Topics in Economics

Axelle Ferriere

Sciences Po, CNRS & CEPR

November 2025

On Inequality and Redistribution

- History of Modern Macroeconomics

On Inequality and Redistribution

- History of Modern Macroeconomics
  - First-generation models: dynamic models with rational expectations
    - Equilibrium, solve, calibrate with a representative agent

On Inequality and Redistribution

- History of Modern Macroeconomics
  - First-generation models: dynamic models with rational expectations
    - Equilibrium, solve, calibrate with a representative agent
  - Second-generation models: account for inequality
    - Macro shocks $\Rightarrow$ inequality, welfare

On Inequality and Redistribution

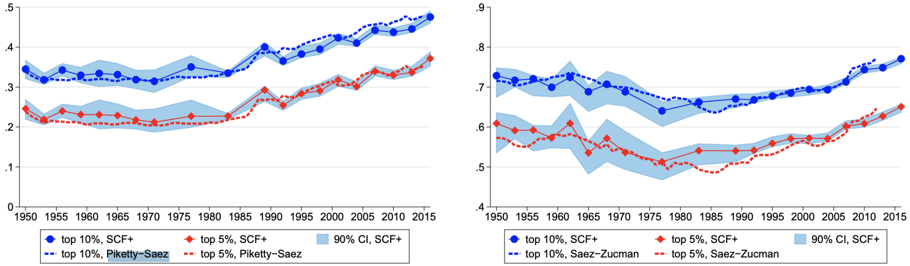
- History of Modern Macroeconomics
  - First-generation models: dynamic models with rational expectations
    - Equilibrium, solve, calibrate with a representative agent
  - Second-generation models: account for inequality
    - Macro shocks $\Rightarrow$ inequality, welfare
  - Third-generation models: business cycles, HANK
    - Amplification, inequality $\Rightarrow$ macro

On Inequality and Redistribution

- History of Modern Macroeconomics
  - First-generation models: dynamic models with rational expectations
    - Equilibrium, solve, calibrate with a representative agent
  - Second-generation models: account for inequality
    - Macro shocks $\Rightarrow$ inequality, welfare
  - Third-generation models: business cycles, HANK
    - Amplification, inequality $\Rightarrow$ macro
- This class: **On inequality and the welfare state**
  - Long run, business cycles

Rising Income and Wealth Inequality

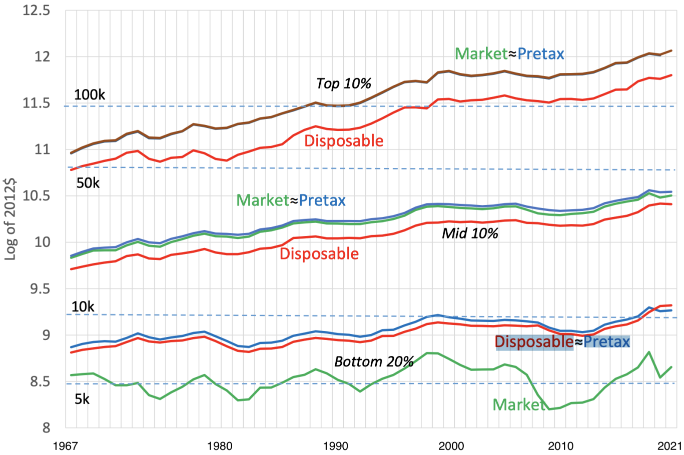
Figure 5: Top 5% and top 10% income and wealth shares



(a) Income (b) Wealth

- Top-income and -wealth shares have increased (SCF+, United States)
  Kuhn, Schularick and Stein (2020)

No Income Growth for the Poor



- Household income has been flat for 5 decades at the bottom (CPS, United States)

  Heathcote, Violante, Perri and Zhang (2023)

On Inequality and Redistribution

- **On the welfare state:** Two main questions

On Inequality and Redistribution

- **On the welfare state:** Two main questions
  - Should we tax wealth? Or capital income?
    - *"Heterogeneity and Persistence in Returns to Wealth"*
      A. Fagereng, L. Guiso, D. Malacrino and L. Pistaferri, Econometrica 2020
    - *"Use It or Lose It: Efficiency and Redistributional Effects of Wealth Taxation"*
      F. Guvenen, G. Kambourov, B. Kuruscu, S. Ocampo and D. Chen, QJE 2023

On Inequality and Redistribution

- **On the welfare state:** Two main questions
  - Should we tax wealth? Or capital income?
    - *"Heterogeneity and Persistence in Returns to Wealth"*
      A. Fagereng, L. Guiso, D. Malacrino and L. Pistaferri, Econometrica 2020
    - *"Use It or Lose It: Efficiency and Redistributional Effects of Wealth Taxation"*
      F. Guvenen, G. Kambourov, B. Kuruscu, S. Ocampo and D. Chen, QJE 2023
  - Should we implement a Universal Basic Income?
    - Some data on long-run trends of the welfare state in the United States
      National Accounts, Moffitt, my own work
    - *"Universal Basic Income: A Dynamic Assessment"*
      D. Daruich and R. Fernandez, AER 2024

On Inequality and Redistribution

- **On the welfare state:** Two main questions
  - Should we tax wealth? Or capital income?
    - *"Heterogeneity and Persistence in Returns to Wealth"*
      A. Fagereng, L. Guiso, D. Malacrino and L. Pistaferri, Econometrica 2020
    - *"Use It or Lose It: Efficiency and Redistributional Effects of Wealth Taxation"*
      F. Guvenen, G. Kambourov, B. Kuruscu, S. Ocampo and D. Chen, QJE 2023
  - Should we implement a Universal Basic Income?
    - Some data on long-run trends of the welfare state in the United States
      National Accounts, Moffitt, my own work
    - *"Universal Basic Income: A Dynamic Assessment"*
      D. Daruich and R. Fernandez, AER 2024
- **On business cycles:** Should we use fiscal policy to dampen recessions?
  - Targeted instruments? Ferriere and Navarro, IMFER 2025

Capital Income Taxes

History of Capital Income Taxes

- First-generation models: Capital taxes should be 0
  - Chamley (1986), Judd (1985)

History of Capital Income Taxes

- First-generation models: Capital taxes should be 0
  - Chamley (1986), Judd (1985)
  - In the long run, with one representative agent
  - Intuition: rolling over the Euler equation for ever

History of Capital Income Taxes

- First-generation models: Capital taxes should be 0
  - Chamley (1986), Judd (1985)
  - In the long run, with one representative agent
  - Intuition: rolling over the Euler equation for ever
- Second-generation models: Capital taxes should be. . . 34%
  - Conesa, Kitao and Krueger (2008)

History of Capital Income Taxes

- First-generation models: Capital taxes should be 0
  - Chamley (1986), Judd (1985)
  - In the long run, with one representative agent
  - Intuition: rolling over the Euler equation for ever
- Second-generation models: Capital taxes should be... 34%
  - Conesa, Kitao and Krueger (2008)
  - Incomplete markets with borrowing constraints, heterogeneous labor income
  - Rich distribution of wealth and income, OLG structure: age dynamics

History of Capital Income Taxes

- First-generation models: Capital taxes should be 0
  - Chamley (1986), Judd (1985)
  - In the long run, with one representative agent
  - Intuition: rolling over the Euler equation for ever
- Second-generation models: Capital taxes should be. . . 34%
  - Conesa, Kitao and Krueger (2008)
  - Incomplete markets with borrowing constraints, heterogeneous labor income
  - Rich distribution of wealth and income, OLG structure: age dynamics
- Why do people accumulate so much wealth?

Heterogeneous Capital Returns Theory

- New theoretical literature in the early 2010s: **heterogeneous capital returns**
  - Benhabib, Bisin, and Zhu (2011), Benhabib, Bisin, and Luo (2019)
  - Gabaix, Lasry, Lions, and Moll (2016)

Heterogeneous Capital Returns Theory

- New theoretical literature in the early 2010s: **heterogeneous capital returns**
  - Benhabib, Bisin, and Zhu (2011), Benhabib, Bisin, and Luo (2019)
  - Gabaix, Lasry, Lions, and Moll (2016)

- Heterogeneity in capital returns can generate fat tails in wealth distribution
  - Very simple idea: labor income is additive, capital income is multiplicative

Heterogeneous Capital Returns Theory

- New theoretical literature in the early 2010s: **heterogeneous capital returns**
  - Benhabib, Bisin, and Zhu (2011), Benhabib, Bisin, and Luo (2019)
  - Gabaix, Lasry, Lions, and Moll (2016)
- Heterogeneity in capital returns can generate fat tails in wealth distribution
  - Very simple idea: labor income is additive, capital income is multiplicative
- A simple example with Bob and Jane
  - Bob and Jane start with a stock of wealth $w_0 = 100$ (consume $c = 0$)
  - Bob earns $y_\ell^b = 110$ and makes 10% of returns on wealth
  - Jane earns $y_\ell^j = 100$ and makes 20% of returns on wealth

Heterogeneous Capital Returns Theory

- A simple example with Bob and Jane (cont.)
  - In year 1, Bob has $w_1 = w_0 + y_\ell^b + r^b \times w_0 = 100 + 110 + 10 \times 100 = 220$

    Jane has $w_1 = w_0 + y_\ell^j + r^j \times w_0 = 100 + 100 + 20 \times 100 = 220$

Heterogeneous Capital Returns Theory

- A simple example with Bob and Jane (cont.)
  - In year 1, Bob has $w_1 = w_0 + y_\ell^b + r^b \times w_0 = 100 + 110 + 10 \times 100 = 220$

    Jane has $w_1 = w_0 + y_\ell^j + r^j \times w_0 = 100 + 100 + 20 \times 100 = 220$
  - In year 2, Bob has $w_2^b = w_1 + y_\ell^b + r^b \times w_1 = 220 + 110 + 10 \times 220 = 352$

    Jane has $w_2^j = w_1 + y_\ell^j + r^j \times w_1 = 220 + 100 + 20 \times 220 = 364$

Heterogeneous Capital Returns Theory

- A simple example with Bob and Jane (cont.)
  - In year 1, Bob has $w_1 = w_0 + y_\ell^b + r^b \times w_0 = 100 + 110 + 10 \times 100 = 220$

    Jane has $w_1 = w_0 + y_\ell^j + r^j \times w_0 = 100 + 100 + 20 \times 100 = 220$
  - In year 2, Bob has $w_2^b = w_1 + y_\ell^b + r^b \times w_1 = 220 + 110 + 10 \times 220 = 352$

    Jane has $w_2^j = w_1 + y_\ell^j + r^j \times w_1 = 220 + 100 + 20 \times 220 = 364$
  - ...
  - In year 5, Bob has $w_5^b = 832$, Jane has $w_5^j = 992$

Heterogeneous Capital Returns Theory

- A simple example with Bob and Jane (cont.)
  - In year 1, Bob has $w_1 = w_0 + y_\ell^b + r^b \times w_0 = 100 + 110 + 10 \times 100 = 220$

    Jane has $w_1 = w_0 + y_\ell^j + r^j \times w_0 = 100 + 100 + 20 \times 100 = 220$
  - In year 2, Bob has $w_2^b = w_1 + y_\ell^b + r^b \times w_1 = 220 + 110 + 10 \times 220 = 352$

    Jane has $w_2^j = w_1 + y_\ell^j + r^j \times w_1 = 220 + 100 + 20 \times 220 = 364$
  - ...
  - In year 5, Bob has $w_5^b = 832$, Jane has $w_5^j = 992$
  - In year 10, Bob has $w_{10}^b \approx 2012$, Jane has $w_{10}^j \approx 3215$
  - ...

Heterogeneous Capital Returns **Theory**

- Needed ingredients for capital returns to generate (a lot of) wealth inequality
  - Persistent idiosyncratic returns (even across generations)
    - *"Type dependence"*

Heterogeneous Capital Returns Theory

- Needed ingredients for capital returns to generate (a lot of) wealth inequality
  - Persistent idiosyncratic returns (even across generations)
    - *"Type dependence"*
  - Correlation of wealth and returns
    - *"Scale dependence"*

Heterogeneous Capital Returns Theory

- Needed ingredients for capital returns to generate (a lot of) wealth inequality
  - Persistent idiosyncratic returns (even across generations)
    - *"Type dependence"*
  - Correlation of wealth and returns
    - *"Scale dependence"*

- Plausible in the data?

Heterogeneous Capital Returns Data

Fagereng, Guiso, Malacrino, and Pistaferri (2020)

- Norwegian administrative data
  - Individual tax records 2005-2015
    - Labor and capital income
    - **Asset holdings and liabilities**

Heterogeneous Capital Returns Data

Fagereng, Guiso, Malacrino, and Pistaferri (2020)

- Norwegian administrative data
  - Individual tax records 2005-2015
    - Labor and capital income
    - **Asset holdings and liabilities**
  - Data on deposits and loans
  - Housing transactions registry
  - Private business balance sheet

Heterogeneous Capital Returns Data

Fagereng, Guiso, Malacrino, and Pistaferri (2020)

- Norwegian administrative data
  - Individual tax records 2005-2015
    - Labor and capital income
    - **Asset holdings and liabilities**
  - Data on deposits and loans
  - Housing transactions registry
  - Private business balance sheet
- Compute individual returns to wealth
  - 33 millions of observations (pooling all years)

Heterogeneous Capital Returns Data

- Large heterogeneity in portfolios

Heterogeneous Capital Returns Data

- Large heterogeneity in portfolios
- Very heterogeneous returns on wealth
  - Large heterogeneity *overall*
    - Large heterogeneity across assets
    - Large heterogeneity within classes of assets
  - Large scale dependence: from net worth-10th to -90th percentile
  - Strong persistence across generations

Heterogeneous Capital Returns Portfolio Compositions

TABLE 1A

PORTFOLIO COMPOSITION OF NET WORTH, BY SELECTED FRACTILES[a]

	Gross Wealth Shares				Leverage Ratios			
	Safe	Risky	Housing	Private Equity	Consumer Debt	Student Debt	Long-Term Debt	Gross Wealth (Logs)
Bottom 10%	0.51	0.03	0.43	0.02	0.50	2.47	9.08	10.73
10–20%	0.78	0.03	0.18	0.01	0.42	3.08	3.39	9.06
20–50%	0.31	0.02	0.66	0.01	0.01	0.05	0.40	11.89
50–90%	0.11	0.02	0.86	0.02	0.00	0.01	0.21	13.42
90–95%	0.12	0.02	0.81	0.05	0.00	0.00	0.12	14.12
95–99%	0.13	0.03	0.73	0.11	0.00	0.00	0.10	14.55
99–99.9%	0.15	0.04	0.44	0.36	0.00	0.00	0.07	15.41
99.9–99.99%	0.14	0.04	0.11	0.71	0.00	0.00	0.04	16.94
Top 0.01%	0.08	0.04	0.03	0.85	0.00	0.00	0.02	18.78

[a]The table reports the share of gross wealth in safe assets (cash/deposits, bonds, outstanding claims and receivables), risky assets (foreign assets, mutual funds, directly held listed stocks), housing, private business wealth, consumer debt, student debt, and long-term debt (mortgages and personal loans) for Norwegian taxpayers against selected fractiles of the net worth distribution. Debt leverage values are winsorized at the top 1%. In the last column, we report the logarithm of real gross wealth. Data are for 2005–2015.

Heterogeneous Capital Returns Portfolio Compositions

TABLE 1A

PORTFOLIO COMPOSITION OF NET WORTH, BY SELECTED FRACTILES[a]

	Gross Wealth Shares				Leverage Ratios			
	Safe	Risky	Housing	Private Equity	Consumer Debt	Student Debt	Long-Term Debt	Gross Wealth (Logs)
Bottom 10%	0.51	0.03	0.43	0.02	0.50	2.47	9.08	10.73
10–20%	0.78	0.03	0.18	0.01	0.42	3.08	3.39	9.06
20–50%	0.31	0.02	0.66	0.01	0.01	0.05	0.40	11.89
50–90%	0.11	0.02	0.86	0.02	0.00	0.01	0.21	13.42
90–95%	0.12	0.02	0.81	0.05	0.00	0.00	0.12	14.12
95–99%	0.13	0.03	0.73	0.11	0.00	0.00	0.10	14.55
99–99.9%	0.15	0.04	0.44	0.36	0.00	0.00	0.07	15.41
99.9–99.99%	0.14	0.04	0.11	0.71	0.00	0.00	0.04	16.94
Top 0.01%	0.08	0.04	0.03	0.85	0.00	0.00	0.02	18.78

[a]The table reports the share of gross wealth in safe assets (cash/deposits, bonds, outstanding claims and receivables), risky assets (foreign assets, mutual funds, directly held listed stocks), housing, private business wealth, consumer debt, student debt, and long-term debt (mortgages and personal loans) for Norwegian taxpayers against selected fractiles of the net worth distribution. Debt leverage values are winsorized at the top 1%. In the last column, we report the logarithm of real gross wealth. Data are for 2005–2015.

Heterogeneous Capital Returns **Portfolio Compositions**

TABLE 1A

PORTFOLIO COMPOSITION OF NET WORTH, BY SELECTED FRACTILES[a]

	Gross Wealth Shares				Leverage Ratios			
	Safe	Risky	Housing	Private Equity	Consumer Debt	Student Debt	Long-Term Debt	Gross Wealth (Logs)
Bottom 10%	0.51	0.03	0.43	0.02	0.50	2.47	9.08	10.73
10–20%	0.78	0.03	0.18	0.01	0.42	3.08	3.39	9.06
20–50%	0.31	0.02	0.66	0.01	0.01	0.05	0.40	11.89
50–90%	0.11	0.02	0.86	0.02	0.00	0.01	0.21	13.42
90–95%	0.12	0.02	0.81	0.05	0.00	0.00	0.12	14.12
95–99%	0.13	0.03	0.73	0.11	0.00	0.00	0.10	14.55
99–99.9%	0.15	0.04	0.44	0.36	0.00	0.00	0.07	15.41
99.9–99.99%	0.14	0.04	0.11	0.71	0.00	0.00	0.04	16.94
Top 0.01%	0.08	0.04	0.03	0.85	0.00	0.00	0.02	18.78

[a]The table reports the share of gross wealth in safe assets (cash/deposits, bonds, outstanding claims and receivables), risky assets (foreign assets, mutual funds, directly held listed stocks), housing, private business wealth, consumer debt, student debt, and long-term debt (mortgages and personal loans) for Norwegian taxpayers against selected fractiles of the net worth distribution. Debt leverage values are winsorized at the top 1%. In the last column, we report the logarithm of real gross wealth. Data are for 2005–2015.

TABLE 3

RETURNS TO WEALTH: SUMMARY STATISTICS[a]

Wealth Component	Mean	St. Dev.	Skewness	Kurtosis	P10	Median	P90
Net worth (before tax)	0.0379	0.0859	−0.79	47.75	−0.0308	0.0321	0.1109
Net worth (after tax)	0.0365	0.0781	−0.71	36.88	−0.0283	0.0316	0.1067
Net worth (before tax, unweighted)	0.0004	0.2205	−6.73	68.46	−0.0600	0.0230	0.1037
Net worth (after tax, unweighted)	0.0155	0.1546	−5.28	56.42	−0.0449	0.0247	0.1040
Financial wealth	0.0105	0.0596	−1.78	22.17	−0.0171	0.0084	0.0530
Safe fin. assets	0.0078	0.0188	4.38	53.52	−0.0106	0.0059	0.0268
Risky fin. assets	0.0425	0.2473	−0.08	6.22	−0.2443	0.0418	0.3037
Non-financial wealth	0.0511	0.0786	1.80	15.47	−0.0215	0.0429	0.1275
Housing	0.0485	0.0653	0.73	9.95	−0.0209	0.0441	0.1165
Private equity	0.1040	0.5169	18.01	836.79	−0.0531	0.0052	0.3616
Debt	0.0236	0.0216	2.51	29.50	0.0030	0.0215	0.0461
Long-term debt	0.0230	0.0209	3.54	56.92	0.0038	0.0209	0.0446
Consumer debt	0.0961	0.1086	4.60	82.60	−0.0124	0.0741	0.2119
Student debt	0.0078	0.0260	0.68	4.14	−0.0213	0.0074	0.0399

[a]The table reports summary statistics for various measures of real returns to wealth, pooling data for 2005–2015. Except when noted, all returns are value-weighted.

Heterogeneous Capital Returns

TABLE 3

RETURNS TO WEALTH: SUMMARY STATISTICS[a]

Wealth Component	Mean	St. Dev.	Skewness	Kurtosis	P10	Median	P90
Net worth (before tax)	0.0379	0.0859	−0.79	47.75	−0.0308	0.0321	0.1109
Net worth (after tax)	0.0365	0.0781	−0.71	36.88	−0.0283	0.0316	0.1067
Net worth (before tax, unweighted)	0.0004	0.2205	−6.73	68.46	−0.0600	0.0230	0.1037
Net worth (after tax, unweighted)	0.0155	0.1546	−5.28	56.42	−0.0449	0.0247	0.1040
Financial wealth	0.0105	0.0596	−1.78	22.17	−0.0171	0.0084	0.0530
Safe fin. assets	0.0078	0.0188	4.38	53.52	−0.0106	0.0059	0.0268
Risky fin. assets	0.0425	0.2473	−0.08	6.22	−0.2443	0.0418	0.3037
Non-financial wealth	0.0511	0.0786	1.80	15.47	−0.0215	0.0429	0.1275
Housing	0.0485	0.0653	0.73	9.95	−0.0209	0.0441	0.1165
Private equity	0.1040	0.5169	18.01	836.79	−0.0531	0.0052	0.3616
Debt	0.0236	0.0216	2.51	29.50	0.0030	0.0215	0.0461
Long-term debt	0.0230	0.0209	3.54	56.92	0.0038	0.0209	0.0446
Consumer debt	0.0961	0.1086	4.60	82.60	−0.0124	0.0741	0.2119
Student debt	0.0078	0.0260	0.68	4.14	−0.0213	0.0074	0.0399

[a]The table reports summary statistics for various measures of real returns to wealth, pooling data for 2005–2015. Except when noted, all returns are value-weighted.

Heterogeneous Capital Returns

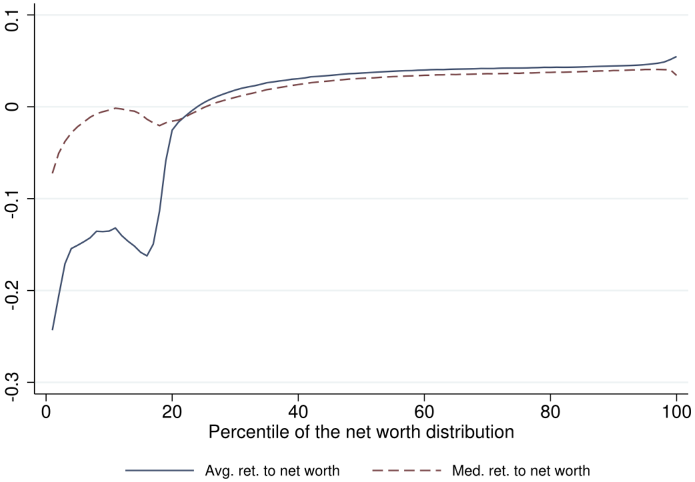
TABLE 3

RETURNS TO WEALTH: SUMMARY STATISTICS[a]

Wealth Component	Mean	St. Dev.	Skewness	Kurtosis	P10	Median	P90
Net worth (before tax)	0.0379	0.0859	−0.79	47.75	−0.0308	0.0321	0.1109
Net worth (after tax)	0.0365	0.0781	−0.71	36.88	−0.0283	0.0316	0.1067
Net worth (before tax, unweighted)	0.0004	0.2205	−6.73	68.46	−0.0600	0.0230	0.1037
Net worth (after tax, unweighted)	0.0155	0.1546	−5.28	56.42	−0.0449	0.0247	0.1040
Financial wealth	0.0105	0.0596	−1.78	22.17	−0.0171	0.0084	0.0530
Safe fin. assets	0.0078	0.0188	4.38	53.52	−0.0106	0.0059	0.0268
Risky fin. assets	0.0425	0.2473	−0.08	6.22	−0.2443	0.0418	0.3037
Non-financial wealth	0.0511	0.0786	1.80	15.47	−0.0215	0.0429	0.1275
Housing	0.0485	0.0653	0.73	9.95	−0.0209	0.0441	0.1165
Private equity	0.1040	0.5169	18.01	836.79	−0.0531	0.0052	0.3616
Debt	0.0236	0.0216	2.51	29.50	0.0030	0.0215	0.0461
Long-term debt	0.0230	0.0209	3.54	56.92	0.0038	0.0209	0.0446
Consumer debt	0.0961	0.1086	4.60	82.60	−0.0124	0.0741	0.2119
Student debt	0.0078	0.0260	0.68	4.14	−0.0213	0.0074	0.0399

[a]The table reports summary statistics for various measures of real returns to wealth, pooling data for 2005–2015. Except when noted, all returns are value-weighted.

Heterogeneous Capital Returns Scale Dependence



Panel A: Average and median return to net worth

Heterogeneous Capital Returns Scale and Type Dependence

- What explains heterogeneous capital returns within a class of assets?

Heterogeneous Capital Returns Scale and Type Dependence

- What explains heterogeneous capital returns within a class of assets?
  - Fixed cost to access some investments? Scale?

Heterogeneous Capital Returns **Scale and Type Dependence**

- What explains heterogeneous capital returns within a class of assets?
  - Fixed cost to access some investments? Scale?
  - Capacity to pick better investments? Types?

Heterogeneous Capital Returns Scale and Type Dependence

- What explains heterogeneous capital returns within a class of assets?
  - Fixed cost to access some investments? Scale?
  - Capacity to pick better investments? Types?
  - Exposure to risk?
  - *"Rich Pickings? Risk, Return, and Skill in Household Wealth"*
    Bach, Calvet and Soldini, AER (2020)

Heterogeneous Capital Returns Scale and Type Dependence

- What explains heterogeneous capital returns within a class of assets?
  - Fixed cost to access some investments? Scale?
  - Capacity to pick better investments? Types?
  - Exposure to risk?
  - *"Rich Pickings? Risk, Return, and Skill in Household Wealth"*
    Bach, Calvet and Soldini, AER (2020)

- Active literature
  - *"Why Are the Wealthiest So Wealthy?"*
    Salgado, Halvorsen, Ozkan and Hubmer, R&R Econometrica (2024)
  - Many other papers looking at ...

Implications for Taxation

- New question for taxation: should we tax capital income? Or the stock of capital?
  - Should we tax capital or wealth?

Implications for Taxation

- New question for taxation: should we tax capital income? Or the stock of capital?
  - Should we tax capital or wealth?

- Under **homogenous returns**, taxing capital = taxing wealth

$$(1 + r(1 - \tau_k))a_i = (1 - \tau_a)(1 + r)a_i$$

  - τ_k is a tax on capital income
  - τ_a is a tax on the stock of capital (wealth)

Implications for Taxation

- New question for taxation: should we tax capital income? Or the stock of capital?
  - Should we tax capital or wealth?

- Under **homogenous returns**, taxing capital = taxing wealth

$$(1 + r(1 - \tau_k))a_i = (1 - \tau_a)(1 + r)a_i$$

  - τ_k is a tax on capital income
  - τ_a is a tax on the stock of capital (wealth)
    - Equivalent as long as $\tau_a = \tau_k r/(1 + r)$

Implications for Taxation

- New question for taxation: should we tax capital income? Or the stock of capital?
  - Should we tax capital or wealth?

- Under **homogenous returns**, taxing capital = taxing wealth

$$(1 + r(1 - \tau_k))a_i = (1 - \tau_a)(1 + r)a_i$$

  - τ_k is a tax on capital income
  - τ_a is a tax on the stock of capital (wealth)
    - Equivalent as long as $\tau_a = \tau_k r/(1 + r)$

- What if returns are heterogeneous?

$$(1 + r_i(1 - \tau_k))a_i \text{ vs. } (1 - \tau_a)(1 + r_i)a_i$$

"Use it or lose it!" Guvenen et al. (2023)

- Assume two agents, a and b,
  - Same wealth $k = \$1000$; but different returns: $r^a = 0 < r^b = 0.2$

"Use it or lose it!" Guvenen et al. (2023)

- Assume two agents, a and b,
  - Same wealth $k = \$1000$; but different returns: $r^a = 0 < r^b = 0.2$
- Policy 1: $\tau^k = 10\%$ on capital income
  - Agent a pays $\$0$
  - Agent b pays $10\% \times 20\% \times 1000 = \$20$

"Use it or lose it!" Guvenen et al. (2023)

- Assume two agents, a and b,
  - Same wealth $k = \$1000$; but different returns: $r^a = 0 < r^b = 0.2$
- Policy 1: $\tau^k = 10\%$ on capital income
  - Agent a pays $\$0$
  - Agent b pays $10\% \times 20\% \times 1000 = \$20$
- (Revenue-neutral) policy 2: $\tau^a = 0.91\%$ tax rate on wealth
  - Agent a pays $0.91\% \times 1000 = \$9.10$
  - Agent b pays $0.91\% \times (1000 + 200) = \$10.90$

"Use it or lose it!" Guvenen et al. (2023)

- Assume two agents, a and b,
  - Same wealth $k = \$1000$; but different returns: $r^a = 0 < r^b = 0.2$
- Policy 1: $\tau^k = 10\%$ on capital income
  - Agent a pays $\$0$
  - Agent b pays $10\% \times 20\% \times 1000 = \$20$
- (Revenue-neutral) policy 2: $\tau^a = 0.91\%$ tax rate on wealth
  - Agent a pays $0.91\% \times 1000 = \$9.10$
  - Agent b pays $0.91\% \times (1000 + 200) = \$10.90$
- A wealth tax shifts the tax burden **away** from the more productive hh

"Use it or lose it!" Guvenen et al. (2023)

- Assume two agents, a and b,
  - Same wealth $k = \$1000$; but different returns: $r^a = 0 < r^b = 0.2$
- Policy 1: $\tau^k = 10\%$ on capital income
  - Agent a pays $\$0$
  - Agent b pays $10\% \times 20\% \times 1000 = \$20$
- (Revenue-neutral) policy 2: $\tau^a = 0.91\%$ tax rate on wealth
  - Agent a pays $0.91\% \times 1000 = \$9.10$
  - Agent b pays $0.91\% \times (1000 + 200) = \$10.90$
- A wealth tax shifts the tax burden **away** from the more productive hh
  - Good for efficiency

“Use it or lose it!” Guvenen et al. (2023)

- Assume two agents, a and b,
  - Same wealth $k = \$1000$; but different returns: $r^a = 0 < r^b = 0.2$
- Policy 1: $\tau^k = 10\%$ on capital income
  - Agent a pays $\$0$
  - Agent b pays $10\% \times 20\% \times 1000 = \$20$
- (Revenue-neutral) policy 2: $\tau^a = 0.91\%$ tax rate on wealth
  - Agent a pays $0.91\% \times 1000 = \$9.10$
  - Agent b pays $0.91\% \times (1000 + 200) = \$10.90$
- A wealth tax shifts the tax burden **away** from the more productive hh
  - Good for efficiency, bad for redistribution?

"Use it or lose it!" Three channels

In a dynamic general-equilibrium model

1. "Use-it-or-lose-it" channel
   - Capital reallocates toward more productive entrepreneurs

“Use it or lose it!” Three channels

In a dynamic general-equilibrium model

1. “Use-it-or-lose-it” channel
    - Capital reallocates toward more productive entrepreneurs

2. “Behavior response” channel
    - More productive entrepreneurs will save more

"Use it or lose it!" Three channels

In a dynamic general-equilibrium model

1. "Use-it-or-lose-it" channel
   - Capital reallocates toward more productive entrepreneurs
2. "Behavior response" channel
   - More productive entrepreneurs will save more
3. "Price" channel
   - Wages and interest rates will adjust

Environment Demographics

- Overlapping generations (OLG) model
  - Age h, live up to H years
  - Wealth inheritance

Environment Demographics

- Overlapping generations (OLG) model
  - Age h, live up to H years
  - Wealth inheritance

- Households make three decisions
  - Endogenous labor until retirement R

Environment Demographics

- Overlapping generations (OLG) model
  - Age h, live up to H years
  - Wealth inheritance
- Households make three decisions
  - Endogenous labor until retirement R
  - Consumption-savings decision

Environment Demographics

- Overlapping generations (OLG) model
  - Age h, live up to H years
  - Wealth inheritance

- Households make three decisions
  - Endogenous labor until retirement R
  - Consumption-savings decision
  - Portfolio choice
    - Choose how much to invest in own technology ("entrepreneurship")

  => No occupation decision, intensive margin

Environment Households

- Labor productivity w_{ih} s.t. $\log w_{ih} = \kappa_i + g(h) + e_{ih}$

Environment Households

- Labor productivity w_{ih} s.t. $\log w_{ih} = \kappa_i + g(h) + e_{ih}$
  - Type: κ_i imperfectly inherited from parents
  - Age-profile $g(h)$
  - Idiosyncratic shock: e_{ih} follows an AR(1)

Environment Households

- Labor productivity w_{ih} s.t. $\log w_{ih} = \kappa_i + g(h) + e_{ih}$
  - Type: κ_i imperfectly inherited from parents
  - Age-profile $g(h)$
  - Idiosyncratic shock: e_{ih} follows an AR(1)
- Social security: $y^R(\kappa, e) = \phi(\kappa, e)\bar{E}$ when $h > R$

Environment Households

- Entrepreneurial ability z_{ih}
  - Type: $\bar{z}_i$ imperfectly inherited from parents

Environment Households

- Entrepreneurial ability z_{ih}
  - Type: $\bar{z}_i$ imperfectly inherited from parents
  - Stochastic process $\mathbb{I}_{ih} \in \{\mathcal{H}, \mathcal{L}, 0\}$

$$z_{ih} = \begin{cases} (\bar{z}_i)^{\lambda} & \text{if } \mathbb{I}_{ih} = \mathcal{H} \quad \text{with } \lambda > 1 : \text{ “fast-lane” entrepreneurs} \\ \bar{z}_i & \text{if } \mathbb{I}_{ih} = \mathcal{L} \\ 0 & \text{if } \mathbb{I}_{ih} = 0 \end{cases}$$

Environment Households

- Entrepreneurial ability z_{ih}
  - Type: $\bar{z}_i$ imperfectly inherited from parents
  - Stochastic process $\mathbb{I}_{ih} \in \{\mathcal{H}, \mathcal{L}, 0\}$

$$z_{ih} = \begin{cases} (\bar{z}_i)^\lambda & \text{if } \mathbb{I}_{ih} = \mathcal{H} \qquad \text{with } \lambda > 1 : \text{ "fast-lane" entrepreneurs} \\ \bar{z}_i & \text{if } \mathbb{I}_{ih} = \mathcal{L} \\ 0 & \text{if } \mathbb{I}_{ih} = 0 \end{cases}$$

  - Stochastic transition downwards

Environment Production

- Final good: $Y = Q^{\alpha} L^{1-\alpha}$
  - Aggregate labor L, with $\alpha = 0.4$
  - Intermediates: $Q = \left(\int x_{ih}^{\mu}\right)^{\frac{1}{\mu}}$, with $\mu = 0.9$
  - Competitive sector

Environment Production

- Final good: $Y = Q^{\alpha} L^{1-\alpha}$
  - Aggregate labor L, with $\alpha = 0.4$
  - Intermediates: $Q = \left(\int x_{ih}^{\mu}\right)^{\frac{1}{\mu}}$, with $\mu = 0.9$
  - Competitive sector

- Intermediate goods: $x_{ih} = z_{ih} k_{ih}$
  - Intermediates: $Q = \left(\int (z_{ih} k_{ih})^{\mu}\right)^{\frac{1}{\mu}}$
  - Price $p_{ih} = \alpha x_{ih}^{\mu-1} Q^{\alpha-\mu} L^{1-\alpha}$

Environment Household entrepreneurial problem

- **Bond market**: individuals can lend and borrow at rate r

Environment Household entrepreneurial problem

- **Bond market**: individuals can lend and borrow at rate r

- **Entrepreneurial choice:** Choose capital to max profits

$$\pi(a,z) = \max_{k \le \nu(z)a} p(zk)zk - (r+\delta)k$$

  - Financial friction which generates misallocation
  - Invests more if z is higher and if a is higher

Environment **Household entrepreneurial problem**

- **Bond market**: individuals can lend and borrow at rate r

- **Entrepreneurial** choice: Choose capital to max profits

$$\pi(a,z) = \max_{k \leq \nu(z)a} p(zk)zk - (r+\delta)k$$

  - Financial friction which generates misallocation
  - Invests more if z is higher and if a is higher

- After-tax wealth

$$\begin{aligned}\Pi(a,z;\tau) &= a + (ra + \pi(a,z) \times (1-\tau_k)) \\ &= a \times (1-\tau_a) + (ra + \pi(a,z))\end{aligned}$$

Environment Household dynamic problem

- Choose how much to work (when $h \leq R$), consume, and save in assets

$$V_h(a, \bar{z}, \mathcal{I}, e, \kappa) = \max_{c,n,a'} u(c, n) + \beta s_{h+1} \mathbb{E}\left[V_{h+1}(a', \bar{z}, \mathcal{I}', e', \kappa)\right]$$

Environment **Household dynamic problem**

- Choose how much to work (when $h \leq R$), consume, and save in assets

$$V_h(a, \bar{z}, \mathcal{I}, e, \kappa) = \max_{c,n,a'} u(c, n) + \beta s_{h+1} \mathbb{E}\left[V_{h+1}(a', \bar{z}, \mathcal{I}', e', \kappa)\right]$$

such that

Environment **Household dynamic problem**

- Choose how much to work (when $h \leq R$), consume, and save in assets

$$V_h(a, \bar{z}, \mathcal{I}, e, \kappa) = \max_{c,n,a'} u(c, n) + \beta s_{h+1} \mathbb{E}\left[V_{h+1}(a', \bar{z}, \mathcal{I}', e', \kappa)\right]$$

such that

$$(1 + \tau_c)c + a' = (1 - \tau_\ell)\bar{w}w(\kappa, e)n + \Pi(a, z; \tau)$$

Environment Household dynamic problem

- Choose how much to work (when $h \leq R$), consume, and save in assets

$$V_h(a, \bar{z}, \mathcal{I}, e, \kappa) = \max_{c,n,a'} u(c, n) + \beta s_{h+1} \mathbb{E}\left[V_{h+1}(a', \bar{z}, \mathcal{I}', e', \kappa)\right]$$

such that

$$(1 + \tau_c)c + a' = (1 - \tau_\ell)\bar{w}w(\kappa, e)n + \Pi(a, z; \tau)$$
$$a' \geq \underline{a}$$

Environment Household dynamic problem

- Choose how much to work (when $h \leq R$), consume, and save in assets

$$V_h(a, \bar{z}, \mathcal{I}, e, \kappa) = \max_{c,n,a'} u(c, n) + \beta s_{h+1} \mathbb{E}\left[V_{h+1}(a', \bar{z}, \mathcal{I}', e', \kappa)\right]$$

such that

$$(1 + \tau_c)c + a' = (1 - \tau_\ell)\bar{w}w(\kappa, e)n + \Pi(a, z; \tau)$$
$$a' \geq \underline{a}$$

- Equilibrium: $\int a = \int k$

Calibration

- Standard earnings risk
- Dynamics of entrepreneurship to match fast wealth growth of super wealthy (Forbes 400)
- Collateral constraint: $\nu(z) = 1 + \varphi(\bar{z} - \bar{z}_0)$, with φ to match business debt/GDP

Calibration

- Standard earnings risk
- Dynamics of entrepreneurship to match fast wealth growth of super wealthy (Forbes 400)
- Collateral constraint: $\nu(z) = 1 + \varphi(\bar{z} - \bar{z}_0)$, with φ to match business debt/GDP
- Taxes: $\tau_k = 25\%$, $\tau_\ell = 22.4\%$, $\tau_c = 7.5\%$, $\tau_a = 0\%$

Calibration

$\Rightarrow$ Generates high wealth inequality!

	top-50	top-10	top-1	top-0.5	top-0.1
Data (SCF+)	0.99	0.75	0.36	0.27	0.14
Model	0.97	0.66	0.36	0.31	0.23

- Model : 50% households with no business income, 7% earn majority of income from business ("entrepreneur")

Main Experiment A Wealth Tax

- Suddenly and unexpectedly ... steady-state comparison
- Set $\tau_k = 0$, balance budget with a wealth tax
  - Wealth tax $\tau_a = 1.13\%$

Main Experiment A Wealth Tax

- Suddenly and unexpectedly ... steady-state comparison
- Set $\tau_k = 0$, balance budget with a wealth tax
  - Wealth tax $\tau_a = 1.13\%$
- New economy features
  - Larger K: $+20\% \rightarrow$ agents save more

Main Experiment A Wealth Tax

- Suddenly and unexpectedly ... steady-state comparison
- Set $\tau_k = 0$, balance budget with a wealth tax
  - Wealth tax $\tau_a = 1.13\%$
- New economy features
  - Larger K: $+20\% \rightarrow$ agents save more
  - Larger Q: $+25\% \rightarrow$ less misallocation

Main Experiment A Wealth Tax

- Suddenly and unexpectedly . . . steady-state comparison

- Set $\tau_k = 0$, balance budget with a wealth tax
  - Wealth tax $\tau_a = 1.13\%$

- New economy features
  - Larger K: $+20\% \rightarrow$ agents save more
  - Larger Q: $+25\% \rightarrow$ less misallocation
  - Larger Y and C: $+10\%$

Main Experiment A Wealth Tax

- Suddenly and unexpectedly . . . steady-state comparison
- Set $\tau_k = 0$, balance budget with a wealth tax
  - Wealth tax $\tau_a = 1.13\%$
- New economy features
  - Larger K: $+20\% \rightarrow$ agents save more
  - Larger Q: $+25\% \rightarrow$ less misallocation
  - Larger Y and C: $+10\%$
  - Lower r, higher wages, large welfare gains: $+6.8\%$! (2020 calibration)

Main Experiment A Wealth Tax

- Why does capital increase? Three channels

Main Experiment A Wealth Tax

- Why does capital increase? Three channels
  - "Use-it-or-loose-it" [fixing prices & decision rules to benchmark] $K \uparrow$
  - GE effects [with prices of new equilibrium] $K \downarrow$
  - Behavioral responses [with new decision rules] $K \uparrow$

Main Experiment A Wealth Tax

- Why does capital increase? Three channels
  - "Use-it-or-loose-it" [fixing prices & decision rules to benchmark] $K \uparrow$
  - GE effects [with prices of new equilibrium] $K \downarrow$
  - Behavioral responses [with new decision rules] $K \uparrow$
- All three channels are approximately of the same magnitude!

Main Experiment A Wealth Tax

- Who wins from the reform?

Main Experiment A Wealth Tax

- Who wins from the reform?

- Welfare gains by age and entrepreneurial ability

TABLE IX – Welfare Gain/Loss by Age Group and Entrepreneurial Ability

Age groups:	*Entrepreneurial Ability Groups ($\bar{z}_i$ Percentiles)* 0–40	40–80	80–90	90–99	99–99.9	99.9+
	RN Reform					
20	7.0	7.3	7.9	8.9	10.6	11.7
21–34	6.5	6.3	6.3	6.6	7.0	6.8
35–49	5.1	4.4	3.9	3.3	1.7	0.1
50–64	2.3	1.8	1.4	0.8	–0.6	–1.8
65+	–0.2	–0.3	–0.4	–0.6	–1.2	–1.8

  – The high-wealth/low-z (= the old) **loose**

  – The young **benefit**... from $\tau_k = 0$ (high z), from higher w (low a)

Optimal Taxation Capital and Wealth Taxes

Optimize steady-state fiscal system

- Optimal wealth tax:
  - $\tau_a \approx 3\%$, $\tau_\ell \approx 14\%$
  - Much larger welfare gains: $+$ 8.7%

Optimal Taxation Capital and Wealth Taxes

Optimize steady-state fiscal system

- Optimal wealth tax:
  - $\tau_a \approx 3\%$, $\tau_\ell \approx 14\%$
  - Much larger welfare gains: $+$ 8.7%
- Optimal capital tax
  - $\tau_k = -14\%$ (!), $\tau_\ell = 31\%$
  - Welfare gains: $+$5.1%

Optimal Taxation Capital and Wealth Taxes

Optimize steady-state fiscal system

- Optimal wealth tax:
  - $\tau_a \approx 3\%$, $\tau_\ell \approx 14\%$
  - Much larger welfare gains: $+$ 8.7%
- Optimal capital tax
  - $\tau_k = -14\%$ (!), $\tau_\ell = 31\%$
  - Welfare gains: $+$5.1%
- Transitions

Taxing Capital? Taking Stock 1/2

- Should we tax capital income?

Taxing Capital? Taking Stock 1/2

- Should we tax capital income?
  - No! $\tau_k = 0$ to reach optimal stock of capital
    - More capital $\Rightarrow$ more output and consumption

Taxing Capital? Taking Stock 1/2

- Should we tax capital income?
  - No! $\tau_k = 0$ to reach optimal stock of capital
    - More capital $\Rightarrow$ more output and consumption
  - Yes! $\tau_k = 34\%$ when there is (also) inequality in labor income
    - When some households are rich and poor and face a borrowing constraint
    - When the young work and save "too much" to accumulate for retirement

Taxing Capital? Taking Stock 1/2

- Should we tax capital income?
  - No! $\tau_k = 0$ to reach optimal stock of capital
    - More capital $\Rightarrow$ more output and consumption
  - Yes! $\tau_k = 34\%$ when there is (also) inequality in labor income
    - When some households are rich and poor and face a borrowing constraint
    - When the young work and save "too much" to accumulate for retirement
  - No! $\tau_k = -14\%$! When there is (also) inequality in capital income
    - Some individuals are better than other in investing in good projects
    - Better allocation of capital

Taxing Capital? Taking Stock 1/2

- Should we tax capital income?
  - No! $\tau_k = 0$ to reach optimal stock of capital
    - More capital $\Rightarrow$ more output and consumption
  - Yes! $\tau_k = 34\%$ when there is (also) inequality in labor income
    - When some households are rich and poor and face a borrowing constraint
    - When the young work and save "too much" to accumulate for retirement
  - No! $\tau_k = -14\%$! When there is (also) inequality in capital income
    - Some individuals are better than other in investing in good projects
    - Better allocation of capital
    - Side comment: Why are we all using US data?

Taxing Capital? Taking Stock 2/2

- With heterogeneous capital returns, positive wealth tax
  - Mostly for efficiency reasons! Reallocation
  - Does it decrease wealth inequality? Not necessarily

Taxing Capital? Taking Stock 2/2

- With heterogeneous capital returns, positive wealth tax
  - Mostly for efficiency reasons! Reallocation
  - Does it decrease wealth inequality? Not necessarily
- Implementability?

Taxing Capital? Taking Stock 2/2

- With heterogeneous capital returns, positive wealth tax
  - Mostly for efficiency reasons! Reallocation
  - Does it decrease wealth inequality? Not necessarily
- Implementability?
- What if high returns reflect rents? Gaillard and Wangner (2024)

Going Forward Data

- What else can we study with the admin Norwegian dataset?
  - Many papers: on who becomes rich, who gives what to their kids, housing, ...

Going Forward Data

- What else can we study with the admin Norwegian dataset?
  - Many papers: on who becomes rich, who gives what to their kids, housing, ...
- *"Why Are the Wealthiest So Wealthy? New Longitudinal Empirical Evidence and Implications for Theories of Wealth Inequality"*

  Ozkan, Hubmer, Salgado, Halvorsen, R&R Econometrica (2024)

Empirical Approach

- Study lifecycle dynamics of wealth accumulation
  - 1993-2015 Norwegian panel data on wealth and income

Empirical Approach

- Study lifecycle dynamics of wealth accumulation
  - 1993-2015 Norwegian panel data on wealth and income
- Backwards approach
  - How many of the wealthiest at age 50 were already wealthy at age 25?
    - "Old Money" vs. "New Money"
  - Where does the wealth of the wealthiest at age 50 come from?
    - Labor income, capital returns, saving rates, inheritances, initial wealth?
- Complementary frontwards approach

Empirical Approach

- Study lifecycle dynamics of wealth accumulation
  - 1993-2015 Norwegian panel data on wealth and income
- Backwards approach
  - How many of the wealthiest at age 50 were already wealthy at age 25?
    - “Old Money” vs. “New Money”
  - Where does the wealth of the wealthiest at age 50 come from?
    - Labor income, capital returns, saving rates, inheritances, initial wealth?
- Complementary frontwards approach
- Accounting . . . complemented with models!

Methodology

- Build measures of net wealth and capital returns
  - Follow Fagereng et al. (2020)

Methodology

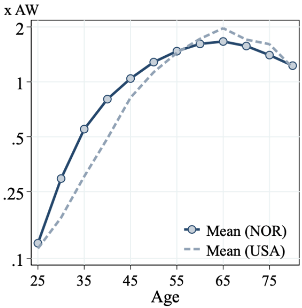
- Build measures of net wealth and capital returns
  - Follow Fagereng et al. (2020)
  - Indirect ownership for retained earnings (7 layers)
  - Inheritance severely undervalued
  - Value of equity owned excludes intangibles

Methodology

- Build measures of net wealth and capital returns
  - Follow Fagereng et al. (2020)
  - Indirect ownership for retained earnings (7 layers)
  - Inheritance severely undervalued
  - Value of equity owned excludes intangibles
- Average wealth (AW) $\approx$ \$437,000 in 2015
  - Life-cycle similar to the US

FIGURE 3 – WEALTH DIST

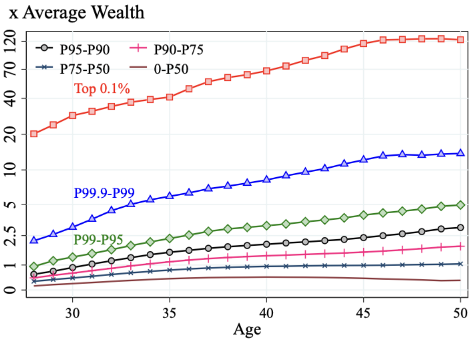
(A) Average Net Worth



Backwards Life-Cycle Profiles

- The Rich Started Rich
  - Top-0.1% 50-54y have 125 AW $\approx$ \$55 million
  - In their late 20s have already 20 AW $\approx$ \$9 million
  - Higher within-cohort inequality earlier in life

(a) Backward-Looking Wealth Profile



Backwards Life-Cycle Profiles

$< P75$	$[P75, P90)$	$[P90, P95)$	$[P95, P99)$	$[P99, P99.9)$	$\geq P99.9$
A. 1994 Wealth Quantile for $BW^{50-54}_{\geq P99.9}$ households					
21.4%	7.4%	5.9%	13.0%	23.2%	29.2%

- The Rich Started Rich
  - 1/3 of the wealthiest at age 50 started in the top-0.1%

    ⇒ "Old Money"
  - 1/5 started with very little wealth

    ⇒ "New Money"

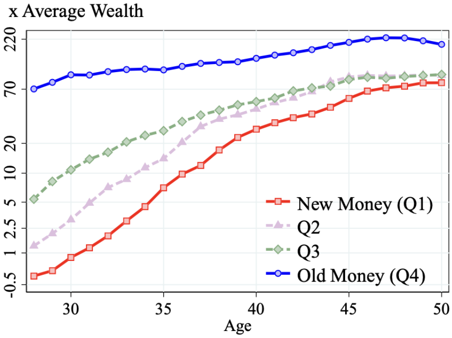
Backwards Life-Cycle Profiles

$< P75$	$[P75, P90)$	$[P90, P95)$	$[P95, P99)$	$[P99, P99.9)$	$\geq P99.9$
A. 1994 Wealth Quantile for $BW^{50-54}_{\geq P99.9}$ households					
21.4%	7.4%	5.9%	13.0%	23.2%	29.2%

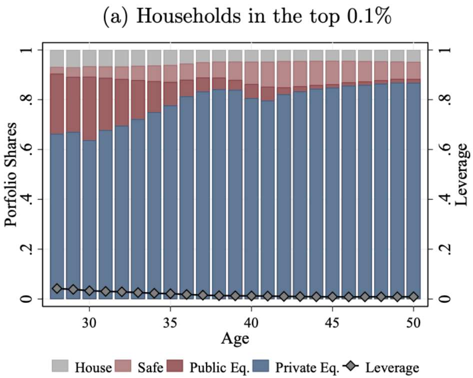
- The Rich Started Rich
  - 1/3 of the wealthiest at age 50 started in the top-0.1%

    ⇒ "Old Money"
  - 1/5 started with very little wealth

    ⇒ "New Money"

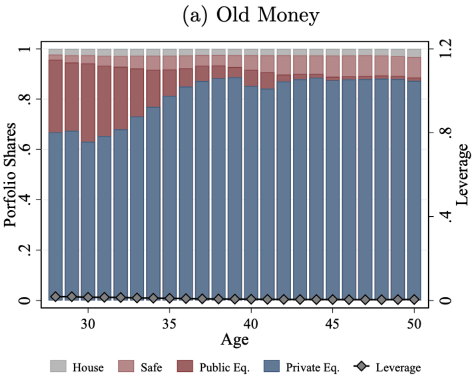


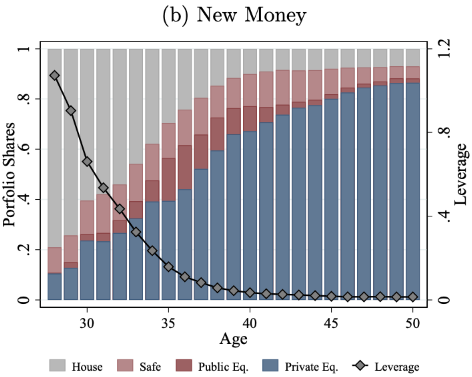
Portfolio Compositions The Rich Hold Equity



- Public + Private equity always above 80%, with little leverage

Portfolio Compositions The Rich Hold Equity





- Public + Private equity always above 80%, with little leverage
  - Old Money: even less housing at younger ages
  - New money: leveraged at younger ages

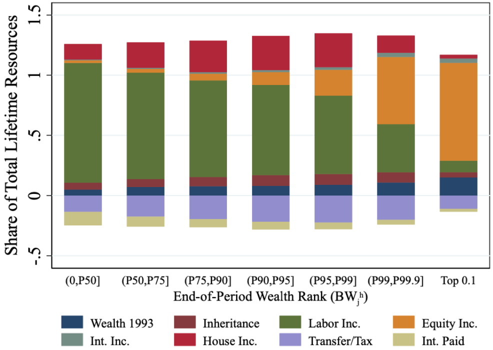
Sources of Income Income of the Rich is Equity Returns

- Accounting equation

$$W_{i,\tau} = W_{i,1993} + \sum_{t=1994}^{\tau} [L_{i,t} + H_{i,t} + R^E_{i,t} + R^S_{i,t} + R^H_{i,t} + T_{i,t} - I^L_{i,t}] - \sum_{t=1994}^{\tau} C_{i,t}$$

Sources of Income Income of the Rich is Equity Returns

Figure 6 – Decomposition of Total Lifetime Resources



- Accounting equation

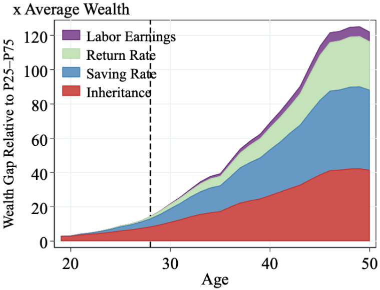
$$W_{i,\tau} = W_{i,1993} + \sum_{t=1994}^{\tau} [L_{i,t} + H_{i,t} + R^E_{i,t} + R^S_{i,t} + R^H_{i,t} + T_{i,t} - I^L_{i,t}] - \sum_{t=1994}^{\tau} C_{i,t}$$

Why are the Wealthiest so Wealthy?

- End wealth can differ because of: inheritances, labor earnings, return rates & saving rates
- Accounting: Shapley-Owen decomposition
  - Simulate the counterfactual evolution of wealth factor by factor

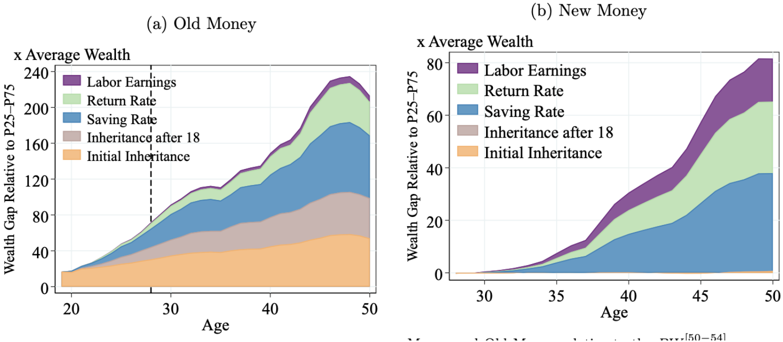
Why are the Wealthiest so Wealthy? Inheritances!

(a) Top 0.1%



- End wealth can differ because of: inheritances, labor earnings, return rates & saving rates
- Accounting: Shapley-Owen decomposition
  - Simulate the counterfactual evolution of wealth factor by factor

Why are the Wealthiest so Wealthy?



- End wealth can differ because of: inheritances, labor earnings, return rates & saving rates

- Accounting: Shapley-Owen decomposition
  - Simulate the counterfactual evolution of wealth factor by factor

Why are the Wealthiest so Wealthy? Taking Stock

- A third is "Old-Money"
  - $\approx 40\%$ comes from inheritances
  - Returns on equity and saving rates
- A fifth is "New-Money"
  - No inheritance, more labor income, mostly returns on equity and saving rates

Why are the Wealthiest so Wealthy? Taking Stock

- A third is "Old-Money"
  - $\approx 40\%$ comes from inheritances
  - Returns on equity and saving rates
- A fifth is "New-Money"
  - No inheritance, more labor income, mostly returns on equity and saving rates
- How many individuals?...
  - Norway: 5 million individuals ... Age $50 - 54 \approx 250{,}000$?
  - Top 0.1% of $50 - 54 \approx 250$ individuals
  - Old Money ≈ 75 individuals, New-Money ≈ 50 individuals?

Why are the Wealthiest so Wealthy?

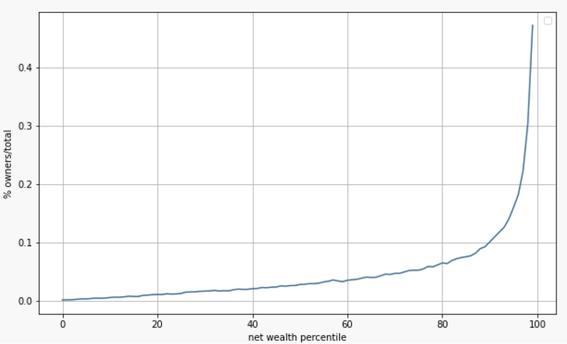
- Going forward: testing alternative models of wealth accumulation

Why are the Wealthiest so Wealthy?

- Going forward: testing alternative models of wealth accumulation
- Going forward: Bacher, Ferriere, Irarrazabal, Lizarraga and Zheng (2025)
  - Same data
  - Focus on private limited liability companies
  - Entrepreneurs or investors? *"When money meet skills"*

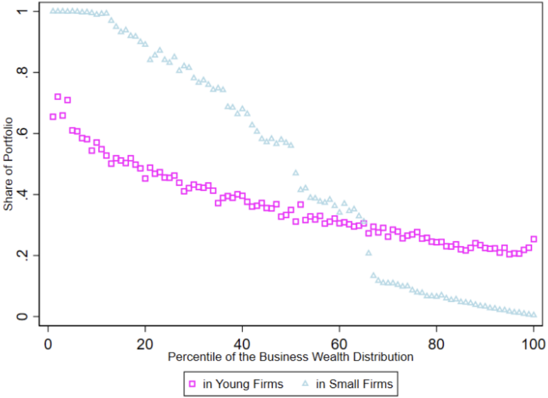
Private Businesses and Wealth Accumulation

- Where are private business owners situated in the net wealth distribution?
  - In the top of the distribution



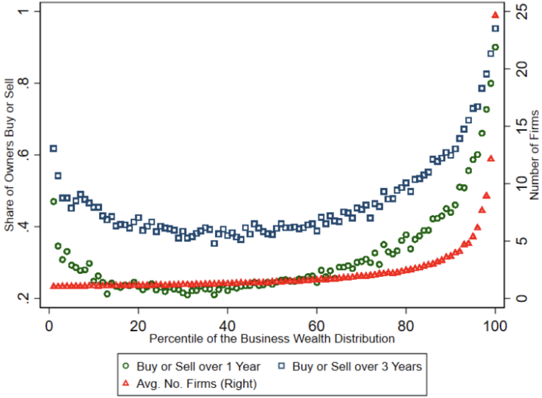
Private Businesses and Wealth Accumulation

- Where are private business owners situated in the net wealth distribution?
- What kind of firms do they owe?
  - Heterogeneity



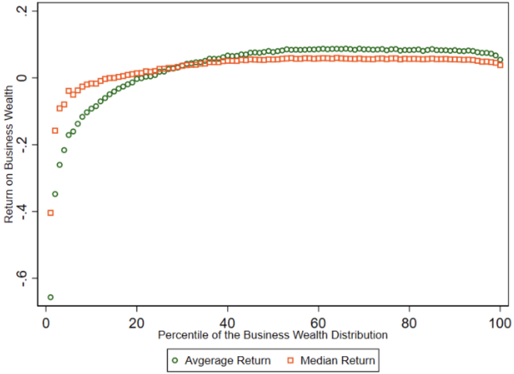
Private Businesses and Wealth Accumulation

- Where are private business owners situated in the net wealth distribution?
- What kind of firms do they owe?
- How many firms do they owe?
  - Mostly one



Private Businesses and Wealth Accumulation

- Where are private business owners situated in the net wealth distribution?
- What kind of firms do they owe?
- How many firms do they owe?
- Scale dependence?
  - Yes! Up to the 50th percentile



Private Businesses and Wealth Accumulation

- Where are private business owners situated in the net wealth distribution?
- What kind of firms do they owe?
- How many firms do they owe?
- Scale dependence?
  - Yes! Up to the 50th percentile

Investors or Entrepreneurs

- Empirical distinction bw entrepreneurs & investors
  - Owners who also supply skill
  - Owners who only supply money
- Role Database
  - Entrepreneurs if have a Role and some shares
  - Multiple layers

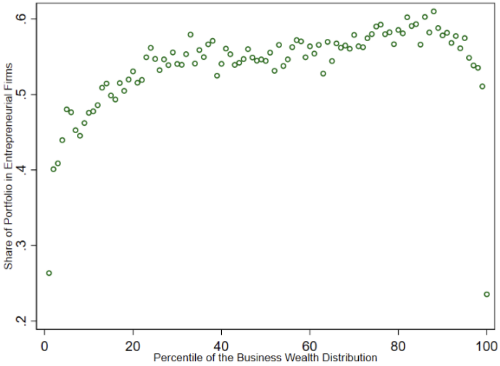
Investors or Entrepreneurs

- Entrepreneurs? If Manager or board chair and have large shares
  - Entrepreneur-owners have 2/3 of business wealth, investor-owners have 1/3

Investors or Entrepreneurs

- Entrepreneurs? If Manager or board chair and have large shares
  - Entrepreneur-owners have 2/3 of business wealth, investor-owners have 1/3

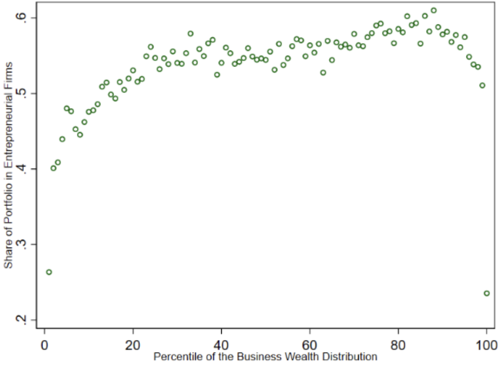
- Majority of business wealth held in entrepreneurial projects



Investors or Entrepreneurs

- Entrepreneurs? If Manager or board chair and have large shares
  - Entrepreneur-owners have 2/3 of business wealth, investor-owners have 1/3

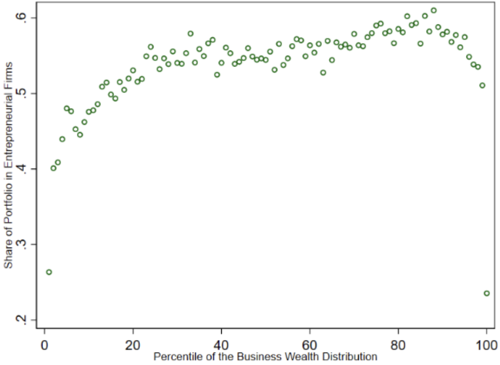
- Majority of business wealth held in entrepreneurial projects
  - Except at the bottom



Investors or Entrepreneurs

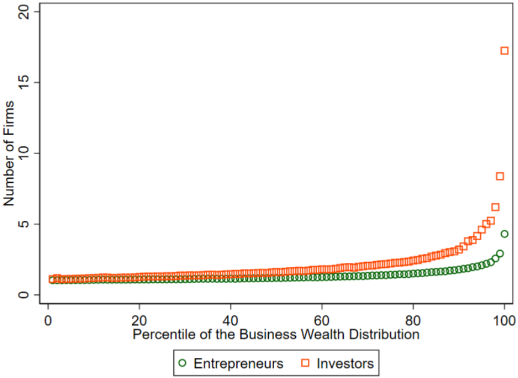
- Entrepreneurs? If Manager or board chair and have large shares
  - Entrepreneur-owners have 2/3 of business wealth, investor-owners have 1/3

- Majority of business wealth held in entrepreneurial projects
  - Except at the bottom
  - Except at the very top



Investors or Entrepreneurs

- Entrepreneurs? If Manager or board chair and have large shares
  - Entrepreneur-owners have 2/3 of business wealth, investor-owners have 1/3
- Majority of business wealth held in entrepreneurial projects
  - Except at the bottom
  - Except at the very top
- Top: Serial investors



Investors or Entrepreneurs

- Which investment has higher returns? As entrepreneur or investor?

- How do you make it to the very top? As entrepreneur or investor?

Investors or Entrepreneurs

- Which investment has higher returns? As entrepreneur or investor?
- How do you make it to the very top? As entrepreneur or investor?
- Who can invest in private businesses?
- Should we tax differently entrepreneurs and investors?

Transfers

On Inequality and Redistribution

- **Broad topic 2**: Transfers

- Focus on the bottom of the income distribution

On Inequality and Redistribution

- **Broad topic 2**: Transfers
- Focus on the bottom of the income distribution
- Brief description of the tax-and-transfer ($t\&T$) system in the US
- Universal Basic Income in models calibrated to the US

The U.S. Tax-and-Transfer System

- Personal income taxes
  - Progressive taxes (brackets) on labor and capital income taxes

The U.S. Tax-and-Transfer System

- Personal income taxes
  - Progressive taxes (brackets) on labor and capital income taxes
    - Deductions
    - Long-run capital gains are partly exempted

The U.S. Tax-and-Transfer System

- Personal income taxes
  - Progressive taxes (brackets) on labor and capital income taxes
    - Deductions
    - Long-run capital gains are partly exempted
- Fiscal rebates
  - Tax credits: EITC, CTC, . . .

The U.S. Tax-and-Transfer System

- Personal income taxes
  - Progressive taxes (brackets) on labor and capital income taxes
    - Deductions
    - Long-run capital gains are partly exempted
- Fiscal rebates
  - Tax credits: EITC, CTC, . . . means-tested, partially refundable

The U.S. Tax-and-Transfer System

- Personal income taxes
  - Progressive taxes (brackets) on labor and capital income taxes
    - Deductions
    - Long-run capital gains are partly exempted
- Fiscal rebates
  - Tax credits: EITC, CTC, ... means-tested, partially refundable
  - Transfers: SNAP, TANF, ...

The U.S. Tax-and-Transfer System

- Personal income taxes
  - Progressive taxes (brackets) on labor and capital income taxes
    - Deductions
    - Long-run capital gains are partly exempted
- Fiscal rebates
  - Tax credits: EITC, CTC, ... means-tested, partially refundable
  - Transfers: SNAP, TANF, ... complex eligibility conditions

The U.S. Tax-and-Transfer System

- Personal income taxes
  - Progressive taxes (brackets) on labor and capital income taxes
    - Deductions
    - Long-run capital gains are partly exempted
- Fiscal rebates
  - Tax credits: EITC, CTC, . . . means-tested, partially refundable
  - Transfers: SNAP, TANF, . . . complex eligibility conditions
- Non-monetary transfers: spending on education, childcare, . . .

Taxes or Transfers?

- Three examples of taxes and transfers
  - My pre-$t\&T$ income is $y = \$10$

Taxes or Transfers?

- Three examples of taxes and transfers
  - My pre-$t\&T$ income is $y = \$10$
  - World A. I pay a tax of $\$1$ and receive a transfer of $\$2$
    - After-$t\&T$ income $\hat{y} = y - 1 + 2 = \$11$
  - World B. I pay a tax of $\$0$ and receive a transfer of $\$1$
    - After-$t\&T$ income $\hat{y} = y - 0 + 1 = \$11$
  - World C. I pay a tax of $\$2$ and receive a refundable tax credit of $\$3$, and no transfer
    - After-$t\&T$ income $\hat{y} = y - (2 - 3) = \$11$

Taxes or Transfers?

- Three examples of taxes and transfers
  - My pre-$t\&T$ income is $y = \$10$
  - World A. I pay a tax of $\$1$ and receive a transfer of $\$2$
    - After-$t\&T$ income $\hat{y} = y - 1 + 2 = \$11$
  - World B. I pay a tax of $\$0$ and receive a transfer of $\$1$
    - After-$t\&T$ income $\hat{y} = y - 0 + 1 = \$11$
  - World C. I pay a tax of $\$2$ and receive a refundable tax credit of $\$3$, and no transfer
    - After-$t\&T$ income $\hat{y} = y - (2 - 3) = \$11$

- Always consider the joint distribution of taxes and transfers
  - In data, in models!

Marginal or Average Progressivity? 1/2

- Three examples of taxes and transfers, revisited
  - Bob makes pre-tax income of $\$10$, Jane makes $\$20$

Marginal or Average Progressivity? 1/2

- Three examples of taxes and transfers, revisited
  - Bob makes pre-tax income of $\$10$, Jane makes $\$20$
  - World 1. Uniform flat taxes of 20% rebated to both hh
    - After-$t\&T$ income is $\hat{y} = (1 - 20\%) \times y + T$, T from government budget constraint

Marginal or Average Progressivity? 1/2

- Three examples of taxes and transfers, revisited
  - Bob makes pre-tax income of $\$10$, Jane makes $\$20$
  - World 1. Uniform flat taxes of 20% rebated to both hh
    - After-$t\&T$ income is $\hat{y} = (1 - 20\%) \times y + T$, T from government budget constraint
    - Bob has: $\hat{y}^b = (1 - 20\%) \times \$10 + \$3 = \$11$
    - Jane has: $\hat{y}^b = (1 - 20\%) \times \$20 + \$3 = \$19$

Marginal or Average Progressivity? 1/2

- Three examples of taxes and transfers, revisited
  - Bob makes pre-tax income of $\$10$, Jane makes $\$20$
  - World 1. Uniform flat taxes of 20% rebated to both hh
    - After-$t\&T$ income is $\hat{y} = (1 - 20\%) \times y + T$, T from government budget constraint
    - Bob has: $\hat{y}^b = (1 - 20\%) \times \$10 + \$3 = \$11$
    - Jane has: $\hat{y}^b = (1 - 20\%) \times \$20 + \$3 = \$19$
    - Bob's average $t\&T$ rate is -10%, Jane's average $t\&T$ rate is 5%
    - Bob and Jane's marginal rate is 20%

$\Rightarrow$ Progressivity in average rates, no progressivity in marginal rates!

Marginal or Average Progressivity? 2/2

- More progressivity in marginal rates
  - World 2. Tax of 0% when $y < \$15$, tax of 10% when $y > \$15$, rebated to both hh

Marginal or Average Progressivity? 2/2

- More progressivity in marginal rates
  - World 2. Tax of 0% when $y < \$15$, tax of 10% when $y > \$15$, rebated to both hh
    - Bob has: $\hat{y}^b = (1 - 0\%) \times \$10 + \$1 = \$11$, average $t\&T$ rate is -10%
    - Jane has: $\hat{y}^b = (1 - 10\%) \times \$20 + \$1 = \$19$, average $t\&T$ rate is 5%

Marginal or Average Progressivity? 2/2

- More progressivity in marginal rates
  - World 2. Tax of 0% when $y < \$15$, tax of 10% when $y > \$15$, rebated to both hh
    - Bob has: $\hat{y}^b = (1 - 0\%) \times \$10 + \$1 = \$11$, average $t\&T$ rate is -10%
    - Jane has: $\hat{y}^b = (1 - 10\%) \times \$20 + \$1 = \$19$, average $t\&T$ rate is 5%

$\Rightarrow$ Same progressivity as W1 in average rates, more progressivity in marginal

Marginal or Average Progressivity? 2/2

- More progressivity in marginal rates
  - World 2. Tax of 0% when $y < \$15$, tax of 10% when $y > \$15$, rebated to both hh
    - Bob has: $\hat{y}^b = (1 - 0\%) \times \$10 + \$1 = \$11$, average $t\&T$ rate is -10%
    - Jane has: $\hat{y}^b = (1 - 10\%) \times \$20 + \$1 = \$19$, average $t\&T$ rate is 5%

  $\Rightarrow$ Same progressivity as W1 in average rates, more progressivity in marginal

- More progressivity in average rates
  - World 3. Uniform flat taxes of 30% rebated to both hh

Marginal or Average Progressivity? 2/2

- More progressivity in marginal rates
  - World 2. Tax of 0% when $y < \$15$, tax of 10% when $y > \$15$, rebated to both hh
    - Bob has: $\hat{y}^b = (1 - 0\%) \times \$10 + \$1 = \$11$, average $t\&T$ rate is -10%
    - Jane has: $\hat{y}^b = (1 - 10\%) \times \$20 + \$1 = \$19$, average $t\&T$ rate is 5%

  $\Rightarrow$ Same progressivity as W1 in average rates, more progressivity in marginal

- More progressivity in average rates
  - World 3. Uniform flat taxes of 30% rebated to both hh
    - Bob has: $\hat{y}^b = (1 - 30\%) \times \$10 + \$4.5 = \$11.5$, average $t\&T$ rate is -15%
    - Jane has: $\hat{y}^b = (1 - 30\%) \times \$20 + \$4.5 = \$18.5$, average $t\&T$ rate is 7.5%

Marginal or Average Progressivity? 2/2

- More progressivity in marginal rates
  - World 2. Tax of 0% when $y < \$15$, tax of 10% when $y > \$15$, rebated to both hh
    - Bob has: $\hat{y}^b = (1 - 0\%) \times \$10 + \$1 = \$11$, average $t\&T$ rate is -10%
    - Jane has: $\hat{y}^b = (1 - 10\%) \times \$20 + \$1 = \$19$, average $t\&T$ rate is 5%

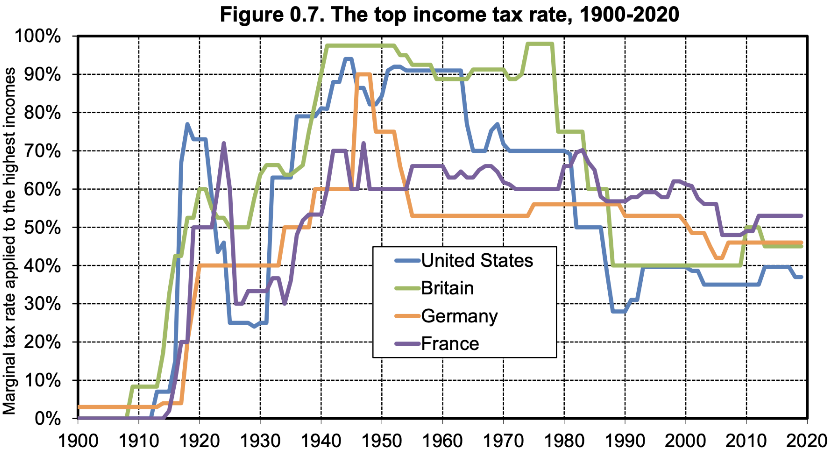
  $\Rightarrow$ Same progressivity as W1 in average rates, more progressivity in marginal

- More progressivity in average rates
  - World 3. Uniform flat taxes of 30% rebated to both hh
    - Bob has: $\hat{y}^b = (1 - 30\%) \times \$10 + \$4.5 = \$11.5$, average $t\&T$ rate is -15%
    - Jane has: $\hat{y}^b = (1 - 30\%) \times \$20 + \$4.5 = \$18.5$, average $t\&T$ rate is 7.5%
  - Same progressivity as W1 in marginal rates, more progressivity in average

The U.S. Tax-and-Transfer System: Trends Over Time

- Marginal progressivity has decreased over time
- Average progressivity has increased over time
- In-work benefits have become much larger

Marginal Progressivity Has Decreased Over Time



Interpretation. The top marginal tax rate applied to the highest incomes averaged 23% in the United States from 1900 to 1932, 81% from 1932 to 1980, and 39% from 1980 to 2018. Over these same periods, the top rate was 30%, 89% and 46% in Britain, 18%, 58% and 50% in Germany, and 23%, 60% and 57% in France. Fiscal progressivity was at its highest level in the middle of the century, especially in the United States and in Britain. **Sources and series**: see piketty.pse.ens.fr/ideology.

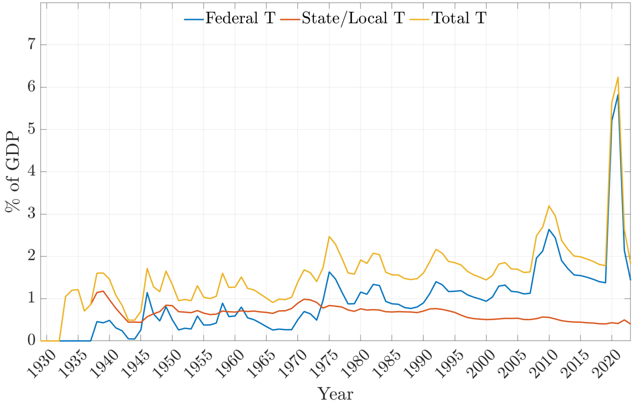
Average Progressivity Has Increased Over Time

- Narrow definition of transfers
  - Federal:

    UI benefits, workers' compensation, food stamps, SSI, refundable tax credits

  - State/local:

    Temporary disability insurance, workers' compensation, family assistance, SSI, general assistance energy assistance, other assistance



Source: NIPA Tables

Optimal Tax-and-Transfer System

- What do models say about optimal progressivity?
  - Workhorse models of taxation: an efficiency-redistribution trade-off

Optimal Tax-and-Transfer System

- What do models say about optimal progressivity?
  - Workhorse models of taxation: an efficiency-redistribution trade-off
  - Redistribution calls for large average progressivity
    - Dispersion in consumption
    - Utilitarian government

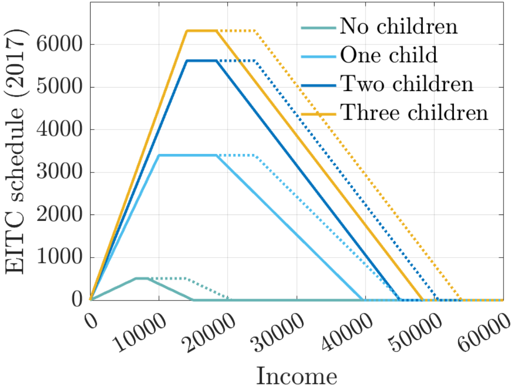
Optimal Tax-and-Transfer System

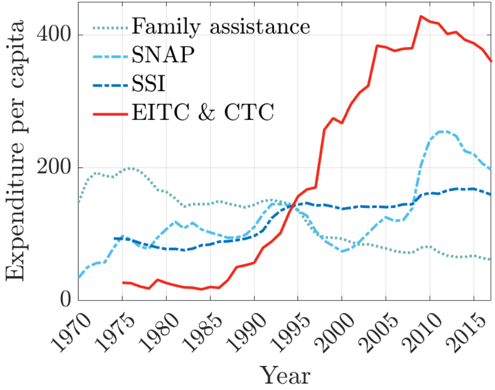
- What do models say about optimal progressivity?
  - Workhorse models of taxation: an efficiency-redistribution trade-off
  - Redistribution calls for large average progressivity
    - Dispersion in consumption
    - Utilitarian government
  - Efficiency calls for small marginal progressivity
    - Dispersion in income
    - To incentivize labor supply and savings

Optimal Tax-and-Transfer System

- What do models say about optimal progressivity?
  - Workhorse models of taxation: an efficiency-redistribution trade-off
  - Redistribution calls for large average progressivity
    - Dispersion in consumption
    - Utilitarian government
  - Efficiency calls for small marginal progressivity
    - Dispersion in income
    - To incentivize labor supply and savings
  - How to implement that?
    - Large transfers, high but flat taxes work pretty well
    - Ferriere, Gruebener, Navarro and Vardishvili (2023)

In-Work Benefits Have Become More Important





- Source: IRS and NIPA, my own computations

Have We Gone Too Far?

- In-work benefits are good for incentives. . .
  - but don't provide income support to the very poor

Have We Gone Too Far?

- In-work benefits are good for incentives. . .
  - but don't provide income support to the very poor
- Should we rather implement a Universal Basic Income?
- Daruich and Fernandez (2024)

A Rich Quantitative Model to Evaluate UBI

- Objective of the paper:
  - Use a general equilibrium overlapping generations (GE-OLG) model
  - Analyze long-term UBI effects on welfare, inequality, and intergenerational mobility
    - Much cheaper than a real experimentation!

A Rich Quantitative Model to Evaluate UBI

- Objective of the paper:
  - Use a general equilibrium overlapping generations (GE-OLG) model
  - Analyze long-term UBI effects on welfare, inequality, and intergenerational mobility
    - Much cheaper than a real experimentation!

- Key ingredients
  - GE life-cycle Aiyagari model with uninsurable wage shocks and capital accumulation

A Rich Quantitative Model to Evaluate UBI

- Objective of the paper:
  - Use a general equilibrium overlapping generations (GE-OLG) model
  - Analyze long-term UBI effects on welfare, inequality, and intergenerational mobility
    - Much cheaper than a real experimentation!

- Key ingredients
  - GE life-cycle Aiyagari model with uninsurable wage shocks and capital accumulation
  - Borrowing constraints, precautionary and life-cycle savings

A Rich Quantitative Model to Evaluate UBI

- Objective of the paper:
  - Use a general equilibrium overlapping generations (GE-OLG) model
  - Analyze long-term UBI effects on welfare, inequality, and intergenerational mobility
    - Much cheaper than a real experimentation!

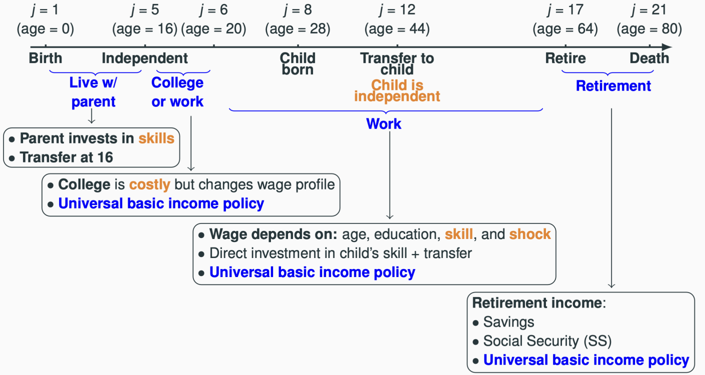
- Key ingredients
  - GE life-cycle Aiyagari model with uninsurable wage shocks and capital accumulation
  - Borrowing constraints, precautionary and life-cycle savings
  - Endogenous education function of parental investments in child skills and intervivo transfers

A Rich Quantitative Model to Evaluate UBI

- Objective of the paper:
  - Use a general equilibrium overlapping generations (GE-OLG) model
  - Analyze long-term UBI effects on welfare, inequality, and intergenerational mobility
    - Much cheaper than a real experimentation!

- Key ingredients
  - GE life-cycle Aiyagari model with uninsurable wage shocks and capital accumulation
  - Borrowing constraints, precautionary and life-cycle savings
  - Endogenous education function of parental investments in child skills and intervivo transfers
  - Distortionary taxes to fund UBI

The Model



- **Representative Firm:** Uses capital, HS labor, and college labor
- **Government:** Raises taxes to pay transfers, SS and fixed expenses G

The Model

$$V_j\left(a,\theta,e,\eta,\boldsymbol{\theta_k}\right) = \max_{c,a',h,m} u(c,h) + \beta\mathbb{E}\left[V_{j+1}\left(a',\theta,e,\eta',\boldsymbol{\theta_k'}\right)\right]$$

$$c + a' + m = y + a\left(1+r\right) - T\left(y,a,c\right)$$

$$y = w_e h\, E_{e,j}\left(\theta,\eta\right) \quad , \quad a' \geq \underline{a}_{e,j} \quad , \quad 0 \leq h \leq 1, \quad \eta' \sim \Gamma_{e,j}(\eta)$$

$$\underbrace{\boldsymbol{\theta_k'}}_{\text{Next period child's skills}} = \left[\alpha_{1j} \underbrace{\boldsymbol{\theta}_k^{\rho_j}}_{\text{Current child's skills}} + \alpha_{2j} \underbrace{\boldsymbol{\theta}^{\rho_j}}_{\text{Parent's skills}} + \alpha_{3j} \underbrace{I^{\rho_j}}_{\text{Parental investments}}\right]^{1/\rho_j} \exp\left(\boldsymbol{\nu}\right), \boldsymbol{\nu} \sim N(0,\boldsymbol{\sigma}_{j,\nu})$$

$$I = \bar{A} \underbrace{m}_{\text{Money}} \qquad m \geq 0$$

Main Forces

- Why UBI Could Be Good?
  - Reduces inequality by providing unconditional transfers to all
  - Improves intergenerational mobility
    - Low-income households can invest more in their kids' skills
    - Kids from low-income families can go to college more

Main Forces

- Why UBI Could Be Good?
  - Reduces inequality by providing unconditional transfers to all
  - Improves intergenerational mobility
    - Low-income households can invest more in their kids' skills
    - Kids from low-income families can go to college more
- Why UBI Could Be Bad?
  - Higher transfers and associated higher taxes both contribute to. . .
    - Lower labor supply, lower savings and capital stock
    - Lower parental investments in child skills, lower college enrollment
    - Lower output and consumption!

General Equilibrium Results

- Impact of UBI of $\approx \$1{,}000/\text{month}$ per adult:
  - Labor supply, education, and capital stock decline
  - Higher mobility and lower inequality

General Equilibrium Results

- Impact of UBI of $\approx \$1{,}000$/month per adult:
  - Labor supply, education, and capital stock decline
  - Higher mobility and lower inequality
- Overall, large welfare losses
- Decomposition
  - Effects of higher taxes vs. higher transfers
  - Endogenous response of capital vs. skills
  - General equilibrium
  - Current cohorts vs. newborns

What Next?

- Richer household heterogeneity
- EITC vs. transfers that phase-out but do not phase-in

Taxes and Transfers and the Business Cycle

Motivation Ferriere & Navarro (2025)

- Design of counter-cyclical policies
  - Monetary policy: short-term nominal interest rate
  - Fiscal policy: spending, unemployment benefits, lump-sum checks

Motivation Ferriere & Navarro (2025)

- Design of counter-cyclical policies
  - Monetary policy: short-term nominal interest rate
  - Fiscal policy: spending, unemployment benefits, lump-sum checks
- Explore the distribution of labor income taxes as a counter-cyclical policy
  - Not commonly used in practice
  - Empirically, tax cuts have large macro effects
    Mertens and Ravn (2013), Zidar (2019)

Motivation Ferriere & Navarro (2025)

- Design of counter-cyclical policies
  - Monetary policy: short-term nominal interest rate
  - Fiscal policy: spending, unemployment benefits, lump-sum checks

- Explore the distribution of labor income taxes as a counter-cyclical policy
  - Not commonly used in practice
  - Empirically, tax cuts have large macro effects
    Mertens and Ravn (2013), Zidar (2019)

- A policy-driven approach
  - Quantitative HANK model
  - Effectiveness of various fiscal stabilization packages after a negative demand shock

Framework

- Standard HANK model with three additional components
  - Heterogeneous stochastic discount factors $\rightarrow$ heterogeneous mpc
  - An extensive labor supply margin $\rightarrow$ heterogeneous labor elasticities
  - Unemployment risk of heterogeneous incidence & varying with the cycle

Framework

- Standard HANK model with three additional components
  - Heterogeneous stochastic discount factors $\rightarrow$ heterogeneous mpc
  - An extensive labor supply margin $\rightarrow$ heterogeneous labor elasticities
  - Unemployment risk of heterogeneous incidence & varying with the cycle

$\Rightarrow$ Relevant framework to quantify fiscal stabilization packages

- Demand-driven recession
  - Negative shock to marginal utility: unexpected, deterministic, transitory

Fiscal Stabilization Packages

- Three fiscal stabilization packages

Fiscal Stabilization Packages

- Three fiscal stabilization packages
  - Targeted-Transfer **(TT)** Package: a transfer targeted to low-income households

Fiscal Stabilization Packages

- Three fiscal stabilization packages
  - Targeted-Transfer **(TT)** Package: a transfer targeted to low-income households
  - Unemployment Insurance **(UI)** Package: a transfer to unemployed households

Fiscal Stabilization Packages

- Three fiscal stabilization packages
  - Targeted-Transfer **(TT)** Package: a transfer targeted to low-income households
  - Unemployment Insurance **(UI)** Package: a transfer to unemployed households
  - Tax Credit **(TC)** Package: a tax credit to low-income working households

Fiscal Stabilization Packages

- Three fiscal stabilization packages
  - Targeted-Transfer **(TT)** Package: a transfer targeted to low-income households
  - Unemployment Insurance **(UI)** Package: a transfer to unemployed households
  - Tax Credit **(TC)** Package: a tax credit to low-income working households

$\Rightarrow$ The TC Package is the most effective to stabilize the economy

  - Output multiplier above 0.9, compared to ≈ 0.6 for UI & 0.4 for TT
  - Despite the larger unemployment risk
  - Operates through both consumption and labor supply

- Robustness and implementability

Literature

- Effects of monetary policy and government spending in HANK models

  Kaplan, Moll, and Violante (2018), Hagedorn, Manovskii, and Mitman (2019), Bilbiie (2020), Auclert, Rognlie, and Straub (2023), Ferriere and Navarro (2024), Alves and Violante (2023)

- Quantitative effects of UI extensions in recessions

  Mitman and Rabinovich (2015), Kekre (2022), Gorn and Trigari (2024), Bardoczy and Guerreiro (2023), Broer, Druedahl, Harmenberg, and Oberg (2024)

- Optimal fiscal and monetary policy in HANK

  Bhandari, Evans, Golosov, and Sargent (2021), Le Grand and Ragot (2022), McKay and Wolf (2023)

- Stabilization and labor taxes in HANK

  Broer et al. (2025), Le Grand, Ragot and Bourany (2024)

Environment

A HANK model with some twists

- Households
  - Bond economy with borrowing constraint
  - Stochastic discount factors
  - Indivisible labor choice
  - Idiosyncratic labor productivity shocks + unemployment shocks

A HANK model with some twists

- Households
  - Bond economy with borrowing constraint
  - Stochastic discount factors
  - Indivisible labor choice
  - Idiosyncratic labor productivity shocks + unemployment shocks
- NK block with sticky prices
  - Linear technology in labor
  - Monetary authority implements a standard Taylor rule
- Government
  - Finances spending, transfers, and UI benefits with debt, labor taxes, and capital taxes

Households Working households

- Individual state: asset a, discount factor β, productivity x, and employment $\eta \in \{\ell, u\}$

Households Working households

- Individual state: asset a, discount factor β, productivity x, and employment $\eta \in \{\ell, u\}$

- Value function when employment "island" $\eta = \ell$

$$V_t(a, x, \ell, \beta) = \max_{c,h,a'} \{\log c - Bh + \beta \mathbb{E}_t [V_{t+1}(a', x', \eta', \beta') | x, \beta, \ell)]\} \quad \text{s.t.}$$

$$c + a' = a + y^\ell + y^k - \mathcal{T}_t(y^\ell, y^k) + T_t + d_t^h(x),$$

$$y^\ell = w_t x h, \quad y^k = r_t a, \quad h \in \{0, \bar{h}\}, \quad a' \geq 0.$$

Households Working households

- Individual state: asset a, discount factor β, productivity x, and employment $\eta \in \{\ell, u\}$

- Value function when employment "island" $\eta = \ell$

$$V_t(a, x, \ell, \beta) = \max_{c,h,a'} \{\log c - Bh + \beta \mathbb{E}_t \left[V_{t+1}(a', x', \eta', \beta') | x, \beta, \ell)\right]\} \quad \text{s.t.}$$

$$c + a' = a + y^\ell + y^k - \mathcal{T}_t(y^\ell, y^k) + T_t + d_t^h(x),$$

$$y^\ell = w_t x h, \quad y^k = r_t a, \quad h \in \{0, \bar{h}\}, \quad a' \geq 0.$$

  – Preference shock on discrete labor choice, distributed Gumbel with variance ρ_h

    + $\rho_h \geq 0$ calibrated to discipline labor elasticities

Households Working households

- Individual state: asset a, discount factor β, productivity x, and employment $\eta \in \{\ell, u\}$

- Value function when employment "island" $\eta = \ell$

$$V_t(a, x, \ell, \beta) = \max_{c,h,a'} \{\log c - Bh + \beta \mathbb{E}_t [V_{t+1}(a', x', \eta', \beta') | x, \beta, \ell)]\} \quad \text{s.t.}$$

$$c + a' = a + y^\ell + y^k - \mathcal{T}_t(y^\ell, y^k) + T_t + d_t^h(x),$$

$$y^\ell = w_t x h, \quad y^k = r_t a, \quad h \in \{0, \bar{h}\}, \quad a' \geq 0.$$

  - Preference shock on discrete labor choice, distributed Gumbel with variance ρ_h
    - $\rho_h \geq 0$ calibrated to discipline labor elasticities
  - AR(1) process for discount factor, productivity and employment status
  - Flat capital tax τ^k, progressive loglinear labor tax (λ_t, τ^ℓ)
    Heathcote, Storesletten, and Violante (2017)

Households Unemployed households

- Value function when in unemployment "island" $\eta = u$

$$V_t(a, x, u, \beta) = \max_{c, a'} \left\{ \log c - B\bar{h} + \beta \mathbb{E}_t \left[V_{t+1}(a', x', \eta', \beta') | x, \beta, u) \right] \right\} \quad \text{s.t.}$$

$$c + a' = a + y^k + \mathcal{B}_t(w_t x) - \mathcal{T}_t(0, y^k) + T_t + d_t^h(x),$$

$$y^k = r_t a, \quad a' \geq 0.$$

Households Unemployed households

- Value function when in unemployment "island" $\eta = u$

$$V_t(a,x,u,\beta) = \max_{c,a'} \left\{ \log c - B\bar{h} + \beta \mathbb{E}_t \left[V_{t+1}(a',x',\eta',\beta') | x,\beta,u) \right] \right\} \quad \text{s.t.}$$

$$c + a' = a + y^k + \mathcal{B}_t(w_t x) - \mathcal{T}_t(0, y^k) + T_t + d_t^h(x),$$

$$y^k = r_t a, \quad a' \geq 0.$$

  – Unemployment benefits function of hourly wage
    Kekre (2022)

$$\mathcal{B}_t(w_t x) = \zeta \min\left(\mathcal{R} w_t x \bar{h}, \overline{ui}\right) + \chi w_t x \bar{h}$$

  + ζ to match fraction of recipients, $\mathcal{R}$ the replacement rate, $\overline{ui}$ the UI cap

  + χ to capture household labor income received while in unemployment

Households Unemployed households

- Value function when in unemployment "island" $\eta = u$

$$V_t(a,x,u,\beta) = \max_{c,a'} \left\{ \log c - B\bar{h} + \beta \mathbb{E}_t \left[V_{t+1}(a',x',\eta',\beta') | x, \beta, u) \right] \right\} \quad \text{s.t.}$$

$$c + a' = a + y^k + \mathcal{B}_t(w_t x) - \mathcal{T}_t(0, y^k) + T_t + d_t^h(x),$$

$$y^k = r_t a, \quad a' \geq 0.$$

  – Unemployment benefits function of hourly wage
    Kekre (2022)

$$\mathcal{B}_t(w_t x) = \zeta \min \left(\mathcal{R} w_t x \bar{h}, \overline{ui} \right) + \chi w_t x \bar{h}$$

    + ζ to match fraction of recipients, $\mathcal{R}$ the replacement rate, $\overline{ui}$ the UI cap

    + χ to capture household labor income received while in unemployment

  – AR(1) process for discount factors, productivity and employment status

Firms and Government

- Standard two-layer structure with a final-good producer and intermediate good producers
  - Sticky prices a la Rotemberg

Firms and Government

- Standard two-layer structure with a final-good producer and intermediate good producers
  - Sticky prices a la Rotemberg

- Monetary authority follows a Taylor rule: $1 + i_t = (1 + \bar{i}) \left(\frac{\Pi_t}{\bar{\Pi}}\right)^{\phi_\Pi}$

- Fiscal authority faces a standard budget constraint

$$G_t + (1 + r_t)D_t + T_t + \int \mathcal{B}_t(w_t x)d\mu_t = D_{t+1} + \int \mathcal{T}_t(y_t^\ell, y_t^k)d\mu_t$$

Fiscal rule

Firms and Government

- Standard two-layer structure with a final-good producer and intermediate good producers
  - Sticky prices a la Rotemberg

- Monetary authority follows a Taylor rule: $1 + i_t = (1 + \bar{i}) \left(\frac{\Pi_t}{\bar{\Pi}}\right)^{\phi_\Pi}$

- Fiscal authority faces a standard budget constraint

$$G_t + (1 + r_t)D_t + T_t + \int \mathcal{B}_t(w_t x) d\mu_t = D_{t+1} + \int \mathcal{T}_t(y_t^\ell, y_t^k) d\mu_t$$

  - Fiscal rule with parameter Φ_D for public debt, λ_t clears the budget constraint
    Uhlig (2010)

    $\Phi_D = 0$ for constant debt, all adjustment in tax level

    $\Phi_D \to 1$ for constant taxes, all adjustment in debt

Fiscal rule

Calibration

Calibration Overview

- Quarterly model calibrated to liquid wealth
  - Stochastic β s.t. top-quintile liquid wealth $\approx 90\%$ (SCF)

Calibration Overview

- Quarterly model calibrated to liquid wealth
  - Stochastic β s.t. top-quintile liquid wealth $\approx 90\%$ (SCF)
- Labor supply: ρ_h to match average annual labor elasticity of ≈ 0.3
  Ferriere and Navarro (2024)

Calibration Overview

- Quarterly model calibrated to liquid wealth
  - Stochastic β s.t. top-quintile liquid wealth $\approx 90\%$ (SCF)
- Labor supply: ρ_h to match average annual labor elasticity of ≈ 0.3
  Ferriere and Navarro (2024)
- Technology: $\varepsilon = 7$, $\Theta = 200 \rightsquigarrow$ Phillips curve slope $\varepsilon/\Theta = 0.035$
  Galí and Gertler (1999)
- Government
  - Standard calibration for taxes and unemployment benefits
  - Automatic responses of inflation and debt: $\Phi_\Pi = 1.5$, $\Phi_D = 0.75$

- Job finding rates and separation rates across hourly wage distribution

  Mueller (2017)

Unemployment Steady State and Business Cycles

- Job finding rates and separation rates across hourly wage distribution
  Mueller (2017)

- Steady State
  - Job finding rates constant, separation rates falling in hourly wage/productivity x
  - Average unemployment rate at 4.3%

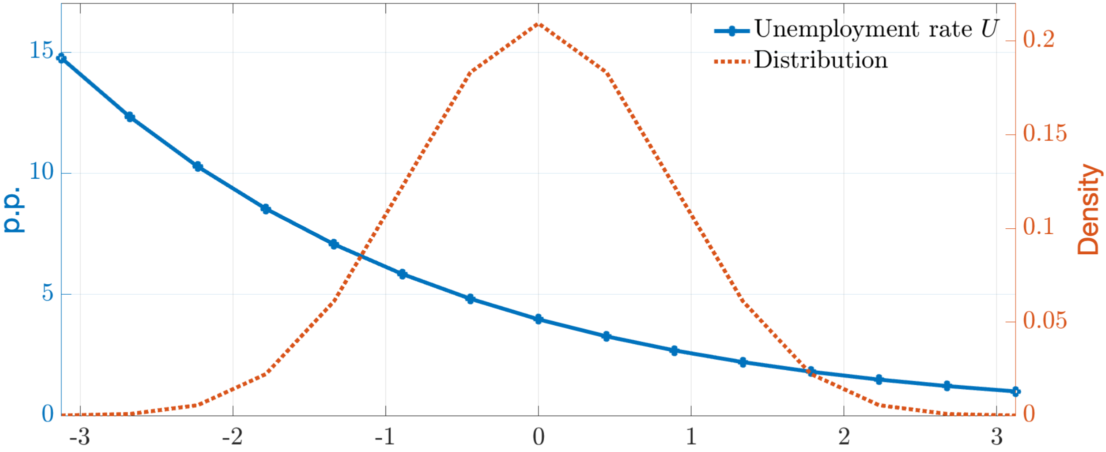
Unemployment Steady State and Business Cycles

- Job finding rates and separation rates across hourly wage distribution
  Mueller (2017)

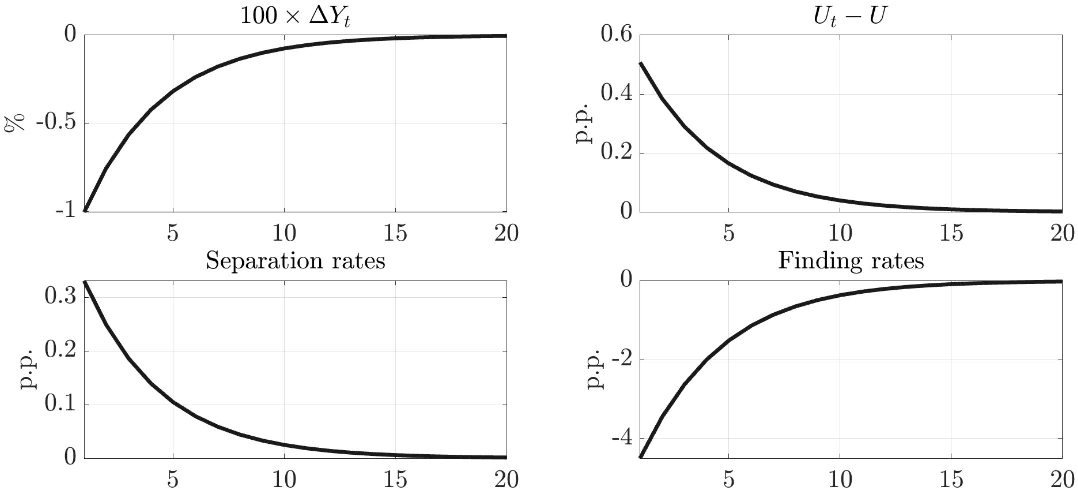
- Steady State
  - Job finding rates constant, separation rates falling in hourly wage/productivity x
  - Average unemployment rate at 4.3%

- Okun's law: Okun coefficient $c_{OK} = 0.5$
  Ball, Leigh, and Loungani (2017)
  - Job finding rates decrease (a lot) equally across households
  - Job separation rates decrease (a bit), higher elasticity for high-x households
    - Functional forms: additive fall in separation rates in recession delivers the pattern

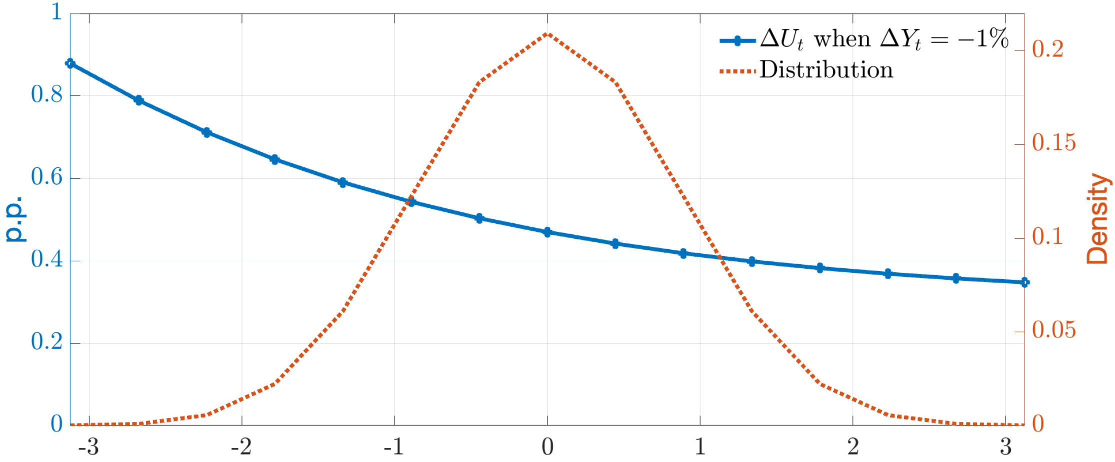
Unemployment Steady State



Unemployment Business Cycle: Okun's law



Unemployment **Business Cycle: Okun's law**



Investigating the Calibration Household responses

- Labor elasticities decline with income

  Triest (1990), Eissa and Liebman (1996), Kleven and Kreiner (2006), Meghir and Phillips (2010), ...

  – Compute labor responses to a 1% change in after-tax rate: average annual elasticity at 0.30

    Erosa, Fuster, and Kambourov (2016)

Income quartile	1	2	3	4
Labor elasticity	0.44	0.34	0.25	0.22

Micro labor elasticity mpc

Investigating the Calibration Household responses

- Labor elasticities decline with income
  Triest (1990), Eissa and Liebman (1996), Kleven and Kreiner (2006), Meghir and Phillips (2010), ...
  - Compute labor responses to a 1% change in after-tax rate: average annual elasticity at 0.30
    Erosa, Fuster, and Kambourov (2016)

Income quartile	1	2	3	4
Labor elasticity	0.44	0.34	0.25	0.22

- Marginal propensities to consume (mpc) Parker, Souleles, Johnson, and McClelland (2013), Kaplan and Violante (2014), ...
  - Compute mpc out of a $500 rebate: average quarterly mpc at 0.13
  - Decline with wealth: from 0.20 to 0.03 from 1st to 4th wealth quartile
  - Larger for unemployed at 0.32, consumption drops by 10% when falling into unemployment
    Saporta-Eksten (2014), Ganong and Noel (2019)

Micro labor elasticity mpc

Investigating the Calibration Tax shocks

- Further investigate aggregate effects of tax shocks
- Compute tax multipliers as in Mertens and Ravn (2013)
  - Tax multiplier at about 0.6 in the model, vs. above 2 in the data
  - Peaks on impact in the model, at 3 quarters in the model

Investigating the Calibration Tax shocks

- Further investigate aggregate effects of tax shocks
- Compute tax multipliers as in Mertens and Ravn (2013)
  - Tax multiplier at about 0.6 in the model, vs. above 2 in the data
  - Peaks on impact in the model, at 3 quarters in the model
- Replicate a tax shock on bottom-90 vs. top-10 as in Zidar (2019)
  - Tax cut on bottom-90 increases employment by 1% in the model vs. above 3% in the data
  - Tax cut on the top-10 has no effects
  - Peaks on impact in the model, at 2 years in the model

Investigating the Calibration Tax shocks

- Further investigate aggregate effects of tax shocks
- Compute tax multipliers as in Mertens and Ravn (2013)
  - Tax multiplier at about 0.6 in the model, vs. above 2 in the data
  - Peaks on impact in the model, at 3 quarters in the model
- Replicate a tax shock on bottom-90 vs. top-10 as in Zidar (2019)
  - Tax cut on bottom-90 increases employment by 1% in the model vs. above 3% in the data
  - Tax cut on the top-10 has no effects
  - Peaks on impact in the model, at 2 years in the model

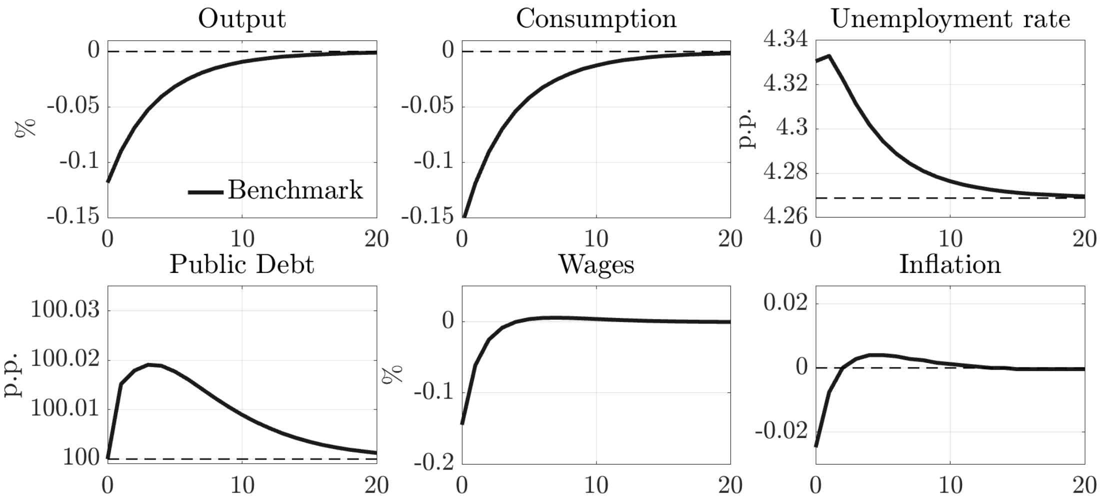
$\Rightarrow$ Conservative calibration regarding tax responses

Recession

Benchmark No Fiscal Stabilization

- Recession induced by a negative demand shock: $(1-\omega_t)u(c_t, n_t)$
  - ω_0 such that $\Delta Y_t = -0.1\%$ on impact
  - Reverts to $\omega = 0$ with persistence $\rho_\omega = 0.75$ at the quarterly level
- Unexpected, transitory, perfect foresight: a 'MIT' shock

Benchmark No Fiscal Stabilization



Three Fiscal Stabilization Packages TT Package

- A Targeted Transfer **(TT)** Package
  - Design to mimic checks sent in 2008: For all low-income households, based on last-year income
  - An "automatic stabilizer" flavor: Phase out over time with persistence ρ_ω

Three Fiscal Stabilization Packages **TT Package**

- A Targeted Transfer **(TT)** Package
  - Design to mimic checks sent in 2008: For all low-income households, based on last-year income
  - An "automatic stabilizer" flavor: Phase out over time with persistence ρ_ω
  - Temporary transfer modeled as a logistic function
    Ferriere, Grübener, Navarro, and Vardishvili (2023)

$$\hat{T}_t(y) = m_t \frac{2\exp(-\chi y/\bar{y})}{1+\exp(-\chi y/\bar{y})}, \quad m_t \text{ the transfer at } y=0,\ \chi \text{ the phasing-out speed}$$

Three Fiscal Stabilization Packages TT Package

- A Targeted Transfer **(TT)** Package
  - Design to mimic checks sent in 2008: For all low-income households, based on last-year income
  - An "automatic stabilizer" flavor: Phase out over time with persistence ρ_ω
  - Temporary transfer modeled as a logistic function

    Ferriere, Grübener, Navarro, and Vardishvili (2023)

$$\hat{T}_t(y) = m_t \frac{2\exp(-\chi y/\bar{y})}{1+\exp(-\chi y/\bar{y})}, \quad m_t \text{ the transfer at } y=0,\ \chi \text{ the phasing-out speed}$$

+ "Based on last-year income": $\tilde{y}(x, \eta, \beta)$

Three Fiscal Stabilization Packages TT Package

- A Targeted Transfer **(TT)** Package
  - Design to mimic checks sent in 2008: For all low-income households, based on last-year income
  - An "automatic stabilizer" flavor: Phase out over time with persistence ρ_ω
  - Temporary transfer modeled as a logistic function
    Ferriere, Grübener, Navarro, and Vardishvili (2023)

$$\hat{T}_t(y) = m_t \frac{2\exp(-\chi y/\bar{y})}{1+\exp(-\chi y/\bar{y})}, \quad m_t \text{ the transfer at } y=0,\ \chi \text{ the phasing-out speed}$$

    + "Based on last-year income": $\tilde{y}(x, \eta, \beta)$
  - Calibration such that *total cost* equals a one-time check of $\$200$ to all households
    + Initial check at $y = 0$ is $m_0 = \$900$
    + Quick phase-out at $\chi = 12$: only 20% households receive more than $\$50$ at $t = 0$

Three Fiscal Stabilization Packages **UI Package**

- A Unemployment Insurance **(UI)** Package
  - A check to all unemployed households, phase out with persistence ρ_ω

Three Fiscal Stabilization Packages UI Package

- A Unemployment Insurance **(UI)** Package
  - A check to all unemployed households, phase out with persistence ρ_ω
  - Calibration such that equals a one-time lump-sum check of $\$200$
    - + Initial check equal to $\$1{,}1000$

Three Fiscal Stabilization Packages **UI Package & TC Package**

- A Unemployment Insurance **(UI)** Package
  - A check to all unemployed households, phase out with persistence ρ_ω
  - Calibration such that equals a one-time lump-sum check of $\$200$
    + Initial check equal to $\$1{,}1000$

- A Tax Credit **(TC)** Package
  - A check to working low-income households, phase-out over time at rate ρ_ω

Three Fiscal Stabilization Packages **UI Package & TC Package**

- A Unemployment Insurance **(UI)** Package
  - A check to all unemployed households, phase out with persistence ρ_ω
  - Calibration such that equals a one-time lump-sum check of $\$200$
    - $+$ Initial check equal to $\$1{,}1000$

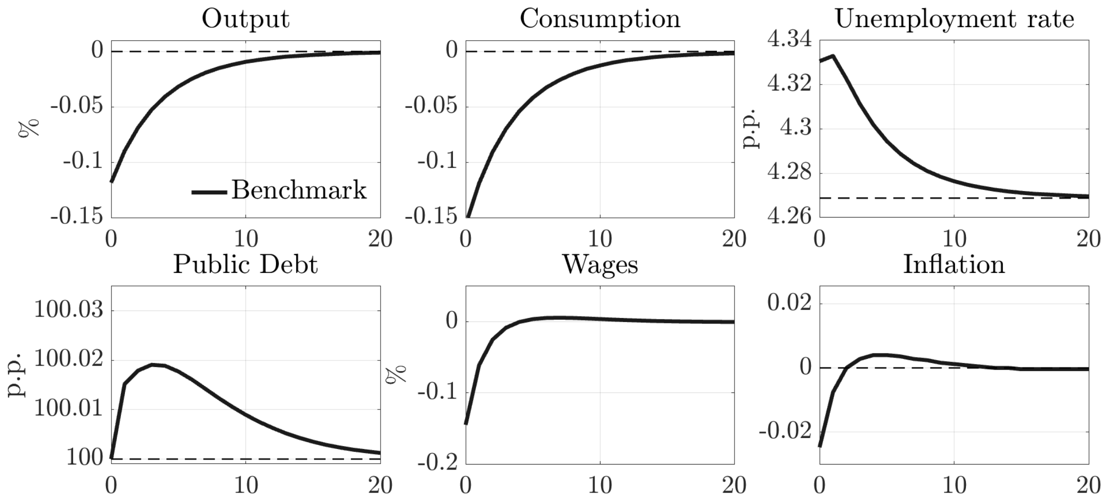
- A Tax Credit **(TC)** Package
  - A check to working low-income households, phase-out over time at rate ρ_ω
    - $+$ Phase out with current labor income $w_t x \bar{h}$
    - $+$ Eligible **only if** $\eta = e$ and $h = \bar{h}$

Three Fiscal Stabilization Packages **UI Package & TC Package**

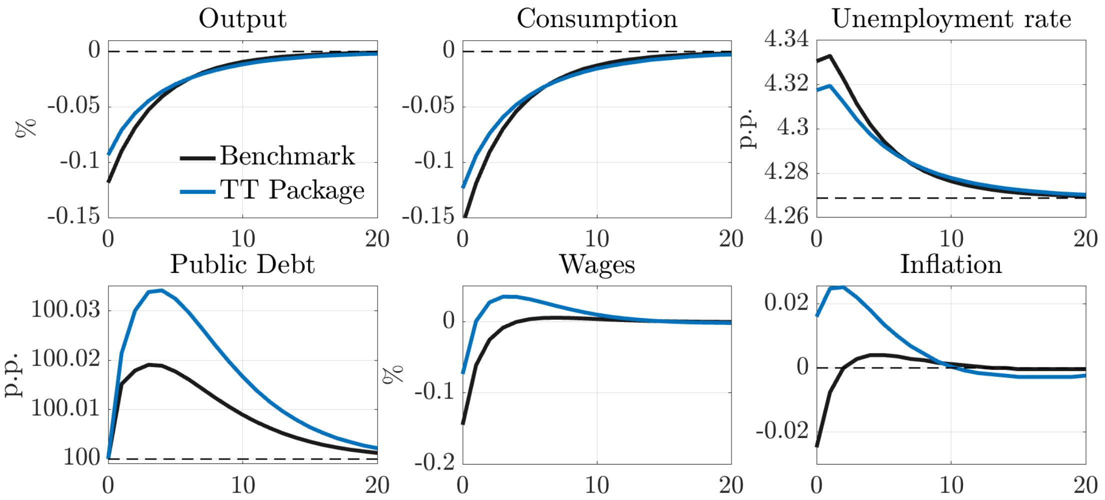
- A Unemployment Insurance **(UI)** Package
  - A check to all unemployed households, phase out with persistence ρ_ω
  - Calibration such that equals a one-time lump-sum check of $\$200$
    - \+ Initial check equal to $\$1{,}1000$

- A Tax Credit **(TC)** Package
  - A check to working low-income households, phase-out over time at rate ρ_ω
    - \+ Phase out with current labor income $w_t x \bar{h}$
    - \+ Eligible **only if** $\eta = e$ and $h = \bar{h}$
  - Calibration such that equals a one-time lump-sum check of $\$200$
    - \+ Initial maximum check of $\$800$, slower phase-out at $\chi = 6$

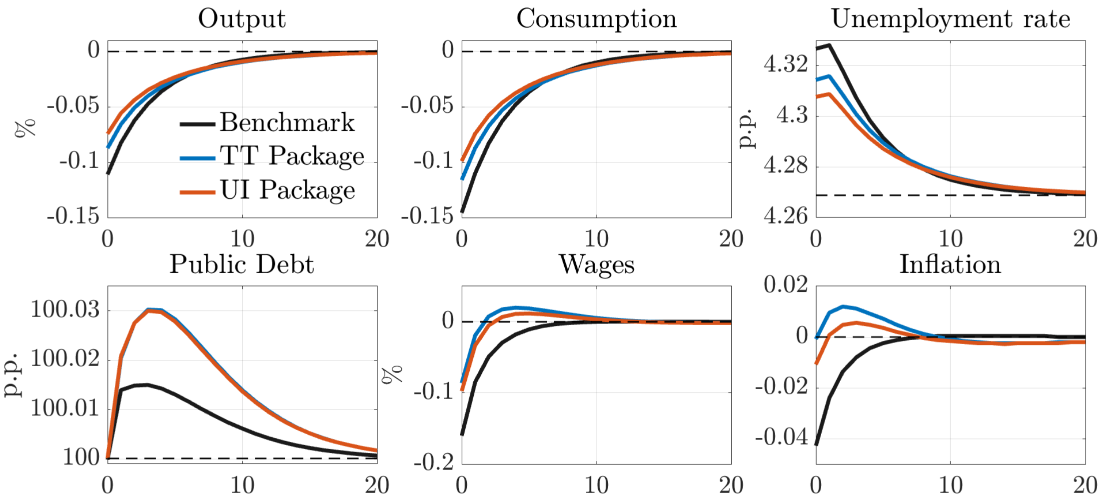
Stabilization Packages Impulse Response Functions



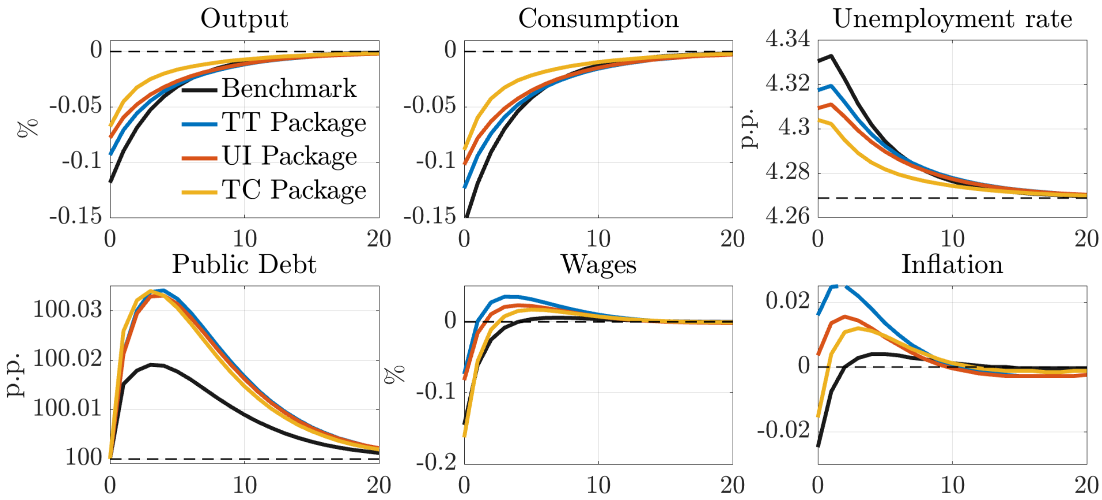
Stabilization Packages Impulse Response Functions



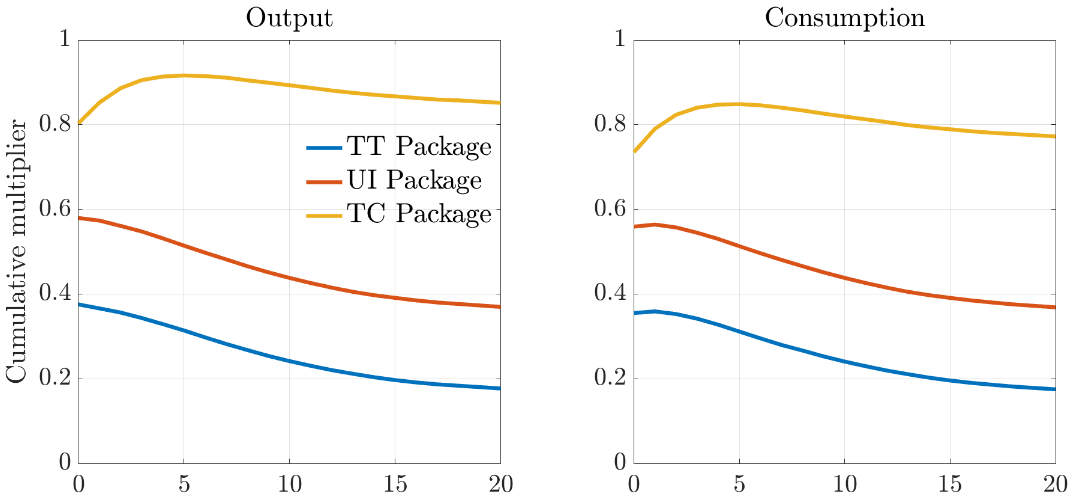
Stabilization Packages Impulse Response Functions



Stabilization Packages Impulse Response Functions



Stabilization Packages Multipliers



Deeper recession

Stabilization Packages Decomposition

- Decomposition between *consumption channel* and *labor channel*

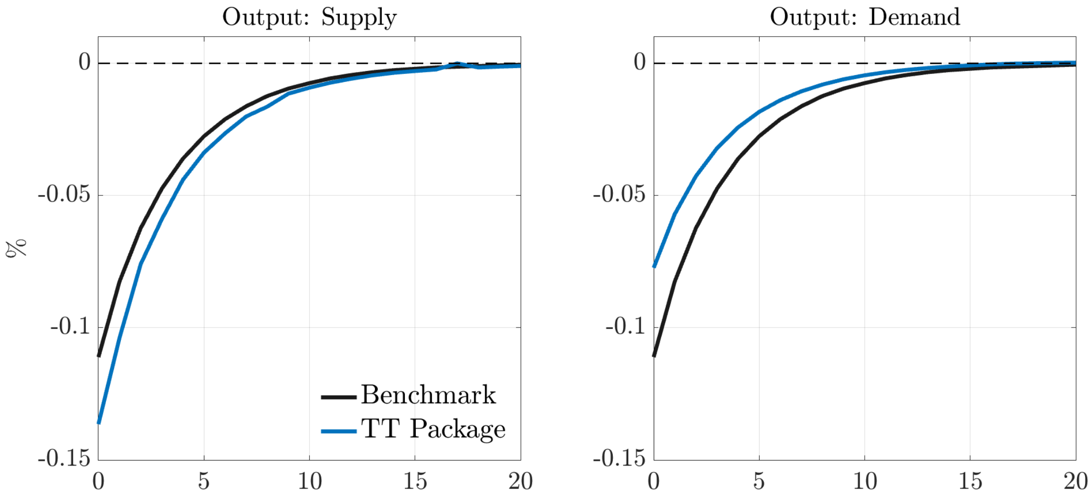
Stabilization Packages Decomposition

- Decomposition between *consumption channel* and *labor channel*
  - Use equilibrium prices and taxes and unemployment risk of the no-stabilization benchmark

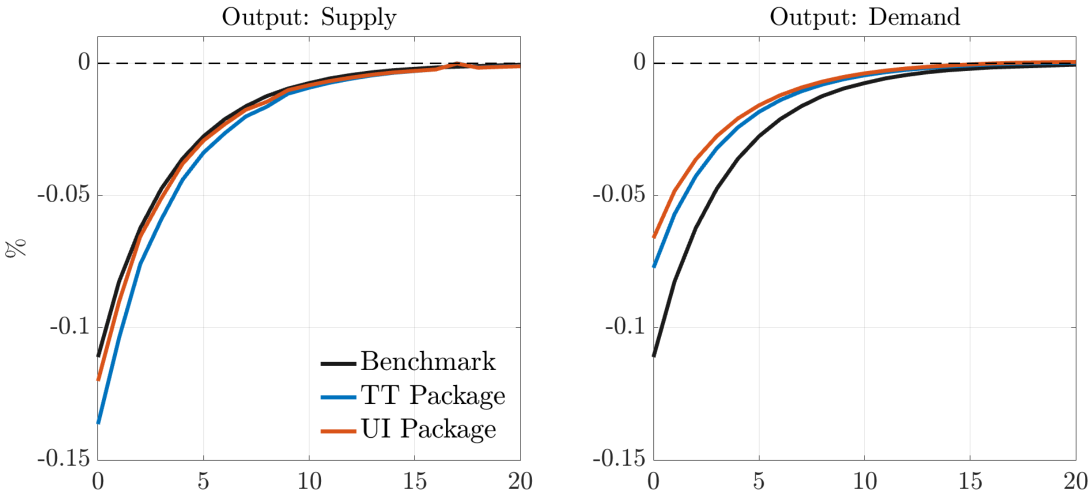
$$\{r_t^b, w_t^b, \lambda_t^b, \pi_{\eta,t}^b, d_t^b\}$$

  - Compute for each package TT, UI, TC
    - Supply output $Y_t^s = L_t$ using households' labor supply policy
    - Demand output $Y_t^d = C_t + \Theta_t + G_t + f$ using households' consumption policy

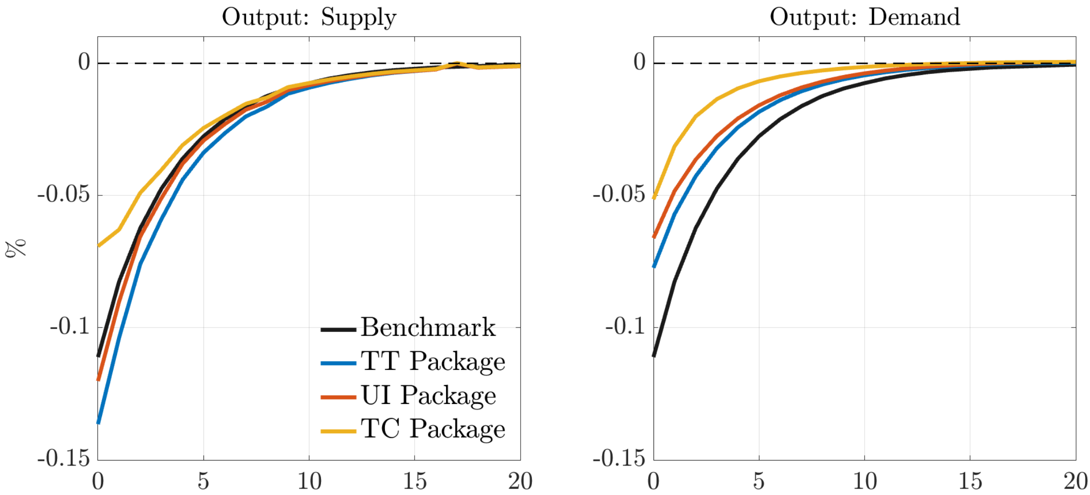
Three Fiscal Stabilization Packages Decomposition



Three Fiscal Stabilization Packages Decomposition



Three Fiscal Stabilization Packages Decomposition



Taking Stock

- Temporary tax credits are an effective fiscal stimulus
  - Implement labor tax cuts targeted to low-income workers
- Caveats on the quantification of the UI package
  - Do not internalize the negative incentive effects on job search [overestimate]
  - Abstracts from heterogeneity between recipients and non-recipients [underestimate]

Investigating the Results

1. Role of public debt
2. Distributional effects across packages
3. Alternative rules for monetary policy
4. Comparison to other packages
5. Deeper recessions
6. Steeper elasticities

Implementation

- Can we actually change taxes at business cycle frequency?

Implementation

- Can we actually change taxes at business cycle frequency?
- Arduous task, but we do
  - UI benefits were extended the GFC and the pandemic
  - Child tax credit expansion under the American Rescue Plan
  - Transfers are also commonly used

Implementation

- Can we actually change taxes at business cycle frequency?
- Arduous task, but we do
  - UI benefits were extended the GFC and the pandemic
  - Child tax credit expansion under the American Rescue Plan
  - Transfers are also commonly used
- A systematic response of the EITC could implement the TC package

Implementation

- Can we actually change taxes at business cycle frequency?
- Arduous task, but we do
  - UI benefits were extended the GFC and the pandemic
  - Child tax credit expansion under the American Rescue Plan
  - Transfers are also commonly used
- A systematic response of the EITC could implement the TC package
- Systematic fluctuations in payroll taxes could implement the TC package
  - Targeted to low-income
  - Easy to implement, would appear on the paycheck of workers every month

Conclusion

Conclusion

- A temporary increase in labor income tax progressivity can stabilize the economy
  - Operates also through consumption and labor supply responses

Conclusion

- A temporary increase in labor income tax progressivity can stabilize the economy
  - Operates also through consumption and labor supply responses
- Combination of packages?

Conclusion

- A temporary increase in labor income tax progressivity can stabilize the economy
  - Operates also through consumption and labor supply responses
- Combination of packages?

References

Alves, Felipe and Giovanni L. Violante (2023). Some Like It Hot: Monetary Policy Under Okunâs Hypothesis. Working Paper.

Auclert, Adrien, Matthew Rognlie, and Ludwig Straub (2023). The Intertemporal Keynesian Cross. Working Paper.

Ball, Laurence, Daniel Leigh, and Prakash Loungani (2017). "Okun's Law: Fit at 50?" Journal of Money, Credit and Banking 49.7, pp. 1413–1441.

Bardoczy, Bence and Joao Guerreiro (2023). Unemployment Insurance in Macroeconomic Stabilization with Imperfect Expectations. Working Papers.

Bhandari, Anmol, David Evans, Mikhail Golosov, and Thomas J. Sargent (2021). "Inequality, Business Cycles, and Monetary-Fiscal Policy". Econometrica 89.6, pp. 2559–2599.

Bilbiie, Florin O. (2020). "The New Keynesian cross". Journal of Monetary Economics 114, pp. 90–108.

Broer, Tobias, Jeppe Druedahl, Karl Harmenberg, and Erik Oberg (2024). Stimulus effects of common fiscal policies. Working Paper.

Chang, Yongsung and Sun-Bin Kim (2006). "From individual to aggregate labor supply: A quantitative analysis based on a heterogeneous agent macroeconomy". International Economic Review 47.1, pp. 1–27.

References (cont.)

Chang, Yongsung and Sun-Bin Kim (2007). "Heterogeneity and Aggregation: Implications for Labor Market Fluctuations". American Economic Review 5.97, pp. 1939–1956.

Chen, Kaiji, Aye Imrohoroglu, and Selahattin Imrohoroglu (2007). "The Japanese Saving Rate Between 1960 and 2000: Productivity, Policy Changes, and Demographics". Economic Theory 32.1, pp. 87–104.

Eissa, Nada and Jeffrey B Liebman (1996). "Labor supply response to the earned income tax credit". The Quarterly Journal of Economics 111.2, pp. 605–637.

Erceg, Christopher J, Dale W Henderson, and Andrew T Levin (2000). "Optimal monetary policy with staggered wage and price contracts". Journal of monetary Economics 46.2, pp. 281–313.

Erosa, Andrés, Luisa Fuster, and Gueorgui Kambourov (2016). "Towards a micro-founded theory of aggregate labour supply". The Review of Economic Studies 83.3, pp. 1001–1039.

Fagereng, Andreas, Luigi Guiso, Davide Malacrino, and Luigi Pistaferri (2020). "Heterogeneity and Persistence in Returns to Wealth". Econometrica 88.1, pp. 115–170.

Farhi, Emmanuel and Ivan Werning (2020). "Monetary Policy, Bounded Rationality, and Incomplete Markets". American Economic Review.

References (cont.)

Ferriere, Axelle, Philipp Grübener, Gaston Navarro, and Oliko Vardishvili (2023). "On the Optimal Design of Transfers and Income Tax Progressivity". Journal of Political Economy Macroeconomics 1.2, pp. 276–333.

Ferriere, Axelle and Gaston Navarro (2024). "The Heterogeneous Effects of Government Spending: Itâs All About Taxes". The Review of Economic Studies Forthcoming.

Galí, Jordi and Mark Gertler (1999). "Inflation Dynamics: A Structural Econometric Analysis". Journal of Monetary Economics 44.2, pp. 195–222.

Ganong, Peter and Pascal Noel (2019). "Consumer Spending during Unemployment: Positive and Normative Implications". American Economic Review 109.7, 2383â2424.

Gorn, Alexey and Antonella Trigari (2024). "Assessing the Stabilizing Effects of Unemployment Benefit Extensions". American Economic Journal: Macroeconomics 16.1.

Guvenen, Fatih, Gueorgui Kambourov, Burhan Kuruscu, Sergio Ocampo-Diaz, and Daphne Chen (2023). "Use It or Lose It: Efficiency Gains from Wealth Taxation". QJE.

Hagedorn, Marcus, Iourii Manovskii, and Kurt Mitman (2019). The Fiscal Multiplier. Working Paper.

References (cont.)

Heathcote, Jonathan, Kjetil Storesletten, and Giovanni L. Violante (2017). "Optimal tax progressivity: An analytical framework". The Quarterly Journal of Economics 132.4, pp. 1693–1754.

Jang, Youngsoo, Takeki Sunakawa, and Minchul Yum (2023). "Tax-and-Transfer Progressivity and Business Cycles". Quantitative Economics 14 (4), pp. 1367–1400.

Kaplan, Greg, Benjamin Moll, and Giovanni L. Violante (2018). "Monetary Policy According to HANK". American Economic Review 108.3, pp. 697–743.

Kaplan, Greg and Giovanni L Violante (2014). "A model of the consumption response to fiscal stimulus payments". Econometrica 82.4, pp. 1199–1239.

Kekre, Rohan (Dec. 2022). "Unemployment Insurance in Macroeconomic Stabilization". The Review of Economic Studies 90.5, pp. 2439–2480.

Kleven, Henrik Jacobsen and Claus Thustrup Kreiner (2006). "The Marginal Cost of Public Funds: Hours of Work Versus Labor Force Participation". Journal of Public Economics 90.10, pp. 1955–1973.

Krusell, Per and Anthony A Smith Jr (1998). "Income and Wealth Heterogeneity in the Macroeconomy". Journal of political Economy 106.5, pp. 867–896.

References (cont.)

Le Grand F., Martin-Baillon A. and X. Ragot (2022). Should monetary policy care about redistribution? optimal fiscal and monetary policy with heterogeneous agents. Working Paper.

McKay, Alisdair and Christian Wolf (2023). Optimal policy rules in HANK. Working Paper.

Meghir, Costas and David Phillips (2010). "Labour supply and taxes". Dimensions of tax design: The Mirrlees review, pp. 202–74.

Mertens, Karel and Morten O. Ravn (2013). "The Dynamic Effects of Personal and Corporate Income Tax Changes in the United States". American Economic Review 103.4, pp. 1212–47.

Mueller, Andreas I. (2017). "Separations, Sorting, and Cyclical Unemployment". American Economic Review 107.7, pp. 2081–2107.

Parker, Jonathan A., Nicholas S. Souleles, David S. Johnson, and Robert McClelland (2013). "Consumer Spending and the Economic Stimulus Payments of 2008". American Economic Review 103.6, pp. 2530–53.

Rogerson, Richard and Johanna Wallenius (2009). "Micro and macro elasticities in a life cycle model with taxes". Journal of Economic theory 144.6, pp. 2277–2292.

References (cont.)

Saporta-Eksten, Itay (2014). Job Loss, Consumption and Unemployment Insurance. Working Paper.

Triest, Robert K (1990). "The Effect of Income Taxation on Labor Supply in the United States". Journal of Human Resources, pp. 491–516.

Uhlig, Harald (2010). "Some Fiscal Calculus". American Economic Review 2.100, pp. 30–34.

Zidar, Owen (2019). "Tax Cuts for Whom? Heterogeneous Effects of Tax Changes on Growth and Employment". Journal of Political Economy 127.3, pp. 1437–1472.

Fiscal Rule

- Public debt adjusts as a function of Φ_D

$$D_{t+1} = (1-\phi_D)D + \phi_D\left(\hat{G}_t - \tau^k r_t A_t - \mathcal{R}_t^\ell\right), \text{ where}$$

  - $\hat{G}_t$ captures total government expenditures, including debt repayments

    $$\hat{G}_t = G_t + T_t + \mathcal{U}_t + (1+r_t)D_t$$

  - $\mathcal{R}_t^\ell$ captures fiscal revenues at steady-state labor tax schedule

    $$\mathcal{R}_t^\ell = w_t L_t - \lambda \int (w_t x h_t(a,x,\eta,\beta))^{1-\tau^\ell} d\mu_t(a,x,\eta,\beta)$$

Return

Steady State Households

- Quarterly model calibrated to liquid wealth

Return

Steady State Households

- Quarterly model calibrated to liquid wealth

- Stochastic $\beta \in \{\bar{\beta} - \Delta,\ \bar{\beta},\ \bar{\beta} + \Delta\}$, duration of 50 years
  Krusell and Smith (1998)
  - $\bar{\beta}$ s.t. $r \equiv 3.5\%$ annually
  - Δ s.t. top-quintile liquid wealth $\approx 90\%$ (SCF)

Return

Steady State Households

- Quarterly model calibrated to liquid wealth

- Stochastic $\beta \in \{\bar{\beta} - \Delta,\ \bar{\beta},\ \bar{\beta} + \Delta\}$, duration of 50 years
  Krusell and Smith (1998)
  - $\bar{\beta}$ s.t. $r \equiv 3.5\%$ annually
  - Δ s.t. top-quintile liquid wealth $\approx 90\%$ (SCF)

- Labor supply decisions
  - B to match employment $\approx 78\%$
    Jang, Sunakawa, and Yum (2023)
  - ρ_h to match average annual labor elasticity of ≈ 0.3
    Ferriere and Navarro (2024)

Return

Steady State Households

- Quarterly model calibrated to liquid wealth

- Stochastic $\beta \in \{\bar{\beta} - \Delta,\ \bar{\beta},\ \bar{\beta} + \Delta\}$, duration of 50 years
  Krusell and Smith (1998)
  - $\bar{\beta}$ s.t. $r \equiv 3.5\%$ annually
  - Δ s.t. top-quintile liquid wealth $\approx 90\%$ (SCF)

- Labor supply decisions
  - B to match employment $\approx 78\%$
    Jang, Sunakawa, and Yum (2023)
  - ρ_h to match average annual labor elasticity of ≈ 0.3
    Ferriere and Navarro (2024)

Return

uctivity $(\rho_x, \sigma_x) = (0.989, 0.287)$

Steady State **Firm and government**

- Technology: $\varepsilon = 7$, $\Theta = 200 \rightsquigarrow$ Phillips curve slope $\varepsilon/\Theta = 0.035$

  Galí and Gertler (1999)

- Dividends redistributed linearly in x: $d_t(x) = \bar{d}_t x$

  Farhi and Werning (2019)

Return

Steady State **Firm and government**

- Technology: $\varepsilon = 7$, $\Theta = 200 \rightsquigarrow$ Phillips curve slope $\varepsilon/\Theta = 0.035$
  Galí and Gertler (1999)

- Dividends redistributed linearly in x: $d_t(x) = \bar{d}_t x$
  Farhi and Werning (2019)

- Government
  - Capital tax $\tau_k = 35\%$, labor income tax progressivity $\tau_\ell = 0.1$
    Chen, Imrohoroglu, and Imrohoroglu (2007), Heathcote, Storesletten, and Violante (2017), Ferriere, Grübener, Navarro, and Vardishvili (2023)
  - Spending $G/Y = 10\%$, transfers $T/Y = 8\%$, debt $D/Y = 100\%$

Return

Steady State **Firm and government**

- Technology: $\varepsilon = 7$, $\Theta = 200 \rightsquigarrow$ Phillips curve slope $\varepsilon/\Theta = 0.035$

  Galí and Gertler (1999)

- Dividends redistributed linearly in x: $d_t(x) = \bar{d}_t x$

  Farhi and Werning (2019)

- Government

  - Capital tax $\tau_k = 35\%$, labor income tax progressivity $\tau_\ell = 0.1$

    Chen, Imrohoroglu, and Imrohoroglu (2007), Heathcote, Storesletten, and Violante (2017), Ferriere, Grübener, Navarro, and Vardishvili (2023)

  - Spending $G/Y = 10\%$, transfers $T/Y = 8\%$, debt $D/Y = 100\%$

  - Unemployment benefits: $\zeta = 0.4$, $\mathcal{R} = 0.5$, $\overline{ui} = 60\%\bar{y}$

    $\chi = 0.15$ to match $C_u/C_e \approx 75\%$

    Kekre (2022), Gorn and Trigari (2024)

Return

Steady State Firm and government

- Technology: $\varepsilon = 7$, $\Theta = 200 \rightsquigarrow$ Phillips curve slope $\varepsilon/\Theta = 0.035$
  Galí and Gertler (1999)

- Dividends redistributed linearly in x: $d_t(x) = \bar{d}_t x$
  Farhi and Werning (2019)

- Government
  - Capital tax $\tau_k = 35\%$, labor income tax progressivity $\tau_\ell = 0.1$
    Chen, Imrohoroglu, and Imrohoroglu (2007), Heathcote, Storesletten, and Violante (2017), Ferriere, Grübener, Navarro, and Vardishvili (2023)
  - Spending $G/Y = 10\%$, transfers $T/Y = 8\%$, debt $D/Y = 100\%$
  - Unemployment benefits: $\zeta = 0.4$, $\mathcal{R} = 0.5$, $\overline{ui} = 60\%\bar{y}$
    $\chi = 0.15$ to match $C_u/C_e \approx 75\%$
    Kekre (2022), Gorn and Trigari (2024)
  - Automatic responses of inflation and debt: $\Phi_\Pi = 1.5$, $\Phi_D = 0.75$

Return

Dividends

- Assume dividends linearly distributed on x

$$\delta_t = \sum_x \tilde{\delta}_t(x)\pi(x) = \sum_x \left(\frac{\delta_t}{\mathbb{E}[x]}x\right)\pi(x)$$

  - Minimize wealth effects of fluctuations in dividends

    Farhi and Werning (2020)

Return

Unemployment and the Business Cycle **Okun's law**

- Finding and separation rates distribution depend on U_t Mueller (2017)
  - Finding rate elasticity decreases homogeneously with ΔY_t

$$\log \pi_{\eta,t}(\ell|u,x) = \log \pi_\eta(\ell|u) - \log\left(1 - \bar{\phi}_e \Delta Y_t\right)$$

  - Separation rate elasticity increases with ΔY_t

$$\pi_{\eta,t}(u|\ell,x) = \pi_\eta(u|\ell,x) - \bar{\phi}_u \Delta Y_t x^{-\phi_{u,x}}$$

Return

Unemployment and the Business Cycle **Okun's law**

- Finding and separation rates distribution depend on U_t Mueller (2017)
  - Finding rate elasticity decreases homogeneously with ΔY_t

$$\log \pi_{\eta,t}(\ell|u,x) = \log \pi_{\eta}(\ell|u) - \log\left(1 - \bar{\phi}_e \Delta Y_t\right)$$

  - Separation rate elasticity increases with ΔY_t

$$\pi_{\eta,t}(u|\ell,x) = \pi_{\eta}(u|\ell,x) - \bar{\phi}_u \Delta Y_t x^{-\phi_{u,x}}$$

  - Joint calibration:
    - $\bar{\phi}_e$ s.t. finding elasticity to $U \approx -0.6$
    - $\phi_{u,x} = 0$ elasticity of separation rates larger for above-median workers
    - $\bar{\phi}_u = 0.33$ to get $c_{OK} = 0.5$

Return

Labor elasticities Two approaches

- Labor elasticities decline with income
  - Compute labor responses to a temporary tax shock
    Erosa, Fuster, and Kambourov (2016)
    - Annual hours response to a 1% change in after-tax rate for one year
    - Aggregate labor elasticity is 0.30, declining with income
  - Simulate steady-state model annually and run applied-micro regression
    Rogerson and Wallenius (2009), Chang and Kim (2006)
    - Estimate b_1 in $\log h_{in} = b_0 + b_1 \log \tilde{w}_{in} - b_2 \log c_{in} + \varepsilon_{in}$
    - Aggregate labor elasticity is 0.45, declining with income

Return

Labor elasticities Two approaches

- Labor elasticities decline with income
  - Compute labor responses to a temporary tax shock
    Erosa, Fuster, and Kambourov (2016)
    - Annual hours response to a 1% change in after-tax rate for one year
    - Aggregate labor elasticity is 0.30, declining with income
  - Simulate steady-state model annually and run applied-micro regression
    Rogerson and Wallenius (2009), Chang and Kim (2006)
    - Estimate b_1 in $\log h_{in} = b_0 + b_1 \log \tilde{w}_{in} - b_2 \log c_{in} + \varepsilon_{in}$
    - Aggregate labor elasticity is 0.45, declining with income

Income quartile	1	2	3	4
Labor elasticity: tax shock	0.44	0.34	0.25	0.22
Labor elasticity: regression	0.56	0.59	0.50	0.26

Return

Steady State Unemployment

- Job finding rates and separation rates across hourly wage distribution

Return

Steady State Unemployment

- Job finding rates and separation rates across hourly wage distribution

- Job finding rates are constant in the distribution
  Mueller (2017)
  - Monthly finding rate of $0.32 \Rightarrow \pi_\eta(\ell|u) = 0.691$

Return

Steady State Unemployment

- Job finding rates and separation rates across hourly wage distribution

- Job finding rates are constant in the distribution
  Mueller (2017)
  - Monthly finding rate of $0.32 \Rightarrow \pi_\eta(\ell|u) = 0.691$

- Separation rates are falling in hourly wage/productivity x
  Mueller (2017)
  - Monthly separation rates of $\approx 1.4\%$ and 0.7% below and above median, respectively

  $\Rightarrow$ $\pi_\eta(u|\ell, x) = \phi_0 x^{\phi_1}$, with $\phi_0 = 0.029$ and $\phi_1 = -0.446$

Return

Steady State Unemployment

- Job finding rates and separation rates across hourly wage distribution

- Job finding rates are constant in the distribution
  Mueller (2017)

  – Monthly finding rate of $0.32 \Rightarrow \pi_\eta(\ell|u) = 0.691$

- Separation rates are falling in hourly wage/productivity x
  Mueller (2017)

  – Monthly separation rates of $\approx 1.4\%$ and 0.7% below and above median, respectively

  $\Rightarrow$ $\pi_\eta(u|\ell, x) = \phi_0 x^{\phi_1}$, with $\phi_0 = 0.029$ and $\phi_1 = -0.446$

- Average unemployment rate at 4.3% with unequal incidence in the distribution

Return

Unemployment and the Business Cycle

- Okun's law type of relation between output and unemployment
  - Okun coefficient $c^{OK} = 0.5$

    Ball, Leigh, and Loungani (2017)

Unemployment and the Business Cycle

- Okun's law type of relation between output and unemployment
  - Okun coefficient $c^{OK} = 0.5$
    Ball, Leigh, and Loungani (2017)

- Job finding rates increase with ΔY_t
  - Elasticity of job finding rates to aggregate unemployment of -0.6
    Mueller (2017)
    - Homogeneous increase in job finding rates

Unemployment and the Business Cycle

- Okun's law type of relation between output and unemployment
  - Okun coefficient $c^{OK} = 0.5$
    Ball, Leigh, and Loungani (2017)

- Job finding rates increase with ΔY_t
  - Elasticity of job finding rates to aggregate unemployment of -0.6
    Mueller (2017)
    - Homogeneous increase in job finding rates

- Job separation rates decrease with ΔY_t
  - *Elasticity* of separation rates to aggregate unemployment larger for above-median workers
    Mueller (2017)
    - Homogeneous additive increase in separation rates

Marginal propensities to consume Distribution x wealth

- Marginal propensities to consume decline with wealth

Wealth quartile	1	2	3	4
mpc	0.20	0.15	0.07	0.03

Return

Deeper Recessions **Bigger Fiscal Packages**

- Consider a recession of about 1% on impact – compared to 12bp on impact in the baseline

- Implement fiscal packages costing $\$1500$ per household

Deeper Recessions **Bigger Fiscal Packages**

- Consider a recession of about 1% on impact – compared to 12bp on impact in the baseline
- Implement fiscal packages costing $\$1500$ per household
- TT Package in the first quarter: equal to $\$1100$ per month for the bottom 5%, $\$500$ per month for the 5-15%
- TC Package in the first quarter: equal to $\$1100$ per month for the bottom 5%, $\$500$ per month for the 5-15%
- UI Package in the first quarter: equal to $\$2800$ per month for all unemployed

Deeper Recessions **Bigger Fiscal Packages**

- Consider a recession of about 1% on impact – compared to 12bp on impact in the baseline
- Implement fiscal packages costing $\$1500$ per household
- TT Package in the first quarter: equal to $\$1100$ per month for the bottom 5%, $\$500$ per month for the 5-15%
- TC Package in the first quarter: equal to $\$1100$ per month for the bottom 5%, $\$500$ per month for the 5-15%
- UI Package in the first quarter: equal to $\$2800$ per month for all unemployed
- Multipliers are similar to the baseline

Return Return

1. Role of Public Debt

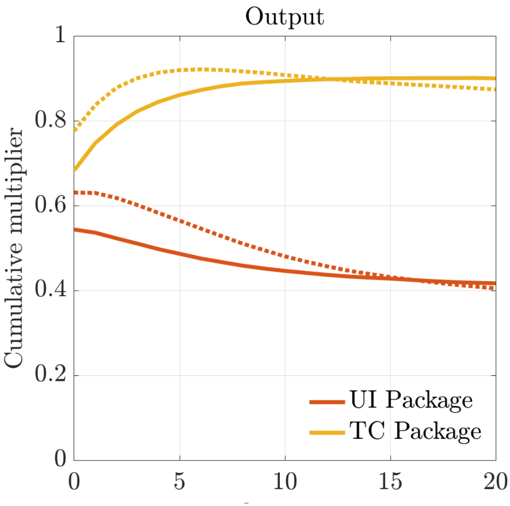
- Compute benchmark and stabilization output paths with constant debt $\Phi_D = 0$

Return

1. Role of Public Debt

- Compute benchmark and stabilization output paths with constant debt $\Phi_D = 0$

- Public debt does help to stabilize

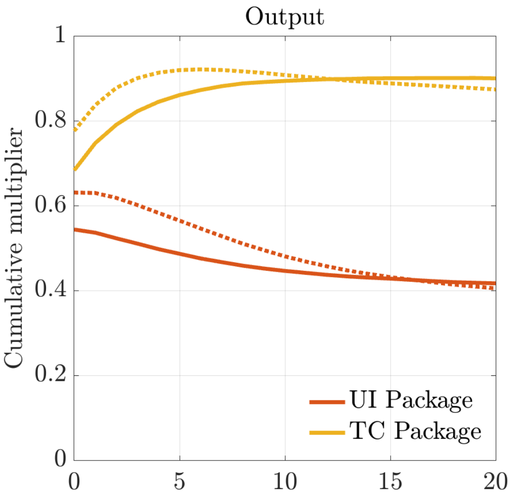


Return

1. Role of Public Debt

- Compute benchmark and stabilization output paths with constant debt $\Phi_D = 0$
- Public debt does help to stabilize
- TC Package No Debt $\equiv$ temporary shock in labor tax progressivity

  $\Rightarrow$ Stabilizes the economy



Return

2. Distributional Effects

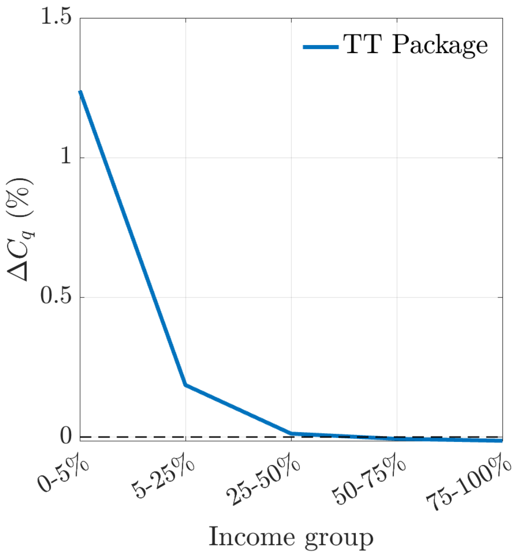
- Consumption by income group
  - Compare with and without stablization

Return

2. Distributional Effects

- Consumption by income group
  - Compare with and without stablization

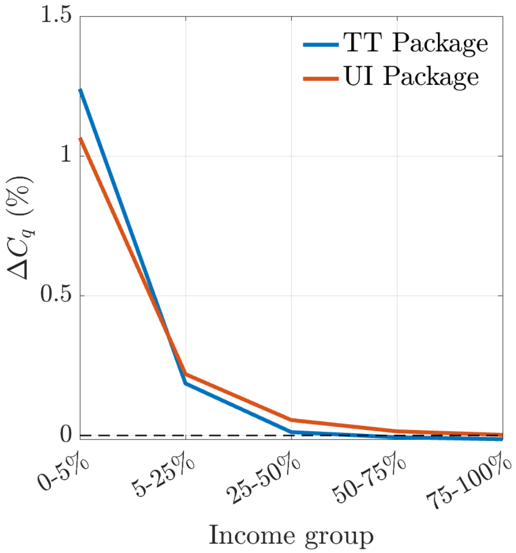
- TT Package targets the lowest-income



Return

2. Distributional Effects

- Consumption by income group
  - Compare with and without stablization
- TT Package targets the lowest-income
  - Better than UI Package

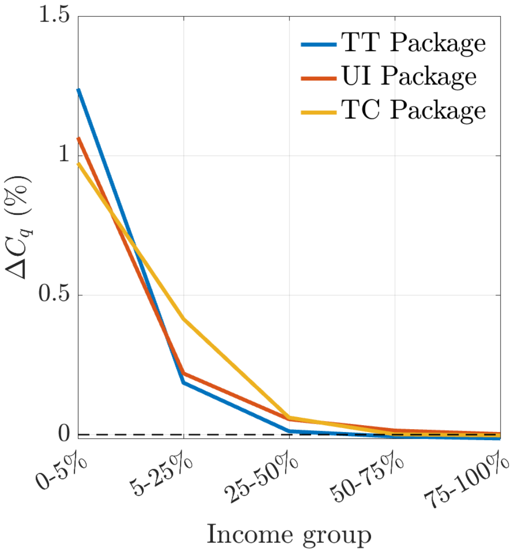


Return

2. Distributional Effects

- Consumption by income group
  - Compare with and without stablization

- TT Package targets the lowest-income
  - Better than UI Package
  - Better than TC Package



Return

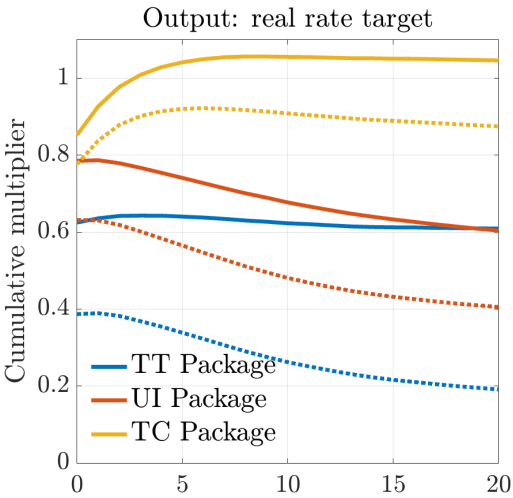
3. Monetary Policy Identical real rate

- Fiscal packages affect inflation differently
  - Monetary policy and real rate differ
- Compare packages under benchmark real rate

Return

3. Monetary Policy Identical real rate

- Fiscal packages affect inflation differently
  - Monetary policy and real rate differ
- Compare packages under benchmark real rate
- TC package remains most effective
  - Larger multipliers than with Taylor rule
  - Especially for the TT package, less for the TC package



Return

3. Monetary Policy More accommodative policy rule

- Effectiveness of fiscal packages depend on constraints on monetary policy

- Consider a richer Taylor rule:

$$\ln\left(\frac{1+i_{t+1}}{1+\bar{i}}\right) = \Phi_{\Pi}\ln\left(\frac{\Pi_t}{\bar{\Pi}}\right) + \Phi_Y\ln\left(\frac{Y_t}{\bar{Y}}\right)$$

Return

3. Monetary Policy More accommodative policy rule

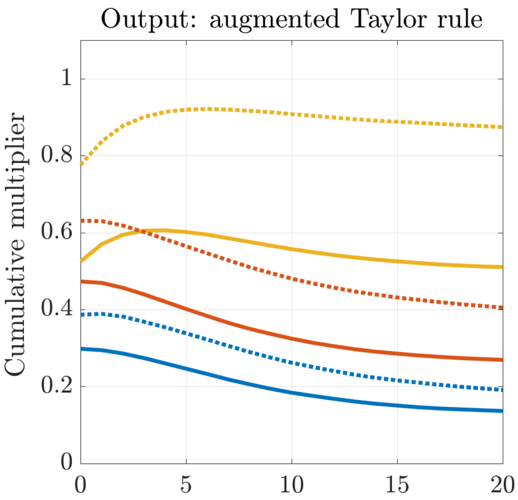
- Effectiveness of fiscal packages depend on constraints on monetary policy

- Consider a richer Taylor rule:

$$\ln\left(\frac{1+i_{t+1}}{1+\bar{i}}\right) = \Phi_\Pi \ln\left(\frac{\Pi_t}{\bar{\Pi}}\right) + \Phi_Y \ln\left(\frac{Y_t}{\bar{Y}}\right)$$

– TC package remains most effective

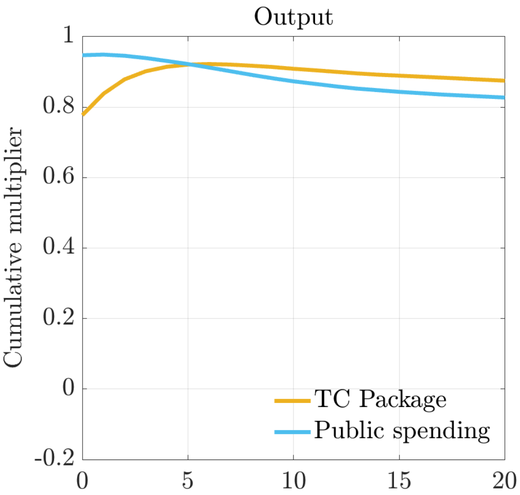
  – Lower multipliers than with Taylor rule



Return

4. Further Fiscal Packages G and T packages

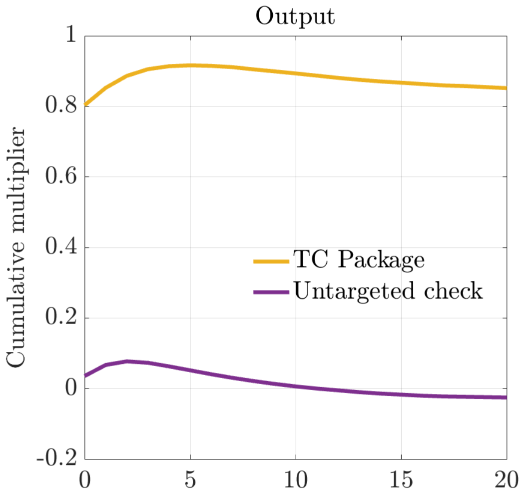
- Public spending generates large output multiplier
  - ... but negative consumption multiplier



Return

4. Further Fiscal Packages G and T packages

- Public spending generates large output multiplier
  - + ...but negative consumption multiplier
- Lump-sum check has modest stabilization properties



Return

6. Steeper labor elasticities

– Lower variance ρ_h to reach steeper labor elasticities
  + 0.75 at Q1 (regression), 1.1 (tax shock)

Return

6. Steeper labor elasticities

- Lower variance ρ_h to reach steeper labor elasticities
  + 0.75 at Q1 (regression), 1.1 (tax shock)
- Closer to evidence on effects of tax shocks
  + Tax multipliers at 1.25 (model) vs. > 2 Mertens and Ravn (2013)
  + Bottom-90 tax cut increases employment by 2.7% (model) vs. 3% Zidar (2019)
- All other targets $\approx$ identical (mpc at 0.10)

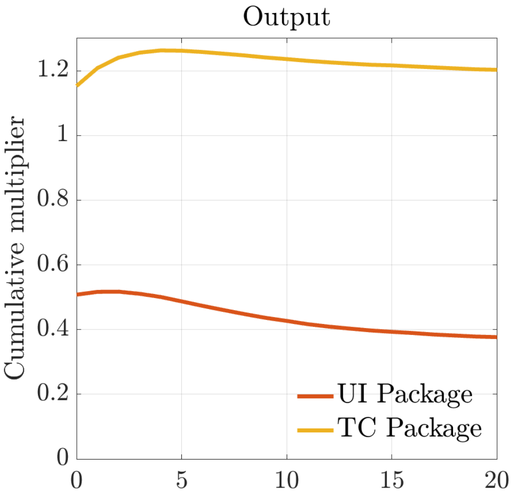
Return

6. Steeper labor elasticities

- Lower variance ρ_h to reach steeper labor elasticities
  - $+$ 0.75 at Q1 (regression), 1.1 (tax shock)
- Closer to evidence on effects of tax shocks
  - $+$ Tax multipliers at 1.25 (model) vs. > 2 Mertens and Ravn (2013)
  - $+$ Bottom-90 tax cut increases employment by 2.7% (model) vs. 3% Zidar (2019)
- All other targets $\approx$ identical (mpc at 0.10)

■ TC Package $\Rightarrow$ **large output** multiplier

Return



Robustness Sticky wages

- Alternative modeling of nominal rigidities with sticky wages
  Erceg, Henderson, and Levin (2000) Ferriere and Navarro (2024)
  - Two-layer structure with a labor packer and labor unions

Robustness Sticky wages

- Alternative modeling of nominal rigidities with sticky wages
  Erceg, Henderson, and Levin (2000) Ferriere and Navarro (2024)
  - Two-layer structure with a labor packer and labor unions

- Competitive labor packer
  - Produces a final labor bundle combining labor from unions $N_t = \left(\int_0^1 n_{kt}^{\frac{\varepsilon-1}{\varepsilon}} \right)^{\frac{\varepsilon}{\varepsilon-1}}$

  $\Rightarrow$ Implies labor demand $n_{kt}^d = (W_{kt}/W_t)^{-\varepsilon} N_t$, where $W_t = w_t P_t$

- Monopolist labor unions +
  - Set wages w_t subject to adjustment cost
  - Hire households labor in a competitive market at wage rate w_t^h

Robustness Sticky wages

- Alternative modeling of nominal rigidities with sticky wages
  Erceg, Henderson, and Levin (2000) Ferriere and Navarro (2024)
  - Two-layer structure with a labor packer and labor unions
- Competitive labor packer
  - Produces a final labor bundle combining labor from unions $N_t = \left(\int_0^1 n_{kt}^{\frac{\varepsilon-1}{\varepsilon}} \right)^{\frac{\varepsilon}{\varepsilon-1}}$

  $\Rightarrow$ Implies labor demand $n_{kt}^d = (W_{kt}/W_t)^{-\varepsilon} N_t$, where $W_t = w_t P_t$
- Monopolist labor unions +
  - Set wages w_t subject to adjustment cost
  - Hire households labor in a competitive market at wage rate w_t^h
- Theorem: Under linear labor technology, **equivalence** between price and wage stickiness

Robustness **Sticky wages**

- Labor union maximization problem

$$J_t^w(W_{kt-1}) = \max_{W_{kt}, n_{kt}} \left\{ d_{kt}^w + \frac{1}{1+r_{t+1}} J_{t+1}^w(W_{kt}) \right\} \quad \text{s.t.}$$

$$d_{kt}^w = \left(\frac{W_{kt}}{P_t} - w_t^h \right) n_{kt} - \Theta_t^w(W_{kt}, W_{kt-1}) - f_w$$

$$n_{kt} = \left(\frac{W_{kt}}{W_t} \right)^{-\varepsilon_w} N_t$$

$$\Theta_t^w(W_{kt}, W_{kt-1}) = \frac{\Theta^w}{2} \left(\frac{W_{kt}}{W_{kt-1}} - \bar{\Pi} \right)^2 N_t$$

$\Rightarrow$ Implies a standard wage Philipps Curve