Minimum Wage and Occupational Mobility

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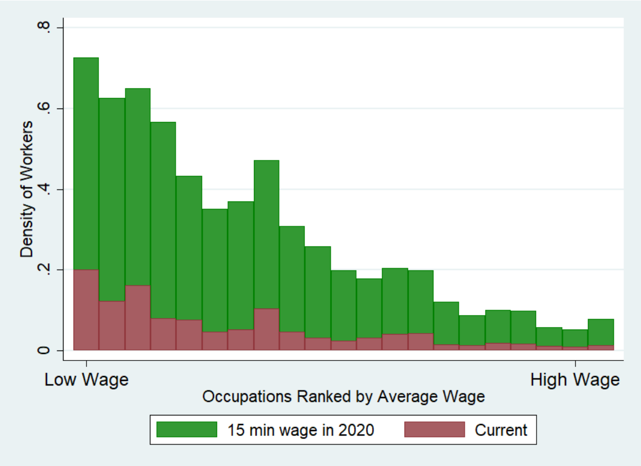
January 15, 2019

Motivation

- Recent minimum wage hikes: state-level, country-level, and city-level
- Debate typically focused on employment effects
- Other labor market outcomes less well known

Density of Workers With Binding Minimum Wage



Personal care	Education	Legal
Building cleaning	Community service	Engineer
Food preparation	Maintenance	Computer and math science

Questions

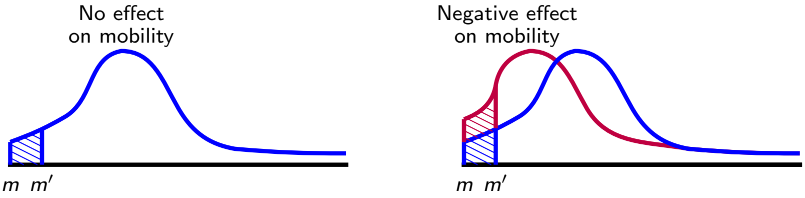
- What is the effect of minimum wage changes on occupational mobility?
- Does mobility response affect
  - wage distribution?
  - aggregate output?

What I Do

- Empirically examine minimum wage changes on occupational mobility
- Construct a search-and-matching model
  1. study the effect of large minimum wage increases on occupational mobility
  2. analyze how the mobility response affects
     - wage distribution
     - aggregate output

What I Find

- Minimum wage changes
  - empirically decreases mobility of younger and less educated workers
  - non-linearly reduce workers' occupational mobility when the change is large
- Mobility response:
  - shifts the wage distribution to the left



  - implies that minimum wage is less effective at reducing wage inequality
  - large minimum wage increases decrease aggregate output

Related Literature

- Empirical:
  - Occupational switch and skill mismatch: Nedelkoska et al. (2015)
  - Minimum wage: Neumark et al.(2014), Powell (2016)
  - Minimum wage and wage inequality: Autor et al. (2016)
  - Minimum wage discourage schooling: Patricia (2010), Neumark et al. (2003)
- Model:
  - Continuous time search-and-matching model: Moscarini (2005)
  - Occupational mobility and learning: Manovskii et al. (2010)
  - Job ladder models: Bagger et al.(2014)

Data Analysis

- Data: CPS 2013 to 2016
- Construct state-level occupational mobility rate detail
  - only consider occupational changes accompanied by employer switch
- Two-way fixed effect regression:

$$\left(\frac{\text{switcher}}{\text{switcher} + \text{stayer}}\right)_{st} = \beta log(MW)_{st} + \delta_t + \lambda_s + \Gamma X_{st} + \epsilon_{st}$$

- Controls:
  - Manufacturing employment share
  - Retail employment share
- Analyze sub-samples:
  - By age:
    - age < 30
    - age $\in (30, 45)$
  - By education:
    - high school and less
    - college

Data Analysis Cont.

	By Age		By Education
age < 30	-0.012** (0.006)	High school	-0.037 (0.033)
age $\in (30, 45)$	0.014 (0.01)	College	0.013 (0.01)
Observations	N $=$ 2448		N $=$ 2448

- Interaction: estimate for (age < 30)$\times$(high school) is -0.062***
- Interpretation: 10% minimum wage increase decreases young, less educated workers occupational mobility by 0.6 percentage points
- Use an alternative method to construct control group:
  - generalized synthetic control (GSC)
  - results are similar

The Effect on Low Skill/Wage Occupations

- Construct occupation mobility by occupation skill/average wage

	By Skill		By Average Wage
Low skill occ	-0.007* (0.004)	Low wage occ	-0.007* (0.004)
High skill occ	0.008 (0.006)	High wage occ	0.008 (0.007)
Observations	N = 2448		N = 2448

- Minimum wage changes
  - decreases occupational mobility in low skill/wage occupations
  - does not affect occupational mobility in high skill/wage occupations

Measurement

- The measure could be related to employer switch only
- Examine the effect of minimum wage on
  - percentage change in employer switchers who remain in the same occupation
  - expect to see negative effect if only employment effect is relevant
    - workers switch employers less often regardless of occupational switch

	Two-way FE
Employer switchers w same occ	-0.42
	(0.45)
Observations	N = 2448

Model

- Continuous time searching-and-matching model
  - study the effect of large minimum wage on occupational mobility
- Model features:
  - Heterogeneous workers indexed by $a \in [0, 1]$: ability
  - Continuum of occupations indexed by $j \in [0, 1]$: skill requirement
  - Job arrival rate λ, on-the-job search $\alpha\lambda$
  - Exogenous separation δ
  - Wage setting: Nash bargaining
    - worker's bargaining power β
    - constrained by the minimum wage
  - Firm free entry with flow cost of vacancy κ

Model Cont.

- Worker output:

$$\frac{dX_t}{X_t} = \tilde{a}dt + \sigma dZ_t$$

- $\tilde{a}$ determined by worker's ability and occupation's skill requirement
  - Match specific component: $\tilde{a}$ decreases in mismatch $(a - j)^2$
  - Non match specific component: $\tilde{a}$ increases in ability a

Worker's Problem

- Fix (a, j)
- Initial output at new occupation: x_p
- Value of unemployment U, wage payment $\widetilde{w} = \max\{w, minwage\}$
- Worker's value function:

$$rV(x) = \widetilde{w} + \tilde{a}xV'(x) + \frac{1}{2}\sigma^2 x^2 V''(x) - \delta[V(x) - U] + \alpha\lambda \max\left\{\int V(x_p, j)dj - V(x), 0\right\}$$

- Unemployed worker:

$$rU = b + \lambda\left[\int V(x_p, j)dj - U\right]$$

Worker's Problem Cont.

- Define $x_s : V(x_s) = \int V(x_p, j)dj$
  - on the job search cutoff
- Define $\underline{x} : V(\underline{x}) = U$
  - endogenous separation cutoff
- Worker behavior:
  - search on the job if $\underline{x} < X(t) < x_s$
  - quit to unemployment if $X(t) \leqslant \underline{x}$

Worker's Problem Cont.

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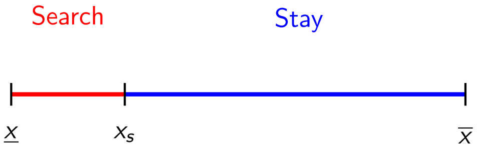

Worker's Problem Cont.

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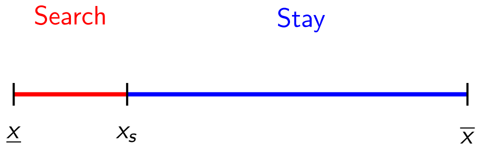


- Mismatched workers' output more likely to be low:
  - more likely to switch occupation

Equilibrium

Definition

A stationary equilibrium is

- a collection of value functions $\{V, J, U\}_{a,j}$
- a collection of stationary wage distributions $f(a, j)$
- a list of parameters $\{\delta, \lambda, \beta, \kappa, \alpha, \sigma\}$.

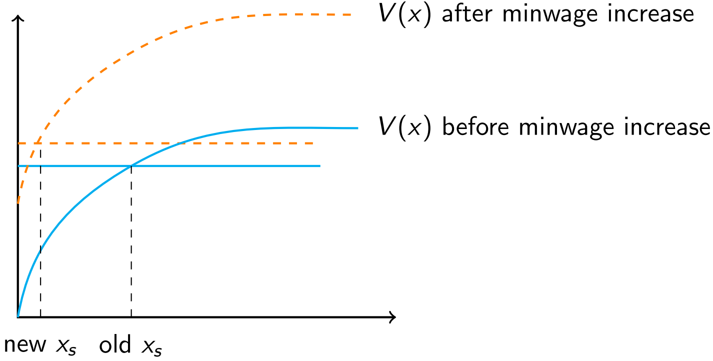
Proposition

A stationary equilibrium exists. proof

- Stationary equilibrium features:
  1. Greater the mismatch $\implies$ more likely to switch
  2. The wage distribution has a Pareto tail
     - locally increasing in ability: larger wage dispersion among high ability workers
     - locally decreasing in mismatch: mismatch compresses wage dispersion

Minimum Wage and Low Ability Workers

- Minimum wage decreases low ability workers' occupational mobility:
  - On the job search cutoff point is determined by
    - value function $V(x)$
    - outside option



Minimum Wage and Low Ability Workers Cont.

- Minimum wage decreases low ability workers' incentive to switch occupations:

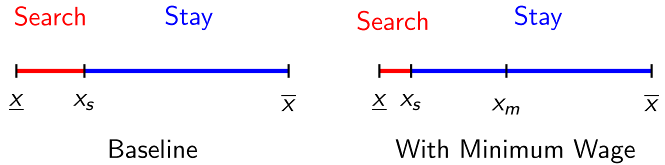


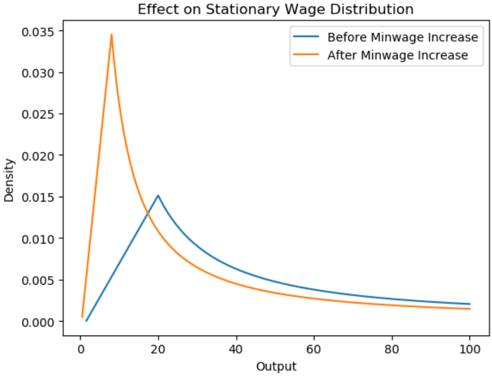
Figure: Low Ability Worker Under Minimum Wage

Effect on Stationary Wage Distribution

- The stationary wage distribution can be derived from a forward equation
  - The solution has the form

$$f(x) = \begin{cases} C_0 x^{\eta_0}, & \underline{x} < x \leqslant x_s, \quad \eta_0 > 0 \\ C_1 x^{\eta_1}, & x_s < x < \overline{x}, \quad \eta_1 < 0 \end{cases}$$

- By changing x_s, the minimum wage shifts the wage distribution to the left



Quantitative Analysis

- Estimate the model using GMM
- Discretize ability and occupational skill requirement into ten grids
- Worker ability distribution $Beta(k_1, k_2)$
- Occupation distribution uniform
- Ability:
  - Low ability: grids 1 and 2 $\Longrightarrow$ high school
  - Medium ability: grids 3 to 7 $\Longrightarrow$ associate and some college
  - High ability: grids 8 to 10 $\Longrightarrow$ college
- Occupation:
  - Low skill: grids 1 to 4
  - Medium skill: grids 5 to 6
  - High skill: grids 7 to 10
- k_1 and k_2 is set to match the education composition exactly

Quantitative Analysis Cont.

- Expand on the job search threshold:

$$x_s(a, j, m, x) = \left(p_0 + p_1 a + p_2 j + p_3 a * j + p_4 a^2 + p_5 j^2\right) * \mathbb{I}_{\{qx \leqslant m\}}$$

- Worker can target their search:
  - match to optimal occupation w.p. ρ
  - equal probability to match to other occupations
- Moment targets:
  - Occupational mobility rate
  - Unemployment rate
  - Wage distribution (P10 to P90) of 2008 to 2017 CPS pooled data
  - Variance to mean ratio of wage distribution

Estimation Results

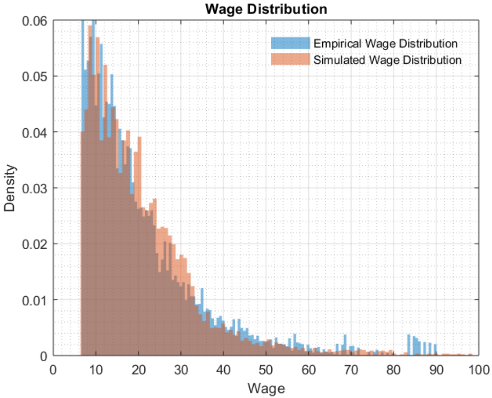
- 9 parameters and 30 moments

Table: Parameter Estimation Results

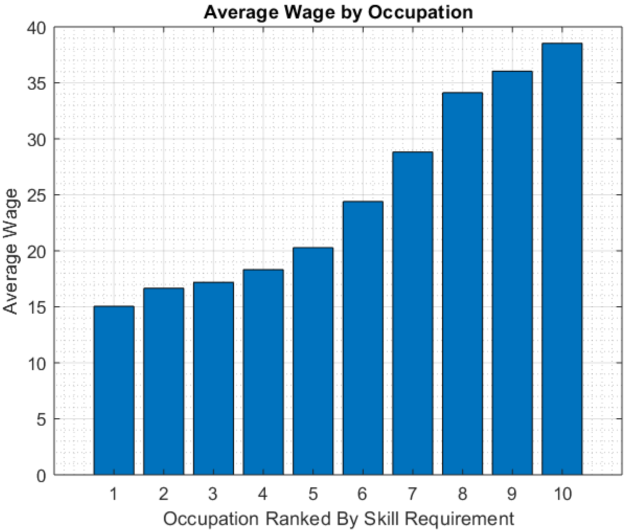
Estimated Parameters			
ρ	0.867** (0.0061)	p_3	-6.45**(3.2075)
σ	0.889** (0.0513)	p_4	4.39 (3.03)
p_0	2.67** (0.2685)	p_5	1.38 (1.63)
p_1	7.89** (2.5942)	q	0.950** (0.294)
p_2	21.75**(2.5348)		
Calibrated Parameters			
α	0.8		Literature
λ	0.36		CPS
δ	0.02		CPS
(k_1, k_2)	(1.33, 1.23)		CPS
β	0.5		Literature

** means significant at 5% level.

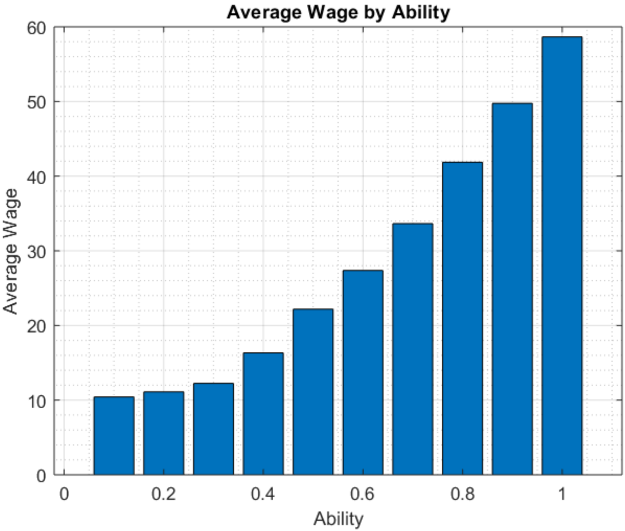
Simulated Wage Distribution



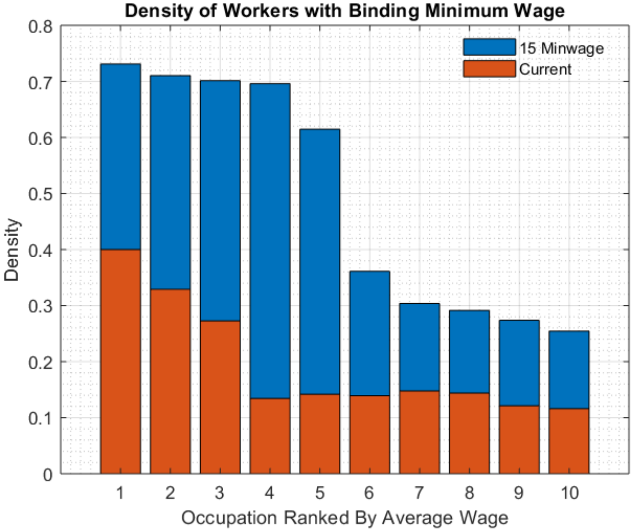
Average Wage by Occupation



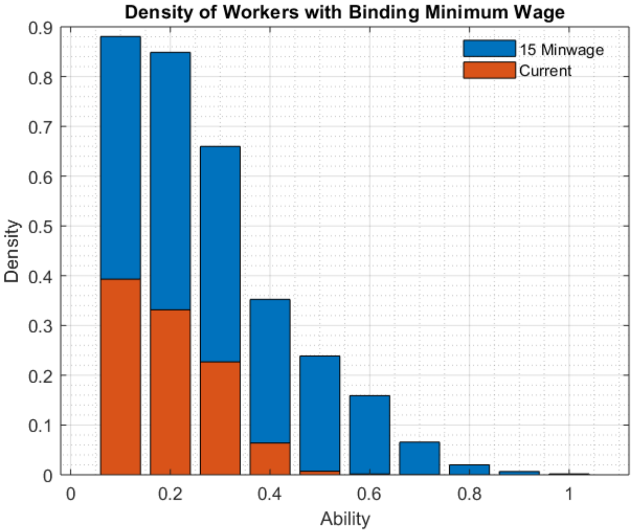
Average Wage by Ability



Workers with Binding Minimum Wage by Occupation

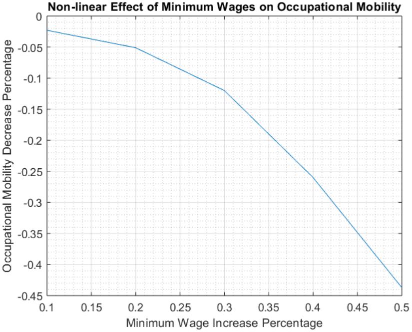


Workers with Binding Minimum Wage by Ability



Effect of Minimum Wage on Occupational Mobility

- Increase minimum wage by 50%:
  - Occupational mobility of low ability workers decreases by 43%
  - No significant effect on high ability workers
- Increase minimum wage by 10%:
  - Occupational mobility of low ability workers decreases by 3%
  - Linear extrapolation inappropriate: $3\% \times 5 < 43\%$
- Intuition: fraction of workers affected by minimum wage highly non-linear



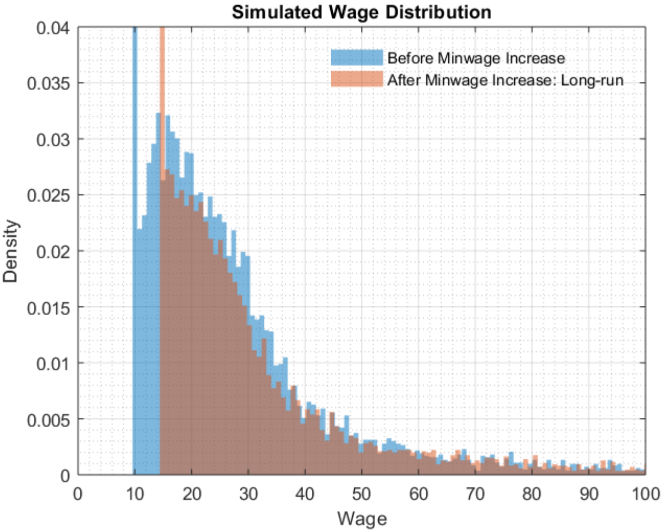
Wage Inequality

- 50% minimum wage change increases low ability workers' average and median wage
- Counterfactual exercise: assume minimum wage does not decrease occupational mobility
  - Mean and median wage increase by 17% more
  - Mobility response damps wage inequality reduction
  - Minimum wage has larger short-run effect than long-run effect on inequality

Short-run and Long-run Effects

Short-run

Short-run and Long-run Effects Cont.



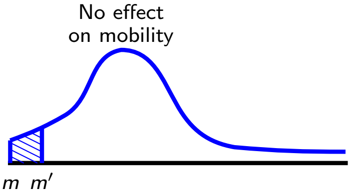
Long-run

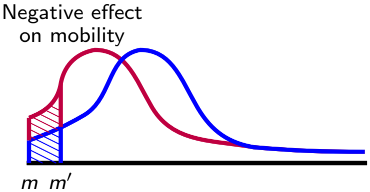
Output Loss

- The leftward shift induced by the minimum wage causes output loss
- The 50% minimum wage increases causes 1.7% decrease in aggregate output
- The effect is concentrated on the low ability workers: decrease output by 7%
- A nationwide $15 minimum wage might decrease output in low wage areas

Conclusion

- Empirical evidence:
  - Minimum wage decreases occupational mobility of younger, less-educated workers
- Model implication:
  - Non-linear effect of minimum wage on occupational mobility
  - Mobility response shifts wage distribution:





  - Large minimum wage increase
    - might not reduce inequality by as much as expected
    - might decrease output in low wage area

Appendix

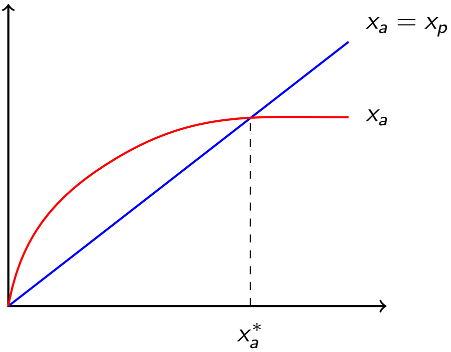
Details of Occupational Mobility Construction

- I merge two consecutive monthly files into one
- An occupation switcher is identified if
  - employed in both months
  - occupational code differs in two months
  - dependent coding
    1. employer change? (preferred measure)
    2. job usual activity and duty change?
    3. occupation and usual activity change?
- Collapse to obtain the mobility rate with final weight

back

On the Job Search Threshold

- $x_a = inf\left\{x : V(x) = \int V(x_p, o)dH(o)\right\}$: choose x_p so that $x_a = x_p$



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Existence of Stationary Equilibrium

- Define matching function: $m(s,v) = s^{\zeta} v^{1-\zeta}$
- $\lambda = m(s,v)/s = \theta^{1-\zeta}$ is the job finding rate
- Free entry of firm with vacancy cost κ:

$$\kappa = \int \int \lambda^{\frac{\zeta}{1-\zeta}} J(x_a, a, j) dadj \tag{1}$$

- A stationary general equilibrium: $\{\lambda, s, v, \{\underline{x}\}, \{x_a\}\}$ and $\{\{J\}, \{V\}, \{f\}\}$
- J is bounded in $[J(\underline{x}, 0, 1), J(\overline{x}, 1, 1)]$. This means $\exists \lambda$ such that (1) holds

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Value Function Shape Parameters

$$\gamma_0 = -\frac{\tilde{a}}{\sigma^2} + \frac{1}{2} - \sqrt{(\frac{1}{2} - \frac{\tilde{a}}{\sigma^2})^2 + \frac{2(\delta + r)}{\sigma^2}} < 0$$

$$\gamma_1 = -\frac{\tilde{a}}{\sigma^2} + \frac{1}{2} + \sqrt{(\frac{1}{2} - \frac{\tilde{a}}{\sigma^2})^2 + \frac{2(\delta + r)}{\sigma^2}} > 0$$

$$\tau_0 = -\frac{\tilde{a}}{\sigma^2} + \frac{1}{2} - \sqrt{(\frac{1}{2} - \frac{\tilde{a}}{\sigma^2})^2 + \frac{2(\alpha\lambda + \delta + r)}{\sigma^2}} < 0$$

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Stationary Distribution

- Stationary output distribution Fokker-Planck equation:

$$\frac{\sigma^2}{2}x^2 f''(x) + (2\sigma^2 - \tilde{a}^2)xf'(x) + (\sigma^2 - \tilde{a})f(x) - (\delta + \alpha\lambda\mathbb{I}_{\{x<x_a\}})f(x) = 0$$

solution

- Boundary conditions
  - $f(\underline{x}+) = 0$: endogenous separation
  - $(\tilde{a} - \sigma^2)f(\overline{x}) = \frac{1}{2}\sigma^2\overline{x}f'(\overline{x})$: reflection at upper-bound
  - Total flow in and out of unemployment constant
  - Total flow in and out of employment (a, j) constant

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Stationary Distribution Solution

- The general solution is:

$$f(x) = [D_0 x^{\eta_0} + D_1 x^{\eta_1}]\mathbb{I}_{\{\underline{x}<x\leqslant x_a\}} + \left[E_0 x^{\xi_0} + E_1 x^{\xi_1}\right]\mathbb{I}_{\{x_a<x<\overline{x}\}}$$

- The shape parameters:

$$\eta_0 = -\frac{2\sigma^2-\tilde{a}}{2} + \frac{1}{2} - \sqrt{(\frac{1}{2} - \frac{2\sigma^2-\tilde{a}}{2})^2 + \frac{2(\tilde{a}+\delta-\sigma^2)}{\sigma^2}} < 0$$

$$\eta_1 = -\frac{2\sigma^2-\tilde{a}}{2} + \frac{1}{2} + \sqrt{(\frac{1}{2} - \frac{2\sigma^2-\tilde{a}}{2})^2 + \frac{2(\tilde{a}+\delta-\sigma^2)}{\sigma^2}} > 0$$

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Stationary Distribution Boundary Conditions

- Total flow in and out of unemployment is constant:

$$\int\int \lambda \left[1 - \int_{\underline{x}}^{\overline{x}} f(x)dx\right] dGdH = \int\int \left\{ \delta \int_{\underline{x}}^{\overline{x}} f(x)dx + \frac{1}{2}\sigma^2 \underline{x}^2 f'(\underline{x}) - (\tilde{a} - \sigma^2)\underline{x} f(\underline{x}) \right\} dGdH$$

- Total flow in and out of employment (a, j) is constant:

$$\lambda \left[1 - \int_{\underline{x}}^{\overline{x}} f(x)dx\right] = \delta \int_{\underline{x}}^{\overline{x}} f(x)dx + \frac{1}{2}\sigma^2 \underline{x}^2 f'(\underline{x}) - (\tilde{a} - \sigma^2)\underline{x} f(\underline{x})$$

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