Markups and Inequality

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Motivation

- Increase in product market concentration, markups
  - Barkai, DeLoecker-Eeckhout, Gutierrez-Philippon, Hall
- Important concern: higher markups increase inequality
  - firm ownership highly concentrated so markups accrue to only a few
- Question: how should policy respond to markups?

Existing Work

- Assume representative consumer who owns all firms
  - markups only have production consequences
  - implicit tax on production
- Subsidy proportional to markup eliminates production distortions
  - if markups $\uparrow$ with firm market share, need size-dependent subsidy
  - $\uparrow$ profits, concentration, but consumer better off since owns firms
- But misses key concern: inequality $\Rightarrow$ equity-efficiency tradeoff

Our Paper

- Study economy with heterogeneous agents and incomplete markets
  - markups have both production and distributional costs

- Evaluate macroeconomic, distributional and welfare implications of
  1. product market policies that fix production distortions
  2. profit taxes that redistribute from firm owners

Model

Overview

- Consumers
  - idiosyncratic shocks to labor market and entrepreneurial efficiency
  - save using risk-free asset
  - option to run a private business, face collateral constraint
  - option to sell business $\Rightarrow$ corporation
- Intermediate goods firms
  - two types: private and corporate firms
  - each is monopoly supplier of differentiated variety
  - optimal markup increases with firm market share
- Final goods producers, government, financial intermediaries

Consumers

- Lifetime utility from consumption c_t, hours h_t

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{c_t^{1-\theta}}{1-\theta} - \frac{h_t^{1+\gamma}}{1+\gamma} \right)$$

  - only idiosyncratic, no aggregate uncertainty

- Wealth a_t with financial intermediary, income i_t

$$i_t = r_{t-1} a_t + W_t e_t h_t + \pi_t$$

- Budget constraint, assuming Benabou/HSV tax function

$$c_t + a_{t+1} = (1-\tau) \frac{i_t^{1-\xi}}{1-\xi} + a_t$$

Consumers

- Lifetime utility from consumption c_t, hours h_t

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{c_t^{1-\theta}}{1-\theta} - \frac{h_t^{1+\gamma}}{1+\gamma} \right)$$

  - only idiosyncratic, no aggregate uncertainty

- Wealth a_t with financial intermediary, income i_t

$$i_t = r_{t-1} a_t + W_t e_t h_t + \pi_t$$

- Budget constraint, assuming Benabou/HSV tax function

$$c_t + a_{t+1} = (1-\tau) \frac{i_t^{1-\xi}}{1-\xi} + a_t + \text{ proceeds from selling business}$$

Income

- Entrepreneurial and labor efficiency z_t, e_t follow independent AR(1)

$$\log z_{t+1} = \rho_z \log z_t + \sigma_z \varepsilon_t^z$$

$$\log e_{t+1} = \rho_e \log e_t + \sigma_e \varepsilon_t^e$$

- Profits, π_t
  - from private business, $\pi_t^e(a_t, z_t)$, depend on a_t due to collateral constraint
  - from ownership stake in previously sold business, $\chi \pi_t^c(z_t)$

- Describe next product market, then problem of entrepreneurs

Final Goods Producers

- Final good used for consumption, investment, government spending

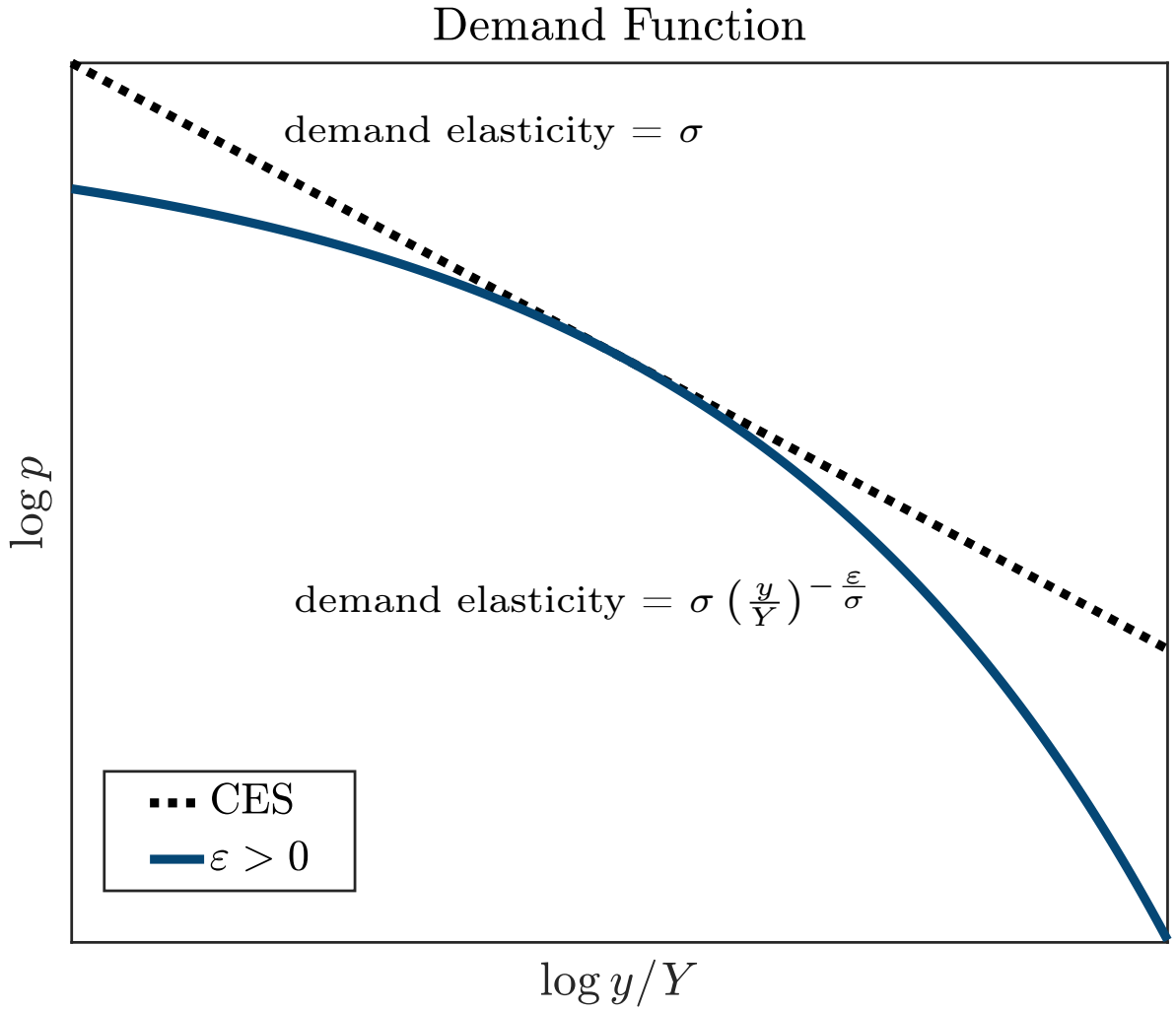
$$Y_t = C_t + X_t + G$$

- Assembled from varieties ω using Kimball aggregator

$$\int_0^1 \Upsilon\left(\frac{y_t(\omega)}{Y_t}\right) d\omega = 1 \qquad \text{with} \qquad \Upsilon' > 0\ ,\ \Upsilon'' < 0$$

- Demand for variety ω

$$p_t(\omega) = \Upsilon'\left(\frac{y_t(\omega)}{Y_t}\right) D_t$$



choke price: $y_t(p_t) = 0$ for $p_t \geq \frac{\sigma-1}{\sigma} \exp\left(\frac{1}{\varepsilon}\right) D_t$

$\Rightarrow$ only most efficient produce, even though no fixed costs

Intermediate Goods Producers

- Each producer monopoly supplier of variety ω
  - mass N_t^e private businesses, N_t^c corporate firms
  - mass ν_t of entreprenurs who sell business, become corporation
  - corporations exit at exogenous rate φ

- Both types of firms operate identical technology: $y_t = z_t k_t^{\alpha} l_t^{1-\alpha}$

- Transitions to corporate sector
  - arrival rate η of opportunity to sell $(1-\chi)$ stake in business, fixed cost F
  - unlimited access to external finance, diversify risk
  - corporate profits subject to linear tax τ_c

Entrepreneur's Problem

- Production choice

$$\pi_t^e(a_t, z_t) = \max p_t(y_t)\, y_t - W_t l_t - R_t k_t,$$

$$\text{subject to } k_t \leq \lambda a_t \quad (\text{multiplier } \mu_t)$$

- Marginal cost

$$\phi_t = \frac{1}{z_t}\left(\frac{R_t + \mu_t}{\alpha}\right)^{\alpha}\left(\frac{W_t}{1-\alpha}\right)^{1-\alpha}$$

- Optimal price

$$p_t = m_t \phi_t, \quad \text{markup } m_t = \frac{\sigma}{\sigma - (y_t/Y_t)^{\frac{\varepsilon}{\sigma}}}$$

Dynamic Choices

- Value of agent who owns private business

$$V_t^e = \eta \max\left[V_t^{ee}, V_t^{ec}\right] + (1-\eta)\, V_t^{ee}$$

  - value of not selling business

$$V_t^{ee}(a,z,e) = \max_{a',c,h} u(c,h) + \beta \mathbb{E}_t V_{t+1}^e\left(a',z',e'\right)$$

$$\text{s.t.} \quad c + a' = a + \frac{1-\tau}{1-\xi}\left[r_{t-1}a + W_t e h + \pi_t^e(a,z)\right]^{1-\xi}$$

  - for most $\pi_t^e(a,z) = 0$: workers

  - if $\pi_t^e(a,z) > 0$: entrepreneurs

Dynamic Choices

- Value of agent who owns private business

$$V_t^e = \eta \max\left[V_t^{ee}, V_t^{ec}\right] + (1-\eta)\, V_t^{ee}$$

  - value of selling business

$$V_t^{ec}(a,z,e) = \max_{a',c,h} u(c,h) + \beta\left[(1-\varphi)\,\mathbb{E}_t V_{t+1}^c\left(a',z',e'\right) + \varphi \mathbb{E}_t V_{t+1}^e\left(a',z',e'\right)\right]$$

$$\text{s.t.} \quad c + a' = a + \frac{1-\tau}{1-\xi}\left[r_{t-1}a + W_t e h + \pi_t^e(a,z)\right]^{1-\xi} + (1-\tau_k)\left(Q_t(z) - F\right)$$

$$Q_t(z) = \frac{1-\varphi}{1+r_t}\mathbb{E}_t\left[Q_{t+1}\left(z'\right) + (1-\chi)(1-\tau_c)\,\pi_{t+1}^c\left(z'\right)\right]$$

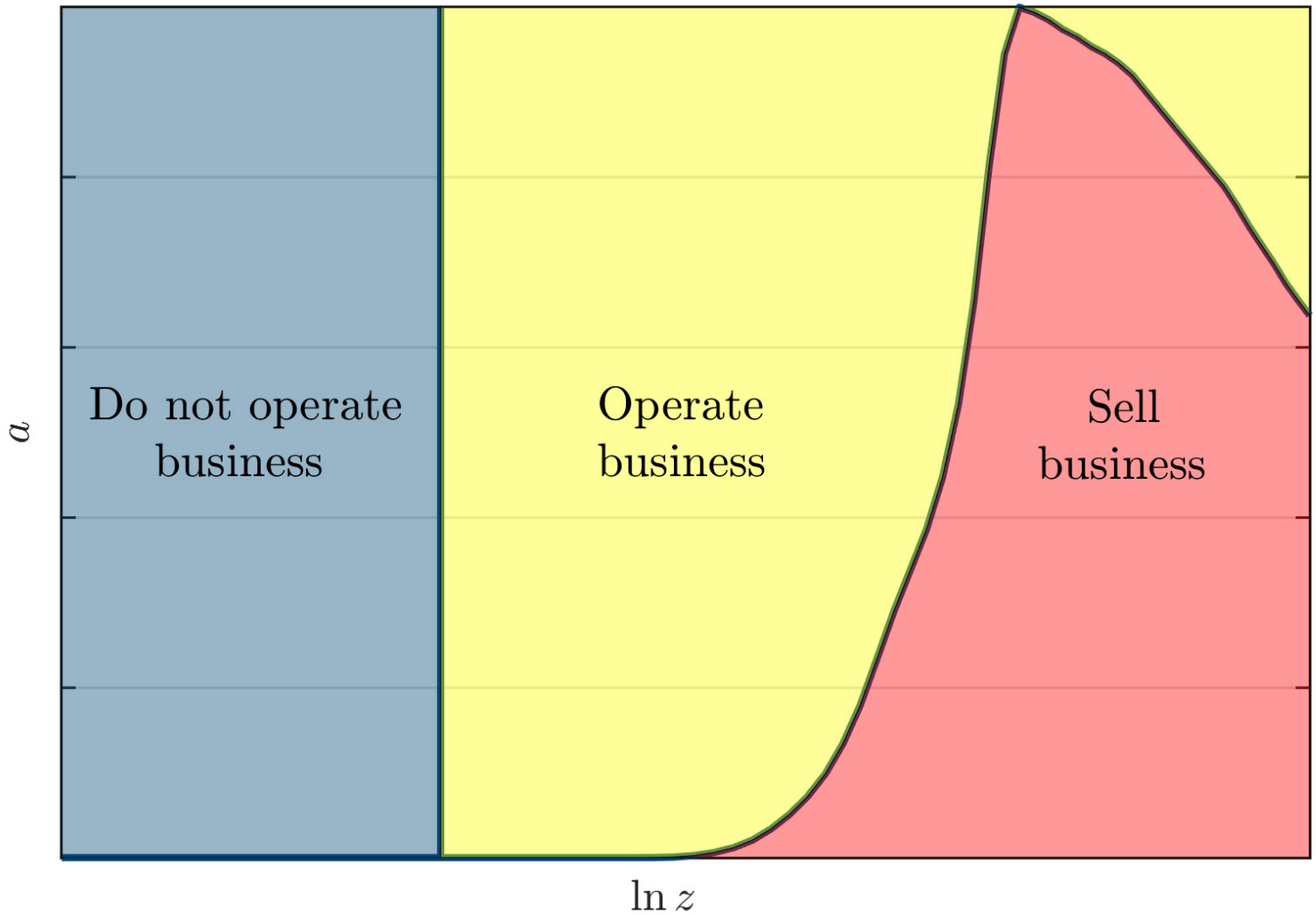
Dynamic Choices

- Value of agent who sold their business

$$V_t^c(a,z,e) = \max_{a',c,h} u(c,h) + \beta\left[(1-\varphi)\,\mathbb{E}_t V_{t+1}^c(a',z',e') + \varphi \mathbb{E}_t V_{t+1}^e(a',z',e')\right]$$

$$\text{s.t.} \quad c + a' = a + \frac{1-\tau}{1-\xi}\left[r_{t-1}a + W_t e h + \chi\,(1-\tau_c)\,\pi_t^c(z)\right]^{1-\xi}$$

Discrete Choice



Government

- Constant outstanding stock of debt $B_t = \bar{B}$
- Exogenous spending G
- Finance with personal income, capital gains and corporate profit taxes T_t

$$r_{t-1}\bar{B} + G = T_t$$

Financial Intermediaries

- Households deposit a_{t+1} with financial intermediaries which invest in
  - government bonds B_{t+1}
  - physical capital K_{t+1}
  - shares in corporate firms with price $Q_t = \int Q_t(z)\left[N_t^c(z) + \nu_t(z)\right] dz$

- No arbitrage and no aggregate uncertainty $\Rightarrow R_t = r_{t-1} + \delta$

Production Distortions

- Aggregate production function $Y = ZK^{\alpha}L^{1-\alpha}$ details

- Aggregate markup M (input-weighted average of firm markups)

$$(1-\alpha)\frac{Y}{L} = W\mathcal{M}$$

  - reduces labor share, equilibrium wage, output
  - can be offset by uniform sales subsidy $1+\xi^s = M$

- Markups increase with firm size $\rightarrow$ dispersion in MRPL, misallocation

$$(1-\alpha)\frac{p_i y_i}{l_i} = W m_i$$

  - can be offset by sales subsidy that increases with firm size $1+\xi_i^s = m_i$

Parameterization

Calibration Strategy

- Period 1 year. Assigned parameters:

θ	CRRA	2
γ	Frisch elasticity	1
α	capital elasticity	1/3
δ	capital depreciation	0.06
τ_c	corporate profit tax	0.36
φ	exit rate, corporations	0.04
χ	retained ownership stake	0.20
τ_k	capital gains tax	0.20

- Set $\varepsilon/\sigma = 0.15$
  - reproduces relation between labor productivity and size (EMX 2019)
  - consistent with other micro-economic evidence emx
- Choose $\bar{B}$ so $r = 2\%$ in initial steady state

Calibration Strategy

- Two groups of calibrated parameters:

  1. Chosen to exactly match corresponding target in data

σ	29.2	aggregate markup	1.15
λ	1.74	debt-to-capital entrepreneurs	0.35
τ	0.26	average income tax rate, all	0.23
ξ	0.07	average income tax rate, top 0.5%	0.33

Calibration Strategy

2. Minimize distance between moments model and data

			Data	Model
		wealth to income	6.1	6.0
		percent entrepreneurs	6.5	6.4
		wealth share entrepr.	0.31	0.25
β	0.928	income share entrepr.	0.18	0.19
ρ_z	0.991			
σ_z	0.069	Gini wealth, all	0.81	0.82
ρ_e	0.955	Gini wealth, entrepr.	0.76	0.86
σ_e	0.341	Gini wealth, workers	0.78	0.75
η	0.021			
F	0.006	Gini income, all	0.58	0.58
		Gini income, entrepr.	0.69	0.78
		Gini income, workers	0.52	0.52
		fraction corporate firms	0.05	0.05
		sales share corporate firms	0.63	0.57

Additional Moments

- Overall, firm owners account for
  - 6.7% of households in the model and 7.1% in the data
  - 37% of wealth in both model and data
  - 21% of income in both model and data

- Model reproduces well additional statistics not used in calibration
  - wealth and income distribution more broadly, even at the top
  - fraction of entrepreneurs in bins of wealth and income distribution
  - wealth and income shares of entrepreneurs in bins of distribution
  - concentration of stock ownership

additional moments

Results

Roadmap

- Evaluate effect of product market policies
  1. uniform sales subsidy
  2. size-dependent sales subsidy

- Evaluate effect of profit taxes

Product Market Policies

Uniform Subsidy

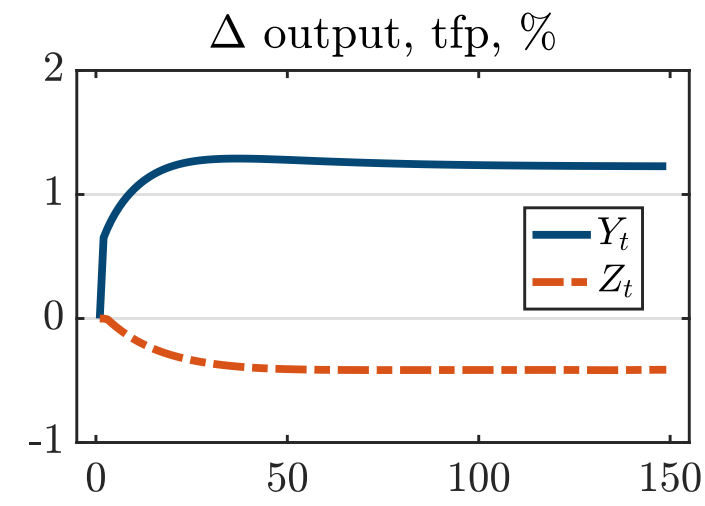
- Eliminates aggregate production distortion

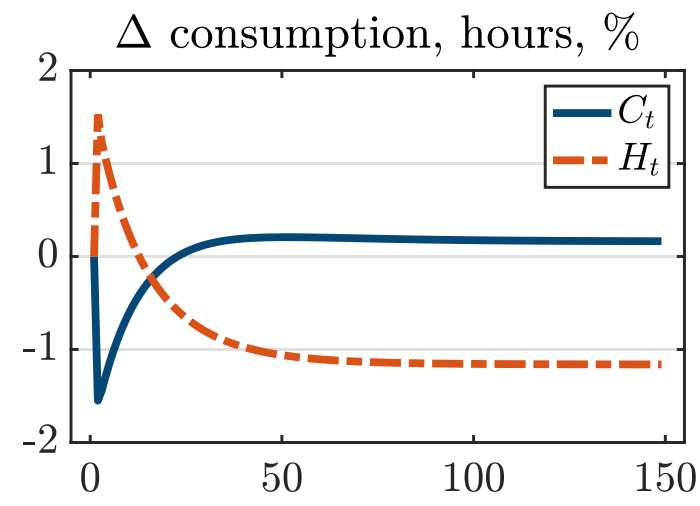
$$(1-\alpha)\frac{Y}{L} = W\,M$$

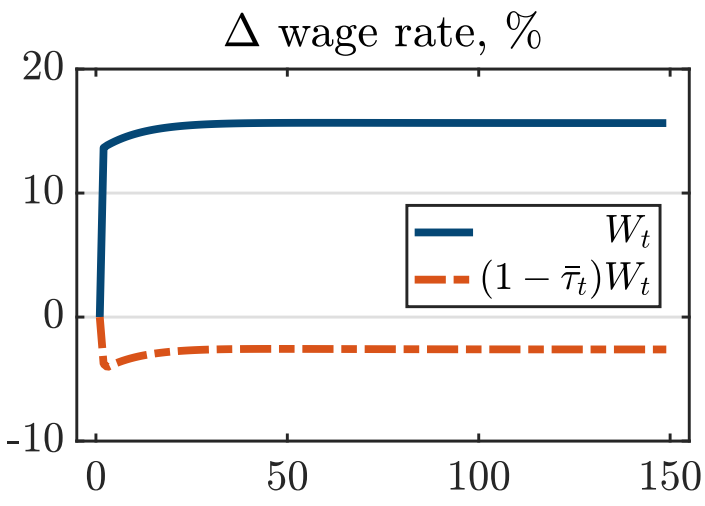
  - M = cost-weighted average of firm markups

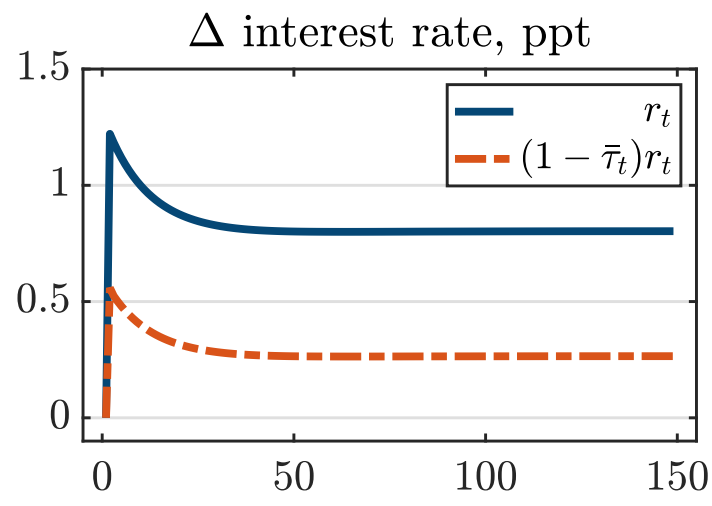
- Uniform subsidy $1+\xi = M$ eliminates wedge
  - reduces optimal price to $p_i = \frac{m_i}{1+\xi} \times \text{marginal cost}_i$
  - increases labor share to $\frac{WL}{Y} = (1-\alpha)$
  - set $\xi = 0.15$ to offset aggregate markup
  - finance by increasing personal income taxes, τ_t

Transition Dynamics









Inequality

Steady-state comparisons:

	benchmark	uniform subsidy
Gini wealth	0.82	0.80
top 1 pct wealth share	0.36	0.35
Gini income	0.58	0.58
top 1 pct income share	0.21	0.20
wealth share firm owners	0.37	0.36
income share firm owners	0.21	0.22

Modest drop in inequality due to higher interest rate

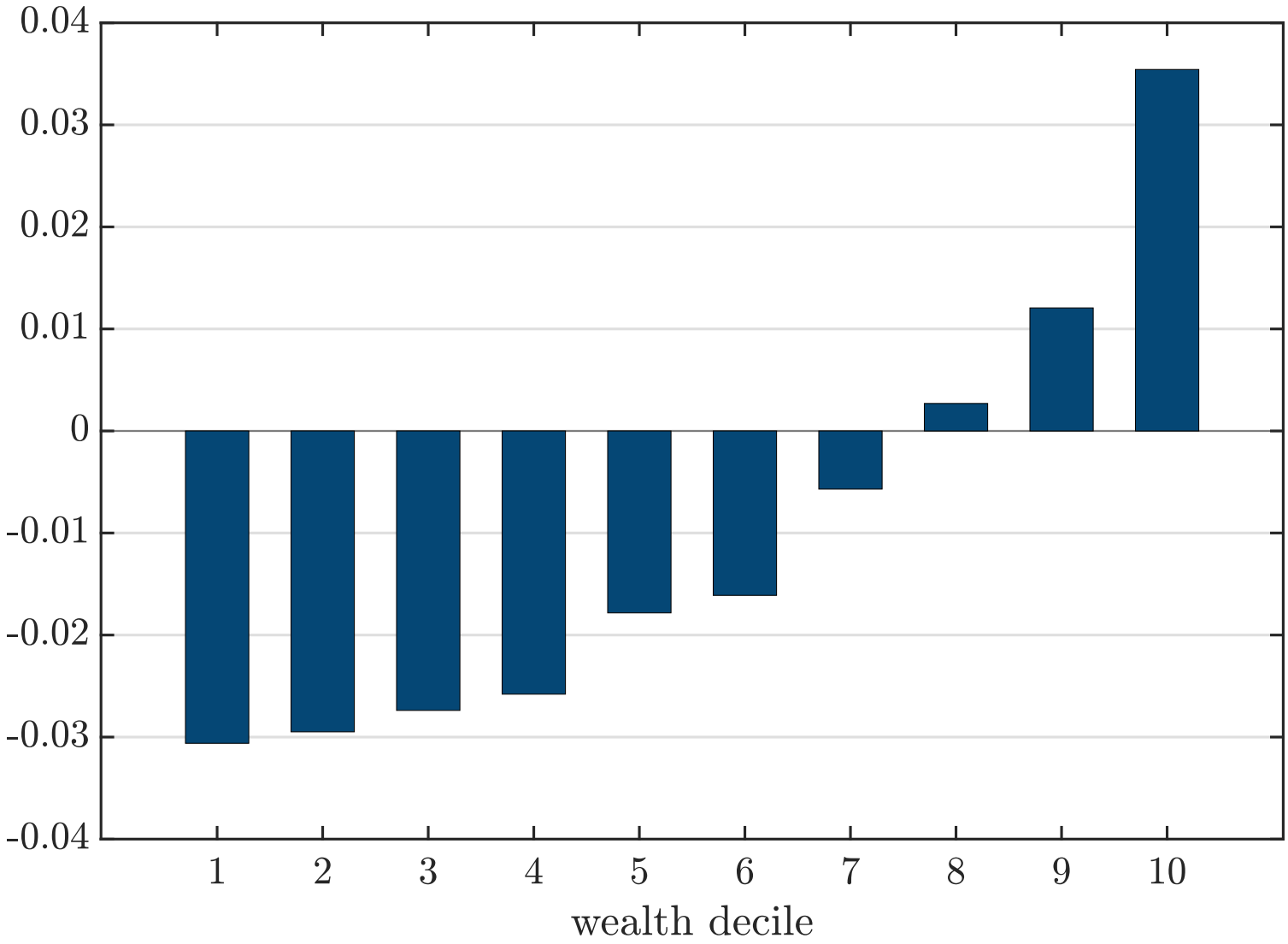
Welfare

- Consumption equivalent gains

	all	workers	firm owners
percentage who gain	27.2	25.8	46.6
median gain, $\times 100$	-1.8	-1.8	-0.4
utilitarian gains, $\times 100$	-1.9		

Contrast to complete markets where welfare gain is $\approx 5\%$

Welfare Gains



Wealthy households gain the most from $\uparrow r$

Alternative Financing of Uniform Subsidy

	baseline	uniform subsidy
average tax bottom 50%	0.11	0.26
average tax top 5%	0.33	0.44
utilitarian gains, $\times 100$	–	-1.9

Alternative Financing of Uniform Subsidy

	baseline	uniform subsidy	uniform subsidy $\xi = 0.15$
average tax bottom 50%	0.11	0.26	0.19
average tax top 5%	0.33	0.44	0.53
utilitarian gains, $\times 100$	–	-1.9	7.2

Alternative Financing of Uniform Subsidy

	baseline	uniform subsidy	uniform subsidy $\xi = 0.15$	no subsidy $\xi = 0.15$
average tax bottom 50%	0.11	0.26	0.19	0.03
average tax top 5%	0.33	0.44	0.53	0.44
utilitarian gains, $\times 100$	–	-1.9	7.2	9.1

1.9% welfare loss from uniform subsidy, even with more tax progressivity

Size-Dependent Subsidy

- Eliminates second source of inefficiency: dispersion in markups

$$(1-\alpha)\frac{p_i y_i}{l_i} = W m_i$$

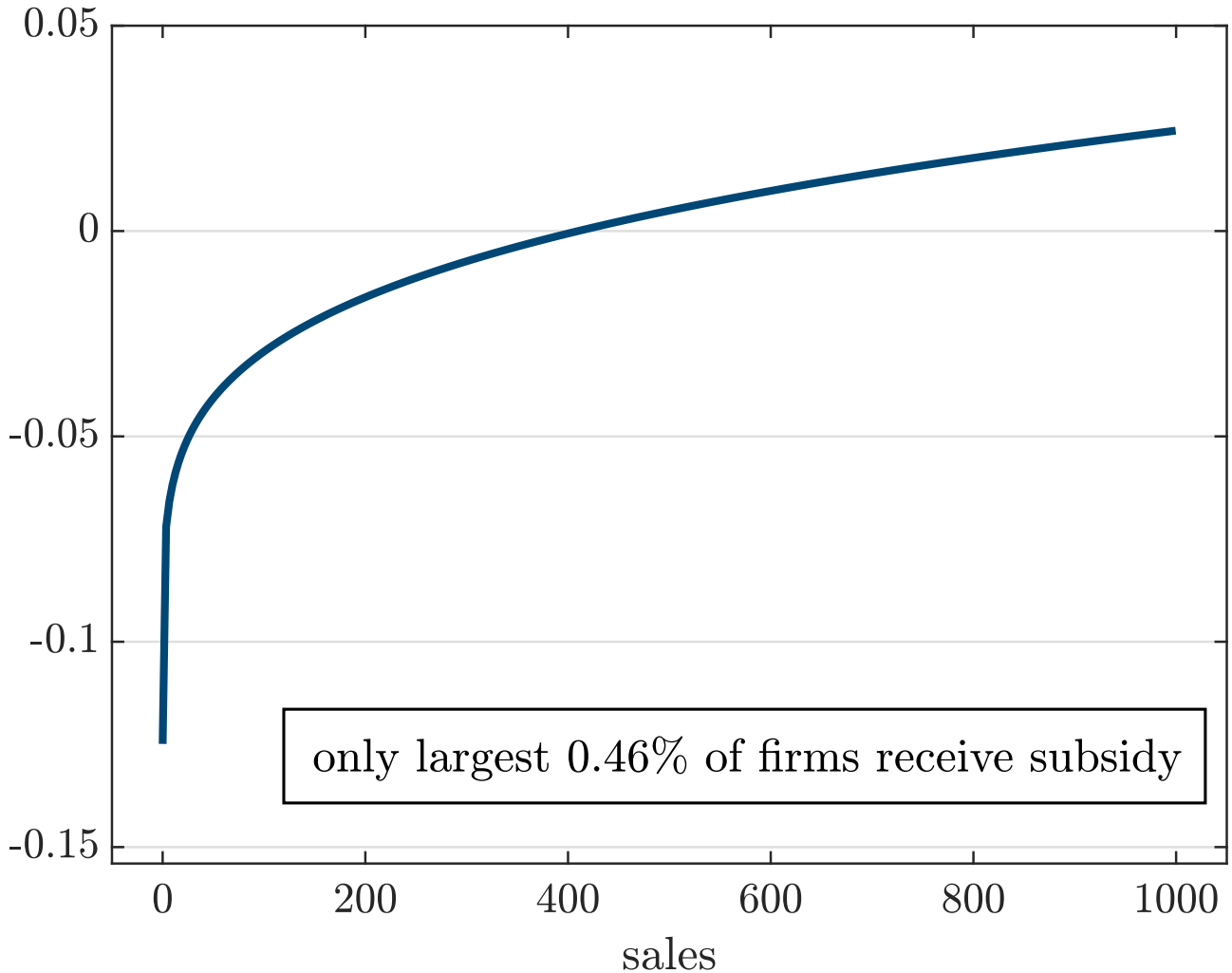
- Marginal subsidy for firm with sales s_i:

$$\frac{m(s_i)}{1+\tau^s} - 1$$

- Optimal price $p_{it} = (1+\tau^s) \times \text{marginal cost}_{it}$, so no MPL dispersion

- Uniform tax $\tau^s = 0.14$ so no Δ in income tax function (or labor share)

Subsidy that Removes Markup Distortion



Concentration, Markups, Efficiency

Steady-state comparisons:

	benchmark	size-dependent subsidy
number of producers	1	0.58
percentage entrepreneurs	6.4	4.2
corporate sales share	0.57	0.62
50 pct markup	1.15	1.16
90 pct markup	1.22	1.25
TFP loss misallocation, %	9.0	9.6

Increases concentration, markups, misallocation

Inequality

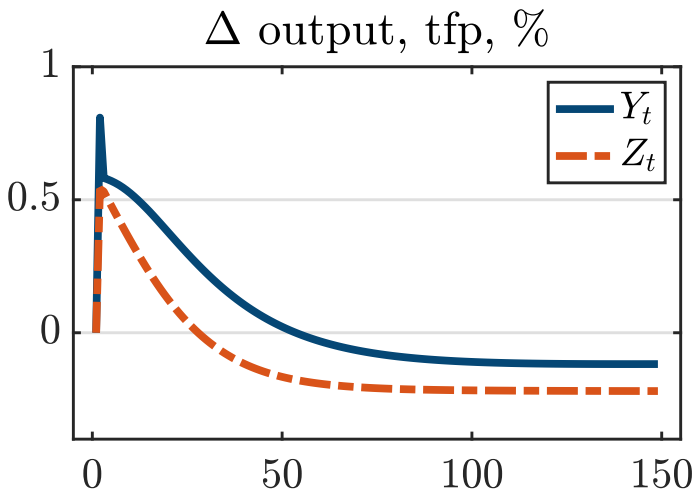
Steady-state comparisons:

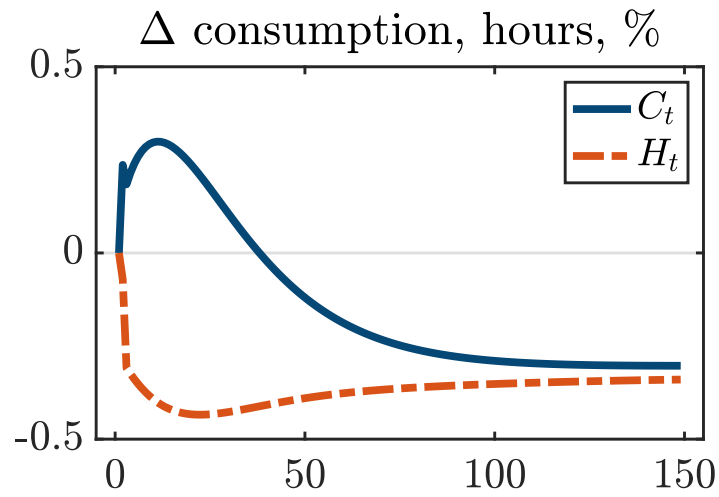
	benchmark	size-dependent subsidy
Gini wealth	0.82	0.81
top 0.1 pct wealth share	0.18	0.21
top 1 pct wealth share	0.36	0.36
wealth share firm owners	0.37	0.33
income share firm owners	0.21	0.18
wealth share entrepreneurs	0.25	0.21
income share entrepreneurs	0.19	0.15

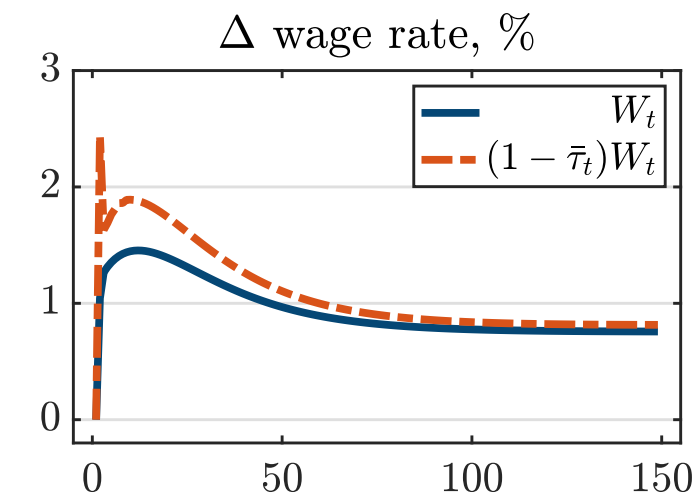
Inequality unchanged: wealthiest even wealthier

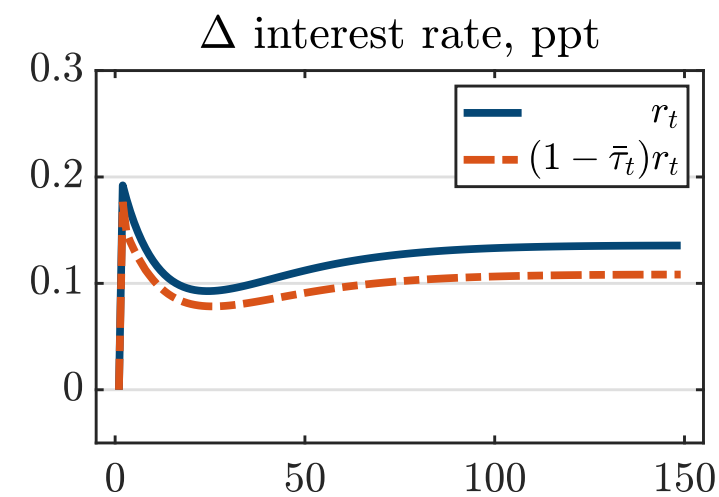
offset by wage increase at the bottom

Transition Dynamics









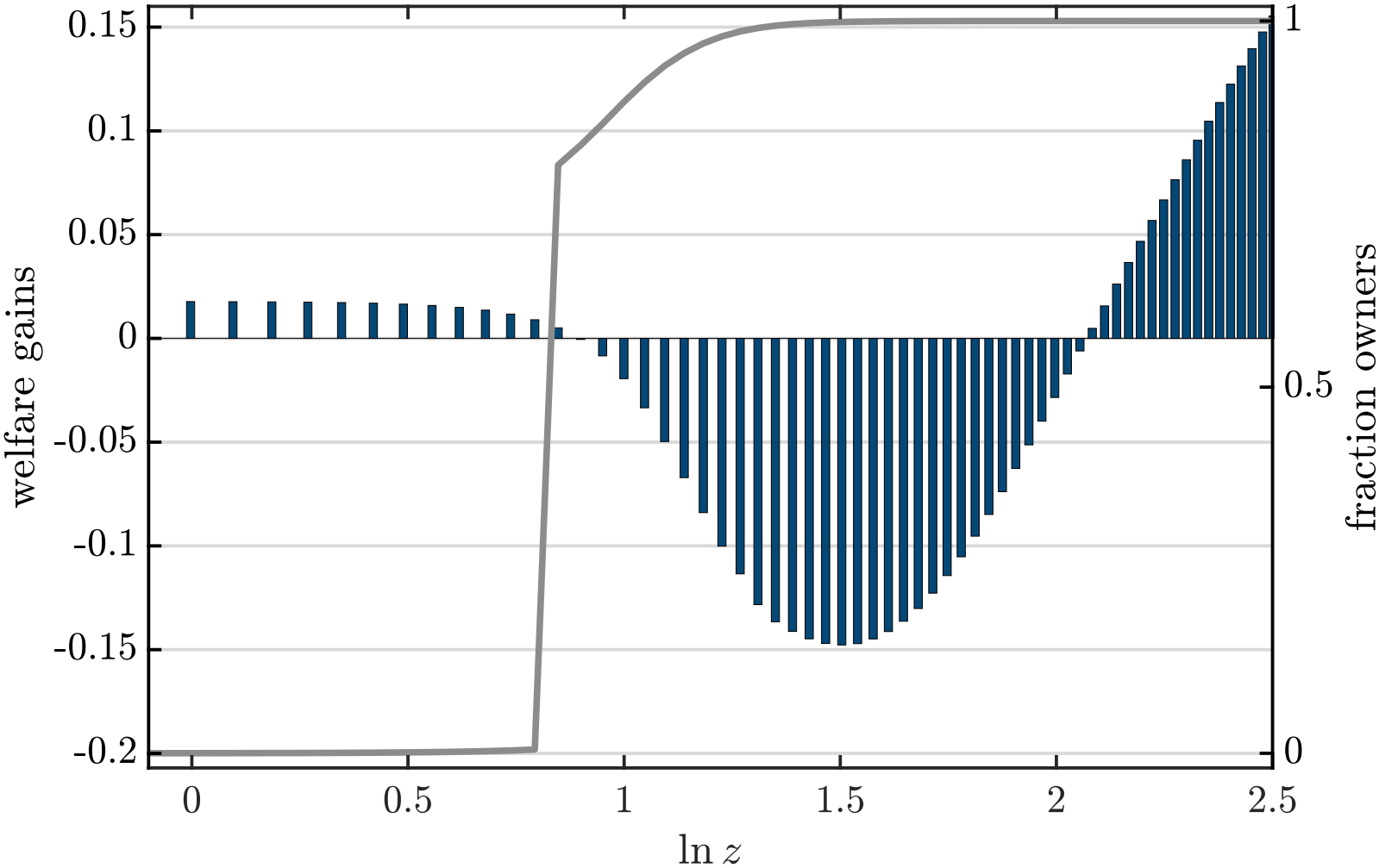
Welfare

- Consumption equivalent gains

	all	workers	firm owners
percentage who gain	94.4	99.9	18.8
median gain, $\times 100$	1.7	1.7	-2.3
utilitarian gains, $\times 100$	1.4		

All workers, one fifth of firm owners benefit from size-dependent subsidy

Welfare Gains



Workers and largest firm owners benefit, mid-sized firm owners lose

Profit Taxes

Profit Tax

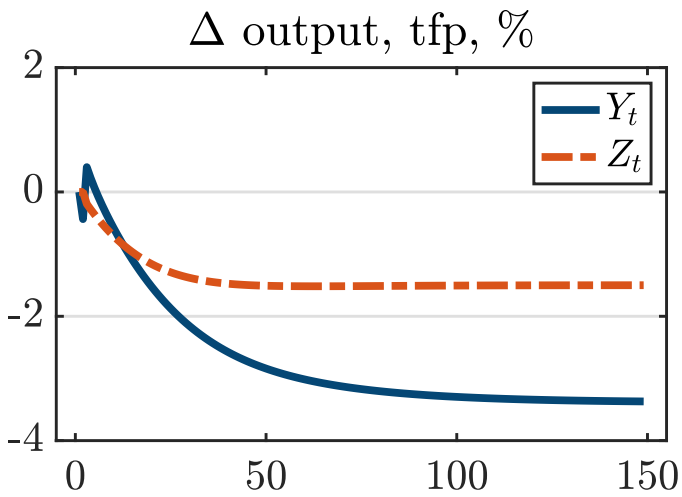
- Aimed at alleviating distributional costs of markups

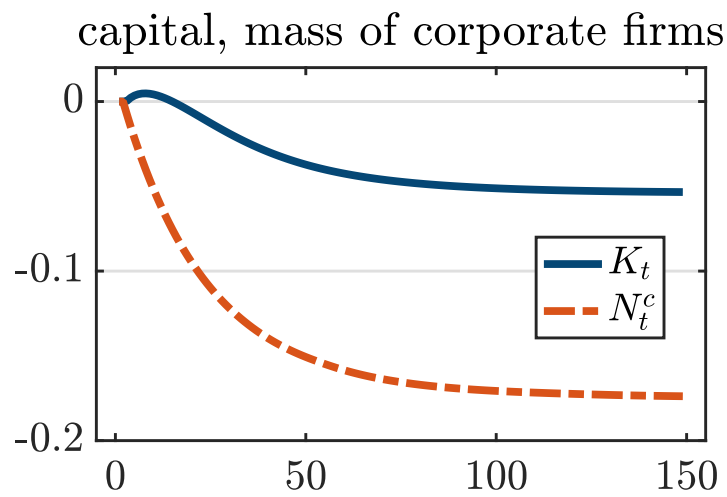
- 25% tax on

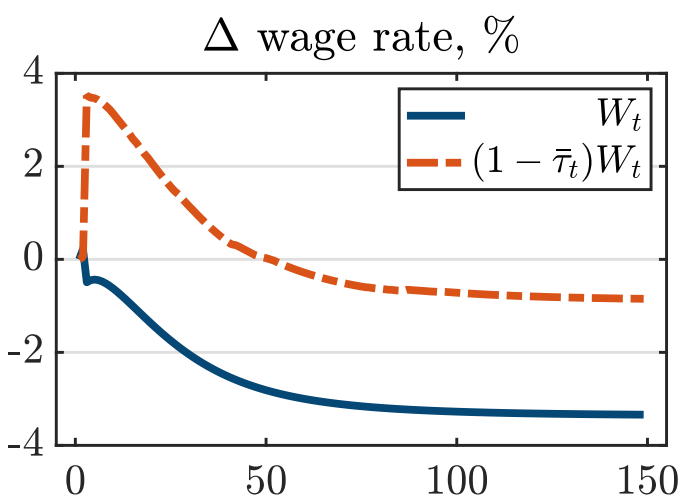
  1. all profits (17% of GDP)
  2. profits above the profits of the 99.5^{th} largest firm (7.5% of GDP)

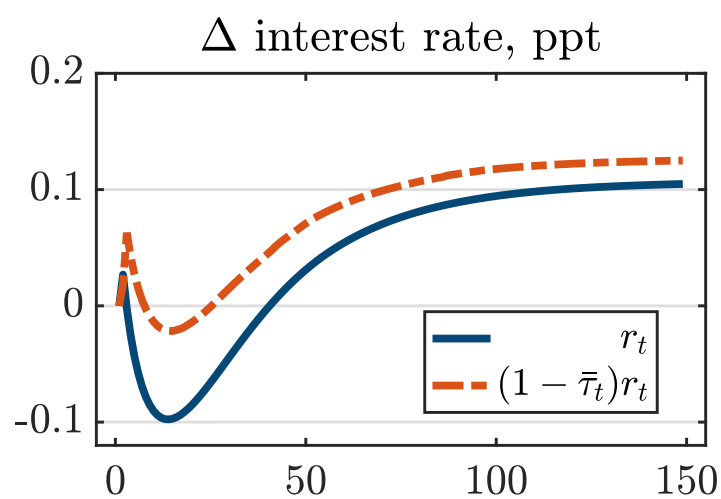
- Use revenue to reduce personal income taxes (τ_t)

Transition Dynamics: Tax All Profits









tax above cutoff

Welfare

- Consumption equivalent gains

	all	workers	firm owners
	25% tax on all profits		
percentage who gain	86.1	89.7	36.2
median gain, $\times 100$	1.7	1.8	-0.9
utilitarian gains, $\times 100$	1.7		

Most households win, since distribution of productivity inelastic

Welfare

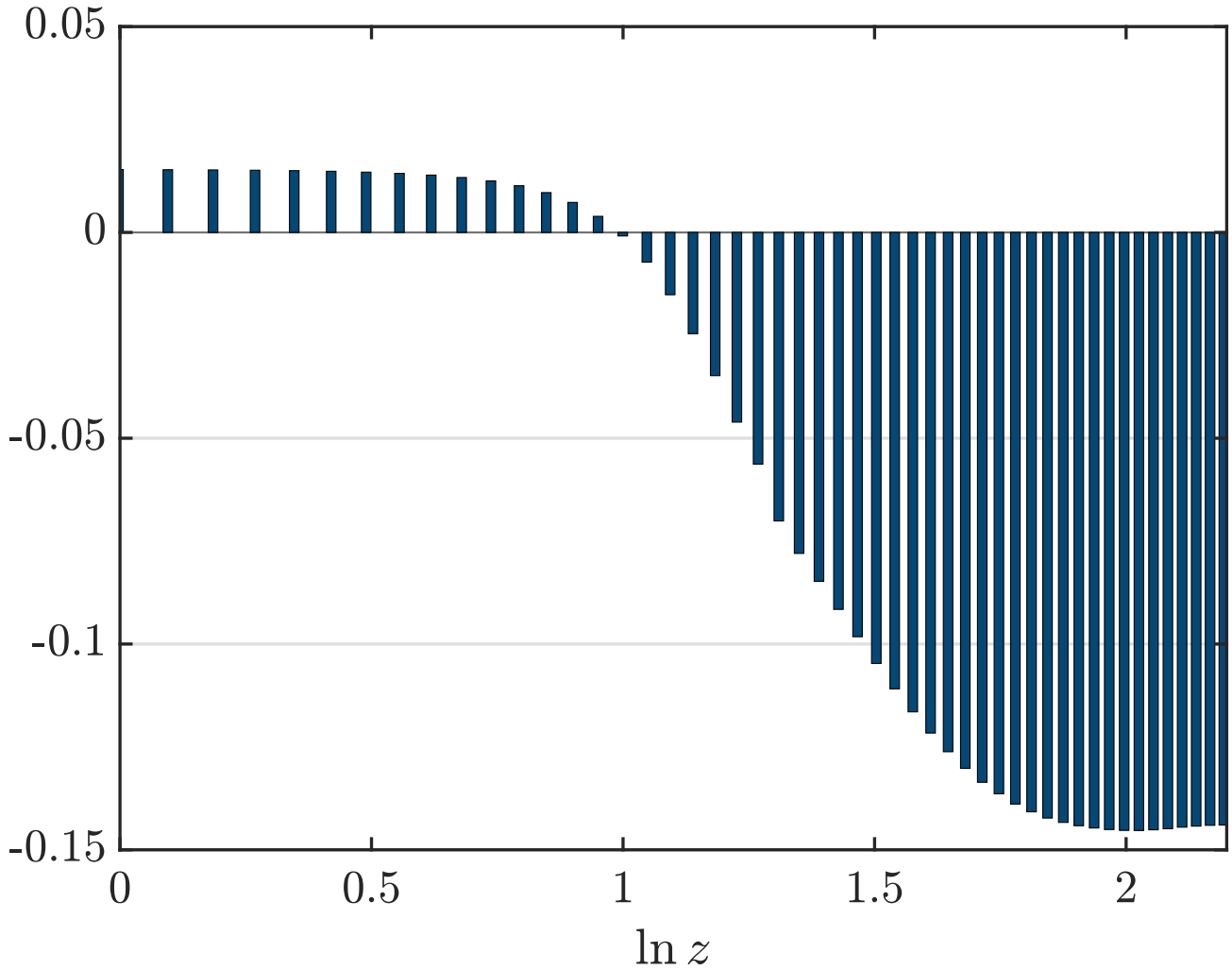
- Consumption equivalent gains

	all	workers	firm owners
	25% tax on all profits		
percentage who gain	86.1	89.7	36.2
median gain, ×100	1.7	1.8	-0.9
utilitarian gains, ×100	1.7		
	25% tax on profits above cutoff		
percentage who gain	82.2	82.7	74.4
median gain, ×100	0.6	0.6	0.4
utilitarian gains, ×100	0.6		

Most households win, since distribution of productivity inelastic

Welfare Gains

- 25% tax on all profits

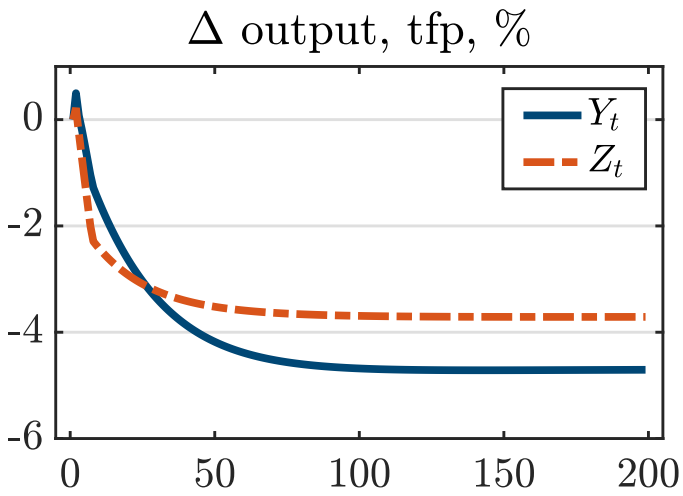


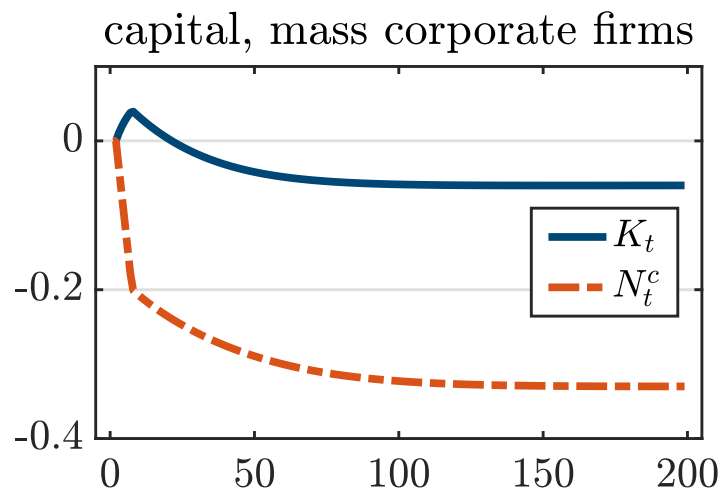
Workers better off, at the expense of firm owners

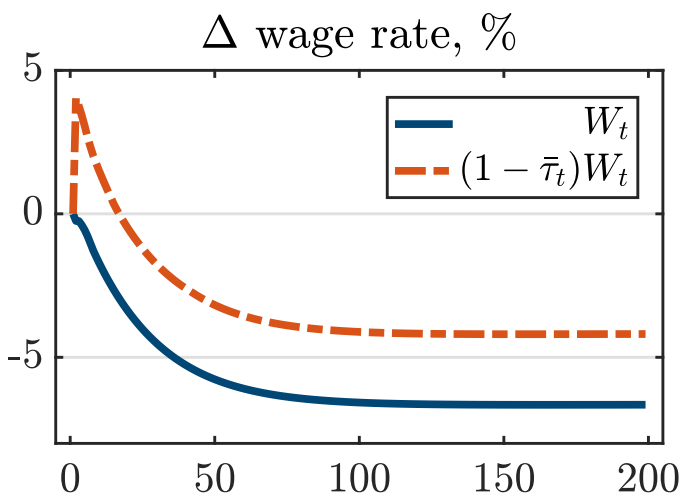
Endogenizing Productivity Distribution

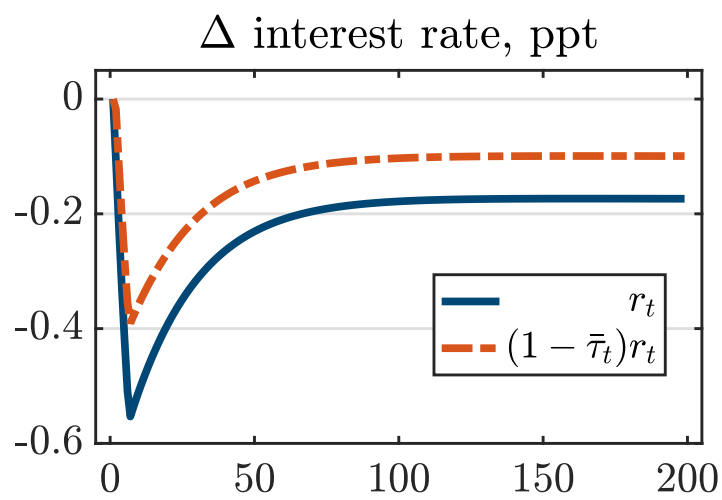
- So far distribution of productivity exogenous
- Though profit taxes depress savings, only mild impact on misallocation
- Consider next Hopenhayn model with free entry in corporate sector
  - firms pay fixed cost to draw initial productivity
  - calibrated to match same moments as earlier
  - distribution of productivity responds to profit taxes
  - profit taxes depress entry, larger effect on TFP

Transition Dynamics: Tax All Profits









Welfare

- Consumption equivalent gains

	all	workers	entrepreneurs
	25% tax on all profits		
percentage who gain	29.4	31.1	7.6
median gain, $\times 100$	-0.5	-0.5	-1.4

Most households lose, especially if only tax largest firms

Welfare

- Consumption equivalent gains

	all	workers	entrepreneurs
	25% tax on all profits		
percentage who gain	29.4	31.1	7.6
median gain, $\times 100$	-0.5	-0.5	-1.4
	25% tax on profits above cutoff		
percentage who gain	5.0	2.6	36.4
median gain, $\times 100$	-0.6	-0.6	-0.2

Most households lose, especially if only tax largest firms

Extensions

- Additional product market interventions
  - size-dependent taxes that reduce concentration and markups

sd tax

- Results robust to
  - no corporate firms, so all businesses privately held

model variants

  - random subsidies negatively correlated with productivity

random subsidies

  - oligopolistic competition with finite number of firms

oligopoly

  - horizontal mergers

mergers

Conclusions

- Studied implications of product market interventions in economy with
  - endogenously variable markups
  - incomplete markets, consistent with U.S. inequality
- Most households benefit from size dependent subsidies
  - despite higher markups, allocative inefficiency
  - benefit workers at the expense of entrepreneurs, reduce inequality
- Profit taxes redistribute towards workers
  - welfare effects depend on how elastic the productivity distribution is
  - much smaller than welfare effects of increasing progressivity

Extras

Bounds on Quantities and Prices

- Second order condition for profit maximization requires

$$1 < \theta(q) = \sigma q^{-\frac{\varepsilon}{\sigma}} \qquad \Leftrightarrow \qquad q < \sigma^{\frac{\sigma}{\varepsilon}} \equiv \overline{q}$$

  Gives upper bound on quantities

- Firms with high marginal costs shut down

$$p < \Upsilon'(0) \qquad \Leftrightarrow \qquad p < \frac{\sigma - 1}{\sigma} \exp\left(\frac{1}{\varepsilon}\right) \equiv \overline{p}$$

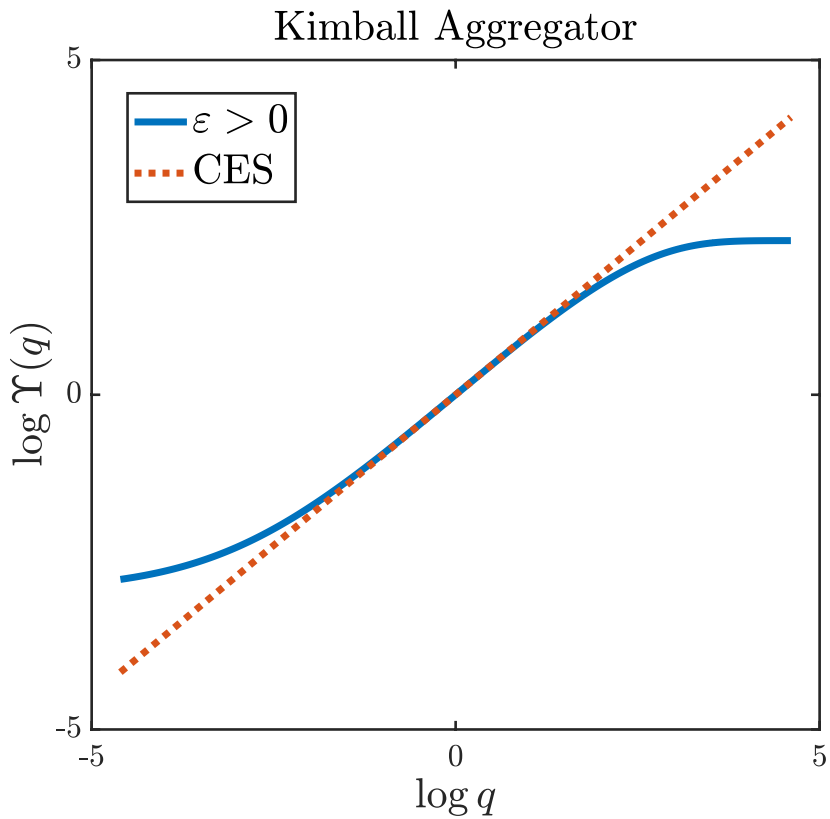
  Gives upper bound on prices

Production Function

$$\Upsilon(q;\sigma,\varepsilon) = 1 + (\sigma-1)\exp\left(\frac{1}{\varepsilon}\right)\varepsilon^{\frac{\sigma}{\varepsilon}-1}\left[\Gamma\left(\frac{\sigma}{\varepsilon},\frac{1}{\varepsilon}\right) - \Gamma\left(\frac{\sigma}{\varepsilon},\frac{q^{\varepsilon/\sigma}}{\varepsilon}\right)\right]$$

$$\Gamma(s,t) = \int_x^\infty t^{s-1}e^{-t}dt$$

$$\varepsilon = 0\text{: } \Upsilon(q) = q^{1-\frac{1}{\sigma}}$$



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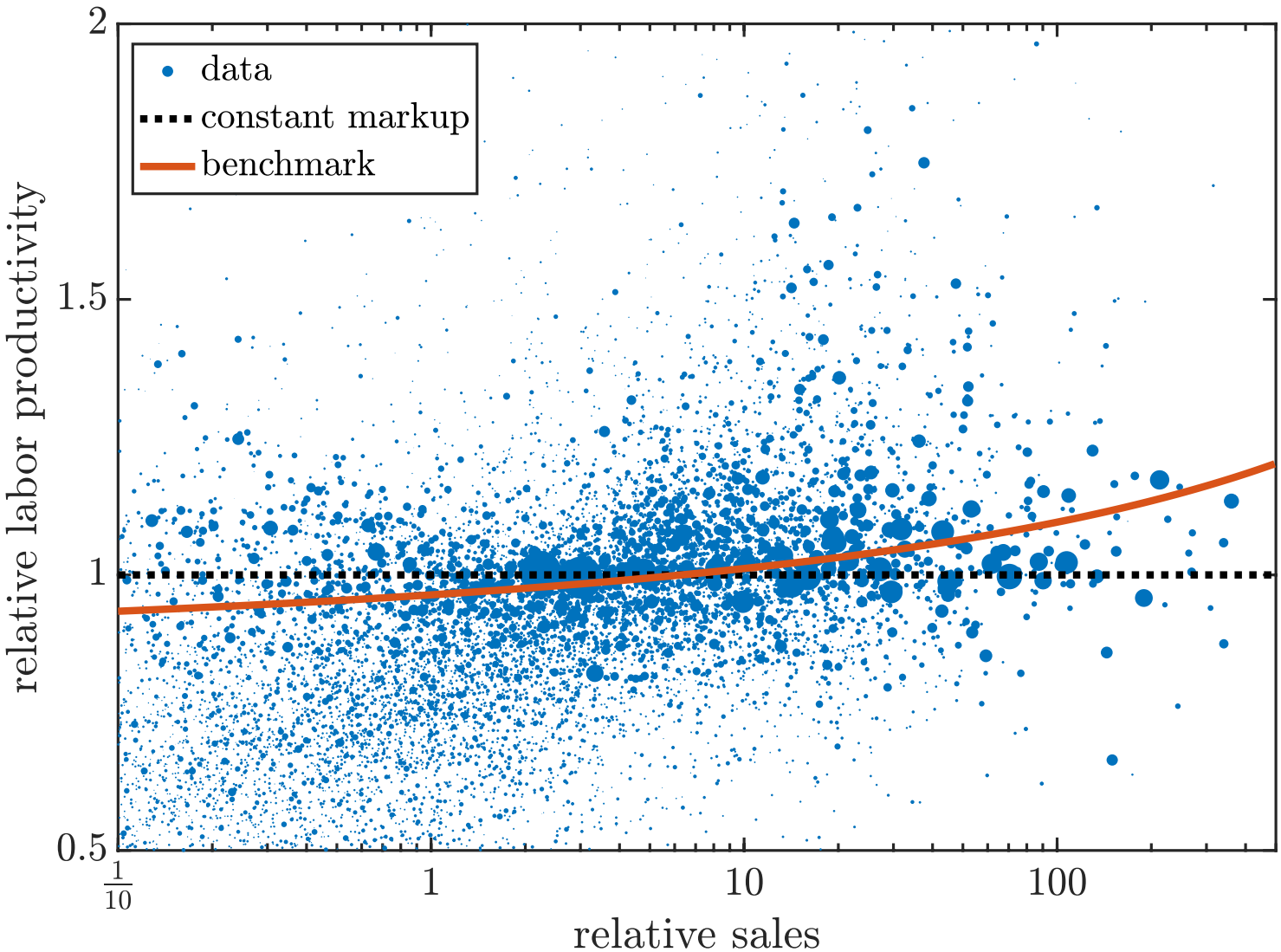
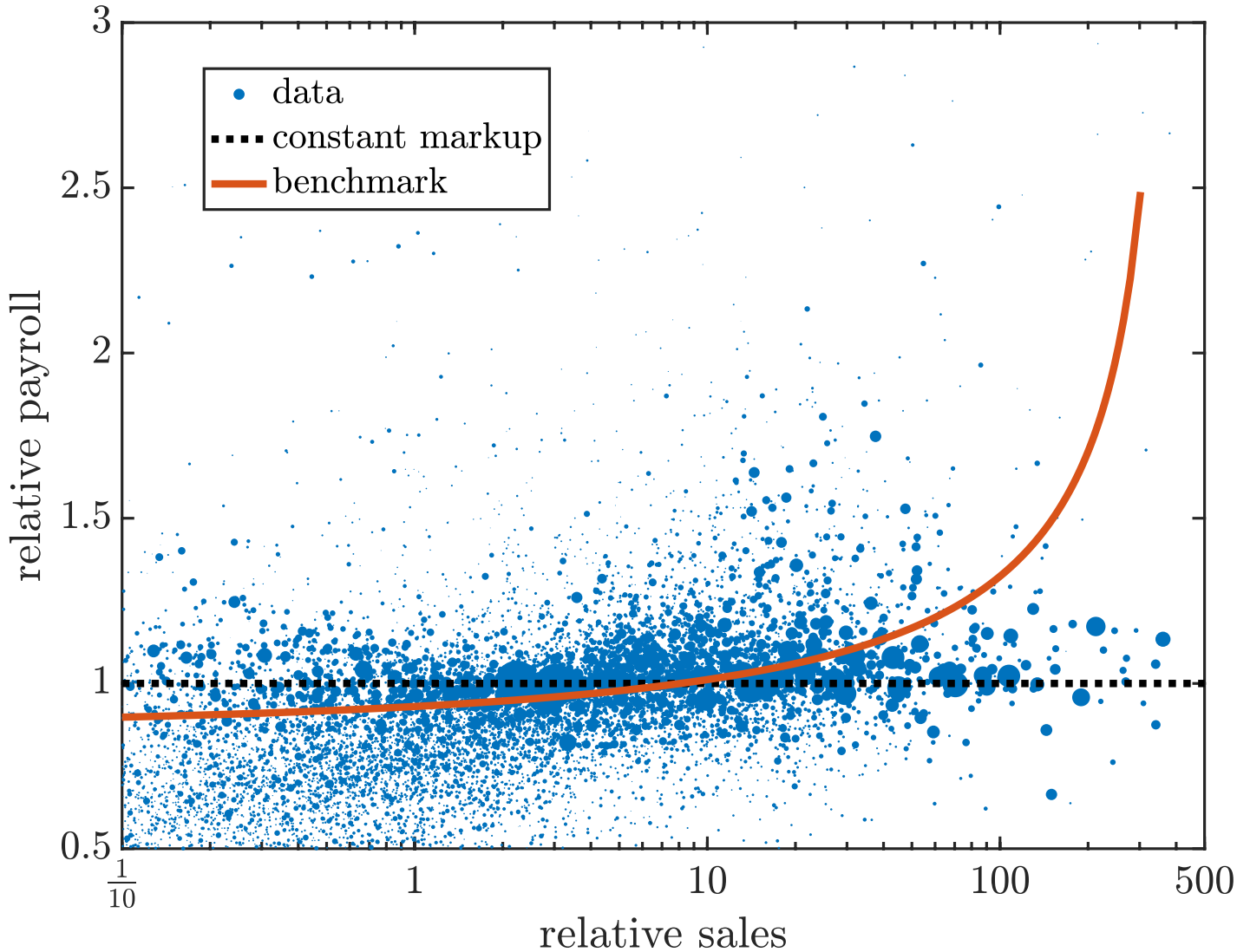
Labor Productivity vs. Size with $\varepsilon/\sigma = 0.15$



Labor Productivity vs. Size with $\varepsilon/\sigma = 0.3$



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Accounting Decomposition

- Aggregate production function

$$\frac{Y_t}{L_t} = Z_t^{\frac{1}{1-\alpha}} \left(\frac{K_t}{Y_t} \right)^{\frac{\alpha}{1-\alpha}}$$

- Real wage

$$W_t = \frac{1-\alpha}{M_t} \frac{Y_t}{L_t}$$

- Thought experiment: remove m_{it} and ν_{it} and trace implications

back

Model Variants

1. No entry
   - constant mass of corporate firms, stock price responds to Δ policy

2. No entrepreneurs
   - no financial constraint, all business income diversified

3. No corporate firms
   - severe financial constraint, all business income private

- Recalibrate to match original moments

Uniform Subsidy

	baseline	no entry	no entrep.	no corpor.
fraction better off	0.29	0.25	0.28	0.28
median welfare gains	-1.4	-0.2	-1.6	-1.6

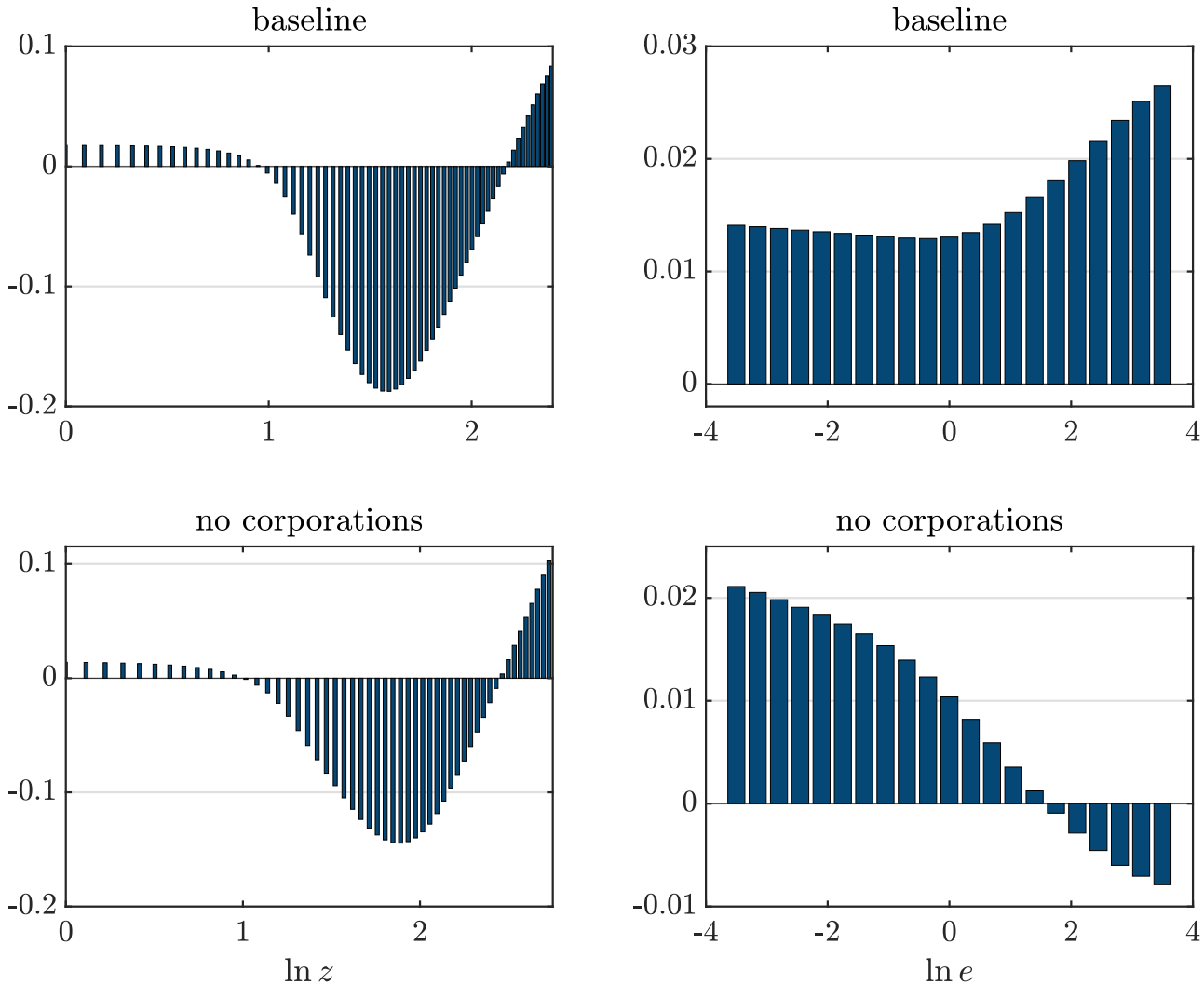
- Welfare losses smaller absent free entry
  - higher stock price implies lower G debt needed to match $r = 2\%$
  - need smaller $\uparrow \tau$ to finance G spending after $\uparrow r$

Size-Dependent Subsidy

	baseline	no entry	no entrep.	no corpor.
fraction better off	0.96	0.96	0.88	0.81
median welfare gains	1.7	1.8	0.7	1.6

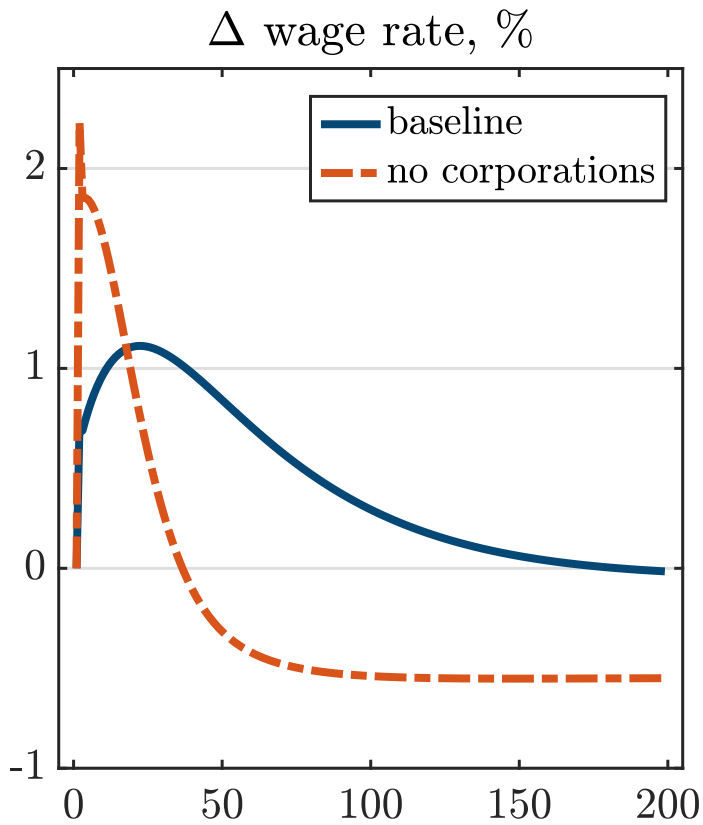
- Absent entrepreneurs, welfare gains since eliminate misallocation
- All others: misallocation ↑, but median HH gains from redistribution
  - ↑ wages during transition benefits workers
  - at the expense of all but largest entrepreneurs

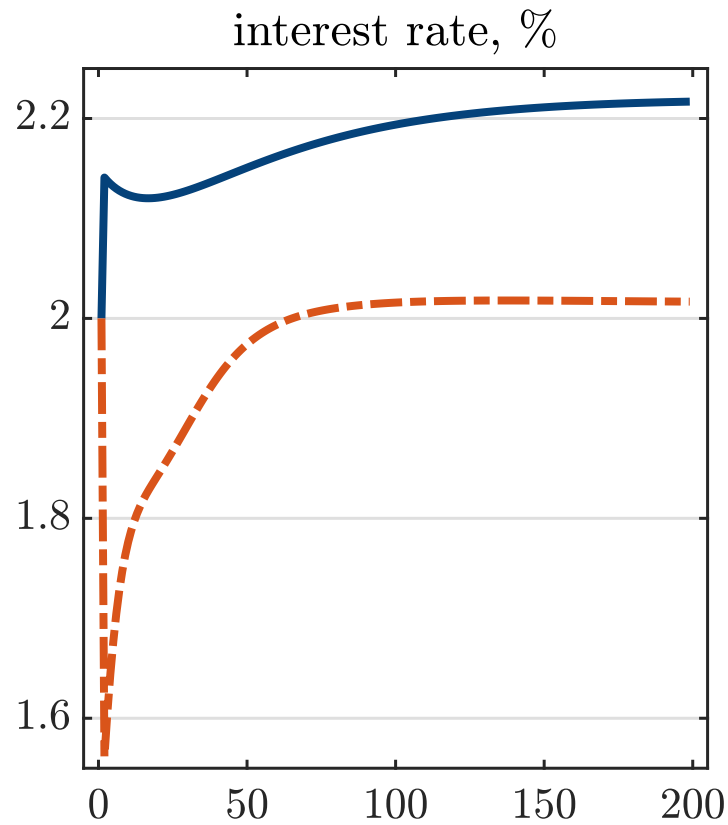
Welfare Gains. Size-Dependent Subsidy



Absent corporations, high e lose, rather than win. Because r falls

Transition Dynamics. Size-Dependent Subsidy





Absent corporations, r drops since more severe credit constraints

Size-Dependent Tax

	baseline	no entry	no entrep.	no corpor.
fraction better off	0.02	0.02	0	0.04
median welfare gains	-10.5	-11.2	-7.6	-10.0

back

Random Subsidies

- Static model, labor only, consumers do not own firms

- Suppose firm ω receives idiosyncratic input subsidy $\tau(\omega)$
  - captures gov't policies, monopsony power or other distortions

- Firm solves

$$p(\omega)\, y(\omega) - \frac{1}{\tau(\omega)} \frac{W}{z(\omega)} y(\omega) \quad \text{so} \quad p(\omega) = \frac{m(\omega)}{\tau(\omega)} \frac{W}{z(\omega)}$$

- Labor productivity dispersion due to both markup and subsidy

$$\frac{p(\omega)\, y(\omega)}{W l(\omega)} = \frac{m(\omega)}{\tau(\omega)}$$

Numerical Example

- Suppose first $\tau(\omega) = 1$ so markup only distortion

- Calibrate σ, ε, var(z) to match
  - aggregate markup $= 1.15$
  - top 5% sales share $= 0.66$
  - elasticity labor productivity to firm size $= 0.037$

- Introduce size-dependent subsidy to remove markup dispersion

$$\frac{1}{1+\tau_s} \times \frac{\sigma}{\sigma - \left(\frac{s_t}{p_t(s_t)Y_t}\right)^{\varepsilon/\sigma}} - 1$$

- Choose τ_s so revenue neutral

Effect of Size-Dependent Subsidy

- Also contrast to efficient allocations (zero weight on firm owners)

	baseline	planner	size-dependent subsidy
Δ tfp, %	–	1.2	1.2
Δ output, %	–	16.4	0.5
Δ hours, %	–	-4.9	-0.7
Δ consumption, %	–	10.7	1.3
profits/output	0.13	0	0.12
sales share largest 5%	0.66	0.81	0.81
welfare gains, %	–	16.9	2.0

Add Random Distortions

- If $\text{corr}(\tau, z) = 0$, labor productivity declines with firm size
  - large firms are large because of subsidies, have lower labor productivity
- Matching 0.037 elasticity labor product. to sales requires $\text{corr}(\tau, z) < 0$
  - subsidize unproductive firms, tax productive
- Set $\text{var}(\tau)$ so 25% misallocation
  - choose $\text{corr}(\tau, z)$ = -0.43 to match 0.037 elasticity
  - choose $\text{var}(z)$ to match 0.66 top 5% sales share

Effect of Size-Dependent Subsidy

back

- Reduce dispersion labor productivity, increase TFP, consumer welfare

	baseline	planner	size-dependent subsidy
Δ tfp, %	–	26.9	1.2
Δ output, %	–	11.8	0.5
Δ hours, %	–	-11.8	-0.7
Δ consumption, %	–	28.7	1.3
profits/output	0.13	0	0.12
sales share largest 5%	0.66	0.87	0.81
welfare gains, %	–	50.2	2.2

Oligopolistic Competition

- Continuum of sectors $Y_t = \left(\int_0^1 y_t(s)^{\frac{\sigma-1}{\sigma}} ds \right)^{\frac{\sigma}{\sigma-1}}$
- N firms in each sector, with technology $y_i(s) = z_i l_i(s)$
- Sectoral production function $y_t(s) = \left(\sum_{i=1}^N y_{it}(s)^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}}$
- $\rho > \sigma$ so goods within sector more substitutable
- Bertrand competition: optimal markup $m_i = \frac{\varepsilon_i}{\varepsilon_i - 1}$ with elasticity

$$\varepsilon_i = \omega_i \sigma + (1 - \omega_i)\rho \quad \text{where} \quad \omega_i = \frac{p_i y_i}{\sum p_i y_i}$$

Numerical Example

- Set $\sigma = 3$ so 50% monopoly markup
- Set $\rho = 13.8$ so aggregate markup $= 1.15$
- $z_2/z_1 = z_3/z_2 = \eta$, with $\eta = 1.146$ so largest firm has 66% market share
- Industry equilibrium

	1	2	3
markup	1.08	1.10	1.18
ω, market share	0.06	0.27	0.67
market share, eff. alloc.	0.03	0.14	0.83

Size-Dependent Subsidy

- Marginal subsidy that increases with firm sales (revenue neutral)

- Industry equilibrium

	1	2	3
w/o subsidy			
markup	1.08	1.10	1.18
ω, market share	0.06	0.27	0.67
with subsidy			
markup	1.08	1.09	1.28
ω, market share	0.02	0.12	0.86
market share, eff. alloc.	0.03	0.14	0.83

Effect of Size-Dependent Subsidy

back

- Reduce dispersion labor productivity, increase TFP, consumer welfare

	baseline	planner	size-dependent subsidy
Δ tfp, %	–	0.7	0.7
Δ output, %	–	-4.1	-0.7
Δ hours, %	–	-4.8	-1.3
Δ consumption, %	–	10.3	2.7
welfare gains, %	–	16.3	4.1

Horizontal Mergers / Collusion

- Important concern about concentration: mergers/collusion
  - allow firms that would otherwise compete to raise markups

- Suppose firms 2 and 3 merge (or collude) and maximize joint profits

- Optimal to charge common markup $\bar{m} = \frac{\bar{\varepsilon}}{\bar{\varepsilon}-1}$ with

$$\bar{\varepsilon} = (\omega_2 + \omega_3)\sigma + (1 - (\omega_2 + \omega_3))\rho$$

Equilibrium with Mergers/Collusion

- Industry equilibrium

	1	2	3
before merger			
markup	1.08	1.10	1.18
ω, market share	0.06	0.27	0.67
after merger			
markup	1.09	1.27	1.27
ω, market share	0.16	0.13	0.72
market share, eff. alloc.	0.03	0.14	0.83

- Doubles misallocation by increasing market share unproductive firm

Effect of Mergers

- Reduce dispersion labor productivity, increase TFP, consumer welfare

	baseline	merger
Δ tfp, %	–	-0.7
Δ output, %	–	2.0
Δ hours, %	–	2.8
Δ consumption, %	–	-5.3
welfare gains, %	–	-7.8

Size-Dependent Subsidy

- Important role for antitrust enforcement in preventing such outcomes
- Our results on size-dependent subsidies are robust however
  - smallest firm inefficiently large so subsidizing larger firms increase TFP

Size-Dependent Subsidy

- Marginal subsidy in the economy after mergers

- Industry equilibrium

	1	2 + 3
w/o subsidy		
markup	1.09	1.27
ω, market share	0.16	0.84
with subsidy		
markup	1.08	1.43
ω, market share	0.03	0.97
market share, eff. alloc.	0.03	0.97

Effect of Size-Dependent Subsidy

back

	mergers	subsidy
Δ tfp, %	–	1.4
Δ output, %	–	-1.0
Δ hours, %	–	-2.4
Δ consumption, %	–	5.0
welfare gains, %	–	7.7

Quantity Quota

- Impose cap on a firm's quantity (market share)
  - limit firm's relative quantity $q \leq \bar{q}$ so markup below $\bar{\mu} = \frac{\sigma}{\sigma - \bar{q}^{\frac{\varepsilon}{\sigma}}}$
  - choose $\bar{q}$ so markup below 15%

- Optimal price

$$p_t = \frac{\sigma}{\sigma - q_t^{\frac{\varepsilon}{\sigma}}} \frac{1}{1 - \xi(q_t)} \times \text{marginal cost}$$

$\xi(q_t) > 0$ if quota binds

- Similar implications to size-dependent tax
  - reduces markup but further increases misallocation
  - median household loses 13%; more inequality since helps entrepreneurs

back

Price Cap

- Cap price to below 1.15 $\times$ marginal cost of unconstrained firm

$$p_t(a,z) \leq \bar{p}_t(z) = 1.15 \times \frac{1}{z_t}\left(\frac{W_t}{1-\alpha}\right)^{1-\alpha}\left(\frac{R_t}{\alpha}\right)^{\alpha}$$

- Corporate firms unconstrained so meet demand at $\bar{p}_t(z)$, lose profits

- Constrained entrepreneurs may sell less than quantity demanded

$$\bar{p}_t(z) = \frac{1}{z_t}\left(\frac{W_t}{1-\alpha}\right)^{1-\alpha}\left(\frac{R_t + \mu_t(q_t;a,z)}{\alpha}\right)^{\alpha} \equiv \text{marginal cost}$$

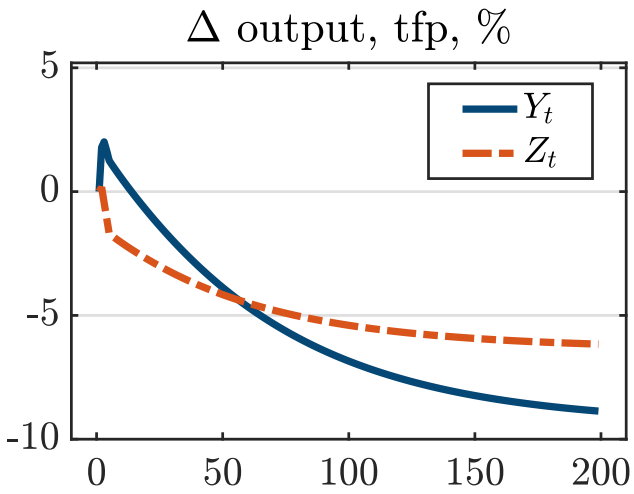
- Similar to size-dependent subsidy, but financed by taxing producers
  - disproportionately hurts constrained entrepreneurs

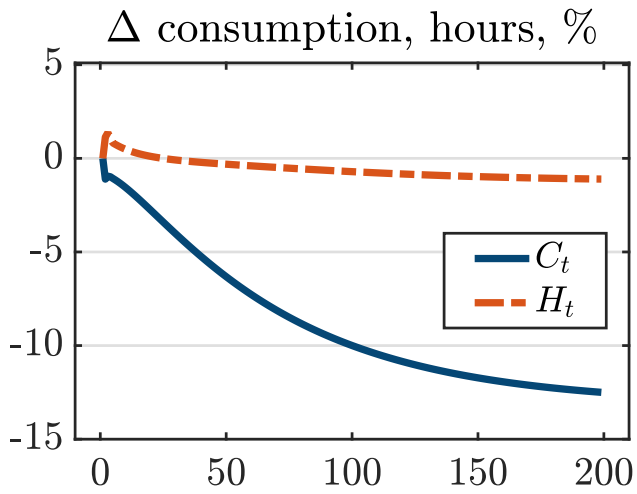
Steady State Implications

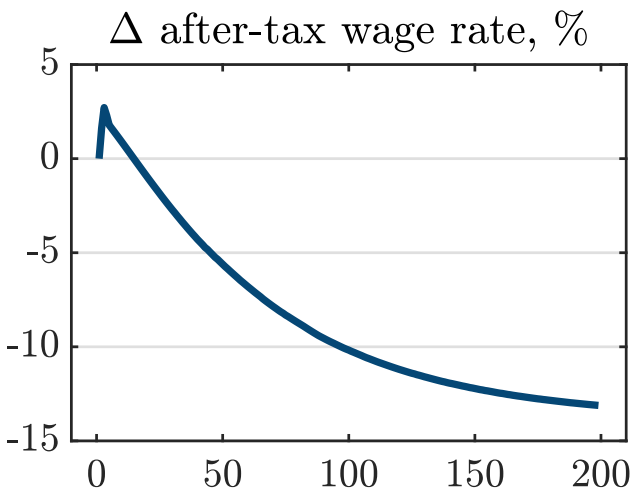
	benchmark	price cap
wealth share top 1%	0.31	0.11
wealth share entrepreneurs	0.29	0.12
number of producers	1	1.23
percentage entrepreneurs	7.1	8.9
corporate sales share	0.63	0.89
sales share largest 0.1% firms	0.30	0.47
TFP loss misallocation, %	6.1	12.1
Δ output, %	–	-8.9
Δ after-tax wage, %	–	-13.0
after-tax interest rate, %	1.6	2.1

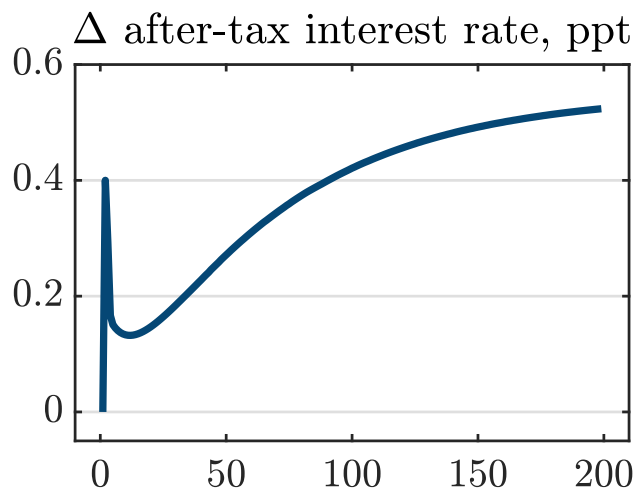
Increases concentration and misallocation, reduces wages, output

Transition Dynamics

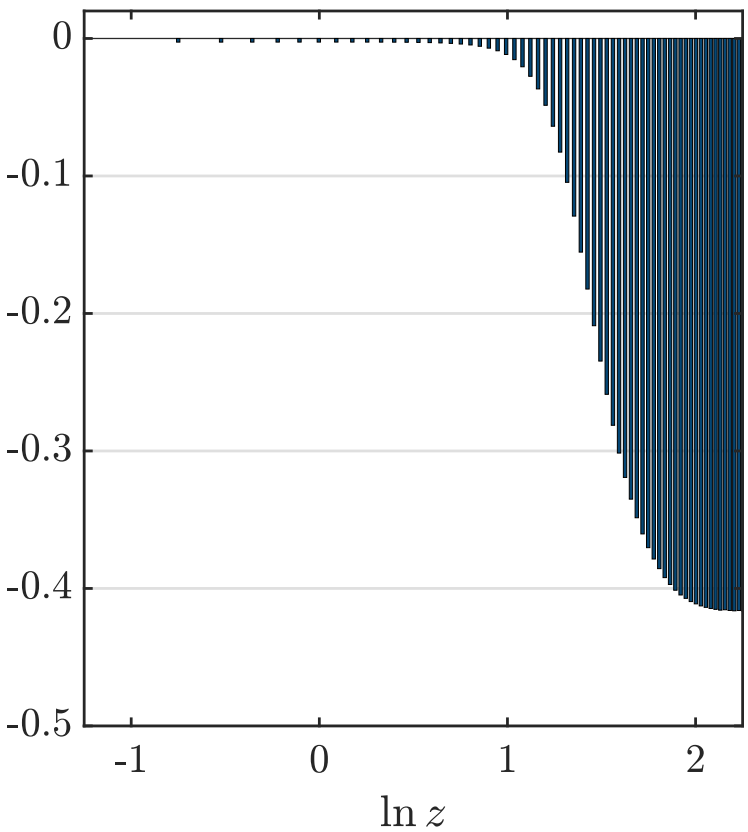


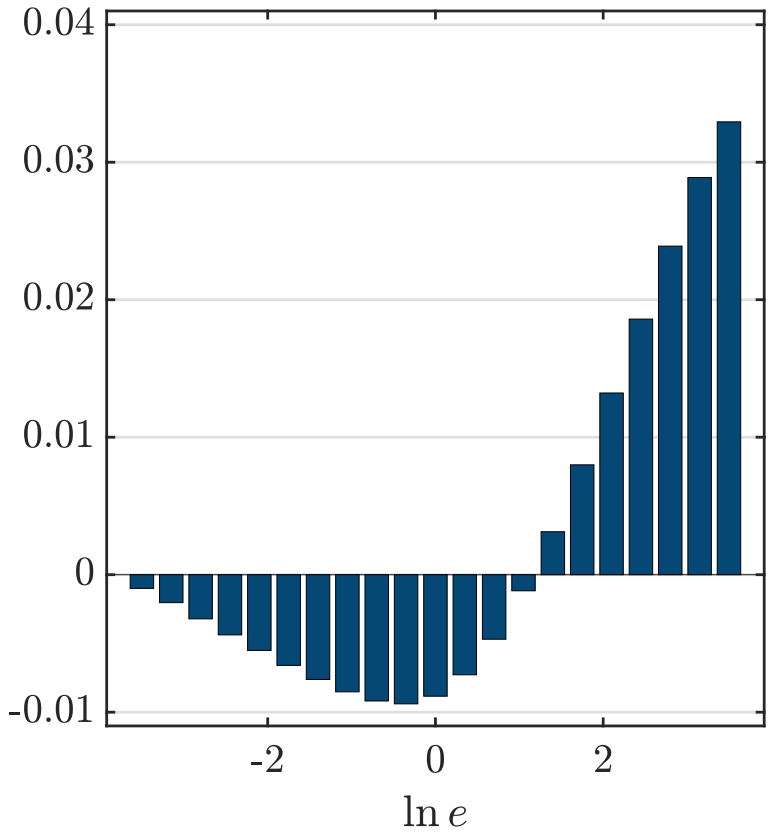






Welfare Gains





Median household loses only 0.6% since mostly hurts entrepreneurs

back

Financial Intermediaries

- Households deposit a_{t+1} with financial intermediaries which invest in
  - government bonds B_{t+1}
  - physical capital K_{t+1}
  - new corporate firms FN^e_{t+1}
  - shares in existing corporate firms with price Q_t

- Intermediary budget constraint

$$K_{t+1} + Q_t S_{t+1} + FN^e_{t+1} + B_{t+1} + (1 + r_{t-1})\, A_t =$$

$$(R_t + 1 - \delta)\, K_t + (Q_t + \Pi^c_t)\left((1 - \delta_c)\, S_t + N^e_t\right) + (1 + r_{t-1})\, B_t + A_{t+1}$$

- No arbitrage and no agregate uncertainty $\Rightarrow$

$$R_t = r_{t-1} + \delta \qquad Q_t = \frac{1 - \delta_c}{1 + r_t}(Q_{t+1} + \Pi_{t+1}) \qquad F \geq \frac{1}{1 + r_t}(Q_{t+1} + \Pi_{t+1})$$

back

Equilibrium

1. Total output satisfies

$$\int \Upsilon\left(\frac{y_t(a,z)}{Y_t}\right) \mathrm{d}n_t(a,z,e) + N_t^c \int \Upsilon\left(\frac{y_t^c(z)}{Y_t}\right) \mathrm{d}n^c(z) = 1$$

2. Labor market clearing

$$\int l_t(a,z)\, \mathrm{d}n_t(a,z,e) + N_t^c \int l_t^c(z)\, \mathrm{d}n^c(z) = \int e h_t(a,z,e)\, \mathrm{d}n_t(a,z,e)$$

3. Asset market clearing

$$\int a_{t+1}(a,z,e)\, \mathrm{d}n_t(a,z,e) \equiv A_{t+1} = K_{t+1} + Q_t S_{t+1} + F N_t^e + B_{t+1}$$

4. Capital market clearing

$$\int k_t(a,z)\, \mathrm{d}n_t(a,z,e) + N_t^c \int k_t^c(z)\, \mathrm{d}n^c(z) = K_t$$

Additional Moments

- Wealth and income shares

	Data	Model		Data	Model
	Wealth Distribution			*Income Distribution*	
Top 1%	0.36	0.36	Top 1%	0.20	0.21
Top 2%	0.47	0.43	Top 2%	0.26	0.26
Top 5%	0.63	0.56	Top 5%	0.36	0.37
Bot 50%	0.01	0.02	Bot 50%	0.14	0.14
Bot 25%	0.00	0.00	Bot 25%	0.04	0.05

Additional Moments

- Fraction of entrepreneurs in bins of wealth and income distribution

	Data	Model		Data	Model
	Wealth Distribution			*Income Distribution*	
Top 1%	0.49	0.38	Top 1%	0.38	0.30
Top 2%	0.43	0.25	Top 2%	0.38	0.22
Top 5%	0.34	0.17	Top 5%	0.29	0.15
Bot 50%	0.02	0.03	Bot 50%	0.04	0.04
Bot 25%	0.02	0.00	Bot 25%	0.03	0.03

Additional Moments

- Wealth and income shares of entrepreneurs in bins of distribution

	Data	Model		Data	Model
	Wealth Distribution			*Income Distribution*	
Top 1%	0.49	0.51	Top 1%	0.45	0.60
Top 2%	0.46	0.45	Top 2%	0.44	0.50
Top 5%	0.42	0.37	Top 5%	0.38	0.39
Bot 50%	0.03	0.07	Bot 50%	0.04	0.05
Bot 25%	0.03	0.00	Bot 25%	0.03	0.03

Additional Moments

- Share of stock market owned by bins of the wealth distribution

	Data	Model
Top 1%	0.36	0.46
Top 2%	0.48	0.52
Top 5%	0.66	0.64
Bot 50%	0.01	0.02
Bot 25%	0.00	0.00

– assuming equal portfolio shares in publicly traded stocks

back

Aggregate Labor and Capital Wedge

- Individual firm sets (m_{it} markup, $\nu_{it} \sim$ multiplier on BC)

$$(1-\alpha)\frac{p_{it}y_{it}}{l_{it}} = W_t m_{it} \qquad \alpha\frac{p_{it}y_{it}}{k_{it}} = R_t m_{it}\nu_{it} = R_t\omega_{it}$$

- Aggregate across all firms

$$(1-\alpha)\frac{Y_t}{L_t} = W_t M_t \qquad \alpha\frac{Y_t}{K_t} = R_t\Omega_t$$

- Aggregate wedges = input weighted average of firm wedges

$$M_t = \int m_{it}\frac{l_{it}}{L_t}\mathrm{d}i \qquad \Omega_t = \int \omega_{it}\frac{k_{it}}{K_t}\mathrm{d}i$$

Misallocation

- Aggregate production function

$$Y_t = Z_t K_t^{\alpha} L_t^{1-\alpha}$$

- Aggregate TFP

$$Z_t = \left[\left(\int \nu_{it}^{\alpha} \frac{q_{it}}{z_{it}} \mathrm{d}i \right)^{1-\alpha} \left(\int \nu_{it}^{\alpha-1} \frac{q_{it}}{z_{it}} \mathrm{d}i \right)^{\alpha} \right]^{-1}$$

- Distorted by dispersion in markups and collateral constraint

$$q_{it} = \left[1 - \varepsilon \log \left(m_{it} \frac{\nu_{it}^{\alpha}}{z_{it}} \Omega_t \frac{\sigma}{\sigma - 1} \right) \right]^{\frac{\sigma}{\varepsilon}}$$

back

Distribution of Wedges

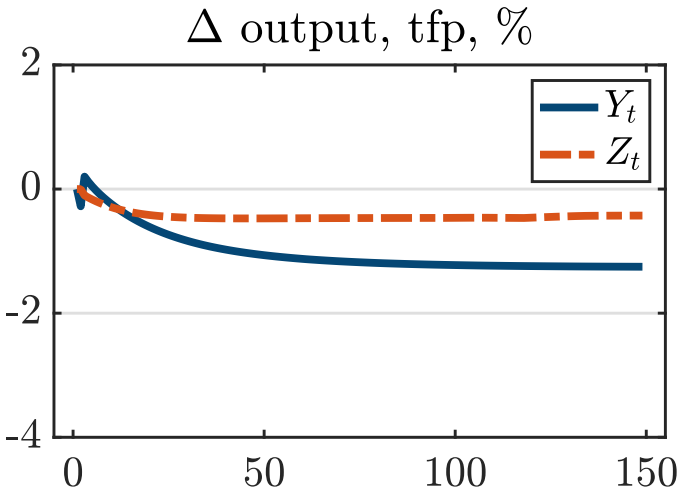
	Entrepreneurs		Corporations
	Labor	Capital	Both
Aggregate	1.13	1.65	1.17
p10	1.06	1.09	1.11
p50	1.12	1.41	1.16
p90	1.19	2.53	1.23

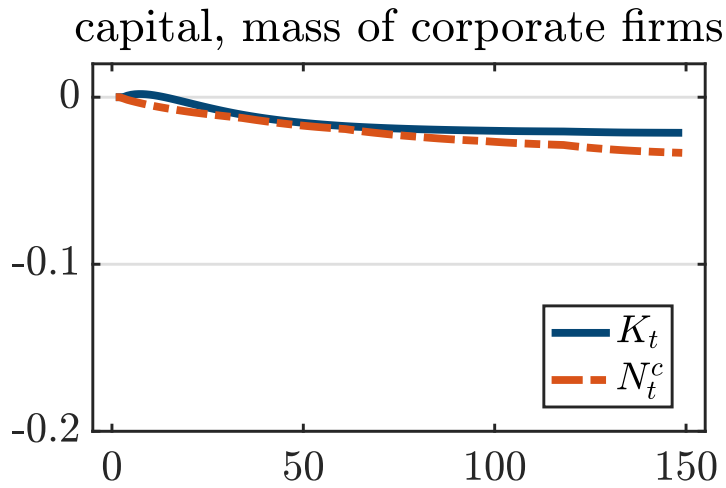
Remove Wedges

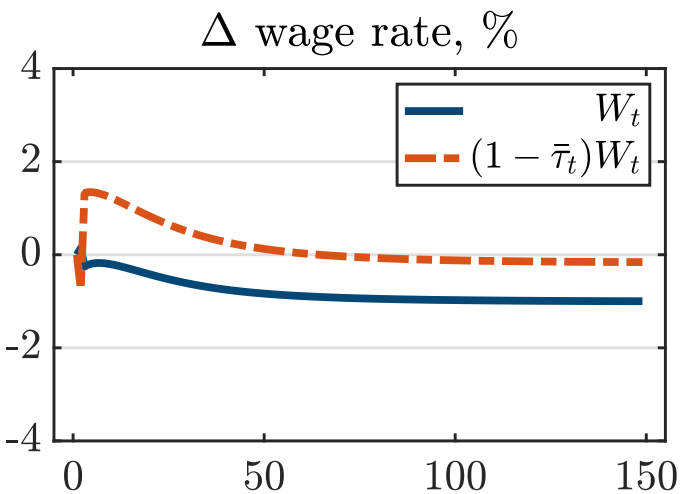
	Baseline	No distortions	No markup distortions	No credit distortions
TFP loss, $\times 100$	9.0	0	8.8	0.9
Sales share corporations	0.57	0.27	0.63	0.20
$\Delta \log W$, $\times 100$	–	0.42	0.22	0.23

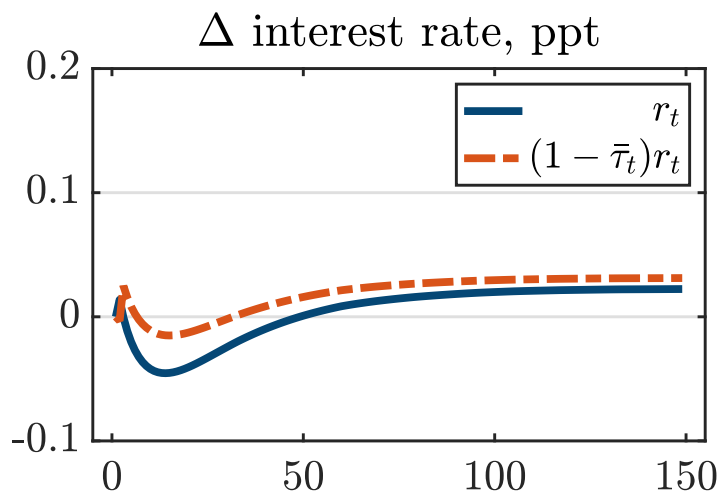
back

Transition Dynamics: Tax Profits Above Cutoff









back

Size-Dependent Tax

- Reduces concentration and markups

- Marginal tax rate increases with sales

$$\tau_s(s_t) = 1 - (1 + \tau_s) \exp\left(-\xi_s s_t\right)$$

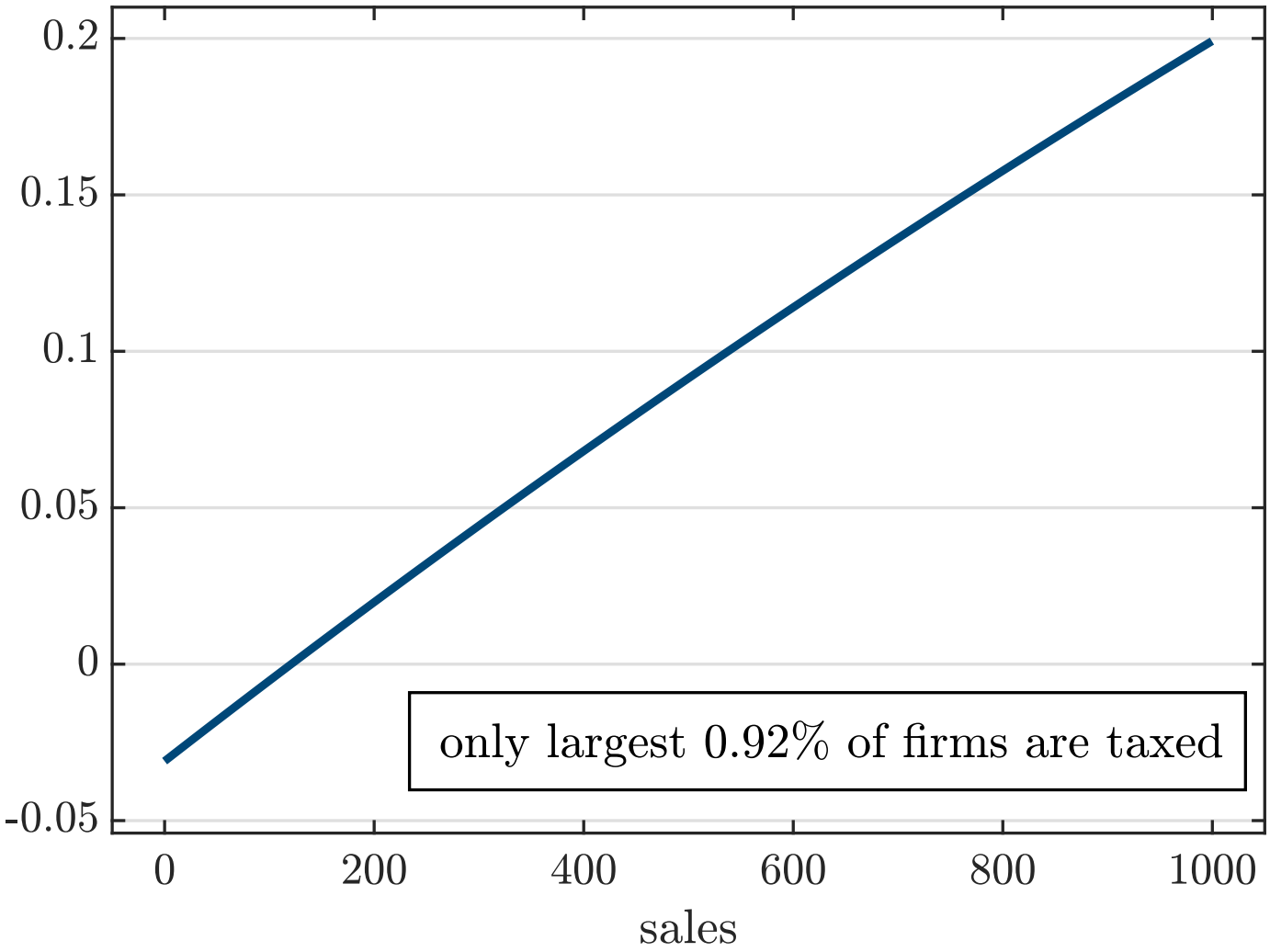
- Optimal price

$$p_t = \frac{m_t}{1 - \tau_s(s_t)} \times \text{marginal cost}$$

- Choose τ_s so no Δ in income tax function

- Choose ξ_s to halve top 0.1% market share

Size-Dependent Tax



Concentration, Markups, Efficiency

Steady-state comparisons:

	benchmark	size-dependent tax
number of producers	1	1.21
percentage entrepreneurs	6.4	9.3
corporate sales share	0.57	0.46
sales share top 0.1%	0.28	0.14
50 pct markup	1.15	1.12
90 pct markup	1.22	1.16
TFP loss misallocation, %	9.0	12.4

Reduces concentration, markups. Increases misallocation

Macro Aggregates

Steady-state comparisons:

	benchmark	size-dependent subsidy
Δ output, %	–	-3.5
Δ consumption, %	–	-4.1
Δ tfp, %	–	-3.4
labor share	0.58	0.56
Δ after-tax wage rate, %	–	-8.8
after-tax interest rate, %	1.6	1.4

Large drop in output due to large drop in TFP

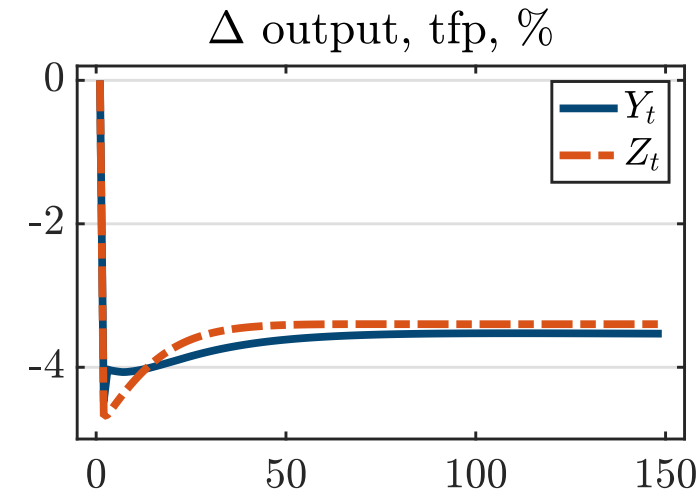
Inequality

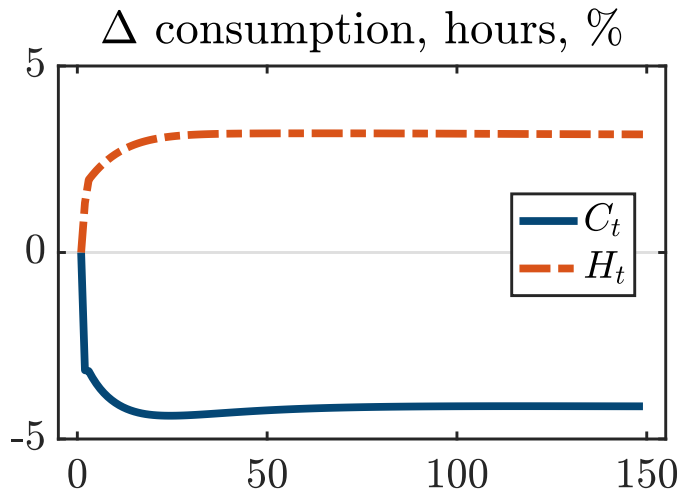
Steady-state comparisons:

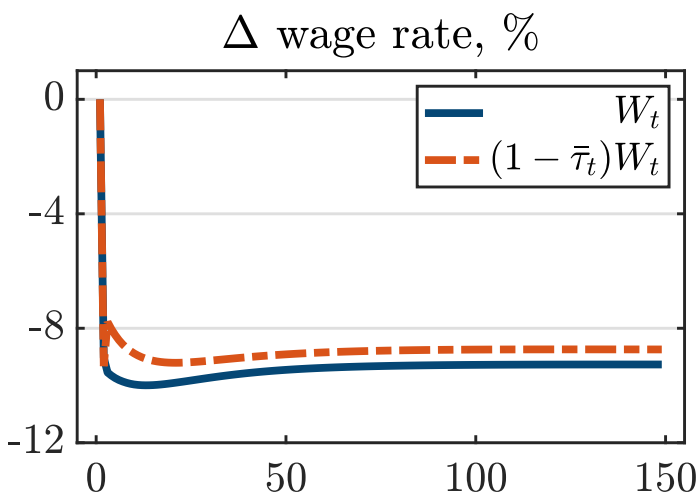
	benchmark	size-dependent tax
Gini wealth	0.82	0.82
top 0.1 pct wealth share	0.18	0.15
top 1 pct wealth share	0.36	0.36
Gini income	0.58	0.59
top 1 pct income share	0.21	0.22
wealth share firm owners	0.37	0.42
income share firm owners	0.21	0.27

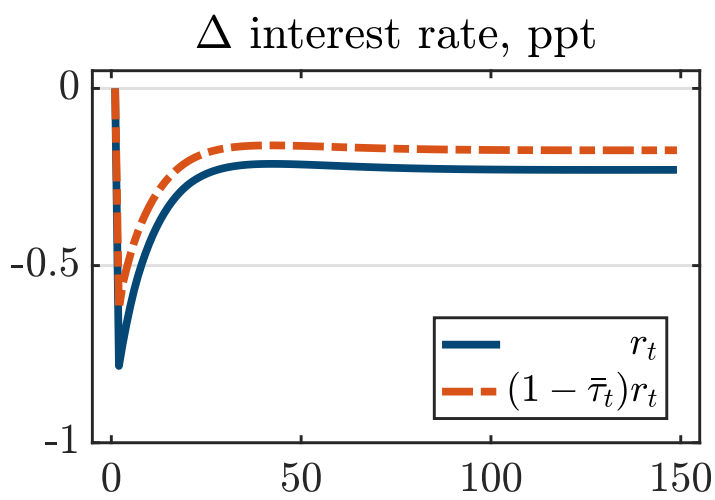
Increases inequality by redistributing from workers to firm owners

Transition Dynamics









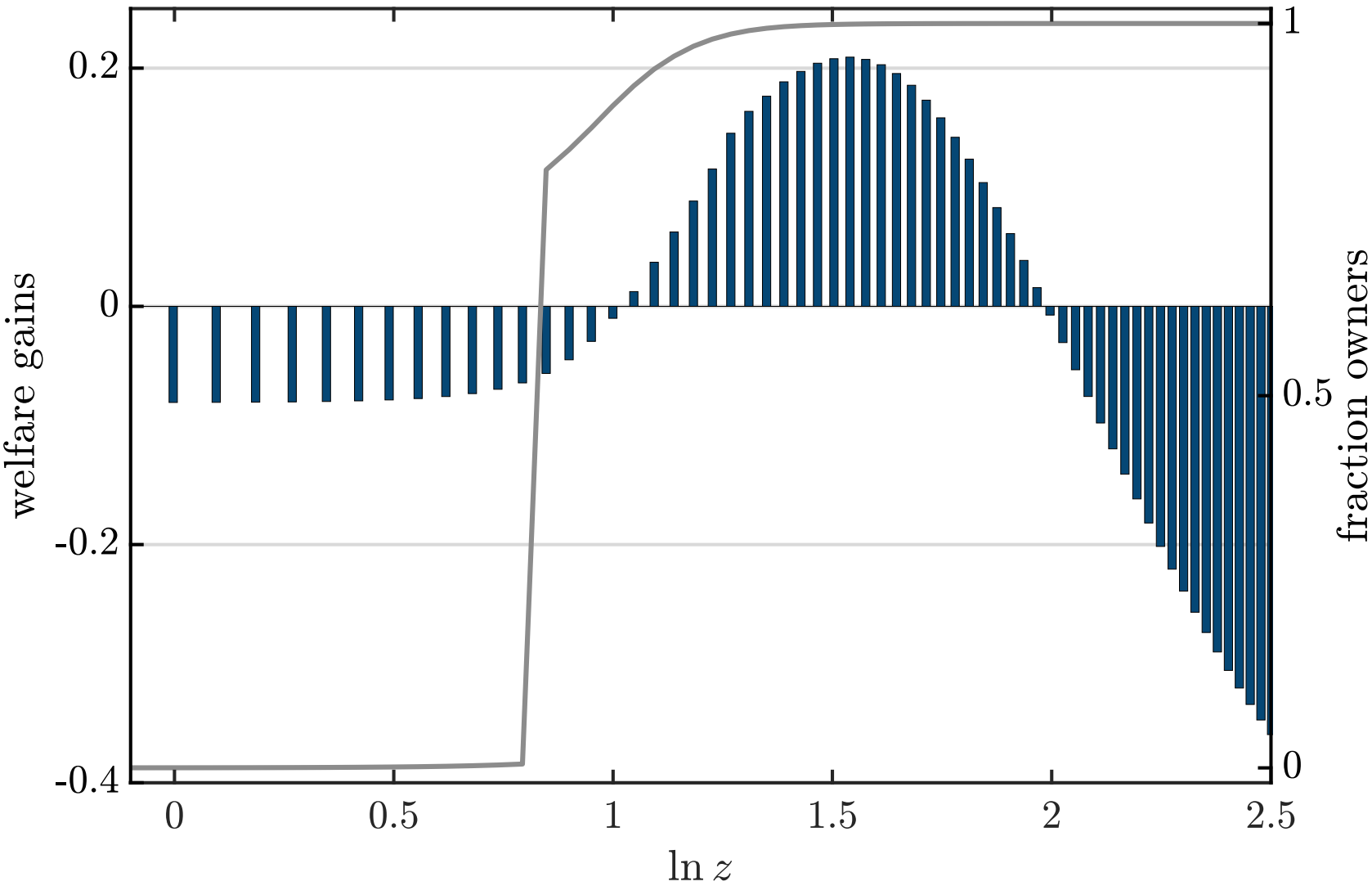
Welfare

- Consumption equivalent gains

	all	workers	business owners
percentage who gain	3.2	0	48.0
median gain, $\times 100$	-8.1	-8.1	-0.4
utilitarian gains, $\times 100$	-7.6		

All workers lose, 1/2 business owners benefit from size-dependent tax

Welfare Gains back



Workers and largest firm owners lose, mid-sized firm owners gain