Income Taxes and Entrepreneurship

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May 11, 2026

Abstract

We estimate the optimal tax rate on entrepreneurial income in a model with occupational choice and endogenous investment in sweat capital—intangible capital built through owner effort that cannot be pledged or rented. The model is parameterized to match U.S. national accounts and administrative tax data, including the distribution, persistence, and concentration of business income. Accounting for sweat investment fundamentally alters both tax elasticities and optimal tax prescriptions. In our baseline calibration, the optimal tax rate on entrepreneurial income is 25 percent, above the current effective U.S. rate of roughly 20 percent but far below estimates from models that abstract from sweat investment. Models without endogenous sweat capital generate near-zero elasticities and optimal rates above 60 percent. We show that transitional dynamics are quantitatively important: ignoring them overstates both optimal tax rates and welfare gains. Our results imply that endogenous entrepreneurial investment substantially moderates optimal taxation of business income.[1]

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[1]This research has been supported by National Science Foundation grant SES-2214248. The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

1 Introduction

Estimates of the optimal tax rate on business income vary substantially across studies of the U.S. tax system—ranging from values near zero or negative to rates well above current U.S. effective levels. If business financing is imperfect, subsidies on business profits can be welfare-improving because resources are effectively reallocated to more productive firms. If household transfers are too low, high tax rates on top earners can provide welfare-improving insurance and redistribution to those in lower income brackets. These two forces—productive efficiency versus insurance—push optimal tax rates in opposite directions. In this paper, we evaluate these forces in a model with occupational choice and investment in sweat capital that is parameterized with data from the U.S. national accounts and administrative tax filings. We consider both the transitional dynamics and welfare gains as we vary key parameters governing the cost of investment, business entry and exit, and income risk.

The model we consider is an incomplete-markets economy populated by individuals that make occupational choices between paid-employment and entrepreneurship. Paid employees can work for the entrepreneurs or in the corporate sector. To be an entrepreneur requires some effort in accumulating sweat capital—for example, the business customer base, tradename, and other intangible assets—before production can occur. Unlike tangible capital, which is also used in production, sweat capital cannot be rented or pledged. Two versions of the model are considered: one with fixed sweat capital and one with variable sweat capital that owners must build. To investigate the role of business financing, we introduce collateral constraints and vary their severity from a baseline parameterization calibrated to U.S. data on firm loans.

Our policy experiments involve changing the tax rate on business income of entrepreneurs. We exploit recent advances in computing transitional dynamics in models with discrete choices to analyze the impacts of the reform and to find the optimal tax rate. For our baseline parameterization based on U.S. data, we find an optimal rate of 25 percent. Since most business owners in the United States are currently subject to little or no third-party reporting, the effective tax rate on their business profits is about 20 percent—below our optimal rate and well below rates paid by wage and salary earnings. A rate of 25 percent is also well below the estimates of Brüggemann (2021) and Imrohoroglu et al. (2023), who study optimal taxation of high earners—in both paid-and self-employment. These studies find optimal rates around 60 percent.[2]

In order to assess the main source of differences between our results and those in the literature, we start by comparing the two versions of our model with fixed and variable sweat capital. Transitional dynamics and welfare impacts in the fixed-sweat model are starkly different from the variable-sweat model. In the fixed-sweat case, the percent change in entrepreneurial profits after increasing the business tax rate to its statutory level is roughly zero and thus the implied tax elasticity is roughly zero as well. The optimal tax rate in this case is 61 percent and nearly the same as the estimates of Brüggemann (2021) and Imrohoroglu et al. (2023). When we allow owners to invest in sweat capital and calibrate the model to administrative tax data, we find significant changes in profits if we increase the tax rate on business income. Since these changes depend on the post-reform horizon, we compute a 2-year elasticity in order to compare to the recent estimate of Goodman et al. (2024). Goodman et al. (2024) use administrative records of taxpayers with different levels of exposure to the Section 199A deduction of 2018, which reduced the effective tax rate on pass-through business income. Translating the policy response into an elasticity with respect to the net-of-tax rate, they find an estimate of 0.75. We find a slightly lower elasticity of 0.64, which we can decompose into extensive versus intensive responses and by subgroups of the population at the time of the reform. The most responsive groups are start-ups in the year of the reform and large incumbent firms.

An investigation of the role played by financing constraints in the variable-sweat model reveals little sensitivity of our main results to the collateral requirement. If we vary the collateral requirement to generate values of business loans to GDP that are half to twice the U.S. share, the implied range for the optimal tax rate is between 22 and 29 percent. These rates are well above estimates of Guvenen et al. (2023), who find it optimal to subsidize business income in order to reallocate resources from low to high-productivity entrepreneurs.[3]

[2] Bhandari, Evans, and McGrattan (forthcoming) also find an optimum close to 60 percent in a model with fixed sweat capital.

[3] Bhandari, Evans, and McGrattan (forthcoming) also find that estimates of optimal tax rates are not sensitive to the collateral requirement in a model with fixed sweat capital.

2 Related Literature

The model we analyze nests two canonical frameworks. If we abstract from self-employment, the individual in our model is similar to one analyzed by Aiyagari (1994) or Aiyagari and McGrattan (1998). Studies based on these models that are focused on paid employees typically find that U.S. transfer levels are too low from a utilitarian planner's perspective. Optimal income-tax reforms can improve welfare through better insurance and redistribution by financing increased transfers with higher tax rates and progressive taxation. See, for example, Heathcote, Storesletten, and Violante (2017), Ferrière et al. (2023), and Bhandari et al. (2025). If we abstract from paid-employment, the individual in our model is similar to one analyzed by Lucas (1978), Quadrini (1999), or Cagetti and De Nardi (2006). Studies based on these models that are focused on entrepreneurs typically find that U.S. financial markets are imperfect, implying borrowing or collateral constraints are too tight. Optimal income-tax reforms can improve welfare through better allocation of productive resources with lower tax rates or subsidies to the most productive firms. See, for example, Guvenen et al. (2023) and Boar and Midrigan (forthcoming).

We build most closely on Bhandari and McGrattan (2021) and Bhandari, Evans, and McGrattan (forthcoming) that study income taxes in models of occupational choice. Our contribution here is twofold: (*i*) incorporating sweat investment into optimal tax analysis and (*ii*) solving for full transition dynamics calibrated to administrative data.

3 Theory

We analyze a discrete-time incomplete-markets economy with occupational choice, which is populated by a continuum of infinitely lived individuals. Individuals face idiosyncratic risk and make occupational choices between entrepreneurship and paid-employment. Entrepreneurs actively manage their own businesses. Paid-employees can work for one of the entrepreneurs or for a stand-in corporate firm. The government levies taxes on earnings, business profits, and consumption to finance spending on goods and services and lump-sum transfers.

Let d_{it} be the discrete choice made by individual $i \in [0, 1]$ at time t. We set d equal to zero if the individual chooses to be an entrepreneur and to one if the individual chooses to be a paid employee. We assume that the choice depends on their initial asset holdings, their productivities in the two activities, and an idiosyncratic taste for paid-employment. The beginning-of-period assets include financial assets, $a_{i,t-1}$, and sweat capital, $\kappa_{i,t-1}$. The levels of productivity are z_{it} and ε_{it} for individual i if running a business or working as an employee in t, respectively. For convenience, we stack the productivity shocks into a vector s_{it}. We include a taste shock ξ_{it}—which has a Gumbel distribution—to capture non-pecuniary reasons for choosing self-employment and, in simulations abstracting from such motivations, to aid computation of transitional dynamics.

Let $v_t^o(a_{i,t-1}, \kappa_{i,t-1}, s_{it})$ be the value of an individual in occupation $o \in \{w, b\}$—where w is *working* in paid-employment and b is running a *business*—that depends on one's financial wealth $a_{i,t-1}$, sweat capital $\kappa_{i,t-1}$, and productivity vector s_{it}. Let $v_t(a_{i,t-1}, \kappa_{i,t-1}, s_{it}, \xi_{it})$ be the value of the same individual before choosing an occupation but after observing the taste shock ξ_{it}. The occupational choice can be summarized as the solution to:

$$\begin{aligned} v_t(a_{i,t-1}, \kappa_{i,t-1}, s_{it}, \xi_{it}) = \max_{d_{it} \in \{0,1\}} \; & d_{it}\{v_t^w(a_{i,t-1}, \kappa_{i,t-1}, s_{it}) + \xi_{it}\} \\ & + (1 - d_{it}) v_t^b(a_{i,t-1}, \kappa_{i,t-1}, s_{it}). \end{aligned} \tag{1}$$

Entrepreneurs have a production technology $y_b = zf(\kappa, k_b, n_b)$ that depends on the sweat capital (κ) they have built up in the business and external capital (k_b) and labor (n_b) that can be rented in spot markets. They bear a utility cost for their effort (e) to update the sweat capital stock, which depreciates at rate δ_κ. Entrepreneurs choose consumption, savings, and effort to build sweat capital, taking wages and rental rates as given. The value function for entrepreneurs is given by

$$v_t^b(a_{i,t-1}, \kappa_{i,t-1}, s_{it}) = \max_{\substack{c_{it}, e_{it}, \kappa_{it} \\ a_{it}, k_{b,it}, n_{b,it}}} u(c_{it}) - \vartheta(e_{it}) + \beta \mathbb{E}_t[v_{t+1}(a_{it}, \kappa_{it}, s_{i,t+1}, \xi_{i,t+1})] \tag{2}$$

$$\text{subject to} \quad a_{it} = (1 + r_t) a_{i,t-1} + (1 - \tau_{bt}) \pi_{it} + \psi_t - (1 + \tau_{ct}) c_{it} \geq 0 \tag{3}$$

$$\kappa_{it} = (1 - \delta_\kappa) \kappa_{i,t-1} + e_{it} \tag{4}$$

$$\pi_{it} = z_t f(\kappa_{i,t-1}, k_{b,it}, n_{b,it}) - (r_t + \delta_k) k_{b,it} - w_t n_{b,it} \tag{5}$$

$$k_{b,it} \leq \chi a_{i,t-1}, \tag{6}$$

where the utility function satisfies $u'(c) > 0$ and $u''(c) < 0$, the disutility function satisfies $\vartheta'(e) > 0$ and $\vartheta''(e) > 0$, and $\beta \in (0, 1)$ is the discount factor. The end-of-period financial asset position

a_{it} depends on the beginning-of-period position plus the net return on those assets $r_t a_{i,t-1}$, profits from running the business π_{it} over the period less taxes owed $\tau_{bt}\pi_{it}$, government transfers ψ_t, and consumption purchases c_{it} and sales taxes $\tau_{ct}c_{it}$. The end-of-period sweat capital stock depends on the beginning-of-period stock $\kappa_{i,t-1}$ less depreciated capital $\delta_\kappa \kappa_{i,t-1}$ plus effort e expended during the period to build the stock. Business profits π_{it} are equal to payments for the business output y_{bt} less payments for capital $(r_t + \delta_k)k_{b,it}$ and labor $w_t n_{b,it}$. Owners take the rental $r_t + \delta_k$ and wage rates as given. Finally, the entrepreneurs face a collateral constraint with requirement $\chi > 1$.

The problem for workers is similar to that analyzed by Aiyagari (1994) with one critical difference. Workers that were previously business owners might have some accumulated sweat capital, although here we assume that this capital cannot be deployed while working as a paid employee. Instead, the capital deteriorates at rate λ while working for someone else. The parameter λ captures the idea that customer bases and tradenames lose value if an owner is not actively running the business and using these assets. The value function for the workers is given by

$$v_t^w(a_{i,t-1}, \kappa_{i,t-1}, s_{it}) = \max_{c_{it}, a_{it},} \; u(c_{it}) + \beta \mathbb{E}_t[v_{t+1}(a_{it}, \kappa_{it}, s_{i,t+1}, \xi_{i,t+1})] \tag{7}$$

$$\text{subject to} \;\; a_{it} = (1+r_t)a_{i,t-1} + (1-\tau_{wt})w_t\varepsilon_{it}\bar{n} + \psi_t - (1+\tau_{ct})c_{it} \geq 0 \tag{8}$$

$$\kappa_{it} = (1-\lambda)\kappa_{i,t-1}, \tag{9}$$

where τ_{wt} is the tax rate levied on employee earnings. Our focus here is on the entrepreneurial choice and thus assume a fixed workweek $\bar{n}$ (which will be normalized to 1) and inelastically supplied labor.

The processes governing productivity in entrepreneurship and paid-employment are assumed to be autoregressive:

$$\ln z_{t+1} = \rho_z \ln z_t + \varsigma_{z,t+1} \tag{10}$$

$$\ln \varepsilon_{t+1} = \rho_\varepsilon \ln \varepsilon_t + \varsigma_{\varepsilon,t+1}, \tag{11}$$

in logarithms. In anticipation of matching these processes to micro data, we use simple Gaussian innovations for ς_ε in the workers' problem but allow for more general right-skewed innovations ς_z in the business owners' problem. More specifically, we use an exponentially modified Gaussian (EMG) distribution:

$$\varsigma_{zt} = \mu_z + \sigma_z \Upsilon_{t+1} + \Omega_{t+1}, \tag{12}$$

where $\Upsilon \sim N(0,1)$ and $\Omega \sim Exp(\lambda_z)$. In this case, the right-skewness is driven by the parameter λ_z.

The workers are employed by the entrepreneurs or by a representative firm that operates in the corporate sector with a constant returns to scale production technology:

$$y_{ct} = AF(k_{ct}, n_{ct}), \tag{13}$$

where A is a parameter measuring the level of total factor productivity, k_{ct} is corporate capital, and n_{ct} is corporate labor.[4] Corporations maximize the present value of dividends paid to individual shareholders after paying for their workers' wages $w_t n_{ct}$, new investments x_{ct}, and corporate income taxes:

$$d_{ct} = y_{ct} - w_t n_{ct} - x_{ct} - \tau_{pt}(y_{ct} - w_t n_{ct} - \delta_k k_{ct}) \tag{14}$$

$$x_{ct} = k_{c,t+1} - (1-\delta_k)k_{ct}, \tag{15}$$

taking wage and tax rates as given.

In equilibrium, factor prices clear the asset and labor markets and we ensure that the goods market clears by checking the government's budget is balanced. The government spends g_t on goods and services, ψ_t on transfers to households, and pays interest on the stock of debt b_t at the rate r_t paid on financial assets. Inflows of revenues come from issuing new debt and from taxes. We can summarize the market clearing conditions as follows:

$$k_{ct} + \int k_{b,it}\mu(i)\,\mathrm{d}i = \int a_{i,t-1}\mu(i)\,\mathrm{d}i \tag{16}$$

$$n_{ct} + \int (1-d_{it})n_{b,it}\mu(i)\,\mathrm{d}i = \int d_{it}\varepsilon_{it}\mu(i)\,\mathrm{d}i \tag{17}$$

$$g_t + \psi_t + r_t b_{t-1} = \Delta b_t + \tau_{ct}\int c_{it}\mu(i)\,\mathrm{d}i + \tau_{wt}\int d_{it}w_t\varepsilon_{it}\mu(i)\,\mathrm{d}i$$

[4] When we calibrate the model, we will include production of non-defense government goods and services since households are the primary beneficiaries of these purchases and the suppliers of labor in federal, state, and local government.

$$+ \tau_{bt} \int (1 - d_{it}) \pi_{it} \mu(i) \, \mathrm{d}i + \tau_{pt}(y_{ct} - w_t n_{ct} - \delta k_{ct}), \tag{18}$$

where $\mu(i)$ is the measure over individuals indexed by i.

Given initial conditions $\{a_{i,-1}, \kappa_{i,-1}, s_{i,0}\}_{i \in [0,1]}$ for financial assets, sweat capital, and shocks, a competitive equilibrium consists of factor prices for capital and labor $\{r_t, w_t\}_{t \geq 0}$, individual choices $\{c_{it}, a_{it}, \kappa_{it}, d_{it}, k_{b,it}, n_{b,it}\}_{t \geq 0, i \in [0,1]}$, corporate factor input choices $\{k_{ct}, n_{ct}\}_{t \geq 0}$, and government fiscal variables $\{g_t, \psi_t, b_t, \tau_{ct}, \tau_{wt}, \tau_{bt}, \tau_{pt}\}_{t \geq 0}$ such that (i) given prices and fiscal policies, individual choices solve the worker and entrepreneur problems; (ii) corporate choices maximize profits; (iii) the government budget constraint holds; and (iv) markets clear. In our quantitative work, we will assume that there is growth in the economy and will therefore detrend variables before computing the equilibrium. The growth rate γ will be included as a parameter.

To compute the equilibrium transition paths following a tax reform, we solve the system of equations consisting of individual optimality conditions, market clearing conditions, and expectations over taste shocks. If convergence to a post-reform steady state takes many periods—which will be the case for our model because sweat capital evolves slowly and productivity shocks are persistent and right-skewed—a good first guess for the sequence of prices and policies is necessary. To compute this guess, we apply the perturbation method developed by Bhandari, Evans, and McGrattan (forthcoming) that is applicable to problems with transition dynamics and discrete choice. The idea is to replace the large system of equations described above with a Taylor expansion around the post-reform steady state. Bhandari, Evans, and McGrattan (forthcoming) show how to characterize the transition path as a sequence of linear systems to solve directional derivatives—that is, derivatives of endogenous variables in the direction of the status quo before a reform has occurred. To apply this perturbation method, users pre-compute coefficients of the linear systems from the Taylor expansion using variable means in the final state. With all coefficients in linear systems pre-computed, the construction of the transition path is fast, scalable, and efficient. This approximate transition path is then the starting point for the standard global solution method.

Table 1: Model Parameters

Parameter	Expression	Value
Preferences		
Relative risk aversion	σ	2.00
Discount factor	β	0.97
Growth (%)	γ	2.00
Gumbel scale parameter	σ_ξ	0.03
Scale of effort disutility	ω	0.50
Curvature of effort disutility	η	1.75
Technologies		
Private business sweat capital share	ϕ	0.30
Private business labor share	ν	0.41
Private business fixed asset share	α	0.29
Corporate fixed asset share	θ	0.53
Sweat capital depreciation (%)	δ_κ	5.80
Sweat capital deterioration (%)	λ	100
Fixed asset depreciation (%)	δ_k	4.10
Collateral requirement	χ	5.00
Corporate TFP	A	0.71
Productivity processes		
Persistence of $\ln z$	ρ_z	0.64
Standard deviation of Gaussian innovation	σ_z	0.01
EMG exponential tail parameter	λ_z	4.00
Persistence of $\ln \varepsilon$	ρ_ε	0.74
Standard deviation of Gaussian innovation	σ_ϵ	0.18
Government financing		
Defense spending (level)	G	0.14
Debt (level)	B	3.40
Tax rate on business income	τ_b	0.20
Tax rate on labor income	τ_w	0.37
Tax rate on consumption	τ_c	0.06
Tax rate on corporate income	τ_p	0.20

Notes: See Section 4 for details of the parameterization of the model.

4 Calibration

We parameterize the model to match aggregate and micro U.S. data. The main sources of aggregate data are national income and products accounts compiled by the Bureau of Economic Analysis and aggregate tax statistics compiled by the Internal Revenue Service. The main source of micro data is administrative tax data compiled by Bhandari et al. (forthcoming). We start by summarizing our baseline parameterization and then report statistics for the model fit.

4.1 Model Parameters

In Table 1, we report the parameters that we use in calibrating the model, including those related to preferences, technologies, productivity, and government financing. For preferences, we use the following functional forms: $u(c) = [c^{1-\sigma} - 1]/(1-\sigma)$ and $\vartheta(e) = \omega e^{\eta}/\eta$. Choices for the relative risk aversion parameter σ, the discount factor β, and the growth rate are standard. The new preference parameters are those related to the taste shock σ_{ξ} and the disutility of effort, $\vartheta(e)$. The taste shock is relatively small and intended to help with computation. For our baseline parameterization, we set the scale parameter of $\vartheta(e)$ equal to $\omega = 0.50$ and the curvature parameter equal to $\eta = 1.75$.

In Figure 1, we show qualitatively how the choice of $\vartheta(e)$ will affect private business exit rates as they age—and why the patterns can help with identification.[5] These identification patterns exploit the fact that sweat investment is front-loaded early in a firm's life. The scale parameter ω directly affects the utility cost of building sweat capital, which must be done before new business owners can produce. If we were to lower this cost by lowering ω, we would find higher exit rates for young businesses. Lowering ω effectively lowers the cost of entry, implying a higher exit rate among the marginal entrants with lower productivity. The curvature parameter η affects the elasticity of effort. If we increase η, we find that the exit hazard function steepens, with higher exit rates at younger business ages and lower exit rates at older ages. In the limit, effort is inelastically supplied.

The next set of parameters in Table 1 are production shares, depreciation rates, the collateral requirement, and corporate TFP. We use the following functional forms for production: $f(\kappa, k_b, n_b) = \kappa^{\phi} k_b^{\alpha} n_b^{\nu}$ and $F(k_c, n_c) = k_c^{\theta} n_c^{1-\theta}$. Values for production shares ϕ, ν, α, and θ ensure that the gross domestic income shares to sweat capital, worker compensation, and capital income

[5] In drawing these variations, we assume that total factor productivity in corporate production is adjusted to ensure that the share of sweat income in gross domestic income remains constant.

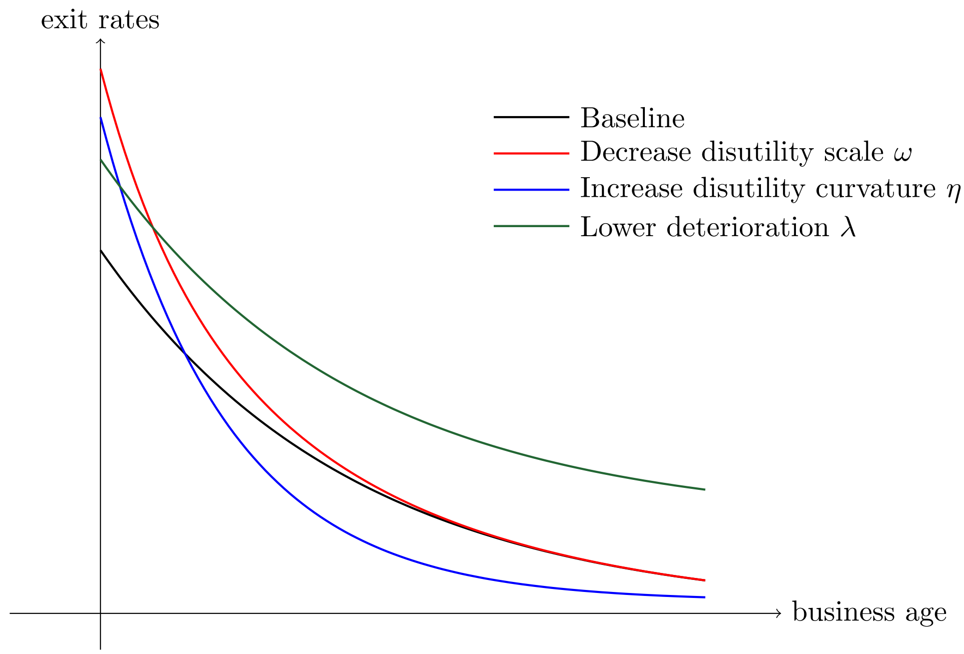
are the same in the model as in the U.S. national accounts. The depreciation rates for sweat capital and fixed assets are consistent with data published by the General Accounting Office and Bureau of Economic Analysis. (See details in Bhandari and McGrattan (2021).) The deterioration rate λ is not standard and is identified along with the parameters of $\vartheta(e)$ using private business exit rates. In Figure 1 we show that a lowering of the rate increases exit rates at all business ages. If λ is close to 0, owners can costlessly switch between paid- and self-employment. If λ is close to 1, they lose all of the sweat capital when switching to paid-employment. In our baseline, we set $\lambda = 1$ to keep the exit rates near values documented in Bhandari et al. (forthcoming). The collateral requirement χ is chosen to ensure that the ratio of loans for entrepreneurs actively managing their businesses to economy-wide GDP is similar to U.S. levels. Here we make a conservative estimate of 39.8 percent for the United States based on loans of partnerships and S corporations[6] The level of corporate TFP is chosen to ensure that activity in the corporate and entrepreneurial sectors match U.S. levels.

The next set of parameters in Table 1 are the productivity processes. The parameterization of these processes are disciplined by IRS data compiled by Bhandari et al. (forthcoming) on income growth profiles and autocorrelations of self- and paid-employed earnings over the lifecycle and the concentration of business incomes in the upper tail of the distribution. These moments can be used to parameterize the persistence of productivity shocks $(\rho_z, \rho_\varepsilon)$, the standard deviations of the Gaussian innovations $(\sigma_z, \sigma_\varepsilon)$, and the EMG exponential tail parameter λ_z.

The final set of parameters are related to government finance, namely, the level of spending on goods and services G, the level of debt B, and all tax rates. We should note that our choices ensure that the government financing in the model is consistent with that of the combined fiscal system in the United States, including federal, state, and local government expenditures and revenues. Because so many U.S. workers are government employees, we include government enterprises with our "corporate" sector. We think of this more broadly as all other production outside of private business production. We also include with consumption any spending on public goods and services normally included with federal non-defense spending and state and local spending—for example, education, transportation, and health—that does not include spending on fixed assets. We include

[6]Ideally, we would also include sole proprietorships and small C corporations with owners that actively manage their firms, but do not have aggregate balance sheet data for these businesses.

Figure 1: Identification of Key Parameters



Notes: See Section 4.1 for a description of these alternative economies.

government non-defense spending on fixed assets with investment.

4.2 Model Fit

Next, we confirm the model fit by comparing the model's pre-reform steady state with U.S. macro data from the national accounts and micro data from IRS tax filings.

In Table 2, we report model and U.S. income and product shares in the upper panel and government expenditures and tax revenues shares in the lower panel. We have made adjustments to U.S. GDP to exclude sales taxes and to include (*i*) consumer durable depreciation and associated capital services; (*ii*) an estimate of misreported S-corporate income based on IRS audits; and (*iii*) an estimate of investment in intellectual property products not currently included in the accounts. When categorizing incomes, we have introduced a separate category called "sweat income," which represents distributed labor earnings of pass-through business owners that run sole proprietorships, partnerships, and S corporations. More formally, sweat income is the BEA measure of proprietors'

Table 2: Model Fit for National Accounts

	Model	Data
GDP shares	100	100
Consumption	66.8	66.7
Investment	29.1	29.2
Defense	4.1	4.1
GDI shares	100	100
Sweat income	9.0	9.0
Compensation	45.5	46.2
Capital income	45.5	44.8
Expenditures (% of GDP)	27.2	26.2
Transfers	20.6	19.7
Net interest	2.5	2.5
Defense	4.1	4.1
Revenues (% of GDP)	27.2	26.2
Taxes on income	23.2	22.2
Taxes on consumption	4.0	4.0

Notes: The data source is the Survey of Current Business and a detailed description of the income categories is provided in the appendix of Bhandari and McGrattan (2021). The model predictions are based on simulations of the initial pre-reform steady state.

income net of imputed capital income plus post-audit estimates of S-corporate business income and compensation from the IRS. The remaining categories of income are “compensation,” which is the BEA measure of wages, salaries, and employee benefits less any Form W-2 compensation to owners and “capital income,” which is all non-labor payments including corporate profits, rental income, interest income, consumption of fixed assets, and an estimate of proprietors’ capital income. (See the appendix to Bhandari and McGrattan (2021) for details.) The match between model and data in Table 2 is close by construction given we chose the production functions, spending levels, and tax rates to ensure this fit. As we noted earlier, consumption and investment include private and public spending and transfers include non-defense spending.

In Table 3, we report model predictions related to business incomes and associated moments from IRS tax filings of pass-through owners compiled by Bhandari et al. (forthcoming). The top

Table 3: Model Fit for Business Incomes

		Model	Data
Profit share	Top 10%	0.62	0.70
Profit growth	10^{th} percentile	$-$ 0.69	-0.54
	25^{th}	$-$ 0.57	-0.20
	50^{th}	$-$ 0.32	0.02
	75^{th}	0.29	0.32
	90^{th}	1.77	1.09
	Autocorrelation	$-$ 0.14	-0.18

Notes: The data source is Bhandari et al. (forthcoming). The model predictions are based on simulations of the initial pre-reform steady state.

row shows the profit share of the highest earning 10 percent of owners. In the data this is 70 percent of profits. The model prediction at 62 percent is close in large part because the right-skewed EMG innovation is critical for matching the profit concentration. A high concentration is achievable with the Gaussian innovation but will lead to patterns of income growth that are inconsistent with the data. These patterns are shown next in Table 3. The specific patterns of income growth that are compared are year over year percent changes and rank autocorrelations. There is huge variation in profit growth in the data—with the U.S. incomes doubling at the 90th percentile and falling in half at the 10th. The predicted dispersion in the model is even larger but not too far off given the simplicity of our baseline parameterization. The model also does well in matching the rank autocorrelations.

In Table 4, we report model predictions related to business entry and exit and compare them to data on private businesses. The data source for exit rates is the Survey of Business Owners from the U.S. Census public-use microsample of 2007. This microsample includes data for non-publicly owned firms at the business level and at the owner level for up to four individuals. The statistics reported for the data in Table 4 under "Exit rate by business age" uses the business establishment data and the answer to question "Is the business currently operating?" The business age is computed by taking the survey year (2007) and subtracting the establishment year for businesses that provide an answer to the question about currently operating.

Table 4: Model Fit for Entry and Exit Rates

	Model	Data
Entry rate, average	0.03	0.02
Exit rates		
By business age, ≤ 1	0.36	0.37
2–6	0.21	0.19
> 6	0.11	0.11
all	0.24	0.21

Notes: The data source for exit rates by business age is the U.S. Census Survey of Business Owners public-use microsample of 2007. Model exit rates are based on simulations of the initial pre-reform steady state. To compute exit rates by business age, we record an age of 0 upon entry.

For the model predictions reported in Table 4, we simulate panel data from the steady state of the baseline model. We construct the age of a business by recording the number of periods since an occupational shift from paid- to self-employment. In Table 4, we compare the exit rates of all businesses to the SBO business sample.

Entry rates are reported in the first row of Table 4 and are about 3 percent in the model and 2 percent in the data. Exit rates are shown next. The exit rates for all businesses, which are compared to SBO rates, fall with age in both the model and the data. Roughly 36 percent of the entrants in the model are exiting as compared to 37 percent in the SBO data. This rate falls to 11 percent for older businesses in the model and 11 percent in the SBO data. If we consider all ages, the model has an exit rate of 24 percent, which is slightly higher than the 21 percent in the data.

To provide a quantitative sense of these results and those shown in Figure 1, we can compare our baseline parameterization to alternatives as we vary the key parameters of the model. In Table 5, we report results for six alternatives to the baseline. The first five vary the rate of deterioration λ, the scale parameter governing disutility of effort ω, and the curvature parameter governing disutility of effort η. The exit rates reported are by business age with the baseline result shown first. Starting with the deterioration rate, we find that lowering it raises the exit rate. As we noted before, if the sweat capital deteriorates little—6 percent per year in this case—individuals can switch back and forth between occupations without sacrificing their accumulated sweat capital.

Table 5: Exit Rates Varying Key Parameters

	Parameters			Exit rate		
Model economy	λ	ω	η	Age ≤ 1	Age 2–6	Age >6
Baseline	1	0.50	1.75	0.36	0.21	0.11
Low λ	0.06	0.50	1.75	0.57	0.45	0.43
Low ω	1	0.10	1.75	0.43	0.22	0.11
High ω	1	2	1.75	0.32	0.22	0.10
Low η	1	0.50	1.50	0.34	0.22	0.18
High η	1	0.50	2.25	0.43	0.24	0.05
Fixed sweat				0.58	0.53	0.53

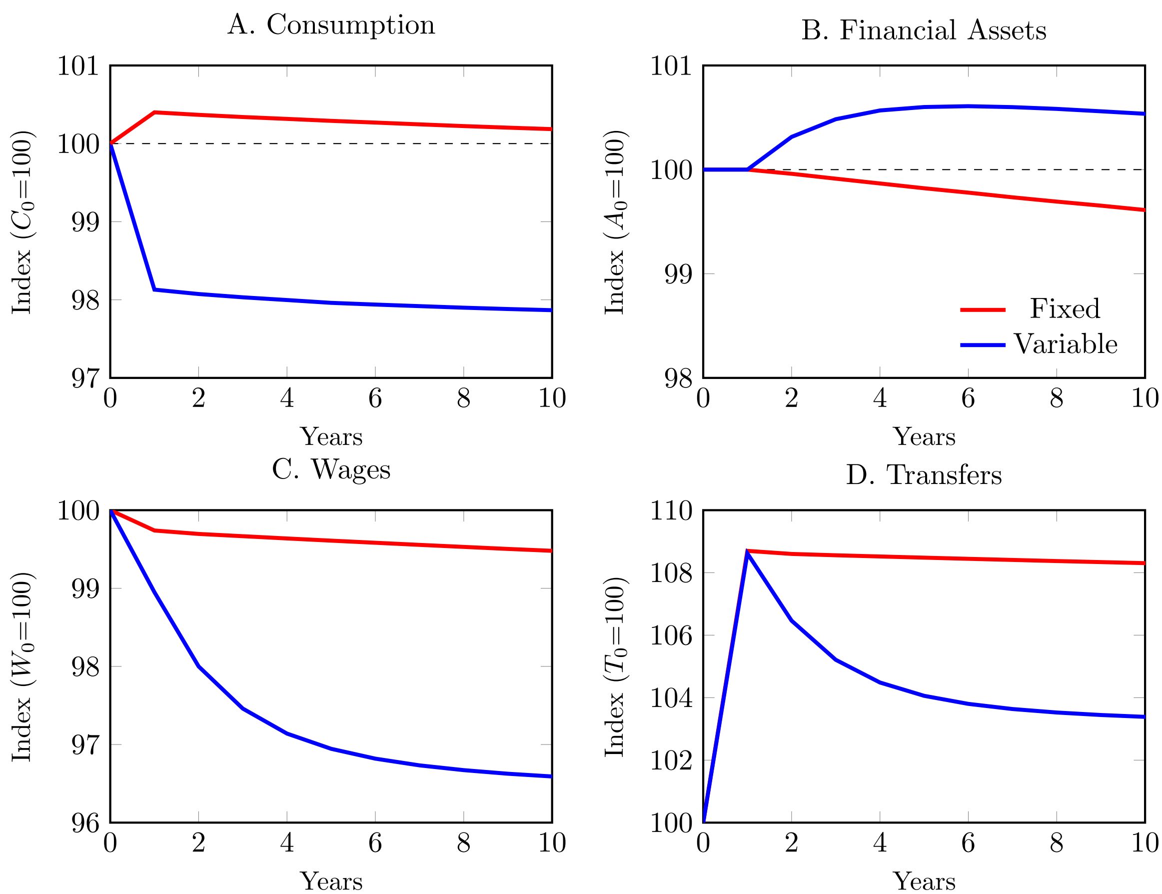
Notes: The model predictions are based on simulations of the initial pre-reform steady state.

For this parameterization, the exit rates roughly double across ages. When we vary the scale of disutility, from $\omega = 0.1$ to $\omega = 2.0$, we find that the exit rates for young businesses vary from 43 percent to 32 percent. When we vary the curvature from $\eta = 1.5$ to $\eta = 2.25$, we find a significant steepening of the curve. The final alternative is the fixed-sweat case, which has no role for the parameters listed in the first columns. For this parameterization, there is no disutility of effort given that sweat capital is a fixed factor and therefore the exit rates are high—roughly double what we find in the baseline.

5 Results

In this section, we discuss the results of our main fiscal policy experiments. The first set of results are transition dynamics following an increase in tax rates on business profits. From these transitions, we compute short- and long-term tax elasticities and compare the former to empirical estimates for pass-through businesses. The second set of results are welfare gains associated with setting the tax on business profits at the optimal level and varying government transfers. We also compute the revenue-maximizing rates, which can be compared to empirical estimates. Two variants of the model are compared in each case: one with fixed sweat capital and one with variable sweat capital.

Figure 2: Transitions Following a Business Tax Increase From 20 to 40%



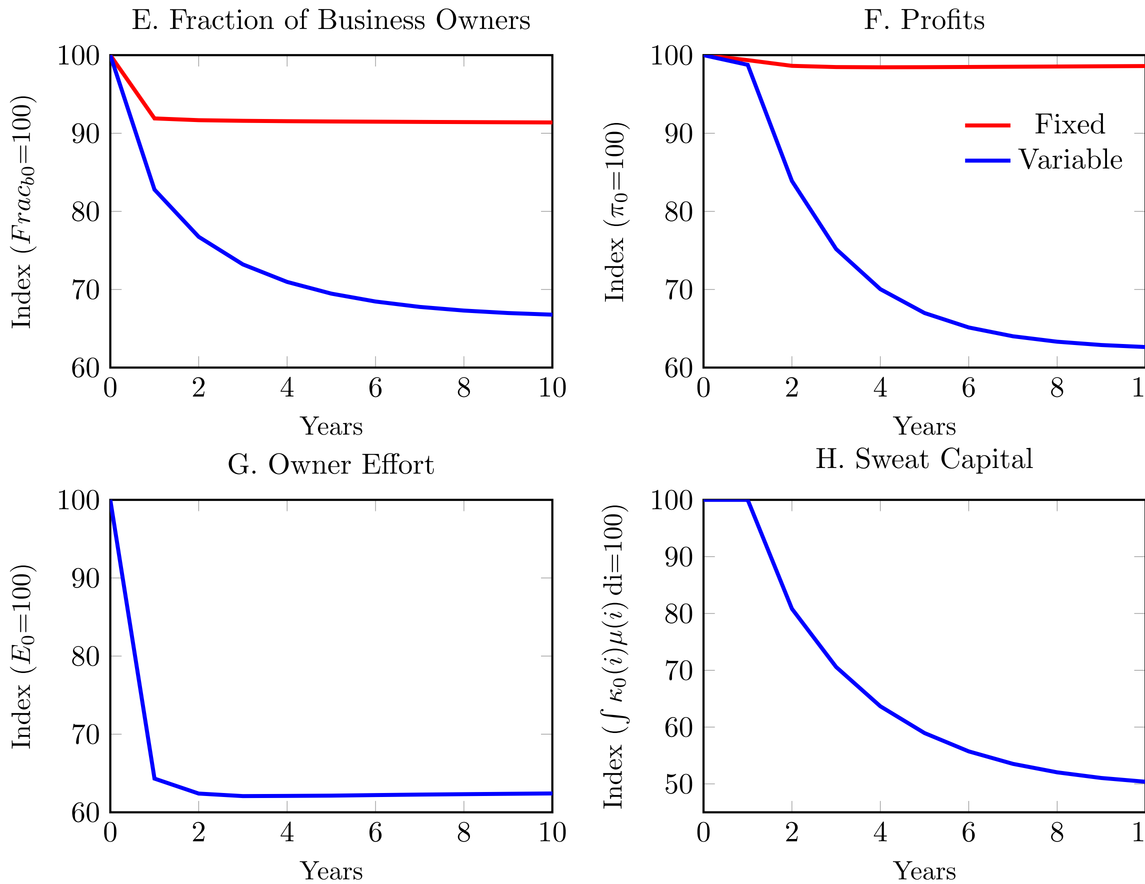
Notes: The transition paths follow an increase in the tax on business τ_b from the baseline 20 percent to 40 percent.

5.1 Transition Paths

In Figure 2, we plot aggregate predictions following an increase in τ_b from 20 percent to 40 percent. As we noted above, the effective rate of 20 percent is lower than the statutory rate because of rampant non-compliance. We interpret this reform as perfect enforcement eliminating tax evasion. The picture shows 10 years following the reform, but we should note that convergence of the state vector to a new steady state takes hundreds of model years.[7] The blue lines in each subplot show changes in the variable-sweat case relative to the initial steady state with $\tau_b = 20$ percent. The red lines are changes in the fixed-sweat case.

[7]In the baseline parameterization, we computed 800-year transition paths in order to ensure an accurate solution.

Figure 2: Transitions Following a Business Tax Increase From 20 to 40% (cont.)



Notes: The transition paths follow an increase in the tax on business τ_b from the baseline 20 percent to 40 percent.

In the first panel of Figure 2, we plot paths of aggregate consumption, financial assets, wages, and transfers. In the long-term, consumption, assets, and wages are all lower with $\tau_b = 40$ percent, regardless of whether the economy has fixed- or variable-sweat capital. The long-term change in transfers in the fixed-sweat economy is roughly double that of our baseline variable-sweat economy and an important contributor to lower consumption in the baseline. The second panel of Figure 2 provides details on the business activities. Here again, we find larger impacts in the variable economy. The fixed-sweat economy, like that in Lucas (1978), has a slight drop in the fraction of owners but almost no change in business profits. In other words, changes in the mass of firms and the selection of firms are nearly offsetting. In the variable-sweat economy, the higher tax has a large impact on both the fraction of owners and their effort, which in turn implies a gradual decline in sweat capital.

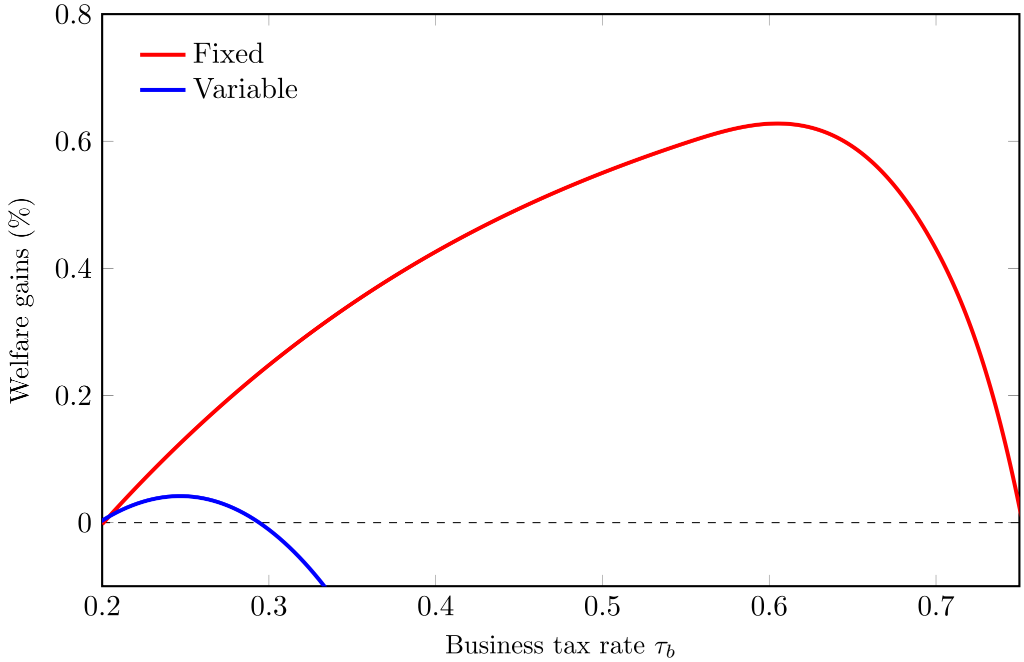
Using the short-term changes in profits in the baseline model, we can compute a tax elasticity from our model that is comparable to that estimated by Goodman et al. (2024). Goodman et al. (2024) measure the change in pass-through income in response to a policy change allowing greater business deductions and effectively lowering the tax rate on certain types of entities. Exploiting differences in exposure to the policy across businesses, the authors estimate an elasticity of 0.75 with respect to the net-of-tax rate on their profits after two years. We do the same for our model and find an elasticity of 0.64 with respect to the net-of-tax rate. Tracking different groups of owners and workers starting in the period of the reform, we find that most of the change in profits is attributable to older firms exiting (on the extensive margin) and better selection of entrants (on the intensive margin). More specifically, the elasticity of 0.64 can be split into the extensive margin contribution of 0.76 and the intensive margin contribution of -0.16 (with 0.04 for the interaction).

5.2 Optimal Taxation

We turn next to our results on the optimal tax rate on business in the fixed- and variable-sweat economies. We compute the optimal permanent reform from the perspective of a utilitarian planner that is maximizing average welfare of individuals in the pre-reform steady state. As before, transfers adjust to ensure the government budget constraint holds leaving the level of government defense spending and public debt unchanged.

In Figure 3, we plot the consumption equivalent welfare gains for the fixed- and variable-sweat economies. This gain is equal to the per-period percentage change in consumption relative to the initial allocation that individuals would have to receive to be indifferent between higher taxes and the status quo with τ_b remaining at 20 percent. As the figure shows, ignoring sweat investment overstates both optimal tax rates and welfare gains. In the fixed-sweat case—which is closest to the environments of Brüggemann (2021) and Imrohoroglu et al. (2023)— we find an optimal tax rate of 61 percent and a welfare gain of 0.63 percent. In our baseline model with variable sweat, we find a much smaller gain of 0.04 percent at an optimal rate of 25 percent—much smaller than the fixed-sweat case.

Figure 3: Welfare Gains in the Fixed- and Variable-Sweat Models



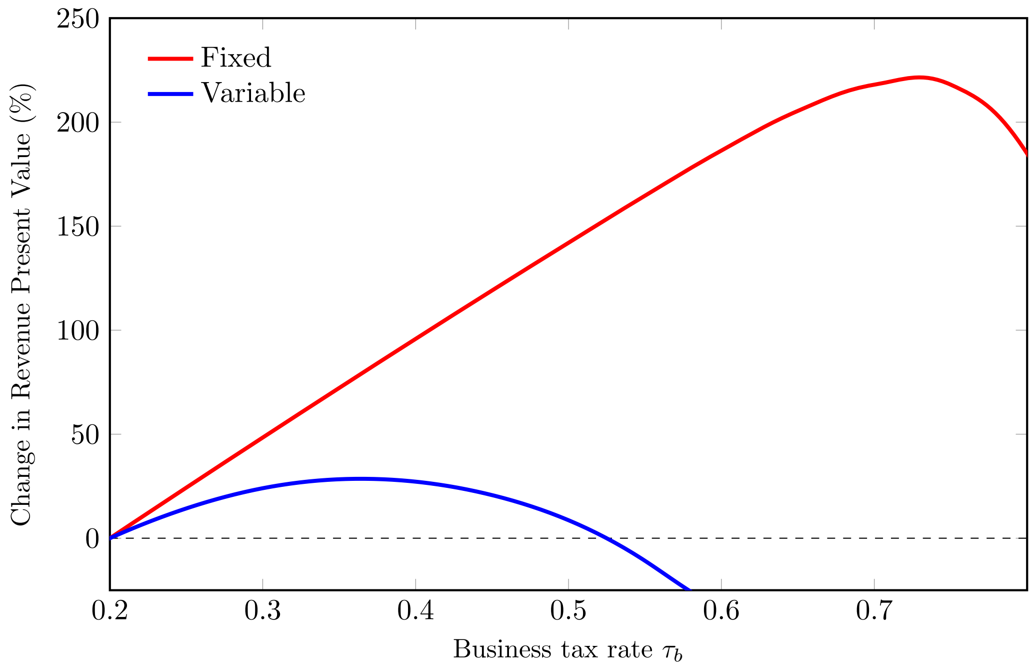
Notes: The welfare gains are computed as the per-period percentage change in consumption relative to the initial allocation required for individuals to be indifferent between having the policy reform and the status quo.

5.3 Laffer Curves

While welfare gain calculations provide a useful benchmark, they are not as practical for day-to-day policy analysis as estimates of the present value of tax receipts for proposed reforms. Here, we discuss the associated Laffer curve that traces out the present value of tax revenues as we increase the tax rate on business. We do this for both the fixed- and variable-sweat economy and provide estimates of the tax rates that maximize the present value of revenues.

In Figure 4, we plot the Laffer curve for business tax receipts. In the fixed-sweat economy, the optimal rate is now 73 percent—higher than the welfare optimum—and generates a 220 percent change in present value of business tax receipts. In the variable-sweat economy, the optimal rate is again higher than the welfare optimum and is 36 percent. At this rate, the business tax receipts are higher by 29 percent. What is clear from the figure is that the Laffer curve is substantially flatter in the variable-sweat economy when compared to the fixed-sweat economy and falls to negative

Figure 4: Present Value of Revenues for Business Tax Receipts



Notes: The change in the revenue present value is computed as the discounted revenue along the transition path with τ_b equal to rates on the x-axis divided by the discounted revenue if τ_b remains at 20 percent permanently.

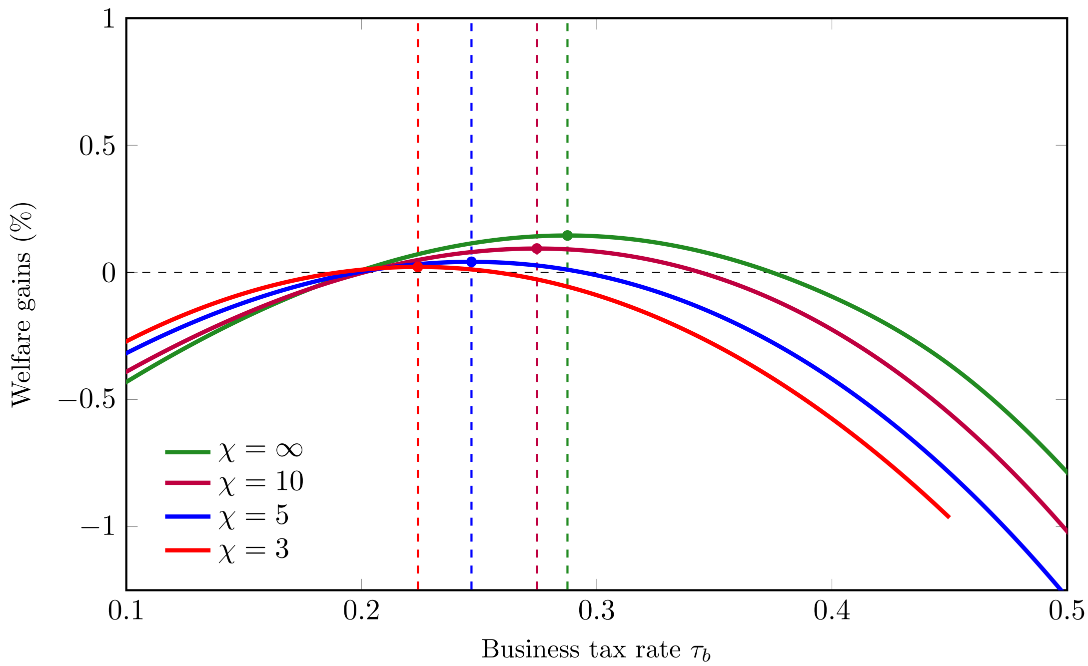
values at rates above 50 percent.

If we plot the Laffer curves for the *total* tax receipts, the optimal rate in the fixed-sweat economy remains about the same at 72 percent. This rate yields an increase in total revenues of 13 percent—which is high when compared to recent tax reform projections in the United States. However, when we allow for variable-sweat capital, the optimal rate is back to the 25 percent rate found in our welfare analysis with a projected tax revenue increase of only 0.13 percent. As with our welfare calculations, endogenous sweat capital plays an important role when quantifying the impacts of business tax reforms.

5.4 Robustness

The main exercise of the paper shows that the accumulation of sweat capital has a significant impact on our optimal tax analysis. In this section, we discuss the quantitative roles of two other modeling choices, namely, including transitional dynamics and including collateral constraints.

Figure 5: Optimal Tax as Collateral Requirement Varied



Notes: The optimal tax is recomputed as the collateral requirement is varied. In each case the model is recalibrated to ensure that the total sweat investment share is kept fixed.

If we ignore transitional dynamics and simply compare steady states as we vary τ_b, we find that the steady state analysis overstates both the welfare gain and the optimal tax rate. The steady state gain is significantly higher at 0.87 percent with the peak tax rate of 48 percent—nearly twice our baseline optimum. This difference underscores the importance of accounting for transition costs in policy evaluation.

If we drive the collateral requirement to infinity—effectively assuming that the collateral constraint never binds—we find an optimum rate of 29 percent with a welfare gain of 0.15 percent. This result is shown in Figure 5. In this case the loan to GDP ratio is close to 80 percent, roughly twice that observed in the U.S. data. If we instead lower the collateral requirement to $\chi = 3$, which yields a loan to GDP share of 27 percent, we find that the optimal tax rate falls to 22 percent—down from our baseline estimate of 25 percent. In this case, the welfare gain is hardly changed: 0.02 percent, down from 0.04 percent in the baseline. Thus, as in Guvenen et al. (2023), we find the potential misallocation from financing constraints pushes us to a lower optimal rate, but the differences in optimal tax rates and gains are relatively small in comparison to the differences in the predicted loan to GDP shares.

6 Summary

In this paper, we estimate the optimal tax rate on entrepreneurial income in a model with occupational choice and investment in sweat capital. Using U.S. data from the national accounts and administrative tax filings, we find a baseline estimate of 25 percent. This rate is 5 percentage points higher than the average effective rate that U.S. owners currently face, but well below the high estimates in the literature that abstracts from sweat investment. Our findings suggest that accounting for endogenous sweat investment substantially moderates optimal tax prescriptions relative to models without such investment.

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