Redistribution & Unemployment Insurance

Antoine Ferey (Sciences Po)

August 2024

Motivation

Governments operate large redistribution and social insurance policies

- How to design income taxes and transfers?
- How to design unemployment insurance? disability insurance? pensions?

Policymakers and academics tend to separate these two questions ...

- Often separate laws and reforms, managed by separate entities
- Optimal tax (Mirrlees, 1971) vs. social insurance (Chetty, Finkelstein, 2013)

... and, at the same time, recognize they are somewhat intertwined

- E.g., social insurance policies are often redistributive
- *"One should ideally analyze tax and social insurance policies in a unified framework rather than optimizing each program [...] separately."* (Chetty, Finkelstein, 2013)

This paper jointly analyzes redistribution and unemployment insurance

- How do tax-transfer and UI policies interact? What are the implications?

This paper

1. **Derive Pareto-efficiency condition linking tax-transfer and UI benefits**
   - Extends Baily-Chetty formula for optimal UI in presence of redistribution
   - Replacement rates decrease with earnings: 100% at origin, $\leq$0% at top
   - Replacement rates depend on redistribution: UI is a redistributive policy!
2. **Characterize optimal tax-transfer schedule with UI benefits**
   - Extends canonical tax formulas in extensive-intensive margin models
   - Additional effects really matter only when unemployment rates are high
   - At low incomes, implications depend on search vs participation elasticities
3. **Empirically assess policy implications in the US and in France**
   - US features decreasing replacement rates, consistent with theory
   - FR features stable replacement rates, room for Pareto-improvement

Related literature

Optimal redistribution: Mirrlees (1971); Diamond (1980, 1998); Saez (2001, 2002); Choné, Laroque (2010, 2011); Jacquet, Lehmann, VdLinden (2013); Golosov, Tsyvinki, Werquin (2014); Sachs, Tsyvinski, Werquin (2019); Bierbrauer, Boyer, Hansen (2022)

Optimal UI: Baily (1978); Chetty (2006, 2008); Schmieder, Von Wachter (2016); Lawson (2017); Landais, Michaillat, Saez (2018); Spinnewijn (2015, 2019); Landais, Spinnewijn (2021)

→ bridge between optimal redistribution and optimal UI literatures

Optimal redistribution with unemployment: Boone, Bovenberg (2004, 2006); [Hungerbühler], Lehmann, Parmentier, VdLinden ([2006], 2011); Boadway, Cuff (2018); Kroft, Kucko, Lehmann, Schmieder (2019); Hummel (2019); Da Costa, Maestri, Santos (2022)

Optimal UI with redistribution: Uren (2018); Setty, Yedid-Levi (2020); Haan, Prowse (2021)

→ joint design of nonlinear redistribution and nonlinear UI policies

Redistribution & social insurance, pooling: Rochet (1991); Cremer, Pestieau (1996); Boadway, Leite-Montero, Marchand, Pestieau (2006); Netzer, Scheuer (2007)

—, dynamic: Golosov, Tsyvinski (2006); Farhi, Werning (2013); Golosov, [Shourideh], Troshkin, Tsyvinski ([2013], 2016); Findeisen, Sachs (2016); Ndiaye (2020); Stantcheva (2020)

→ no pooling logic ; no inverse Euler equation nor absorbing state

Outline

1. Heuristic derivation of Pareto-efficiency
2. Extensions of Pareto-efficiency
3. Labor supply and optimal tax-transfer schedule
4. Empirical application

Heuristic derivation of Pareto-efficiency

Setting

Population of individuals with heterogeneous earnings when employed, z

- Spend fraction of time $e(z)$ employed and $1 - e(z)$ unemployed
- $u_e(c_e(z))$ and $u_u(c_u(z))$: consumption utilities
- $k(z)$ and $\psi(e(z), z)$: disutility from work and from job search

$$V(z) := e(z)\Big[u_e\left(c_e(z)\right) - k(z)\Big] + (1 - e(z))\Big[u_u\left(c_u(z)\right) - \psi\left(e(z), z\right)\Big]$$

Simplifying assumptions

- No labor supply, earnings z are exogenous
- Job search decisions are utility-maximizing and interior, $0 < e(z) < 1$
- No heterogeneity within earnings levels and no risk, unique $e(z)$
- No savings, $c_e(z) = z - T_e(z)$, never expiring UI, $c_u(z) = B_u(z)$

$$\mathcal{R}(z) := e(z)T_e(z) - (1 - e(z))B_u(z)$$

Impact of tax-benefit reforms

Impact of tax-benefit reforms on individuals' utility

- Tax increase $dT_e(z)$ decreases utility
- Benefit increase $dB_u(z)$ increases utility
- Changes in job search $de(z)$ do not affect utility (envelope argument)

$$dV(z) = -e(z)u_e'\left(c_e(z)\right)dT_e(z) + (1 - e(z))\,u_u'\left(c_u(z)\right)dB_u(z)$$

Impact of tax-benefit reforms on government's revenue

- Tax increase $dT_e(z)$ increases revenue
- Benefit increase $dB_u(z)$ decreases revenue
- Changes in job search $de(z)$ affect revenue

$$d\mathcal{R}(z) = e(z)dT_e(z) - (1 - e(z))\,dB_u(z) + de(z)\left(T_e(z) + B_u(z)\right)$$

Sufficient statistics

Job search semi-elasticities

- Measure changes in the time spent unemployed, $1 - e(z)$

$$\mu_e(z) := \frac{1}{1-e(z)} \frac{\partial (1-e(z))}{\partial T_e(z)} \qquad \mu_u(z) := \frac{1}{1-e(z)} \frac{\partial (1-e(z))}{\partial B_u(z)}$$

- Given the structure of the baseline model,

$$\frac{\mu_e(z)}{u'(c_e(z))} = \frac{\mu_u(z)}{u'(c_u(z))}$$

- Empirical literature measures $\mu_u^{elast} = 0.5$ (Schmieder, von Wachter, 2016)

$$\mu_u^{elast}(z) := B_u(z)\mu_u(z)$$

Pareto-improving tax-benefit reforms

Can we increase the government's revenue without affecting welfare?

- A tax-benefit reform that leaves individuals' utility constant satisfies

$$dV(z) = 0 \iff dT_e(z) = \frac{(1 - e(z))\, u'_u\left(c_u(z)\right)}{e(z) u'_e\left(c_e(z)\right)} \underbrace{dB_u(z)}_{=1}$$

- This tax-benefit reform leads to a change in time spent employed

$$de(z) = -\left(1 - e(z)\right)\left[\mu_e(z) dT_e(z) + \mu_u(z) dB_u(z)\right] = -\frac{1 - e(z)}{e(z)} \mu_u(z)$$

- This tax-benefit reform leads to a change government's revenue

$$d\mathcal{R}(z) = \left(1 - e(z)\right)\left[\frac{u'_u(c_u(z))}{u'_e(c_e(z))} - 1 - \frac{\mu_u(z)}{e(z)}\left(T_e(z) + B_u(z)\right)\right]$$

There exists a Pareto-improving reform if and only if $d\mathcal{R}(z) \neq 0$

Pareto-efficiency

Proposition 1. A Pareto-efficient tax-benefit system satisfies at each $z > 0$

$$\overbrace{\frac{u_u'(c_u(z))}{u_e'(c_e(z))} - 1}^{\text{insurance value}} = \overbrace{\frac{\mu_u^{elast}(z)}{e(z)^2}}^{\text{job search responses}} \left[1 + \overbrace{\frac{e(z)\,T_e(z) - (1-e(z))\,B_u(z)}{B_u(z)}}^{\text{net contribution to tax-benefit system}}\right]$$

Redistribution & UI: heterogeneous z, net contribution broadly increasing z

- Fiscal externality of UI depends on redistribution $\rightarrow$ interaction!
- Leads to replacement rates, $\frac{c_u(z)}{c_e(z)}$, that decrease with earnings

Baily-Chetty formula for UI: representative z, net contribution is 0

- Fiscal externality of UI is independent of redistribution
- Leads to a unique replacement rate, $\frac{c_u}{c_e}$, constant across earnings

$$\overbrace{\frac{u_u'(c_u)}{u_e'(c_e)} - 1}^{\text{insurance value}} = \overbrace{\frac{\mu_u^{elast}}{e^2}}^{\text{job search responses}}$$

Policy implications

1. Optimal replacement rate at origin of the income distribution is 100%

Corollary. If (i) $u'_e(.) = u'_u(.)$, (ii) $T_e(z)$, $B_u(z)$ and $e(z)$ are continuous, and (iii) job search elasticity $\mu_u^{elast}(z)$ are locally constant at very low incomes, then

$$\lim_{z \to 0} B_u(z) = - \lim_{z \to 0} T_e(z).$$

2. Simple policy rule with log utility highlights the interaction!

Corollary. With logarithmic consumption utilities, $u_e(c) = u_u(c) = \log(c)$,

$$B_u(z) = \frac{e(z)}{e(z) + \mu_u^{elast}(z)} z - T_e(z).$$

Illustration with log utility and linear taxes

Parametric example with log utility and linear taxes

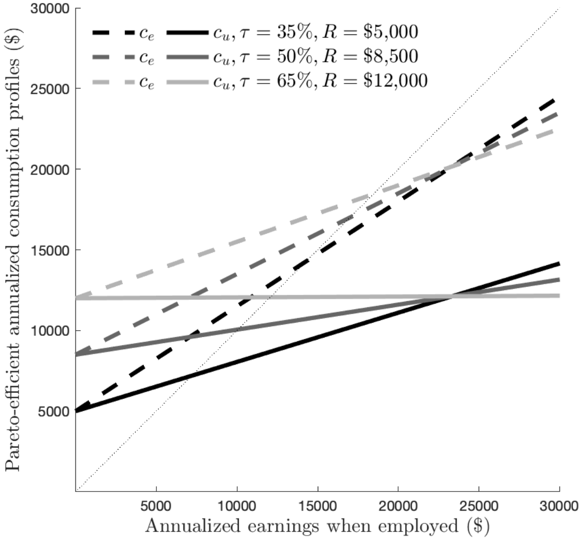
- Linear tax rate τ
- Lump-sum transfer R_0

$$c_e(z) = z - T_e(z) = (1-\tau)z + R_0$$
$$c_u(z) = B_u(z) = \left(\frac{e(z)}{e(z) + \mu_u^{elast}(z)} - \tau \right) z + R_0$$

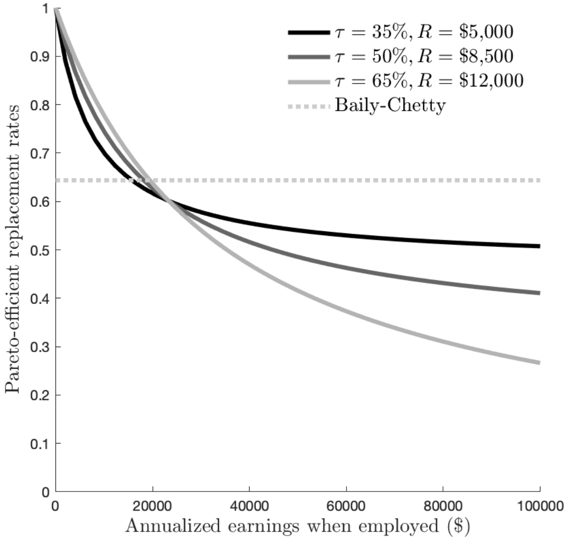
Tax-transfer schedule shapes UI benefits: UI is a redistributive policy!

- Higher transfers, $R_0 \nearrow \implies$ higher benefits when unemployed, $B_u \nearrow$
- Steeper tax schedule, $\tau \nearrow \implies$ flatter profile of benefits when unemployed
- Replacement rates decrease with earnings, starting from 100% at origin

P-efficient consumption profiles ($e = 95\%, \mu_u^{elast} = 0.5$)



P-efficient replacement rates ($e = 95\%, \mu_u^{elast} = 0.5$)



Extensions of Pareto-efficiency

Extensions of Pareto-efficiency

Savings: stronger decrease in replacement rates, 100% at origin, $\leq$0% at top

- Introduce liquid savings $s(z)$ and illiquid assets $a(z)$
- General sufficient statistics formulas spanning many microfoundations

Internalities & externalities: additional corrective terms going either way

- Wedge between privately chosen and optimal job search
- Covers individual's biases but also general equilibrium effect

Multidimensional heterogeneity: ambiguous effects going either way

- Heterogeneity within earnings levels, distribution of e at each z
- Optimality condition that involves horizontal redistribution

Skip

Savings: Setting

Individuals: earnings z, liquid savings $s(z)$, illiquid assets $a(z)$

- Consumption when employed, $c_e(z) = z - T_e(z) - s(z) - a(z)$
- Consumption when unemployed, $c_u(z) = B_u(z) + \frac{e(z)}{1-e(z)} s(z)$
- Additional utility from illiquid assets, $V(z) + U(e(z)a(z))$

Benchmark 1: privately-optimal savings and assets (often used in macro)

$$u_e'(c_e(z)) = u_u'(c_u(z))$$
$$u_e'(c_e(z)) = U'(e(z)a(z))$$

Benchmark 2: exogenous savings and assets (often used in public econ)

$$\frac{\partial s(z)}{\partial T_e(z)} = \frac{\partial s(z)}{\partial B_u(z)} = 0$$
$$\frac{\partial a(z)}{\partial T_e(z)} = \frac{\partial a(z)}{\partial B_u(z)} = 0$$

Savings: Pareto-efficiency

Proposition 2. A Pareto-efficient tax-benefit system satisfies at each $z > 0$

$$K_r(z)\frac{u_u'(c_u(z))}{u_e'(c_e(z))}-1=\left[1+K_r(z)K_\mu(z)\frac{1-e(z)}{e(z)}\right]\frac{\mu_u^{elast}(z)}{e(z)}\left[1+\frac{e(z)\,T_e(z)-(1-e(z))\,B_u(z)}{B_u(z)}\right]$$

- $K_r(z)$ such that $dT_e(z)=K_r(z)\frac{1-e(z)}{e(z)}\frac{u_u'(c_u(z))}{u_e'(c_e(z))}dB_u(z)$ leaves utility constant
- $K_\mu(z)$ such that job search semi-elasticities verify $\frac{\mu_e(z)}{u_e'(c_e(z))}=K_\mu(z)\frac{\mu_u(z)}{u_u'(c_u(z))}$
- $K_r(z)=1$ in both benchmarks, and $K_\mu(z)=1$ only in exogenous case

Presence of savings reduces insurance value of UI

- Savings unambiguously push for lower benefits
- Since savings grow with earnings, stronger decrease in replacement rates

Adjustment factors have ambiguous effects

- In general, $K_r \leq 1$, which pushes for lower benefits (UI crowds out savings)
- When $K_\mu \leq 1$ it pushes for higher benefits (dampening of μ_u^{elast})

Savings: Policy implications

1. Optimal replacement rates at top incomes are negative

Corollary. If individuals above earnings $\overline{z}$ have enough savings to be perfectly self-insured against unemployment, then at $z \geq \overline{z}$,

$$B_u(z) = -T_e(z).$$

2. Simple policy rule with log utility now includes savings rates

Corollary. If consumption utilities are logarithmic and if $K_r(z) = 1$, denoting $\rho_s(z) := \frac{s(z)}{z}$ and $\rho_a(z) := \frac{a(z)}{z}$ the savings rates and $\mathcal{K}_s(z) \sim K_\mu(z)$, we get

$$B_u(z) = \frac{e(z)}{e(z) + \mu_u^{elast}(z)\mathcal{K}_s(z)} \left(1 - \frac{\rho_s(z)}{1 - e(z)} - \rho_a(z)\right) z - T_e(z),$$

Skip

Labor supply and the optimal tax-transfer schedule

Labor supply and the optimal tax-transfer schedule

Anatomy of labor supply decisions

- Extensive margin: wether to participate in labor market, given fixed cost χ
- Intensive margin: how much to income to earn, given earnings ability ω

Labor supply decisions have (almost) no impact on replacement rates

- Extensive margin responses do not affect Pareto-efficiency condition
- Intensive margin responses adds income effects term, quantitatively small

Labor supply decisions at the heart of optimal tax theory

- Extend classical optimal tax formulas in extensive-intensive margin models

Labor supply: Individuals

Individual choose their earnings and search efforts

- Heterogeneous earnings ability ω, work cost $k(z;\omega)$, search cost $\psi(e,z;\omega)$

$$V(\omega) := \max_{z} \left[\max_{e} e \Big[\underbrace{u_e(z - T_e(z)) - k(z;\omega)}_{\text{employed}} \Big] + (1-e) \Big[\underbrace{u_u(B_u(z)) - \psi(e,z;\omega)}_{\text{unemployed}} \Big] \right]$$

Individuals choose to participate in the labor market if and only if

- Heterogeneous participation costs χ, social assistance R_0

$$\underbrace{V(\omega) - \chi}_{\text{participating}} \geq \underbrace{u_0(R_0)}_{\text{not participating}} \iff \chi \leq \tilde{\chi}(\omega) \equiv V(\omega) - u_0(R_0)$$

New sufficient statistics

- Compensated earnings semi-elasticity ζ_e, income effect parameter η_e
- Cross-partial effect of earnings on job search ξ_z^{1-e}
- Participation semi-elasticities, π_e

Labor supply: Pareto-efficiency is (almost) unaffected

Proposition 3. A Pareto-efficient tax-benefit system satisfies at earnings z

$$\frac{u'(c_u(z))}{u'(c_e(z))} - 1 = \frac{\mu_u^{elast}(z)}{e(z)^2}\left[1 + \frac{e(z)T_e(z) - (1-e(z))B_u(z)}{B_u(z)}\right]$$
$$+ \frac{\eta_e(z)}{e(z)}\left[\frac{B_u'(z)}{1-T_e'(z)}\frac{u''(c_u(z))}{u''(c_e(z))} - \frac{u'(c_u(z))}{u'(c_e(z))}\right]$$
$$\times \left[\underbrace{\left(e(z)T_e'(z) - (1-e(z))B_u'(z)\right)}_{\text{marginal rate of net contribution}} - \underbrace{\left(T_e(x) + B_u(x)\right)}_{\text{employment tax}}\xi_z^{1-e}(z)\right]$$

New corrective term related to earnings income effects

- Empirically negligible at low earnings
- More relevant at higher earnings, but low replacement rates anyway

All important aspects do not appear in formula!

- Participation responses: irrelevant as joint reforms keep utility V constant
- Earnings decisions: need eligibility thresholds $\underline{e}$ against double deviations

Labor supply: Government

Objective: weighted sum of utility with social welfare function $G(.)$

$$\int_z \Bigg[\underbrace{\int_{\chi \leq \tilde{\chi}(z)} G\Big(V(z) - \chi\Big)}_{\text{participating}} + \underbrace{\int_{\chi \geq \tilde{\chi}(z)} G\Big(u\left(R_0\right)\Big)}_{\text{not participating}} \Bigg] dF_{\chi,z}(\chi, z)$$

Resource constraint: exogenous expenditure requirement Exp

$$\int_z \Bigg[\underbrace{\int_{\chi \leq \tilde{\chi}(z)} \Big(e(z)\, T_e(z) - (1 - e(z))\, B_u(z) \Big)}_{\text{participating}} - \underbrace{\int_{\chi \geq \tilde{\chi}(z)} R_0}_{\text{not participating}} \Bigg] dF_{\chi,z}(\chi, z) \geq Exp$$

New sufficient statistic: social marginal welfare weight

$$g_e(z) := \frac{\overline{G'(V(z) - \chi)}}{\lambda} u'_e(c_e(z))$$

Extensive margin only: Optimal tax formula

Proposition 4. An optimal tax-transfer schedule $T_e(z)$ satisfies at each $z > 0$,

$$\underbrace{(T_e(z)+R_0)}_{\text{participation tax}}\pi_e(z) - (1-e(z))\underbrace{(T_e(z)+B_u(z))}_{\text{employment tax}}(\pi_e(z)-\mu_u(z)) = e(z)(1-g_e(z)).$$

Generalizes optimal tax formula in extensive margin models

- Usually assume $e(z) = 1$ as in Diamond (1998), Saez (2002), ...
- EITC policy is desirable, $R_0 < -T_e(z)$ if and only if $1 < g_e(z)$

$$(T_e(z)+R_0)\pi_e(z) = (1-g_e(z))$$

Net impact on tax-transfer schedule is ambiguous

- Unemployment dampens mechanical effect
- Unemployment dampens participation effect, optimal $T_e \nearrow$
- Job search effect calls for job search incentives, optimal $T_e \searrow$

Extensive-intensive margins: Optimal tax formula

Proposition 5. The optimal marginal tax rate $T_e'(.)$ satisfies at earnings z

$$\Big[\underbrace{\big(e(z)T_e'(z)-(1-e(z))B_u'(z)\big)}_{\text{marginal rate of net contribution}} - \underbrace{\big(T_e(z)+B_u(z)\big)}_{\text{employment tax}}\xi_z^{1-e}(z)\Big]\zeta_e(z)\,z\,h_z(z)$$

$$= \int_{x\geq z}\Big\{e(x)\underbrace{\big(1-g_e(x)\big)}_{\text{mech. eff.}} + (1-e(x))\underbrace{\big(T_e(x)+B_u(x)\big)}_{\text{employment tax}}(\pi_e(x)-\mu_e(x)) - \underbrace{\big(T_e(x)+R_0\big)}_{\text{particip. tax}}\pi_e(x)$$

$$+\underbrace{\big(e(z)T_e'(z)-(1-e(z))B_u'(z)\big)}_{\text{marginal rate of net contribution}}\eta_e(x) - \underbrace{\big(T_e(x)+B_u(x)\big)}_{\text{employment tax}}\xi_z^{1-e}(x)\eta_e(x)\Big\}h_z(x)dx$$

Extends standard ABC formula (Diamond, 1998; Saez, 2001)

- Optimality condition for the schedule of marginal tax rates $T_e'(z)$
- Top marginal tax rates are (almost) unaffected
- Large search responses may imply negative marginal tax rates

Empirical application

Testing Pareto-efficiency in the US

Pareto-efficiency condition: baseline + log utility (CRRA=1; Chetty, 2006)

$$\overbrace{\frac{B_u(z)}{z - T_e(z)}}^{\text{replacement rate}} = \left(1 + \frac{\mu_u^{elast}(z)}{e(z)^2}\left[1 + \frac{\overbrace{e(z)T_e(z) - (1 - e(z))B_u(z)}^{\text{net contribution to tax-benefit system}}}{B_u(z)}\right]\right)^{-1}$$

Compute actual replacement rates from tax-benefit schedules

- OECD tax-benefit calculator TaxBEN, focus on childless singles
  - → T_e = income tax + contributions - EITC - social assistance
  - → B_u = unemployment benefits - income tax + social assistance

Compute Pareto-efficient replacement rates (Redistribution & UI)

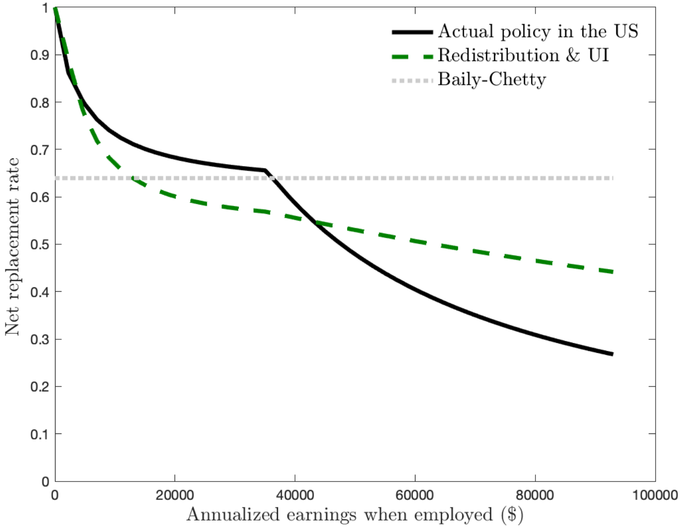
- Search elasticity $\mu_u^{elast} = 0.5$ (Schmieder & von Wachter, 2016)
- Link unemployment rates and earnings through education (BLS, CPS)

Compute Baily-Chetty optimal replacement rate (UI only)

- Net contribution to tax-benefit system = 0, average unempl't rate = 5.81%

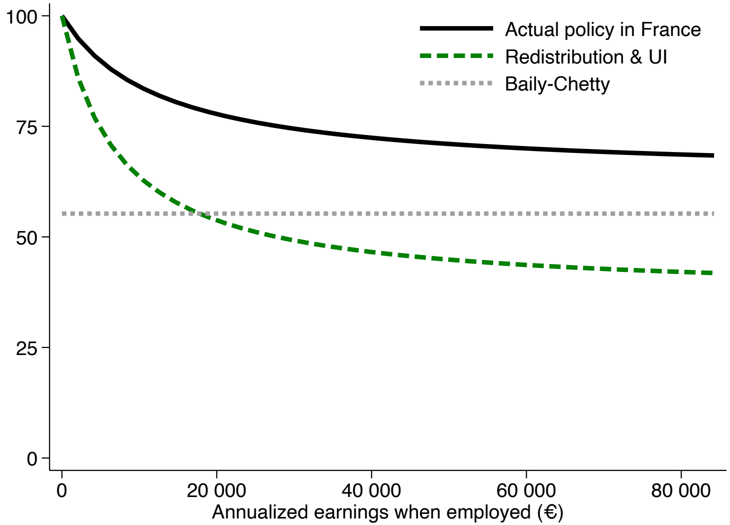
Testing Pareto-efficiency in the US

Back



Testing Pareto-efficiency in France

Back



Discussion

US: actual replacement rates decrease with earnings, broadly efficient

- Low-income: improve schedule of linearly increasing benefits with a cap?
- High-income: adding savings would lower efficient replacement rates
  - $\rightarrow$ Simulating optimal policies requires a calibrated structural model

FR: actual replacement rates stable with earnings, broadly inefficient

- Low-income: high transfers & high UI is broadly efficient
- High-income: high taxes & high UI creates room for Pareto-improvement!
  - $\rightarrow$ Interactions between redistribution & UI call for policy coordination

Conclusion

Conclusion

Analyze the interactions between redistribution and UI policies

- Unifying framework bridging canonical models of optimal tax & optimal UI
- Sufficient statistics characterization of optimal policies

Pareto-efficiency implies a tight link between optimal tax and optimal UI

- Efficient replacement rates decrease with earnings
- Efficient replacement rates are (in part) shaped by redistribution

Interactions between redistribution & UI call for policy coordination

- US: actual replacement rates decrease with earnings, broadly efficient
- FR: actual replacement rates stable with earnings, broadly inefficient

Redistribution & Unemployment Insurance

Antoine Ferey (Sciences Po)

August 2024

Steady-state representation of dynamic model Back

Population of individuals with **heterogeneous earnings** when employed, z

Employed at t: exogenous probability $q(z)$ to become unemployed at $t+1$

- Utility, $u_e(.)$, from consumption, $c_e(z)$
- Costs of working, $k(z)$

Unemployed at t: endogenous probability $p(z)$ to become employed at $t+1$

- Utility, $u_u(.)$, from consumption, $c_u(z)$
- Costs of searching, $\tilde{\psi}(p(z), z)$

Lemma 1. This (stationary) dynamic model converges to a steady state, where the utility of an individual with earnings z when employed is

$$\underbrace{\frac{p(z)}{q(z)+p(z)}}_{e(z)}\Big[\underbrace{u_e\left(c_e(z)\right)-k(z)}_{\textit{employed}}\Big]+\underbrace{\frac{q(z)}{q(z)+p(z)}}_{1-e(z)}\Big[\underbrace{u_u\left(c_u(z)\right)-\tilde{\psi}(p(z),z)}_{\textit{unemployed}}\Big]$$

Appendix: Other sufficient statistics Back

Participation semi-elasticities: changes in the number of participants, $h_z(z)$

$$\pi_e(z) \equiv -\frac{1}{h_z(z)} \frac{\partial h_z(z)}{\partial T_e(z)} \qquad \pi_u(z) \equiv \frac{1}{h_z(z)} \frac{\partial h_z(z)}{\partial B_u(z)}$$

$$\frac{\pi_e(z)}{e(z)\, u'(c_e(z))} = \frac{\pi_u(z)}{(1-e(z))\, u'(c_u(z))}$$

Social marginal welfare weights: changes in utility (value of public funds λ)

$$g_e(z) \equiv \frac{\overline{G'(V(z)-\chi)}}{\lambda} u'_e(c_e(z)) \qquad g_u(z) \equiv \frac{\overline{G'(V(z)-\chi)}}{\lambda} u'_u(c_u(z))$$

$$\frac{g_e(z)}{u'(c_e(z))} = \frac{g_u(z)}{u'(c_u(z))}$$

Appendix: Optimal tax schedule $T_e(z)$ Back

Proposition 1b. The optimal tax schedule satisfies at earnings z

$$\underbrace{\left(T_e(z)+R_0\right)}_{\text{participation tax}}\pi_e(z)-(1-e(z))\underbrace{\left(T_e(z)+B_u(z)\right)}_{\text{employment tax}}\left(\pi_e(z)-\mu_e(z)\right)=e(z)\underbrace{\left(1-g_e(z)\right)}_{\text{mechanical effect}}$$

Redistribution benchmark (e.g., Saez, 2002): no unemployment, $e(z)=1$

- Trade-off: redistribution vs. participation

$$\underbrace{\left(T_e(z)+R_0\right)}_{\text{participation tax}}\pi_e(z)=\underbrace{\left(1-g_e(z)\right)}_{\text{mechanical effect}}$$

Redistribution & UI: unemployment + job search

- Unemployment dampens the mechanical effect → reduces $T_e(z)$
- New term weighting participation vs search responses → ambiguous

Appendix: Proof of optimal tax formula Back

Reform: increase taxes by $dT_e(z)$

1. Impact on social welfare (envelope argument)

$$\underbrace{-e(z)\, u_e'(c_e(z))\, dT_e(z)}_{dV(z)}\ \overline{\frac{G'(V(z)-\chi)}{\lambda}}\ h_z(z)$$

2. Mechanical effect on government budget

$$e(z)\, h_z(z)\, dT_e(z)$$

3. Fiscal externality from participation responses

$$\Big(\underbrace{e(z)\, T_e(z) - (1-e(z))\, B_u(z) + R_0}_{\text{"total" participation tax}}\Big)\pi_e\,(z)\, dT_e(z)\, h_z(z)$$

4. Fiscal externality from search responses

$$\Big(\underbrace{T_e(z) + B_u(z)}_{\text{employment tax}}\Big)(1-e(z))\, \mu_e\,(z)\, dT_e(z)\, h_z(z)$$

Appendix: Optimal benefit schedule $B_u(z)$

Proposition 1c. The optimal benefit schedule satisfies at earnings z

$$(1-e(z))\underbrace{\left(T_e(z)+B_u(z)\right)}_{\text{employment tax}}\left(\pi_u(z)+\mu_u(z)\right)-\underbrace{\left(T_e(z)+R_0\right)}_{\text{participation tax}}\pi_u(z)=(1-e(z))\underbrace{\left(g_u(z)-1\right)}_{\text{mechanical effect}}$$

UI only: exogenous labor $\pi_u(z)=0$ + no redistributive concerns in $g_u(z)$

- Trade-off: insurance vs. search

$$\underbrace{\left(T_e(z)+B_u(z)\right)}_{\text{employment tax}}\mu_u(z)=\underbrace{\left(g_u(z)-1\right)}_{\text{mechanical effect}}$$

Redistribution & UI: redistributive concerns + participation responses

- Redistributive concerns in $g_u(z)$ call for progressivity in optimal $B_u(z)$
- Participation responses induce additional fiscal externalities → ambiguous

Back

Appendix: Proof of Pareto-efficiency condition

Back

Reform: increase benefits by $dB_u(z) = 1$ and taxes by $dT_e(z) = \frac{(1-e(z))u_u'(c_u(z))}{e(z)u_e'(c_e(z))}$

1. No impact on expected utility thus on participation (envelope argument)

$$dV(z) = -e(z)\, u_e'(c_e(z))\, dT_e(z) + (1 - e(z))\, u_u'(c_u(z))\, dB_u(z) = 0$$

2. Mechanical effect on government budget

$$[e(z)dT_e(z) - (1 - e(z))dB_u(z)]\, h_z(z) = (1 - e(z)) \left[\frac{u_u'(c_u(z))}{u_e'(c_e(z))} - 1\right] h_z(z)$$

3. Fiscal externality from search responses

$$T_e(z) + B_u(z) = \frac{B_u(z)}{e(z)} \left[1 + \frac{e(z)\, T_e(z) - (1 - e(z))\, B_u(z)}{B_u(z)}\right]$$

with the magnitude of search responses (using $\frac{\mu_e(z)}{u'(c_e(z))} = \frac{\mu_u(z)}{u'(c_u(z))}$)

$$(1 - e(z))\, [\mu_e\,(z)dT_e(z) + \mu_u\,(z)dB_u(z)]\, h_z(z) = (1 - e(z))\frac{\mu_u\,(z)}{e(z)} h_z(z)$$

Appendix: Application to log utility

Pareto-efficient unemployment benefits

$$B_u(z) = \frac{e(z)}{e(z) + \mu_u^{elast}(z)} z - T_e(z)$$

Globally optimal tax schedule (assuming utilitarian SWF, $g_e(z) = \frac{1}{\lambda} \frac{1}{z - T_e(z)}$)

$$T_e(z) = \frac{e(z)}{e(z)+\pi_e^{elast}(z)} \left[z - \frac{1}{\lambda} + (1 - e(z)) \frac{\pi_e^{elast}(z) - \mu_u^{elast}(z)}{e(z)+\mu_u^{elast}(z)} z \right] - \frac{\pi_e^{elast}(z)}{e(z)+\pi_e^{elast}(z)} R_0$$

Back

Appendix: Pareto-efficiency condition with savings Back

$$K_r(z) = \frac{1 + \frac{e(z)}{1-e(z)} \frac{u_e'(c_e(z))}{u_u'(c_u(z))} \left[\left(\frac{u_u'(c_u(z))}{u_e'(c_e(z))} - 1 \right) \frac{\partial s(z)}{\partial B_u(z)} + \left(\frac{U'(e(z)a(z))}{u_e'(c_e(z))} - 1 \right) \frac{\partial a(z)}{\partial B_u(z)} \right]}{1 - \left(\frac{u_u'(c_u(z))}{u_e'(c_e(z))} - 1 \right) \frac{\partial s(z)}{\partial T_e(z)} - \left(\frac{U'(e(z)a(z))}{u_e'(c_e(z))} - 1 \right) \frac{\partial a(z)}{\partial T_e(z)}}$$

$$K_\mu(z) = \frac{\mathcal{K}_T(z) + \left[\mathcal{K}_s(z) \frac{\partial s(z)}{\partial T_e(z)} + \mathcal{K}_a(z) \frac{\partial a(z)}{\partial T_e(z)} \right]}{\mathcal{K}_B(z) + \frac{u_e'(c_e(z))}{u_u'(c_u(z))} \left[\mathcal{K}_s(z) \frac{\partial s(z)}{\partial B_u(z)} + \mathcal{K}_a(z) \frac{\partial a(z)}{\partial B_u(z)} \right]}$$

where, omitting arguments of functions to economize on space,

$$\mathcal{K}_T = 1 - e \frac{u_e''}{u_e'} \left[\frac{\partial s}{\partial e} + \frac{\partial a}{\partial e} \right] - e \left[\left(\frac{u_u'}{u_e'} - 1 \right) \frac{\partial^2 s}{\partial T_e \partial e} + \left(\frac{U'}{u_e'} - 1 \right) \frac{\partial^2 a}{\partial T_e \partial e} \right]$$

$$\mathcal{K}_B = 1 - \frac{u_u''}{u_u'} \left[\frac{s}{1-e} + e \frac{\partial s}{\partial e} \right] - e \frac{u_e'}{u_u'} \left[\left(\frac{u_u'}{u_e'} - 1 \right) \frac{\partial^2 s}{\partial B_u \partial e} + \left(\frac{U'}{u_e'} - 1 \right) \frac{\partial^2 a}{\partial B_u \partial e} \right]$$

$$\mathcal{K}_s = \frac{u_u''}{u_e'} \frac{e}{1-e} \left[\frac{s}{1-e} + e \frac{\partial s}{\partial e} \right] + \frac{u_e''}{u_e'} e \left[\frac{\partial s}{\partial e} + \frac{\partial a}{\partial e} \right] + \left(\frac{u_u'}{u_e'} - 1 \right) \left[1 + e \frac{\partial^2 s}{\partial s \partial e} \right] + e \left(\frac{U'}{u_e'} - 1 \right) \frac{\partial^2 a}{\partial s \partial e}$$

$$\mathcal{K}_a = \frac{U''}{u_e'} e \left[a + e \frac{\partial a}{\partial e} \right] + \frac{u_e''}{u_e'} e \left[\frac{\partial s}{\partial e} + \frac{\partial a}{\partial e} \right] + \left(\frac{u_u'}{u_e'} - 1 \right) e \frac{\partial^2 s}{\partial a \partial e} + \left(\frac{U'}{u_e'} - 1 \right) \left[1 + e \frac{\partial^2 a}{\partial a \partial e} \right]$$

Appendix: New sufficient statistics Back

Earnings responses to tax-benefit reforms

- Compensated earnings semi-elasticities

$$\zeta_e(z) \equiv -\frac{1}{z}\frac{\partial z}{\partial T_e'(z)} \qquad \zeta_u(z) \equiv \frac{1}{z}\frac{\partial z}{\partial B_u'(z)}$$

$$\frac{\zeta_e(z)}{e(z)\,u'(z - T_e(z))} = \frac{\zeta_u(z)}{(1 - e(z))\,u'(B_u(z))}$$

- Income effects parameters

$$\eta_e(z) \equiv \frac{\partial z}{\partial T_e(z)} \qquad \eta_u(z) \equiv -\frac{\partial z}{\partial B_u(z)}$$

$$\frac{\eta_e(z)}{(1 - T_e'(z))\,e(z)\,u''(z - T_e(z))} = \frac{\eta_u(z)}{B_u'(z)\,(1 - e(z))\,u''(B_u(z))}$$

Cross-partial effect of earnings on job search

$$\xi_z^{1-e}(z) \equiv \frac{\partial(1 - e(z))}{\partial z}$$

Appendix: Optimal allocations in mechanism design Back

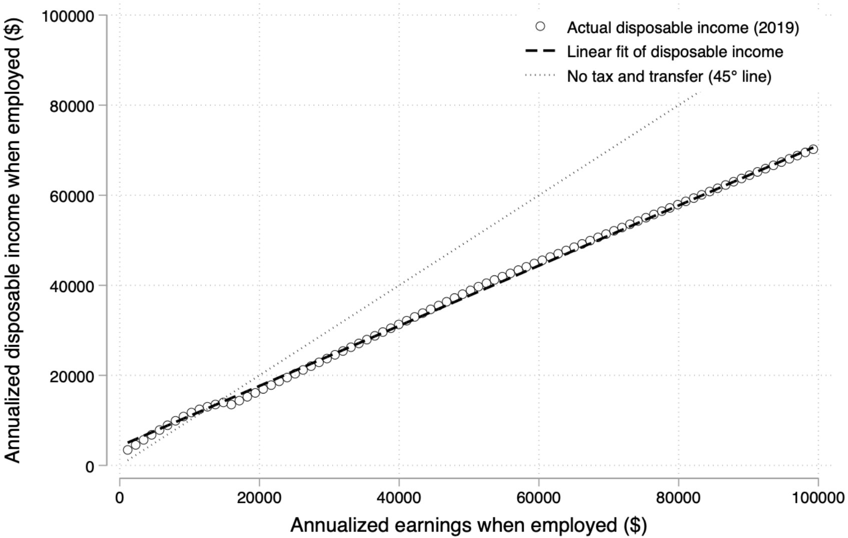
Second-best allocations: $\{z(\omega), c_e(\omega), c_u(\omega), e(\omega)\}_\omega$ **and** c_0

- Planner dictates $e(\omega)$ and provides full insurance $c_e(\omega) = c_u(\omega)$
  - $\rightarrow$ Involves unrealistic discontinuities in allocations across values of $e(\omega)$

Third-best allocations: $\{z(\omega), c_e(\omega), c_u(\omega)\}_\omega$ **and** c_0 **given** $\underline{e}$

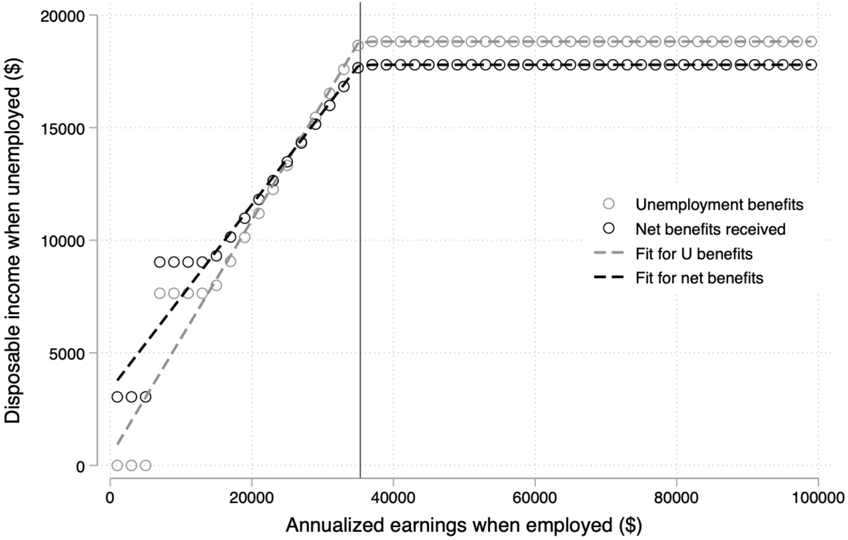
- Threshold mechanism: allocation is independent of e as long as $e \geq \underline{e}$
  - $\rightarrow$ Threshold mimicks eligibility requirements of actual UI systems
- If $\underline{e} = 0$, incentive compatibility restricts insurance to be lump-sum
  - $\rightarrow$ Upward deviations: work one day, enjoy unemployment insurance forever
- If $\underline{e} > 0$, eligibility requirements restore the possibility to provide insurance
  - $\rightarrow$ Eliminate upward deviations (+ smoothes and concavifies the problem)

Appendix: Tax schedule in the US MTR Back



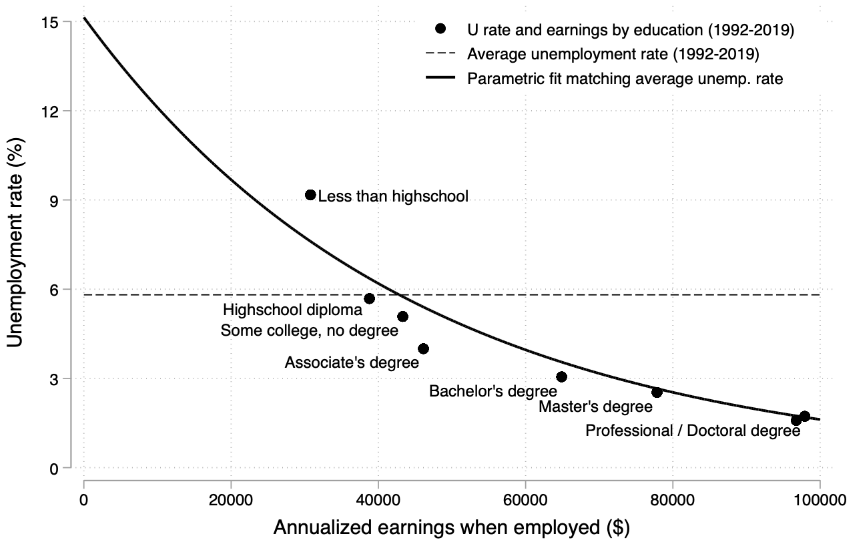
Appendix: Benefit schedule in the US

Back to Intro Back to Application



Appendix: Unemployment rates by earnings in US

Back



Appendix: Simulating counterfactual policies Back

Simulating counterfactual policies

- Specify linear tax schedule, $T_e(z) = \tau z - R_0$
- Analyze feasible Pareto-efficient policies for different tax rates τ

Calibrate search costs $\psi(e, z)$

- Unemployment rates across earnings
- Search elasticity $\mu_u^{elast} = 0.5$

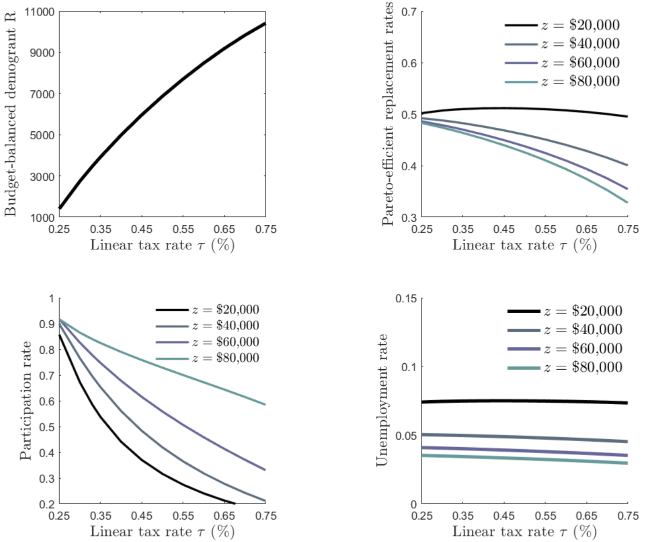
Calibrate fixed participation costs χ

- Participation rates across earnings
- Participation elasticity decreasing from $\pi_e^{elast} = 0.5$ to 0 above \$100,000

Calibrate earnings distribution $h_z(z)$

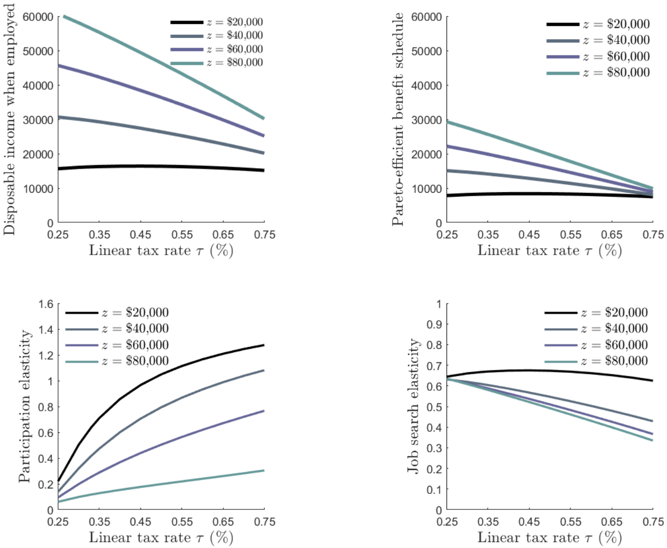
- CPS microdata, variable *usual weekly earnings*, append Pareto-tail

Appendix: Simulating counterfactual policies Back

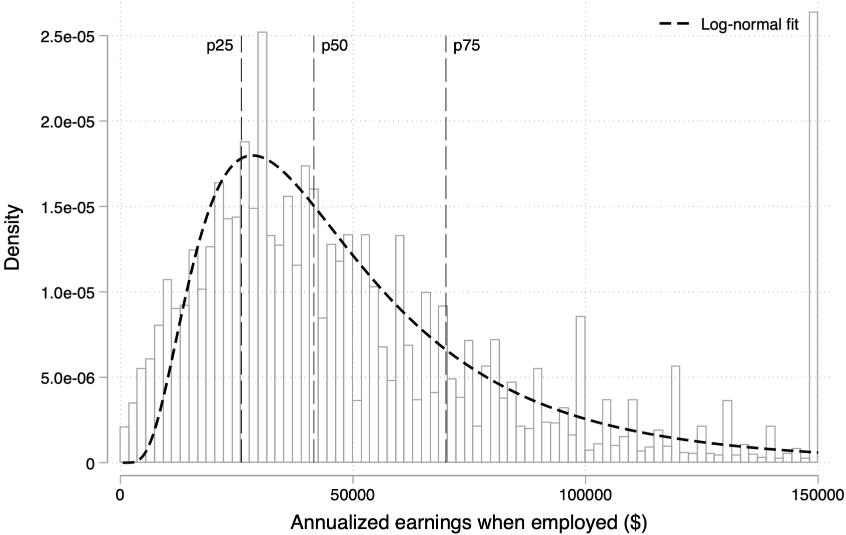


Appendix: Simulating counterfactual policies

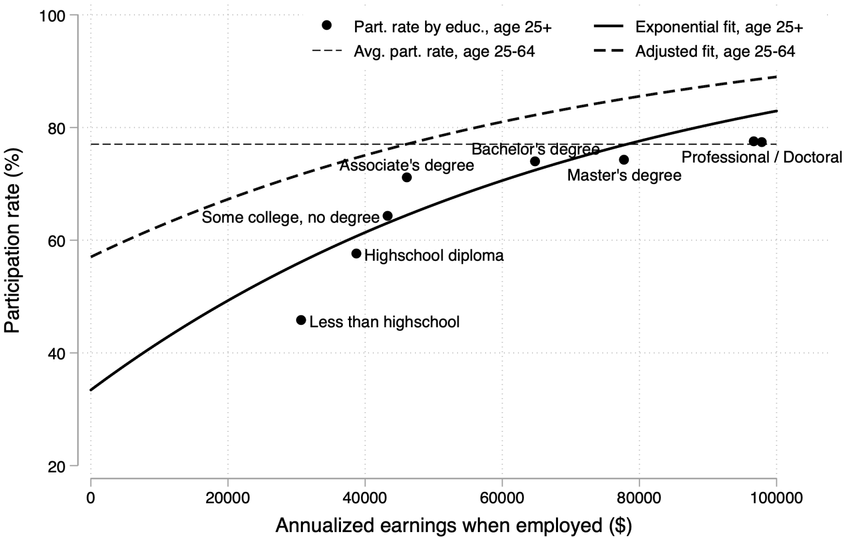
Back



Appendix: Earnings distribution in US Back



Appendix: Participation rates across earnings in US



Appendix: Marginal tax rates in the US

Back