28.5 $\rightarrow$ 20)	-26.32
elasticity of (Y/L) w.r.t τ_c	-0.03
Barro and Furman (2018)	
% change in Y	3.1
% change in τ_c (38 $\rightarrow$ 26)	-31.58
elasticity of (Y/L) w.r.t τ_c	-0.1
Current baseline with LFO	
% change in Y	0.07
% change in τ_c (29 $\rightarrow$ 21)	-27.58
elasticity of (Y/L) w.r.t τ_c	-0.21
Current baseline without LFO	
% change in Y	0.03
% change in τ_c (29 $\rightarrow$ 21)	-27.58
elasticity of (Y/L) w.r.t τ_c	-0.12
	Average firm TFP (Z)
Chen et al. (2018) with LFO	
% change in Z	-0.3
elasticity of (Z) w.r.t τ_c	0.01
Sedláček and Sterk (2019)	
% change in Z	2.00
% change in τ_c (35 $\rightarrow$ 21)	-40.0
elasticity of (Z) w.r.t τ_c	-0.05
Current baseline with LFO	
% change in Z	-0.18
elasticity of (Z) w.r.t τ_c	0.01
Current baseline without LFO	
% change in Z	-1.8
elasticity of (Z) w.r.t τ_c	0.06

Note: % change numbers are those reported by the authors. The corresponding corporate tax cut implemented in each paper is also reported whenever the paper/model is cited for the first time. I then deduct each elasticity using its standard formula. p.p. = percentage point.

Chen et al. (2018) find in their LFO framework that cutting the tax rate from 35% to 20% increases the output level by 1.3% in the long-run, and by 4.0% when the corporate tax is completely eliminated. This magnitude is drastically lower as compared to the 42% (or 24% without immediate expensing) found in Sedláček and Sterk (2019). Consequently, the induced elasticity is 26 time (-1.05/-0.04) higher than that of Chen et al. (2018). More importantly, my two benchmarks (with and without LFO) are quantitatively similar.

Table 12: Comparison of elasticities II

	Output (Y)
Chen et al. (2018) with LFO	
% change in Y	1.3
% change in τ_c (28.5 $\rightarrow$ 21)	-26.32
elasticity of (Y) w.r.t τ_c	-0.04
Sedláček and Sterk (2019)	
% change in Y	42
% change in τ_c (35 $\rightarrow$ 21)	-40.0
elasticity of (Y) w.r.t τ_c	-1.05
Current baseline with LFO	
% change in Y	5.1
% change in τ_c (29 $\rightarrow$ 21)	-27.58
elasticity of (Y) w.r.t τ_c	-0.18
Current baseline without LFO	
% change in Y	2.65
% change in τ_c (29 $\rightarrow$ 21)	-27.58
elasticity of (Y) w.r.t τ_c	-0.10

Note: % change numbers are those reported by the authors. I then deduct each elasticity using its standard formula.

A.8 Comparison of age distributions in the long run

This section discusses the main differences in the age distribution between Sedláček and Sterk (2019) and the current setup. Sedláček and Sterk (2019) predict a sharp increase in the share of young firms and a reduction of older firms in the new economy due to the strong entry/exit channel. They find that the average entry rate increases by 95%. A given firm in their model either exit or stay in the production sector and all firm in their universe are treated as C-corp. Therefore, the potential positive incentives for S-corps that would have dampened the large entry of new firm is not taken into account.

On the other hand, the household side is an important aspect in the current setup, which could potentially create mixed results about the firm dynamics. For instance, entrepreneurs accumulate business experience through *learning-by-doing*, which later increases their productivity and can reduce their exit rate. When I consider the model without the human capital channel with a corporate tax cut, the difference is not quantitatively significant for older firms (over than 15 years). Since the return on business experience is less than one (the exponent θ of variable κ in the model), the high accumulated business experience at some point no longer increases the firm's value for old entrepreneurs.

Table 13: Long-run change in age distribution

	Age distribution				
	< 1	$1-5$	$6-10$	$11-15$	> 15
Data	9.8	29.4	18.4	12.9	29.5
Sedlacek and Sterk (2019)					
- Baseline	13.8	34.3	17.9	11.6	22.3
- After reform	28.7	51	13.2	4.5	2.6
- change in percentage point	14.9	16.7	-4.7	-7.1	-19.7
Current baseline with business experience					
- Baseline	10.5	22.9	27.9	20.2	18.5
- After reform (all provisions)	9.8	22.5	27.9	20.6	19.2
- change in percentage point	-0.7	-0.4	0.01	0.4	0.7
Current baseline with business experience					
- Baseline	10.5	22.9	27.9	20.2	18.5
- After reform (only corp. tax cut)	10.6	23.0	27.6	20.3	18.45
- change in percentage point	0.1	0.2	-0.3	0.1	-0.07
Current baseline without business experience					
- Baseline	13.3	32.9	31.42	14.6	7.84
- After reform (only corp. tax cut)	13.2	33.2	31.36	14.5	7.79
- change in percentage point	-0.1	0.3	-0.06	-0.1	-0.06

Note: Data are from the Business Dynamics Statistics as reported by Sedláček and Sterk (2019) . " < 1" in my model corresponds to the category of firm with exactly 1 year. The equivalent of the category " 1 - 5 " is " 2 - 5 " in the present model. The model without business experience is calibrated to match the same moment targets as in the baseline with accumulation of experience.

In addition, the literature has underscored the relevance of financial constraints in the model considered in this type of model. The existence of financial constraints works as an entry cost for a would-be entrepreneur to the extent that personal wealth plays as collateral. Since it takes time to build up some savings to overcome these financial frictions, younger workers who usually have little or no net worth then save and wait before starting to run a business. The life-cycle structure of the model induces a positive

correlation between age and net worth, thereby generating more old entrepreneurs in the economy. For example, *figure 10: Entrepreneurship by age in online Appendix A.2* gives an overview of the non-targeted age profile of entrepreneurs, entry and exit rates in the data and two versions of the model. Overall, the models tend to fit the general pattern of the data.

I acknowledge that the modelling devises and assumptions generate a large difference between the current baseline and theirs quantitatively. However, qualitatively the present model induces the same trend when only the corporate tax is cut: an increase in young firms' share and a decrease in older firms' share.

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