Progressive Taxation in the Directed Search Model

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[1]The views of this research are only author's one. Any error is mine.

Progressive Taxation

- Higher income pays more, Lower income pays less
- Put it another way: Marginal Tax Rate $>$ Average Tax Rate
- Not about very theoretical taxation such as Ramsey/Mirrleesian taxation. Instead, mechanically talk about progressive income tax

Progressive Taxation: Visualization

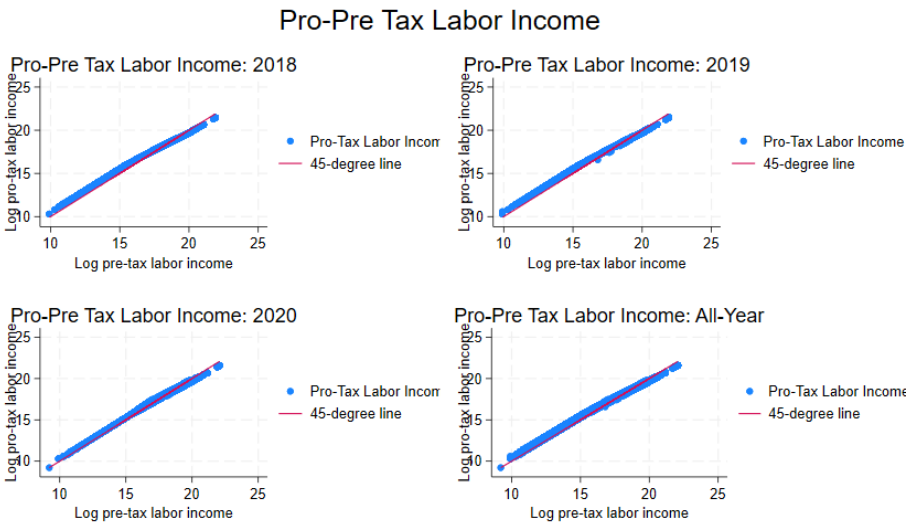


Figure: Pre-Post Tax Labor Income

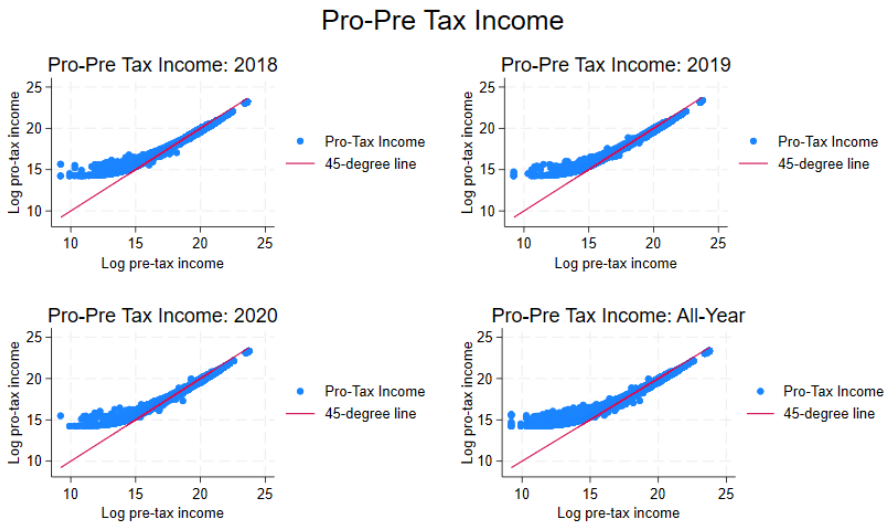


Figure: Pre-Post TaxIncome

How to formulate progressive taxation in a DSGE model?

- One of the most famous way: HSV tax function
- In the real world, it's a step-function. However, it makes life a lot easier using a HSV tax function
- HSV tax function: Let y be a pre-tax income. Then,

$$\text{Income tax: } T(y) = y - \lambda y^{1-\tau}$$

$$\text{Disposable income: } D(y) = y - T(y) = \lambda y^{1-\tau}$$

If $\tau > 0$: Tax is progressive. If $\tau = 1$: All agents have identical income

Key Concepts

- If taxes are more progressive,
- Benefits
  - Inequality $\downarrow$
  - Poor households' additional consumption & utility from the fiscal policy large $\rightarrow$ Can improve social welfare
  - Social welfare: $\int u(c(a,x), n(a,x))d\mu(a,x)$
- Costs
  - Efficiency $\downarrow$
  - Rich households save less $\rightarrow K \downarrow \rightarrow w \downarrow$ & $r \uparrow$
  - Work less $\rightarrow$ contribution to aggregate labor efficiency $\downarrow \rightarrow w \downarrow$ & $r \downarrow$

Transition: Optimal Progressive Income Tax

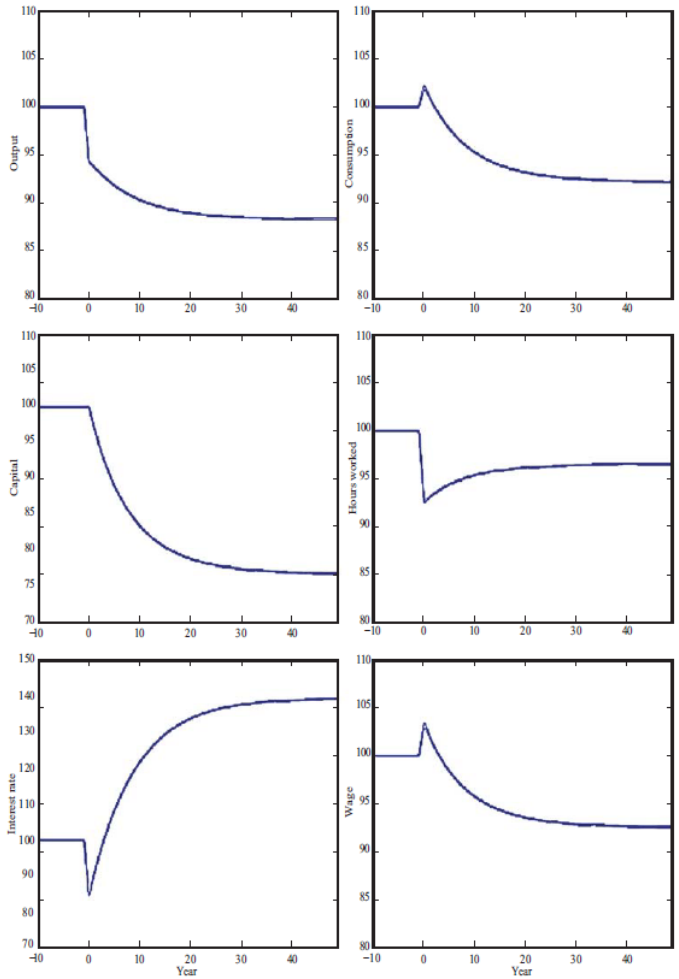


Figure: Transition to new steady state.
$(\tau, \tau_k) = (0.14, 0.24) \rightarrow (\tau^*, \tau_k^*) = (0.24, 0.39)$. Reference: Chang, Kim and Chang (2015)

Why Efficiency and Welfare could be Opposite

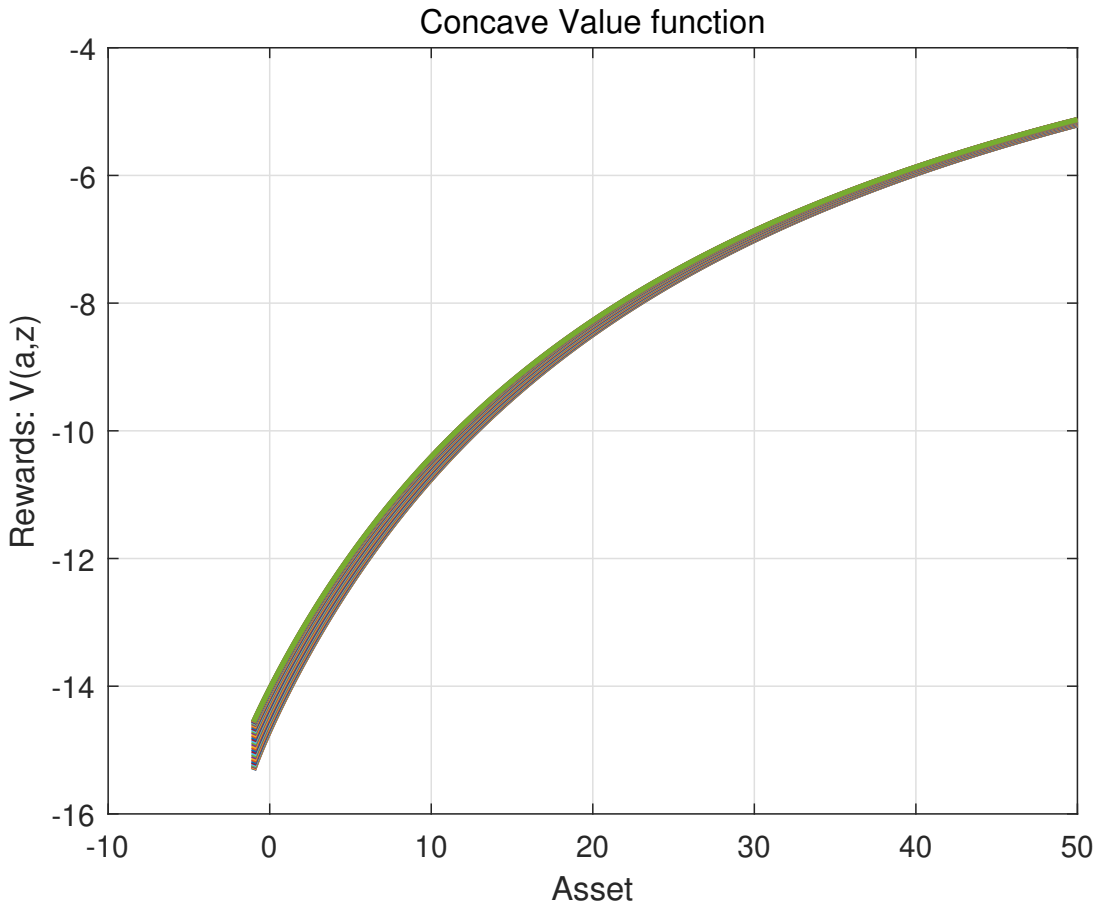


Figure: Value function $V(a, z)$

So, what I do in this research

- In the standard model, there is no unemployment. Thus, as $\tau \uparrow \rightarrow$ wage $\downarrow$ ($w = \alpha(K/N)^{1-\alpha}$) $\rightarrow$ labor supply discourages, in particular for higher skill workers
- Question: What if there is unemployment due to search frictions?
- Nash bargaining model: Exists and it implies that more progressive income tax leads to lower unemployment
- Directed search model(What I do): To my best knowledge, it is the first research to model with directed search model
  − Benefit: Easy to add another fiscal policy, such as lower bounds of unemployment insurance benefit + Aggregate shock

Model: Subperiod 1 - Separation & Search

Unemployed job seeker's value function:

$$R^U(b,a,h) = \max_{\mu'} \left\{ p(\theta(\mu',a,h))E(\mu',a,h) + (1 - p(\theta(\mu',a,h))U(b,a,h) \right\} \tag{1}$$

Trade-off: Better job offer $\mu' \uparrow \rightarrow$ Less probability to get a job $p(\theta(\mu',a,h)) \downarrow$

Employed worker's value function:

$$R^E(\mu,a,h) = \max_{\mu'} \left\{ \lambda_e p(\theta(\mu',a,h))E(\mu',a,h) - E(\mu,a,h) \right\} + E(\mu,a,h) \tag{2}$$

Model: Subperiod 2 - Matching and Consumption/Saving

Employed worker's value function:

$$E(\mu, a, h) = \max_{c,a',n} \left\{ u(c,n) + \beta \left[\delta R^U(b, a', h) + (1-\delta) R^E(\mu, a', h) \right] \right\} \quad (3)$$

subject to

$$(1+\tau_c)c + a' = \lambda(\mu hn + r(1-\tau_k)a)^{1-\tau} + a$$
$$b = \max\{min\{RepRatio * \mu hn, \bar{B}\}, \underline{B}\}$$

Model: Subperiod 2 - Matching and Consumption/Saving

Unemployed worker's value function:

$$U(b,a,h) = \max_{c,a'} \left\{ u(c) + \beta \left[\gamma R^U(\underline{b}, a', h) + (1-\gamma) R^U(b, a', h) \right] \right\} \quad (4)$$

subject to

$$(1+\tau_c)c + a' = \lambda(b + r(1-\tau_k)a)^{1-\tau} + a$$

Model: Firm's problem

Matched firm's value function:

$$J(\mu, a, h) = (1-\mu)hn + \beta(1-\delta)(1-\lambda_e p(\theta(\mu'(\mu, a', h), a', h)))J(\mu, a', h) \quad (5)$$

Vacancy posting:

$$V = -\kappa + q(\theta(\mu, a, h)J(\mu, a, h)$$

Free entry condition: Equilibrium labor market tightness $\theta = v/u$

$$V = 0$$

Matching function:

$$M(u, v) = \chi u^{1-\eta} v^{\eta}$$

Parametrization(Preliminary)

Parameter	Description	Value	Reference/Target
σ	CRRA parameter	2.0000	CRRA utility parameter
ψ	Frisch elasticity	1.0000	Literature
β	Time Discount Factor	0.9946	Monthly frequency
r	Risk-free asset	0.0029	3.5% Annual rate
$\bar{n}$	Indivisible hours work	0.3410	Survey report on labor conditions by employment type
$\bar{n}_2$	Part-Time working hours	0.2257	2004−2022 EAPS
τ	Income tax progressivity	0.11	Estimates from NTS
λ	HSV tax function	0.98	Needs to be calibrated τ_c
Value-added tax	0.1000	Standard	
τ_k	Capital income tax	0.237	Chang et al.(2015)
λ_e	OJS job offer probability	0.5882	Griffy (2021)
RepRatio	Replacement ratio of U.I benefit	0.6000	60% Current Policy
γ	Duration of U.I benefit	0.5400	Six-month
$\underline{b}$	Lower bounds of U.I benefit		one-day lower bound 60, 120 won
$\bar{b}$	Upper bounds of U.I benefit		one-day upper bound 66, 000 won (**needs to be fixed**)
δ	Job separation	0.0152	2017 − 2020 Regular workers' involuntarily job separation
χ	Matching efficiency	0.3200	Literature
η	Matching elasticity	0.5000	Literature
κ	Fixed cost of posting vacancy	1.0000	Needs to be revised
$(\mathbb{E}h, \sigma_h)$	Ex-ante heterogeneity of human capital	(11.2849, 0.4061)	Needs to be revised

Job Application Policy Function: $\mu(b, a, h)$

Unemployed job seekers

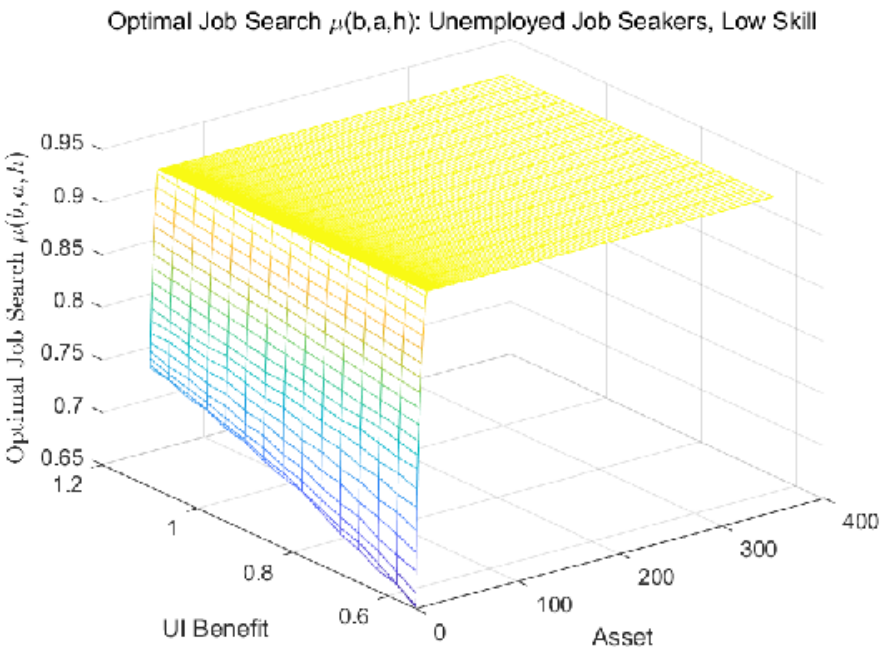


Figure: Low Human Capital

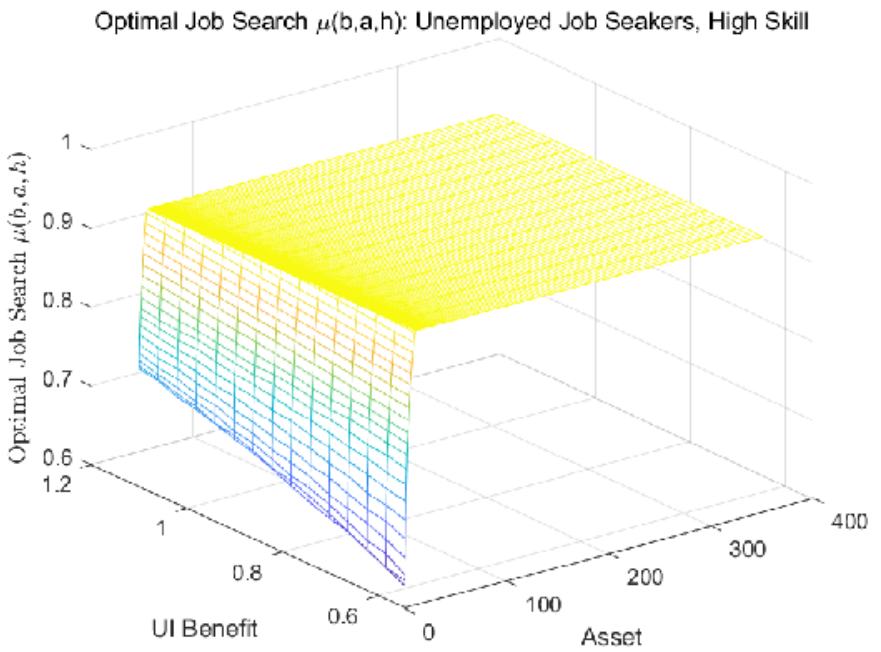
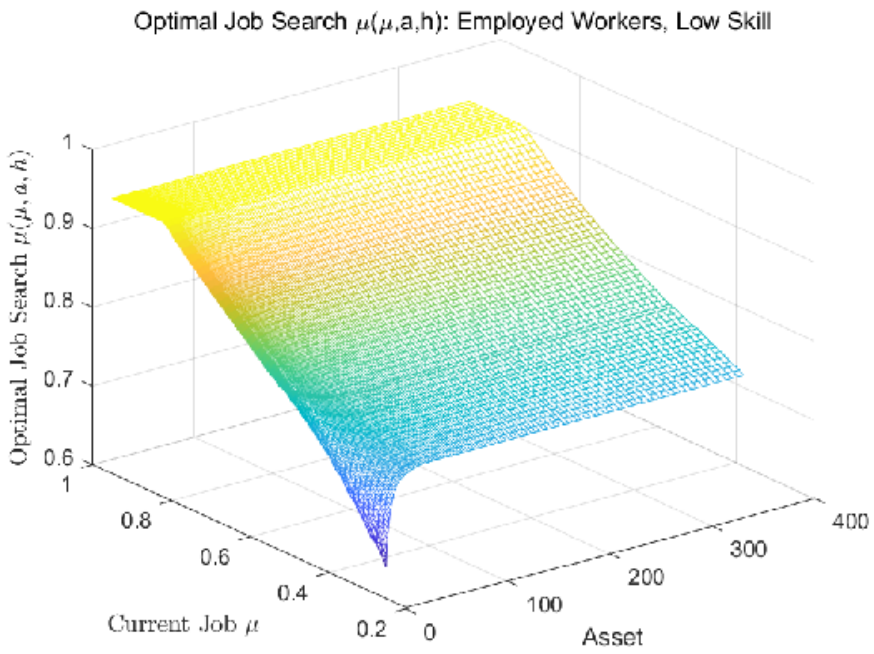


Figure: High Human Capital

Job Application Policy Function: $\mu(\mu, a, h)$

Employed job seekers



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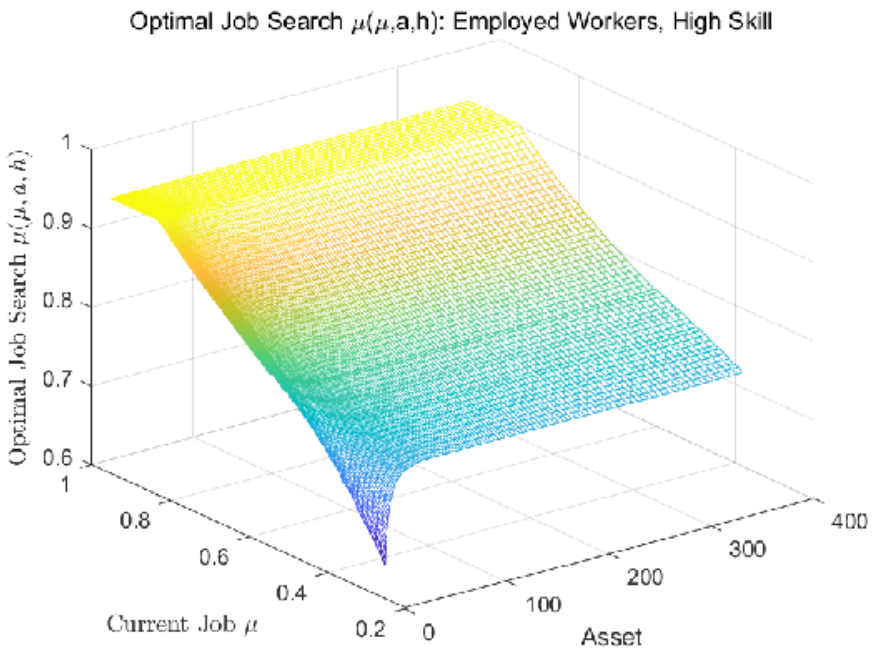

Figure: High Human Capital

Stationary Distribution: Asset

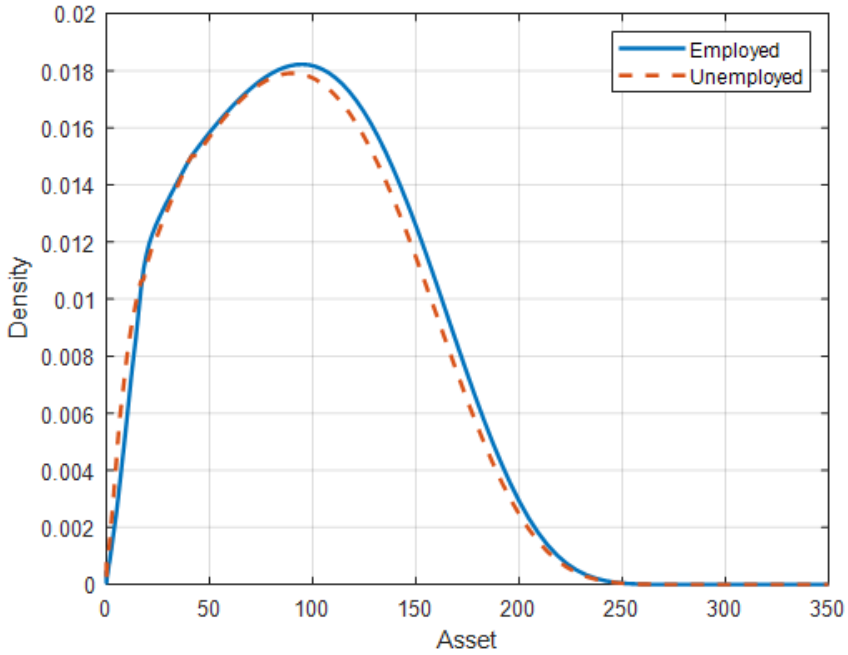

Figure: Asset Dist. when $\tau = 0.11$

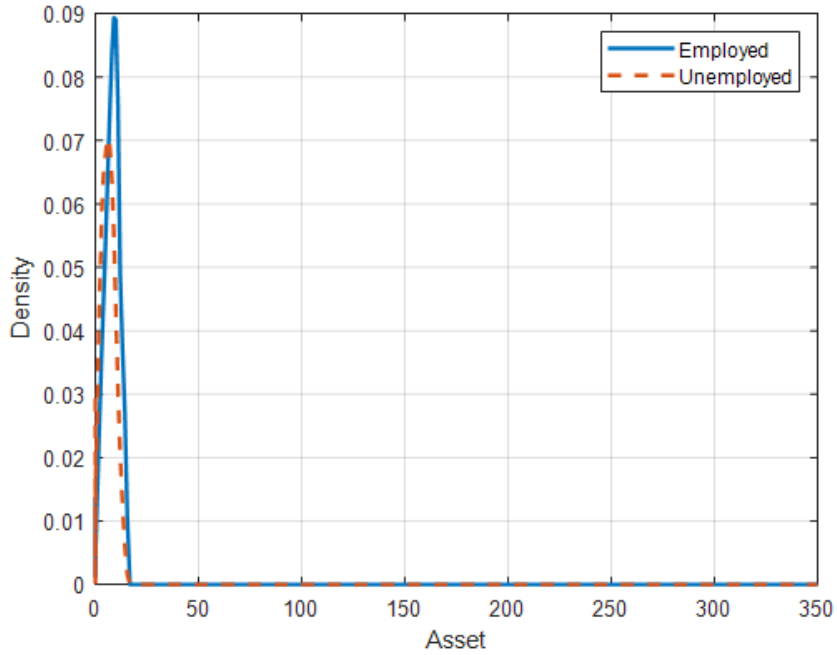

Figure: Asset Dist. when $\tau = 0.24$

Benchmark vs. More progressive taxation

1. Benchmark: $\tau = 0.11$ (Esitmates)
   - Aggregate capital: $K = 79.16$
   - Unemployment rate: 7.49%
2. More Progressive: $\tau = 0.24$ (Policy experiments)
   - Aggregate capital: $K = 6.91$
   - Unemployment rate: 6.56%

What We Need More

- Calibration
- Policy experiments
  - Change of UI benefit
  - Optimal income tax progressivity
- Model ingredients
  - Endogenous hours work & human capital
  - Preference heterogeneity