Income Taxes and Entrepreneurship

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Motivation

- US entrepreneurs actively managing businesses:
  - Have higher average incomes than paid-employed peers Income Profiles
  - Run firms generating most US business net income Net Income

$\Rightarrow$ Central role in income tax debates

Challenges

- US entrepreneurs actively managing businesses:
  - Report only half of their taxable income (Cheating)
  - Create business value through off-book intangible investments (Intangibles)

$\Rightarrow$ Not easy to analyze

This Paper

- Develops theory with occupational choice and business *sweat capital*
- Parameterizes baseline model using US NIPA and *IRS administrative tax data*
- Estimates optimal income tax rates with *transitional dynamics*
- Want:
  - To reassess/narrow a wide range of estimates in the literature
  - To understand how key parameters impact policy trade-offs

Theory

Environment

- Two business sectors:
  - Actively-managed businesses (eg, pass-throughs)
  - All other businesses (eg, C-corporate plus government enterprises)
- Households
  - Endowed with stochastic abilities
  - Face occupational choice in self- or paid-employment
- Government
  - Revenues from taxes on incomes and consumption
  - Expenditures on goods and services and transfers

Occupational Choice

- Choose employment (w) or entrepreneurship (b)

$$v(a,\kappa,s,\xi,o)=(1-q^o)\,v^o(a,\kappa,s)+q^o\left[\max_{d\in\{0,1\}} d\{v^w(a,\kappa,s)+\xi\}+(1-d)v^b(a,\kappa,s)\right]$$

where

$$\begin{aligned}
d &= \text{occupational choice}\\
v &= \text{pre-choice value function}\\
v^o &= \text{value function with occupation } o=w,b\\
q^o &= \text{probability of choosing occupation } o=w,b\\
a &= \text{financial assets}\\
\kappa &= \text{sweat capital (customer-bases, tradenames, etc)}\\
s &= \text{shocks to productivity in self- and paid- employment}\\
\xi &= \text{occupational taste shock}
\end{aligned}$$

Owners' Dynamic Program

- Choose consumption, factor inputs, next period assets

$$v^b(a, \kappa, s) = \max \{u(c) - \vartheta(e) + \beta E[v(a', \kappa', s', \xi', b)]\}$$

$$\begin{aligned} \text{s.t.} \quad a' \leq & \ (1 + r)a + (1 - \tau_b)\pi + tr - (1 + \tau_c)c \geq 0 \\ \kappa' \leq & \ (1 - \delta_\kappa)\kappa + e \\ \pi \ = & \ zf(\kappa, k_b, n_b) - (r + \delta_k)k_b - wn_b \\ k_b \leq & \ \chi a \end{aligned}$$

where

$$\begin{aligned} c &= \text{consumption} \\ e &= \text{time for building sweat capital} \\ \pi &= \text{business profits} \\ z &= \text{shock to business productivity} \in s \\ k_b &= \text{tangible capital rented by businesses} \\ n_b &= \text{workers hired by businesses} \\ \tau_b, \tau_c &= \text{tax rates} \end{aligned}$$

Owners' Dynamic Program (Dentist)

- Choose consumption, factor inputs, next period assets

$$v^b(a,\kappa,s) = \max \left\{u(c) - \vartheta(e) + \beta E[v(a',\kappa',s',\xi',b)]\right\}$$

$$\begin{aligned}
\text{s.t.} \quad a' \leq & \ (1+r)a + (1-\tau_b)\pi + tr - (1+\tau_c)c \geq 0 \\
\kappa' \leq & \ (1-\delta_\kappa)\kappa + e \\
\pi \ = & \ zf(\kappa, k_b, n_b) - (r+\delta_k)k_b - wn_b \\
k_b \leq & \ \chi a
\end{aligned}$$

where

$$\begin{aligned}
c &= \text{consumption} \\
e &= \text{time for building patient list } (\kappa) \\
\pi &= \text{business profits} \\
z &= \text{shock to business productivity} \in s \\
k_b &= \text{rented dental office and equipment} \\
n_b &= \text{dental hygienists} \\
\tau_b, \tau_c &= \text{tax rates}
\end{aligned}$$

Workers' Dynamic Program

- Choose consumption and next period financial assets

$$v^w(a,\kappa,s) = \max \{u(c) + \beta E[v(a',\kappa',s',\xi',w)]\}$$

$$\begin{aligned}\text{s.t.} \quad a' &\leq (1+r)a + (1-\tau_w)w\epsilon\bar{n} + tr - (1+\tau_c)c \geq 0 \\ \kappa' &\leq (1-\lambda)\kappa\end{aligned}$$

where

$$\begin{aligned} c &= \text{consumption} \\ \kappa &= \text{sweat capital from previous business ownership} \\ \bar{n} &= \text{fixed time at work} \\ \epsilon &= \text{shock to work productivity} \in s \\ \tau_w, \tau_c &= \text{tax rates}\end{aligned}$$

Workers' Dynamic Program (Dentist)

- Choose consumption and next period financial assets

$$v^w(a,\kappa,s) = \max \{u(c) + \beta E[v(a',\kappa',s',\xi',w)]\}$$

$$\begin{aligned} \text{s.t.} \quad a' \leq \; & (1+r)a + (1-\tau_w)w\epsilon\bar{n} + tr - (1+\tau_c)c] \geq 0 \\ \kappa' \leq \; & (1-\lambda)\kappa \end{aligned}$$

where

c = consumption

κ = patient list from previous business ownership

$\bar{n}$ = time as employee at another dental office

ϵ = shock to work productivity $\in s$

τ_w, τ_c = tax rates

Corporate Sector

- Choose hours and investment

$$v^c(k_c) = \max \left\{(1-\tau_d)d_c + \left(\frac{1}{1+r}\right) v^c(k_c')\right\}$$

$$\begin{aligned} \text{s.t.} \quad k_c' &\leq \ (1-\delta_k)k_c + x_c \geq 0 \\ y_c &= AF(k_c, n_c) \\ d_c &= y_c - wn_c - x_c - \tau_p(y_c - wn_c - \delta_k k_c) \end{aligned}$$

where

$$\begin{aligned} n_c \ &= \text{hours} \\ x_c \ &= \text{investment} \\ y_c \ &= \text{output} \\ d_c \ &= \text{dividends} \\ \tau_d, \tau_p &= \text{tax rates} \end{aligned}$$

Mutual Funds

- Choose asset holdings to maximize pv of dividends

$$v^m(x) = \max \{d_m + \left(\frac{1}{1+r}\right) v^m(x')\}$$

$$\begin{aligned}
\text{s.t.} \quad d_m = {} & ps + b + \int k_b(i)\mu(i)di - \int a(i)\mu(i)di && (1)\\
& + (1-\tau_d)d_c s + rb + (r+\delta_k)\int k_b(i)\mu(i)di - r\int a(i)\mu(i)di && (2)\\
& - [ps' + b' - \int a'(i)\mu(i)di] - \int x_b(i)\mu(i)di && (3)
\end{aligned}$$

where

(1) = net worth of shares, bonds, fixed assets less deposits, beginning of period
(2) = financial income earned during the period
(3) = new deposits less investments in shares, bonds, fixed assets, end of period

Competitive Equilibrium

- Given initial conditions $\{a_{i,-1}, \kappa_{i,-1}, s_{i,0}\}_{i\in[0,1]}$, a CE consists of
  - Factor prices $\{r_t, w_t\}_{t\geq 0}$
  - Individual choices $\{c_{it}, a_{it}, \kappa_{it}, d_{it}, k_{b,it}, n_{b,it}\}_{t\geq 0, i\in[0,1]}$
  - Corporate choices $\{k_{ct}, n_{ct}\}_{t\geq 0}$
  - Fiscal variables $\{G_t, T_t, B_t, \tau_{ct}, \tau_{wt}, \tau_{bt}, \tau_{pt}\}_{t\geq 0}$

- Given the prices and policies:
  - Individual choices solve individual optimality
  - Corporate choices maximize profits
  - Government budget holds
  - Markets clear

Calibrating the Model

Calibrating the Model

- Macro moments (easy)
  - National income and product accounts (BEA)
  - Aggregate tax data (IRS)

- Micro moments (harder)
  - Surveys of business owners (Census)
  - Tax filings of business owners (IRS)

Key Parameters Calibrated

- Tax rates on incomes, τ_{bt}, τ_{wt}
  - To match effective after-audit tax rates
- Productivity processes, $\{z_t, \epsilon_t\}$
  - To match business income shares and growth rates
- Occupational switching, σ_ξ, q^b, λ, $\vartheta(e) = \omega e^\eta / \eta$
  - To match business entry and exit rates Hazard plots
- Collateral constraint, $k_b \leq \chi a$
  - To match S corporation and partnership loans to GDP

All parameters

Targeted Business Income Moments

- Two calibration targets from IRS study[†]
  - Top 10% of business owners earn 70% of total business income
  - Distribution of business income growth Distribution
- Wage productivity process ϵ_t calibrated similarly

[†] Bhandari et al. (2025), "On the Nature of Entrepreneurship"

Business Productivity: Random Walk with Reset

- Business log productivity governed by $\ln z$:

$$\ln z_{t+1} = \begin{cases} 0, & \text{with probability } pr_z, \\ \ln z_t + \sigma_z \zeta_{t+1}, & \text{with probability } 1 - pr_z, \end{cases}$$

  - σ_z: dispersion of productivity innovations
  - pr_z: probability of resetting productivity to its initial level
  - $\zeta \sim \mathcal{N}(0, 1)$

- Dispersion of innovation controls distribution of business income growth
- Frequency of resets controls top 10% income share
- Productivity resets ensure the process is stationary

Macro Moments: BEA

National Income and Product			Government Budget		
	Model	Data		Model	Data
GDP shares	100	100	Expenditures (% of GDP)	27	28
Consumption	64	68	Transfers	20	21
Investment	32	28	Net interest	3	3
Defense	4	4	Defense	4	4
GDI shares	100	100	Revenues (% of GDP)	27	28
Sweat income	9	9	Taxes on income	23	24
Compensation	46	46	Taxes on consumption	4	4
Capital income	45	45			

Macro Moments: IRS

- Combine S-corporation and partnership debt liabilities:
  - Mortgages, notes, bonds payable (short- and long-term)
  - Nonrecourse loans
  - Loans from shareholders
  - Loans from partners

$\Rightarrow$ 39.8% of GDP in data compared to 39.6% in model

Micro Moments: Business Income

		Model	Data
Profit share	Top 10%	0.70	0.70
Profit growth	10^{th} percentile	-0.59	-0.54
	25^{th}	-0.28	-0.20
	50^{th}	0.03	0.02
	75^{th}	0.44	0.32
	90^{th}	1.07	1.09
	Autocorrelation	0.02	-0.18

Wage Income

Micro Moments: Business Entry and Exit

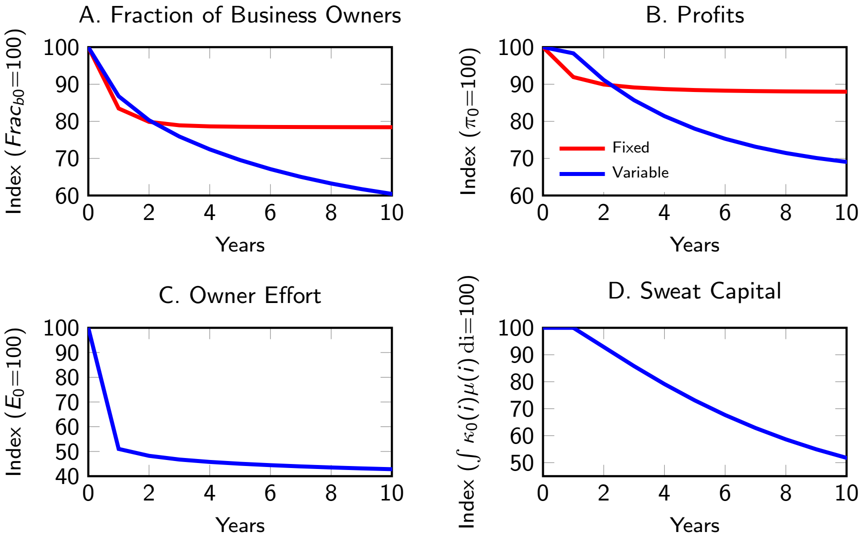
	Model	Data
Entry rate, average	0.022	0.020
Exit rates by business age		
Age ≤ 1	0.37	0.37
Age 2–6	0.18	0.19
Age > 6	0.10	0.11
All ages	0.22	0.21

Model Predictions

- Results:
  - Transitions with $\tau_b = 40\%$ in new steady state $\Rightarrow$ full enforcement
  - Optimal τ_b^* and consumption-equivalent welfare gains
- Two economies:
  - Sweat capital fixed
  - Sweat capital variable

Model Predictions

Transitions, τ_b: 20%$\rightarrow$ 40%



Business Tax Elasticities

- Predicted elasticities $\Delta \ln X_t / \Delta \ln(1 - \tau_{bt})$
  - Intensive margin (employment):

    Short-run $= 0.1$

    Long-run $= 0.3$
  - Aggregate elasticity (business profits):

    Short-run $= 0.3$

    Long-run $= 1.3$
- In line with Giroud-Rauh (2019) study of pass-throughs Details

Optimal Taxation

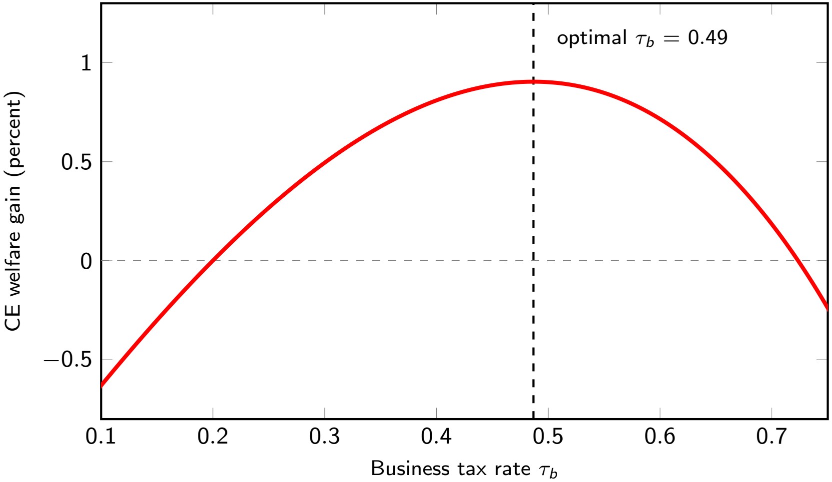
Optimal Taxation

- Current US system:
  - Weak enforcement of private business
  - Low effective rates on owner profits

- Primary concerns motivating reforms:
  - Too little insurance and redistribution
  - Misallocated resources
  - Distorted entry and investment

Let's consider the fixed- and variable-sweat economies in turn

Welfare in Fixed-Sweat Economy



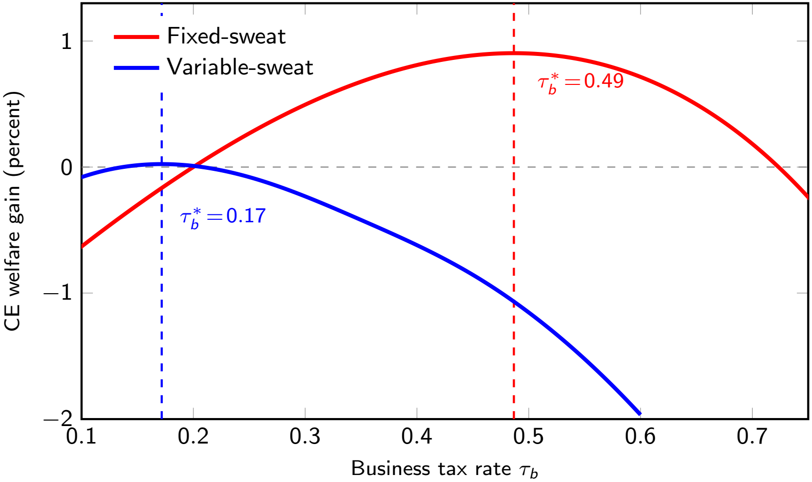
Welfare in Fixed-Sweat Economy

- Results similar to
  - Theoretical studies of canonical firm dynamics model (Lucas 1978)
  - Quantitative studies of taxing entrepreneurs (Bruggemann 2021 and Imrohoroglu et al. 2023)

- Relatively inelastic business activity supports a high optimal tax

Next consider the variable-sweat economy

Welfare in Variable- and Fixed-Sweat Economies



Welfare in Variable-Sweat Economy

- Optimum is well below the fixed-sweat economy
- Welfare gain is 0.01% at $\tau_b^* = 17\%$ vs 1% at $\tau_b^* = 49\%$ in the fixed-sweat economy
- Key reason is higher elasticity of business activity in variable-sweat model

Laffer Curve

Role of Transition Dynamics

- Optimum with transition dynamics
  - Gain of 0.024%
  - Tax rate of 17.2%
- Optimum in steady state Figure
  - Gain of 0.78%
  - Tax rate of 0.2%

$\Rightarrow$ Steady-state analysis overstates the welfare gain and understates the optimal tax rate

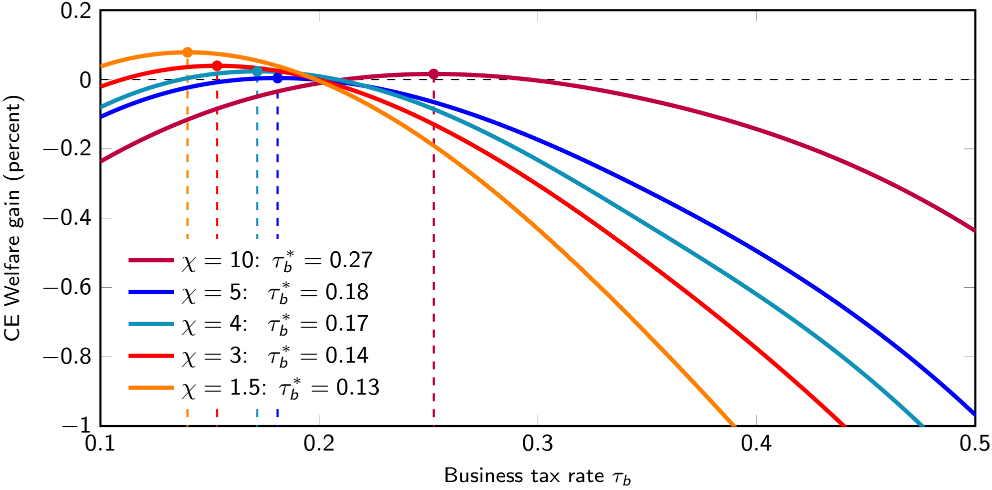
Role of Collateral Constraints

- Vary χ in $k_b \leq \chi a$
- Predicted loan shares:

χ	Loan-to-GDP (%)
1.5	12.0
3	31.5
4	39.6
5	45.7
10	62.3

How does the optimal tax change?

Optimal Tax Rates across Collateral Constraints



Summary

- Optimal rate of 17.2% is
  - Slightly lower than current effective rate in US
  - Significantly different from estimates in literature

- Quantitative role of
  - Transitional dynamics are consequentional
  - Commonly-used collateral constraints are inconsequential

Appendix

Income Profiles

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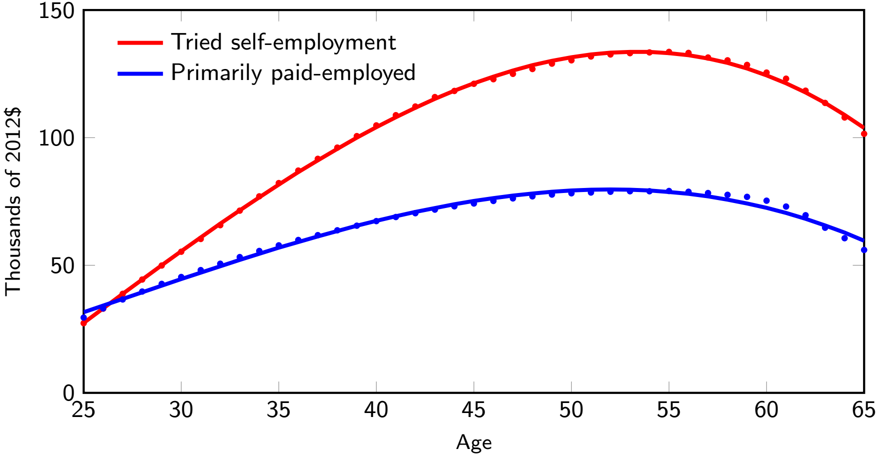
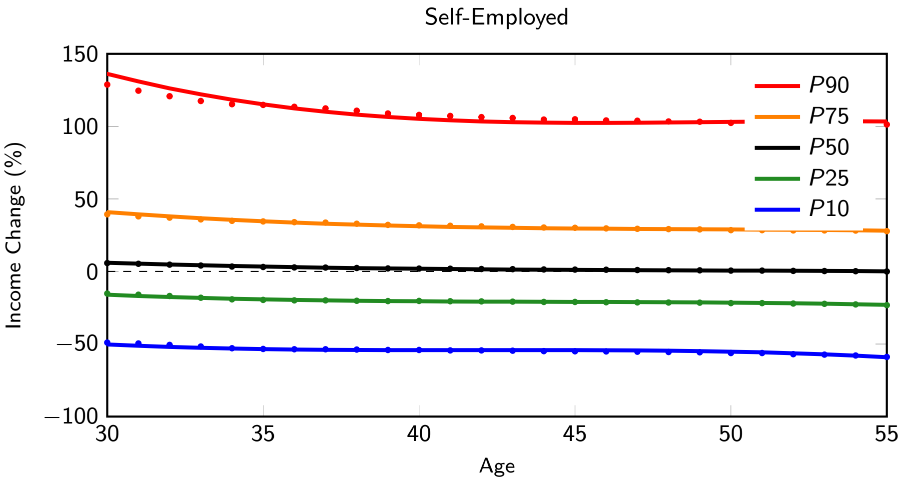


Source: Bhandari et al. (2025), "On the Nature of Entrepreneurship"

Risk

back



Source: Bhandari et al. (2025), "On the Nature of Entrepreneurship"

Growth in Pass-Throughs

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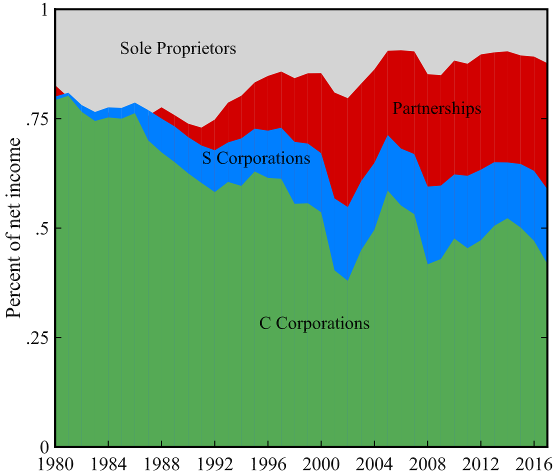
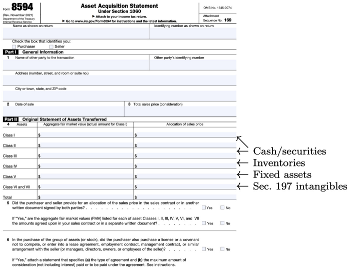


Source: IRS Integrated Business Data

Section 197 Intangibles

back

- Most capital is **not observable until transferred**
- Transferred assets are primarily **intangible** (from Form 8594 ≈ 70%)
    - Customer bases and client lists, non-compete covenants
    - Trademarks and tradenames
    - Licenses and permits
    - Workforce in place
    - Goodwill and going concern value
- Assets are **sold as a group**
- Sale **requires time** to find buyers/negotiate (typical from brokered data ≈ 7 months)



Source: "Capital Reallocation and Private Firm Dynamics," Bhandari, Martellini, McGrattan (2025)

Less Visibility Leads to Greater Misreporting (Source: IRS)

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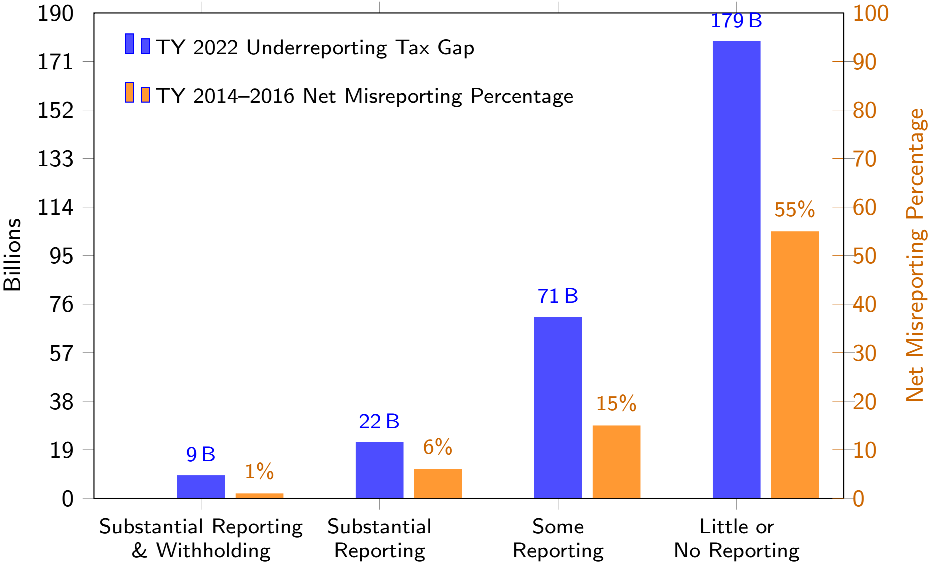

Age Distribution of Businesses

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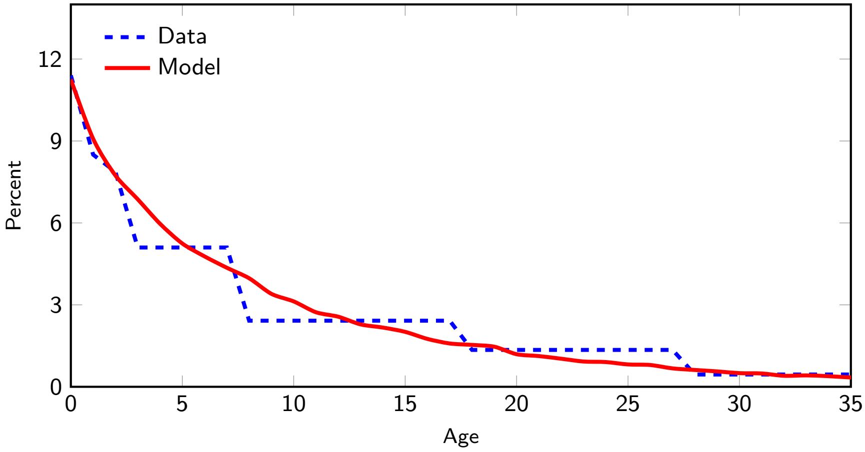

Source: Bhandari and McGrattan (2021), "Sweat Equity in U.S. Private Business"

Distribution of Annualized 3-Year Growth

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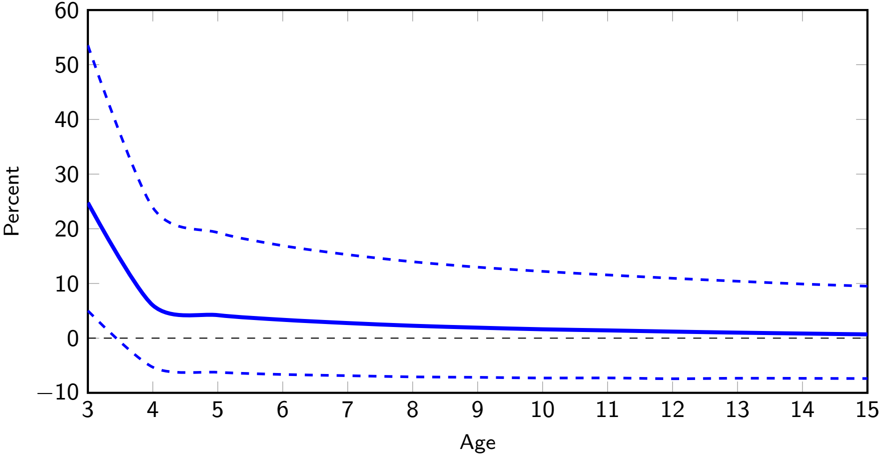

Source: "Capital Reallocation and Private Firm Dynamics," Bhandari, Martellini, McGrattan (2025)

EGM in 2-D

back

- Dynamic programming with two endogenous states and a discrete choice
- Standard value-function iterations are very slow
- Overcoming challenges in applying a faster EGM-type method:
  1. Two endogenous states requires interpolation over a non-rectangular 2-D grid

  $\Rightarrow$ Use 1-D interpolation per state variable

  2. Discrete choice implies the FOCs insufficient

  $\Rightarrow$ Drop non-optimal choices by comparing value functions

Approximating Transition Dynamics

back

- Perturbation method:
  - Stack *all* individual optimality plus market clearing conditions into $\mathcal{F}$
    - Let Z_{-1} = initial aggregate state and distribution over states
    - Let X_t = aggregate variables that are not distributions
    - Let the stacked system be denoted by $\mathcal{F}(\{X_t\}, Z_{-1}) = 0$
  - Add taste shocks with positive variance to handle discrete choice manifold[†]
  - Replace $\mathcal{F}$ with Taylor expansion around *post-reform* steady state
  - Characterize dynamics as sequence of linear systems for *directional derivatives*
  - Pre-compute coefficients of linear systems using final steady state means

$\Rightarrow$ Fast, scalable, and efficient

[†] Bhandari, Evans, McGrattan (2025)

Micro Moments: Wage Income

back

		Model	Data
Wage share	Top 7.9%	0.28	0.29
Wage growth	10^{th} percentile	-0.36	-0.24
	25^{th}	0.00	-0.06
	50^{th}	0.00	0.03
	75^{th}	0.00	0.15
	90^{th}	0.42	0.44
	Autocorrelation	-0.07	-0.13

Calibration Details

- Choose the parameters to minimize the distance between model and targeted moments
  - Sweat production and depreciation parameters (ω, η, λ)
  - Occupational choice shock parameters (σ_ξ, q^b)
  - z-process parameters (pr_z, σ_z)
- Targeted moments:
  - Entry rate, exit rates by business age (≤ 1, 2–6, > 6)
  - Top 10% business income share, P90–P10 spread in business-income growth
- Objective function:

$$J(\theta) = \sum_{m \in \mathcal{M}} \left(\frac{m(\theta) - m^{\text{data}}}{s_m} \right)^2 + \sum_j \left(\frac{R_j(\theta)}{c_j} \right)^2 .$$

$m(\theta)$: targeted moments, $R_j(\theta)$: equilibrium residuals.

- σ_ε is necessary to generate a sufficiently high entry rate
  - With very small σ_ε, the entry rate is too low
- q^b is necessary to generate a smooth decline in exit rates, especially at ages 2–6

Some Computational Challenges

- Want to compute transition dynamics and optimal taxes
- Need to deal with
  - Large state space with two endogenous states
  - Discrete occupational choice
  - Long transition periods

Addressing the Challenges

- Want to compute transition dynamics and optimal taxes
- Developed
  - Variant of EGM algorithm on 2-dimensional grid
  - Approximation method for transition dynamics with discrete choice
  - Memory-saving techniques for long transitions (need $T > 500$)

EGM

Transitions

Parameters

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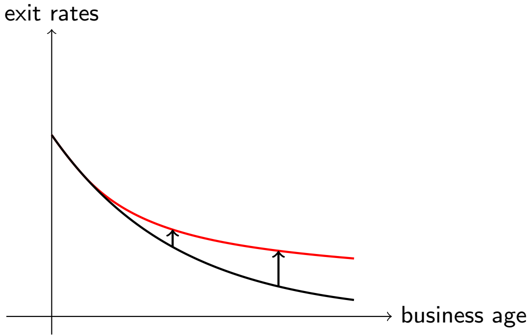
Parameter	Description	Value
Preferences		
σ	Risk aversion	2
ω	Disutility of sweat building scale	10
η	Disutility of sweat building curvature	1.51
β_o	Unadjusted discount factor	0.99
γ	Economic growth rate (%)	2
β	Growth adjusted discount factor	0.97
Private Business		
χ	Collateral constraint looseness	4
ϕ	Sweat capital share in production	0.30
α	Physical capital share	0.29
ν	Labor share	0.41
δ_κ	Owner sweat depreciation (%)	5.8
λ	Worker sweat depreciation (%)	22
Other Business		
A	Corporate TFP	0.48
θ	Capital share in corporate production	0.53
δ_k	Tangible capital depreciation (%)	4.1

Parameter	Description	Value
Taxes		
τ_b	On business income	0.20
τ_w	On labor income	0.37
τ_c	On consumption	0.06
τ_p	On corporate profits	0.20
Government Spending		
tr	Lump-sum transfer	0.30
G	Government spending	0.06
B	Government debt	2.64
Income Shocks		
σ_z	Std. dev. of random-walk z innovation	0.140
pr_z	Probability of resetting z	0.196
σ_ϵ	Std. dev. of random-walk ϵ innovation	0.226
pr_ϵ	Probability of resetting ϵ	0.098
Taste Shocks		
σ_ξ	Scale of Gumbel shocks	0.07
q^b	Switch opportunity, b	0.69
q^w	Switch opportunity, w	1.00

Decline in Sweat Deterioration in Paid Work, λ

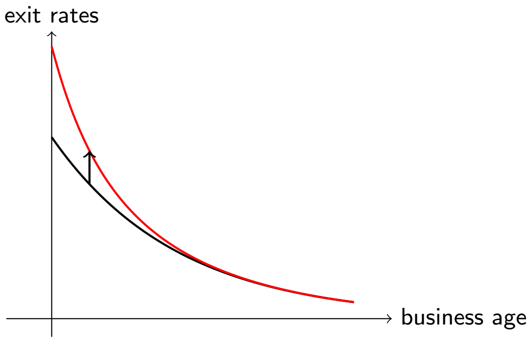
back

- Higher λ has little effect on initial exit, but raises exit rates at later ages



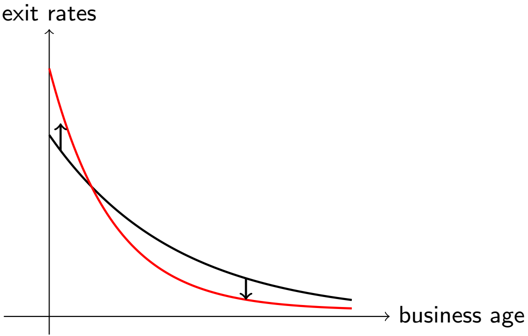
Increase in Scale Parameter of $\vartheta(e) = \omega e^{\eta}/\eta$

- ω affects initial exit rates

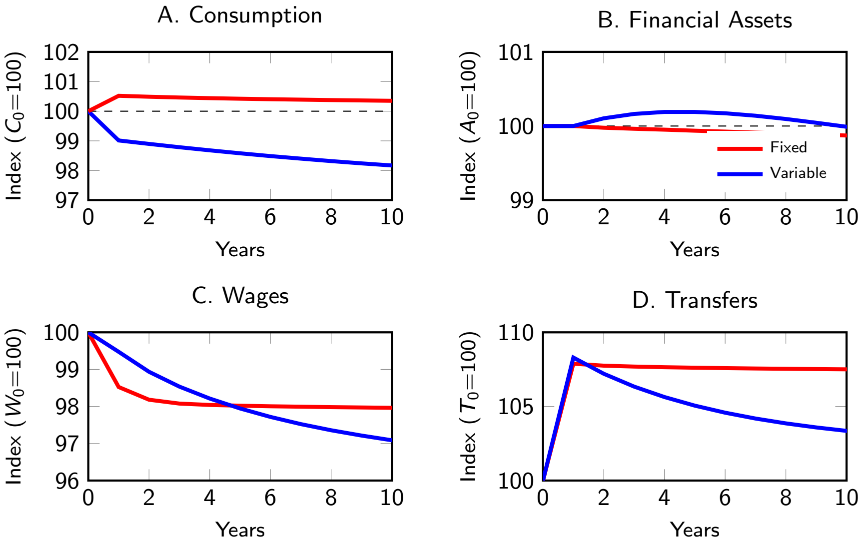


Increase in Curvature Parameter of $\vartheta(e) = \omega e^{\eta}/\eta$

- η affects how steeply exit rates decline with business age



Transitions, τ_b: 20%→ 40%



Business Tax Elasticities

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- Empirical findings of Giroud and Rauh (2019)
  - Studies impact of state tax policy changes on business activity
  - Exploits fact that C corps and pass-throughs taxed differently
  - Estimates tax elasticities over horizons of 1 to 10 years
  - Finds elasticities for pass-throughs:
    - Intensive margin (employment): 0.2 (short-run) to 0.4 (long-run)
    - Extensive margin (establishments): 0.4 (short-run) to 0.9 (long-run)
- Our theoretical findings
  - Uses the transition results to compute $\Delta \ln X_t / \Delta \ln(1 - \tau_{bt})$
  - Constructs "twins" with and without reform for intensive margin
  - Finds elasticities:
    - Intensive margin (employment): 0.1 (short-run) to 0.3 (long-run)
    - Aggregate elasticity (profits): 0.3 (short-run) to 1.3 (long-run)

Role of Transition Dynamics: Variable-Sweat Economy

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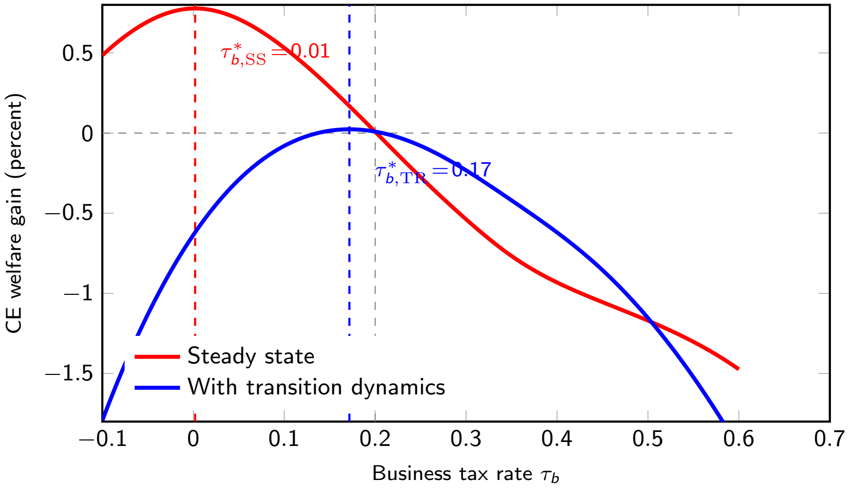

Laffer Curve of Business Tax Revenue

back

- Another perspective on tax elasticities
  - How much revenue can be raised?
  - How targeted can tax policy be?

$\Rightarrow$ Look at the Laffer curve

Laffer Curve of Business Tax Revenue