The Aggregate Labor Supply Curve at the Extensive Margin:

A Reservation Wedge Approach

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Empirical regularity: extensive margin dominates in fluctuations in $H_t = \sum_i h_{it} \cdot e_{it}$

Motivation: Labor Supply in Macro

- **Intensive margin relatively uncontroversial:**
  - E.g., transparent "MaCurdy" constant-Frisch-elasticity modeling approach:

$$h_{it}^{1/\eta} = \lambda_{it} w_{it}$$

  - Empirical estimates implying $0.0 < \eta < 1.0$ **(e.g. Chetty, Guren, Manoli, Weber 2012)**

- **Extensive margin has "loose ends":**
  - No empirical consensus on e.g. elasticity **(e.g. Chetty, Guren, Manoli, Weber (2012), Rogerson and Keane (2012))**
  - In modeling practice,

Either: Ad-hoc "handwaving": **(e.g., Gali 2015)**

$$L_t^{1/\eta} = \lambda_t w_t \quad (1)$$

Or: "Serious" extensive-margin choices $e^* \in \{0, 1\}$, but: **(e.g., Rogerson-Wallenius 2008; Het Agents...)**

- No transparent and easy-to-calibrate ALSC (vs: "η")
- Overwhelming complexity (multi-dim. heterogeneity, "hidden calibrations",...)
- Hard to (i) interrelate and (ii) adjudicate between empirically

This Paper

1. **Propose basic framework for EM-ALSC**

$1-\mathcal{T}_t$: **Prevailing aggregate wedge:** linear, homogeneous mark-up/down on labor income

$1-\tau_{it}^*$: **Micro reservation wedge:** hypothetical $1-\mathcal{T}_t$ rendering i indifferent b/w working and not:

- Frischian i.e. λ_{it}-constant pertubation in $1-\mathcal{T}_t$

$F_t(1-\tau^*)$: **Aggregation** of individual RW's $\Rightarrow$ short-run EM-ALSC:

$$E_t = P(1-\tau_{it}^* \leq 1-\mathcal{T}_t) = F_t(1-\mathcal{T}_t)$$

2. **Model meta-analysis:** recast in RW framework to uncover & make comparable ALSCs
3. **Custom survey of U.S. pop'n:** directly measure RW distribution (US EM-ALSC)
   - Large local elasticities of 3 and up
   - Non-constant, asymmetric arc-elasticities: smaller elasticities upwards
4. **Macro implications of empirical EM-ALSC** used as calibration target
   - No existing model provides tight fit
   - Fit one model's $F_t(1-\tau^*)$ tightly to the empirical analogue
   - Labor wedge exercise: considerably less cyclical

Outline

1. **Reservation Wedge Framework**
   - Individual-Level EM Choice
   - Extensions
   - Aggregation into EM ALSC
2. **Model Meta-Analysis**
3. **Measurement In Survey**
4. **Macro Implications**

Micro EM Labor Supply

$$\max_{a_{it},h_{it},c_{it}} \mathbb{E}_t \sum_t \beta^t u_i(h_{it}, c_{it}) \qquad \text{s.t.} \qquad a_{it} + c_{it} \leq a_{i,t-1}(1 + r_{i,t-1}) + (1 - \mathcal{T}_t) y_{it}(h_{it}) + T_{it}(.)$$

- Prevailing aggregate labor wedge $1 - \mathcal{T}_t$
- Indivisible labor: $h_{it} \in \{0, \widetilde{h}_{it}\}$
- Potential earnings $y_{it} = w_{it} \widetilde{h}_{it}$
- Labor disutility $v_{it} = u_i(c^e_{it}, \widetilde{h}) - u_i(c^n_{it}, 0)$

Labor supply is discrete (employment) choice:

$$\Rightarrow h^*_{it} = \begin{cases} 0 & \text{if} \quad v_{it} > (1 - \mathcal{T}_t) w_{it} \widetilde{h}_{it} \lambda_{it} \\ \widetilde{h}_{it} & \text{if} \quad v_{it} \leq (1 - \mathcal{T}_t) w_{it} \widetilde{h}_{it} \lambda_{it} \end{cases} \Leftrightarrow e^*_{it} = \begin{cases} 0 & \text{if} \quad v_{it} > (1 - \mathcal{T}_t) y_{it} \lambda_{it} \\ 1 & \text{if} \quad v_{it} \leq (1 - \mathcal{T}_t) y_{it} \lambda_{it} \end{cases}$$

Reservation wedge $1 - \tau^*_{it}$: hypothetical $1 - \mathcal{T}_t$ rendering i indifferent between working and not:

$$v_{it} \boxed{=} (1 - \tau^*_{it}) y_{it} \lambda_{it} \quad \Leftrightarrow \quad 1 - \tau^*_{it} = \frac{v_{it}}{y_{it} \lambda_{it}}$$

Sufficient statistic for i's Frischian employment preferences:

$$\Rightarrow e^*_{it} = \begin{cases} 0 & \text{if} \quad 1 - \mathcal{T}_t < 1 - \tau^*_{it} \\ 1 & \text{if} \quad 1 - \mathcal{T}_t \geq 1 - \tau^*_{it} \end{cases}$$

Extensions

- Nonemployment subsidies/opportunity cost of working — **Chodorow-Reich and Karababounis (2016)**
- Non-Frischian contexts, income/wealth effects
- Intensive margin / hours choices / job menus
- Long-term jobs — **Mui and Schoefer (201X)**
- Human-capital accumulation — **Imai and Kene (2004), Ljungqvist and Sargent (2006, 2008)**
- Adjustment costs — **Chetty (2012)**
- Amenities — **Hall and Mueller (2018)**

Job Menus: Allowing for Intensive Margins

- Choice j from a menu $J_{it} \in \{(y_{it,j}, v_{it,j})\}_j$: j-specific earnings and disutility/amenities
  - Nests j-specific heterogeneity in hours $\widetilde{h}^j_{it}$

$$\max_{a_{it}, j_{it} \in J_{it}, c_{it}} \mathbb{E}_t \sum_t u(j, c_{it}) \quad \text{s.t.} \quad a_{it} + c_{it} \leq a_{i,t-1}(1 + r_{t-1}) + (1 - \mathcal{T}_t) y_{it,j} + T_{it}(.)$$

- For any given wedge $1 - \mathcal{T}_t$, intensive-margin job choice (ignoring participation):

$$\Rightarrow j^*(1 - \mathcal{T}_t) = \underset{j \in J_{it}}{\text{argmax}} \{\mathbb{E}_t \sum_t u(j, c_{it}) \text{ s.t. (BC) } | 1 - \mathcal{T}_t\}$$

- Extensive-margin choice respecting intensive margin choice:

$$\Rightarrow e^*_{it} = \begin{cases} 0 & \text{if} \quad (1 - \mathcal{T}_t) y_{it}^{j^*(1-\mathcal{T}_t)} \lambda_{it} < v_{it}^{j^*(1-\mathcal{T}_t)} \\ 1 & \text{if} \quad (1 - \mathcal{T}_t) y_{it}^{j^*(1-\mathcal{T}_t)} \lambda_{it} \geq v_{it}^{j^*(1-\mathcal{T}_t)} \end{cases}$$

- Implicitly defined RW *conditional on having (re-)optimized job choice*:

$$1 - \tau^*_{it} = \frac{v_{it}^{j^*(1-\tau^*_{it})}}{y_{it}^{j^*(1-\tau^*_{it})} \lambda_{it}}$$

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Aggregation: Labor Supply Curve at Extensive-Margin

- **CDF** of the RWs, $F_t(1-\tau^*)$, fully characterizes the EM-ALSC
- **"Aggregate wage" concept:** shifts in $1-\mathcal{T}_t$
  - Taxes, wage growth (e.g., marginal product shifts,...),...
  - Frischian, λ-constant variation
- **(Desired) Employment Rate:**

$$E_t(1-\mathcal{T}_t) = P(1-\tau^* \leq 1-\mathcal{T}_t) = F_t\left(1-\mathcal{T}_t\right)$$

- **Marginal Individual**: $1-\tau^*_{it} = 1-\mathcal{T}_t$
- **Employment Adjustment:** Increase in aggregate wedge from $(1-\mathcal{T}_t)$ to $(1-\mathcal{T}_t')$:

$$dE_t = F_t\left(1-\mathcal{T}_t'\right) - F_t\left(1-\mathcal{T}_t\right)$$

- **Discrete Elasticity:**

$$\frac{F_t\left(1-\mathcal{T}_t'\right) - F_t\left(1-\mathcal{T}_t\right)}{F_t\left(1-\mathcal{T}_t\right)} \Bigg/ \frac{\left(1-\mathcal{T}_t'\right)-\left(1-\mathcal{T}_t\right)}{1-\mathcal{T}_t}$$

Infinitesimal:

$$\frac{(1-\mathcal{T}_t)f_t(1-\mathcal{T}_t)}{F_t(1-\mathcal{T}_t)}$$

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Model Meta-Analysis: EM-ALSCs as RWs

- Make tangible ⇒ recast respective detailed model into RW framework
- Make comparable ⇒ unifying bridge across models

Three-step "recipe" for each model:

1. Define individual-level RW $1 - \tau_{it}^{*}$
2. Construct ALSC from CDF $F(1 - \tau_{it}^{*})$
3. Study properties – e.g. (local) elasticity

Models:

1. Representative "command" household with consumption insurance
2. Heterogeneous agent models with extensive margin
3. Lifecycle, intensive margins, and nonconvexities (Rogerson and Wallenius (2008))

Rep HH w/ Insurance and "Command" Labor Supply

$$\max_{\{c_{it},e_{it}\}_i,A_t} \mathbb{E}_0 \sum_{t=0}^{\infty} \int_0^1 [u_i(c_{it}) - e_{it} v_{it}] g(i) di$$

$$\text{s.t. } A_t + \int_0^1 c_{it} g(i) di \leq A_{t-1}(1+r_{t-1}) + \int_0^1 (1-\mathcal{T}_t) y_{it} e_{it} g(i) di + T_t$$

- Pooled budget constraint & full "insurance" $\Rightarrow \overline{\lambda}_t = \frac{\partial u_i(c_{it})}{\partial c_{it}} \quad \forall\ i$

1 Define micro RW:

$$1 - \tau_{it}^* = \frac{v_{it}}{\overline{\lambda}_t y_{it}}$$

2 CDF i.e. EM-ALSC:

$$E_t = F_t(1-\mathcal{T}_t) = P(1-\tau_{it} \leq 1-\mathcal{T}) = P\left(\frac{v_{it}}{y_{it}\overline{\lambda}_t} \leq 1-\mathcal{T}_t\right) = P\left(\frac{v_{it}}{y_{it}} \leq (1-\mathcal{T}_t)\overline{\lambda}_t\right)$$

$$= \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} \mathbb{1}\left[\frac{v}{y} \leq (1-\mathcal{T}_t)\overline{\lambda}_t\right] dG(v,y) \quad \Rightarrow \text{Properties of EM-ALSC follow } G(v,y)$$

RHH Example: Heterogeneity in Disutility

- Heterogeneity in v only: $v_{it} \sim G^{v}(v)$

1 Micro RWs characterized by disutility type $v(i)$:

$$1 - \tau^{*}_{it} = \frac{v_{it}}{\overline{y}_t \overline{\lambda}_t} = 1 - \tau^{*}_{vt}$$

2 Wedge distribution – and hence CDF and ALSC – inherits shape of v_{it}-distr'n:

$$E_t = F_t(1 - \mathcal{T}_t) = P\left(1 - \tau^{*}_{it} \leq 1 - \mathcal{T}_t\right) = P\left(v_{it} \leq \frac{1 - \mathcal{T}_t}{\overline{y}_t \overline{\lambda}_t}\right) = G^{v}\left(\frac{1 - \mathcal{T}_t}{\overline{y}_t \overline{\lambda}_t}\right)$$

3 Elasticity (local at $1 - \mathcal{T}_t$) is given by $\left[(1 - \mathcal{T}_t) g^{v}\left(\frac{1 - \mathcal{T}_t}{\overline{y}_t \overline{\lambda}_t}\right)\right] / \left[1 - G^{v}\left(\frac{1 - \mathcal{T}_t}{\overline{y}_t \overline{\lambda}_t}\right)\right]$

Rep HH Specific Example 1: Hansen (1985)

- $G(v, w)$ for homogeneous households:

$$y_{it} = \overline{y}_t \quad \forall i$$
$$v_{it} = \overline{v} = A \ln(1 - h_{it}) \forall i$$

1 Homogeneous micro RWs:

$$1 - \tau^*_{it} = 1 - \overline{\tau}^*_t = \frac{\overline{v}}{\overline{\lambda}_t \overline{y}_t}$$

2 Degenerate wedge distribution

$$F_t(1 - \mathcal{T}_t) = \begin{cases} 0 & \text{if} \quad 1 - \mathcal{T}_t < \frac{\overline{v}}{\overline{\lambda}_t \overline{y}_t} \\ 1 & \text{if} \quad 1 - \mathcal{T}_t > \frac{\overline{v}}{\overline{\lambda}_t \overline{y}_t} \end{cases}$$

3 Infinite Frisch elasticity

Log Change in Employment (non-Hansen)
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
0.0
1.0
0
Employment = 0.607
Employment Level (Hansen)
Hansen (Indivisible Labor)
−0.2
−0.1
0.0
0.1
0.2
Log Change in Aggregate Wedge

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Hansen (Indivisible Labor)
MaCurdy (Isoelasticity 0.32)
MaCurdy (Isoelasticity 2.5)

RHH Example: Constant Elasticity

Ex: If v follows power distribution, $\Rightarrow$ iso-elasticity (“MaCurdy", Gali):

$$\epsilon_{E_t,1-\mathcal{T}_t} = \frac{(1-\mathcal{T}_t)F_t(1-\mathcal{T}_t)}{F_t(1-\mathcal{T}_t)} = \frac{(1-\mathcal{T}_t)\alpha_v(1-\mathcal{T}_t)^{-1}\left(\frac{(1-\mathcal{T}_t)\overline{y}_t\overline{\lambda}_t}{v_{\mathbf{max}}}\right)^{\alpha_v}}{\left((1-\mathcal{T}_t)\overline{y}_t\overline{\lambda}_t/v_{\max}\right)^{\alpha_v}} = \boxed{\alpha_v}$$

- General conditions and cases in paper

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Heterogeneous Agent Models

- No insurance $\implies$ heterogeneity in λ_{it}
- Huggett (1993) model (one asset plus borrowing constraint) + extensive margin
  - Stochastic potential earnings (productivity)
  - Incomplete markets ⇒ imperfect insurance

$$\max_{c_{it}, e_{it}\in\{0,1\}, a_{it}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{c_{it}^{1-\sigma}}{1-\sigma} - \overline{v} e_{it} \right]$$

$$\text{s.t.} \quad a_{i,t+1} = (1-\mathcal{T}_t) y_{it} e_{it} + (1+r_t) a_{it} - c_{it}$$

$$a_{it} \geq \underline{a}$$

Heterogeneous Agent Models

After solving the model,

1. Define micro RW

$$1 - \tau^*_{ay} = \frac{\overline{v}}{\lambda_{ay} y}$$

- Within (a, y) individuals are homogeneous, so RWs are indexed by (a, y).
- Employed individuals tend to be higher productivity, lower assets.
- Marginal individuals exist within every productivity level.

2. CDF i.e. EM-ALSC:

$$E_t = F_t(1 - \mathcal{T}_t) = \sum_y \int_{\underline{a}}^{\infty} \mathbb{1}[1 - \tau^*_{a,y} \leq 1 - \mathcal{T}_t] \underbrace{\boxed{g(a, y)}}\, da$$

Complicated object given by earnings process and consumption/savings decisions!

3. Elasticities etc.?

- Calibrate $\sigma = 2$, $r = 0.03$, $\beta = 0.97$, earnings process Markovian (33 states) from HANK (Kaplan et. al 2018), $\bar{v}$ to match 0.607 (BLS E-Pop Feb. 2019)

0.6
0.4
0.2
0.0
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−0.4
−0.6
0.0
1.0
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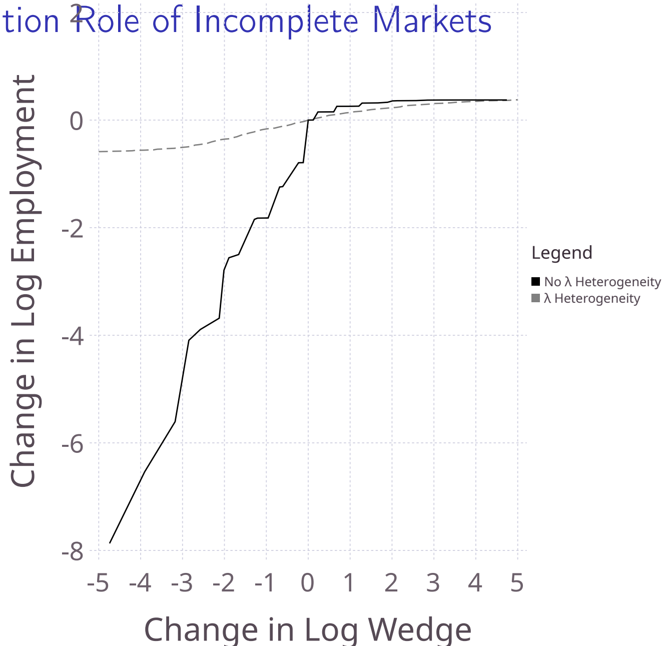
Heterogeneous Agent Model
Het. Agent Model Income Process Only

The Stabilization Role of Incomplete Markets



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Model Meta-Analysis: Rogerson-Wallenius (2008)

Model with heterogeneous wages and intensive margin hours choices

- OLG: unit mass of individuals born at every instant; alive between age $a \in [0,1]$.
- a-specific wages w_a – triangle $\Rightarrow$ lifecycle labor supply

$$\max_{c_a, h_a} \int_{a=0}^{1} e^{-\rho a} \left[u(c_a) - v(h_a) \right] da$$
$$\text{s.t.} \quad \int_{a=0}^{1} e^{-ra} c_a = \int_0^1 e^{-ra} y_a(h) da$$

- Intensive-margin choice: pick optimal hours with MaCurdy disutility $v(h_a) = \Gamma \frac{h_a^{\mathbf{1}+\mathbf{1}/\gamma}}{1+1/\gamma}$.
- Nonconvexity in form of fixed hours cost of working: $y_a(h_a) = w_a \max\{h_a - \underline{h}, 0\}$

Model Meta-Analysis: Rogerson-Wallenius (2008)

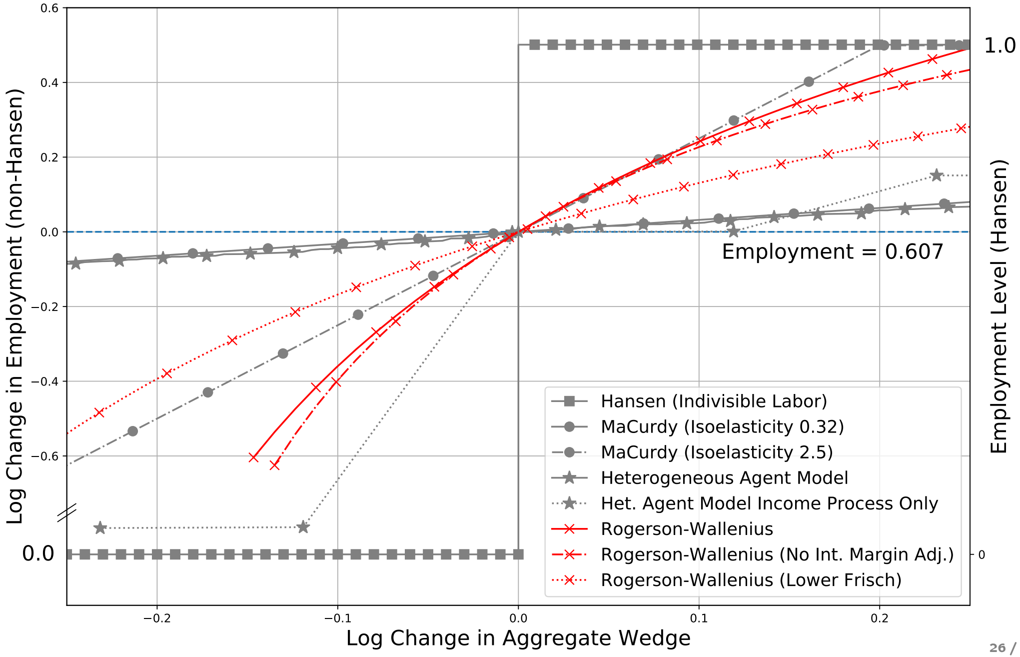
1. Define micro RW:

$$1 - \tau_a^* = \frac{v(h(a, 1-\tau_a^*))}{w_a[h(a, 1-\tau_a^*) - \bar{h}]\lambda} = \frac{\Gamma\left(\underline{h}(1/\gamma + 1)\right)^{1/\gamma}}{w_a \lambda}$$

2. CDF:

$$F(1-\mathcal{T}) = P\left(\frac{\Gamma\left(\underline{h}(1/\gamma+1)\right)^{1/\gamma}}{w_a\lambda} \leq 1-\mathcal{T}\right) = P\left(\frac{1}{w_a} \leq \frac{(1-\mathcal{T})\lambda}{\Gamma\left(\underline{h}(1/\gamma+1)\right)^{1/\gamma}}\right)$$

3. Shape? Elasticity? Determined by age (i) distribution and (ii) wage-age profile



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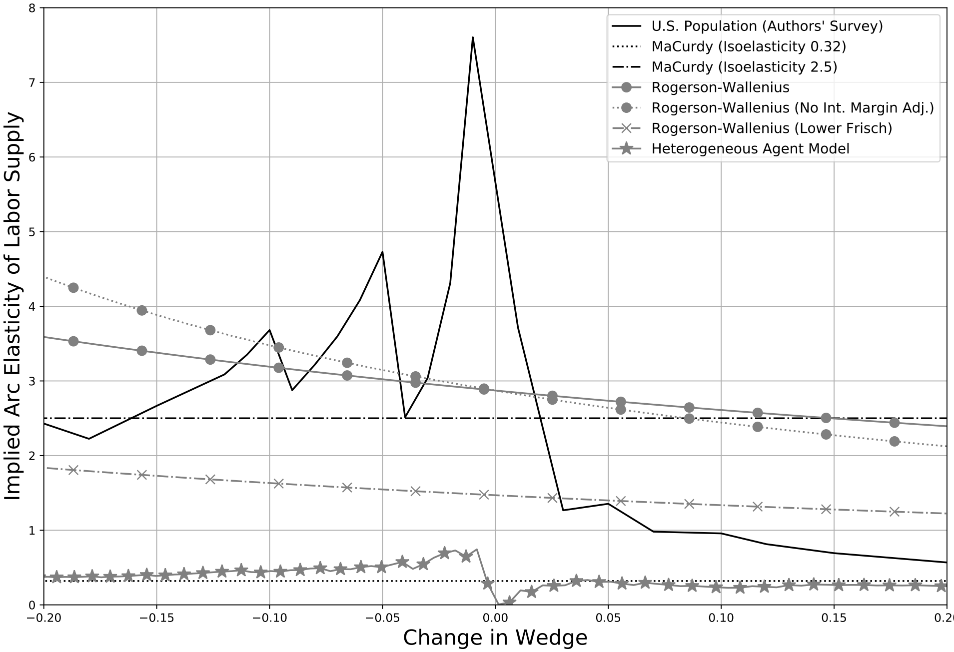

U.S. Population (Authors' Survey)
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Heterogeneous Agent Model
Implied Arc Elasticity of Labor Supply
Change in Wedge
0
1
2
3
4
5
6
7
8
−0.20
−0.15
−0.10
−0.05
0.00
0.05
0.10
0.15
0.20

Outline

1. Reservation Wedge Framework
2. Model Meta-Analysis
3. **Measurement In Survey**
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Measurement of the EM-ALSC

1. Our approach: survey to elicit preferences (reservation wedge)

Caveat: quality of responses

2. Quasi-experimental: response of *realized* employment to shifts in return to working
   - Canonical example: Icelandic tax holiday — **Bianchi, Gudmundsson, Zoega (2001)**
   - Identify one specific arc elasticity of global EM-ALSC:

$$\epsilon_{E_t,(1-\mathcal{T}_t)\to(1-\mathcal{T}_t')} = \frac{F_t(1-\mathcal{T}_t') - F_t(1-\mathcal{T}_t)}{F(1-\mathcal{T}_t)} \Bigg/ \frac{(1-\mathcal{T}_t') - (1-\mathcal{T}_t)}{1-\mathcal{T}_t}$$

Caveat: Realized (“net of frictions") vs. desired labor supply

3. Structural estimation

Caveat: Distributional assumptions, relies on realized employment too

Measurement of Reservation Wedge

- **Ideal Measure** (Frischian temporary tax wedge in a spot labor market):

  You are currently [non-]employed. Suppose the following thought experiment: you (and only you) receive a temporary linear incremental tax [or subsidy] on your take-home earnings (at whichever hours or job you may choose to work). At what incremental tax [or subsidy] rate would you be indifferent between not working for this period and working (at whichever job would be your best choice at that given tax [subsidy] rate)?

- **Feedback from MTurk pilots**:
  - "The wording of the question was confusing"
  - "bizarre scenario"
  - ...

Custom Reservation Wedge Survey

- **In practice:**
  - We translate this ideal questions into three variants, routed by labor force status.
  - Specify specific "Frischian" time horizon to "one month"
  - Piloting: evoke "job-constant" scenario
- Nationally representative U.S. survey of 2,000 respondents.
- Fielded by NORC (University of Chicago): AmeriSpeak Omnibus program
- March and April, 2019.
- To come (Fall 2019): Integration into German Socio-Economic Panel (additional covariates, etc.)

Survey Question: Out of Labor Force

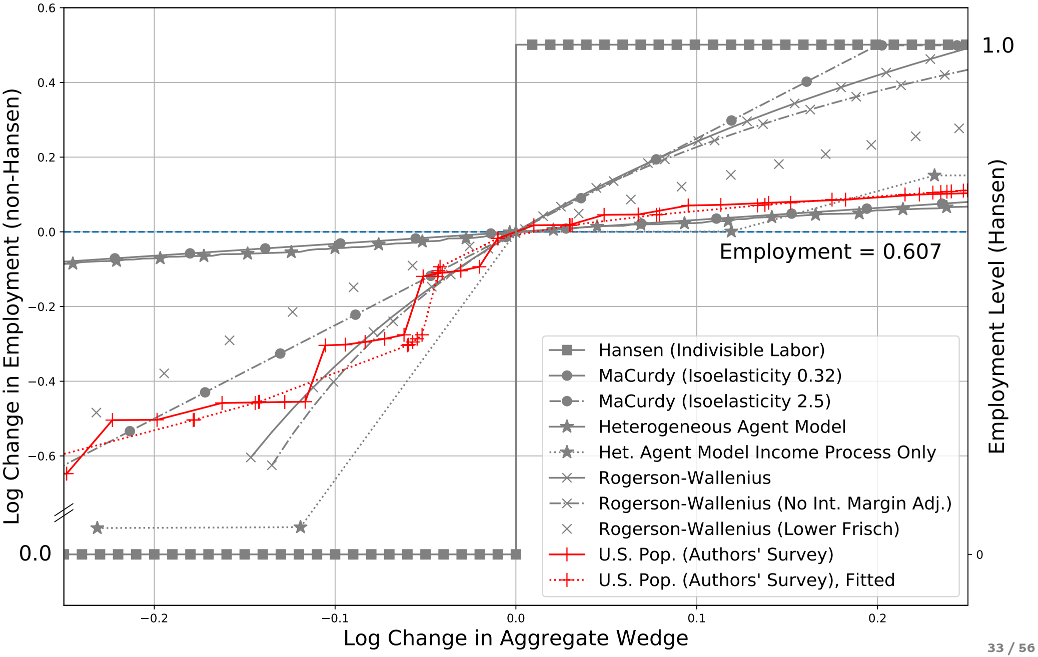
Think of the range of jobs that you would realistically be offered if you searched for jobs (even if you currently are not looking for a job and may not accept any of these potential jobs).

Suppose you had such job offers in hand. Currently you would likely not take such jobs, at least not at the usual salary. However, suppose the employer were nevertheless trying hard to recruit you, specifically by offering an additional sign-up bonus. The requirement to receive the bonus is that you will work for at least one month. The bonus comes as a raise of the first month's salary. This sign-up bonus will only be paid in the first month (on top of the regular salary that month), afterwards the salary returns to the regular salary.

...

5% means you would take the job if your employer paid a bonus of just 5% of the regular salary in the first month. 100% means you would require a bonus as large as the regular salary. 500% would mean you require a bonus equal to five times as large as the regular salary.

Other Q's



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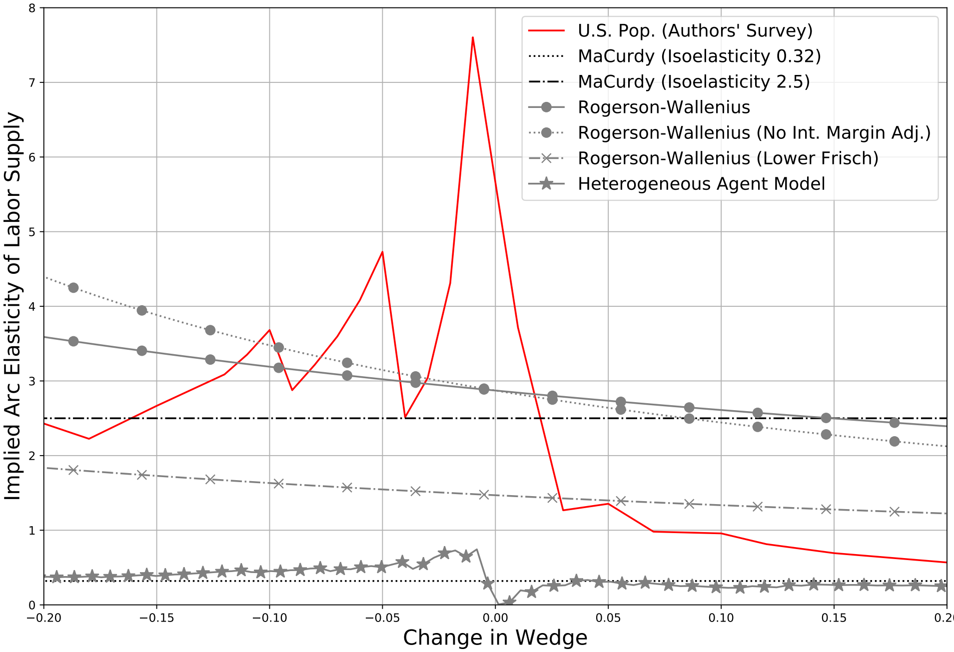
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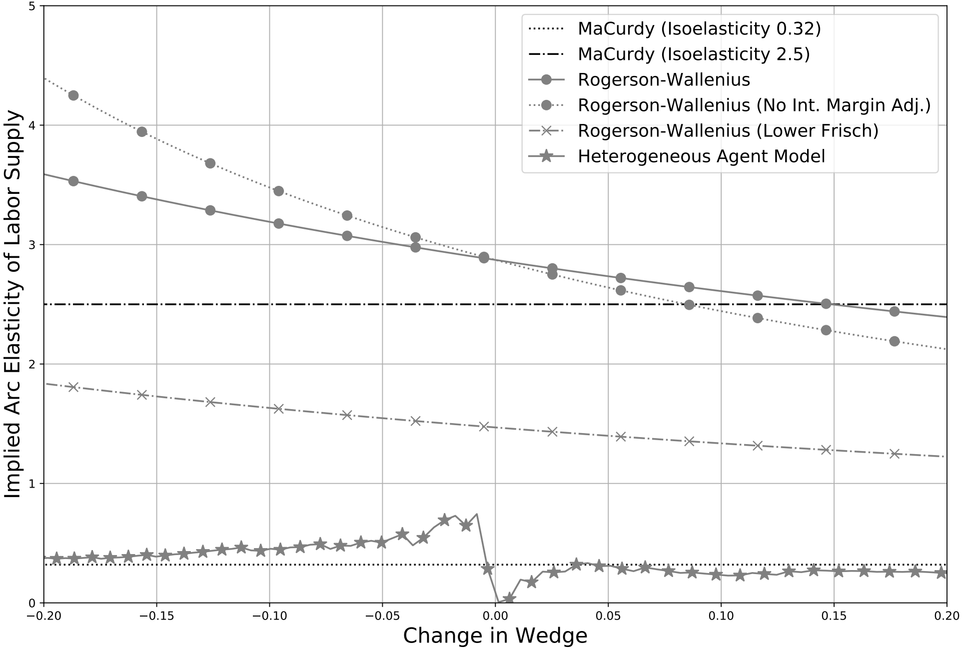
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Distribution of Reservation Wedge

	+/-		+		-	
Agg. L. S. Curve	$\frac{d\text{Emp}}{\text{Pop}} \times 100$	Elasticity	$\frac{d\text{Emp}}{\text{Pop}} \times 100$	Elasticity	$\frac{d\text{Emp}}{\text{Pop}} \times 100$	Elasticity
Panel A: **Interval: 0.01**						
Rog.-Wall.	1.74	2.87	1.73	2.84	1.76	2.90
Het. Agent	0.25	0.41	0.11	0.18	0.43	0.72
U.S. **Data**	3.44	5.66	2.26	3.72	4.61	7.59
Panel B: **Interval: 0.03**						
Rog.-Wall.	5.23	2.87	5.01	2.79	5.40	2.96
Het. Agent	0.75	0.42	0.42	0.23	1.04	0.58
U.S. **Data**	6.87	3.77	5.53	3.04	5.55	3.05
Panel C: **Interval: 0.05**						
Rog.-Wall.	8.72	2.87	8.30	2.74	9.18	3.02
Het. Agent	1.34	0.45	0.93	0.31	1.52	0.51
U.S. **Data**	7.49	2.47	4.11	1.35	3.35	2.01
Panel D: **Interval: 0.10**						
Rog.-Wall.	17.48	2.88	15.85	2.61	19.37	3.19
Het. Agent	2.45	0.41	0.93	0.16	1.52	0.25
U.S. **Data**	10.21	1.68	5.81	0.96	15.71	2.59

Outline

1. Reservation Wedge Framework
2. Model Meta-Analysis
3. Measurement In Survey
4. **Macro Implications**
    - Calibration target: global $V(E)$
    - Labor wedge with data-consistent $V(E)$

Calibrating the Labor Supply Curve

- None of the models capture the global empirical wedge distribution
- Next: one example matching it perfectly
- RHH $v \sim G^v(v)$

$$\max_{\bar{c}_t, \{e_{vt}\}, A_t} \mathbb{E}_0 \sum_{t=0}^{\infty} \left[u(\bar{c}_t) - \int e_{vt} v dG_t^v(v) \right]$$

$$\text{s.t. } A_t + \bar{c}_t \leq A_{t-1}(1 + r_{t-1}) + (1 - \mathcal{T}_t) y_t \int e_{vt} dG_t^v(v) + T_t$$

Data individual of type $1 - \hat{\tau}_{vt}$ **has peer** $v = (1 - \hat{\tau}_{vt}) \overline{y}_t \overline{\lambda}_t$ **in the model**

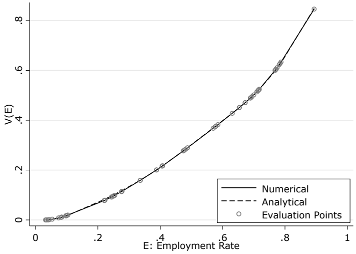
$$V(E) \equiv \int e_v v dG^v(v) = \int_{-\infty}^{\mu(E)} v dG^v(v)$$

$$V'(E) = \mu(E)$$

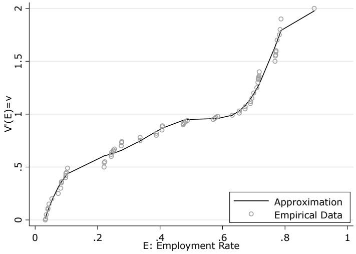
where $\mu(E) \equiv (G^v)^{-1}(E)$ is the quantile function of the disutility distribution.

Fitting Polynomial to $V(E)$

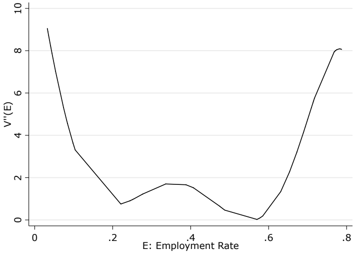
$V(E)$



Fit: $V'(E)$



$V''(E)$



Fit a (7th-order) polynomial to function of $V'(E) = \mu(E)$ (wedge at point E) to E (CDF) – get analytical antiderivative $V(E)$ and derivative $V''(E)$

$E = G(\mu(E))$. $V'(E) = \mu(E)g(\mu(E))\mu'(E) = \mu(E) > 0$, as $\mu'(E) = \frac{1}{g(\mu(E))}$. It is immediate that $V''(E) = \frac{1}{g(\mu(E))} > 0$ over the support.

Outline

1. **Reservation Wedge Framework**
2. **Model Meta-Analysis**
3. **Measurement In Survey**
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Revisiting the Labor Wedge $(1 - \theta_t)$

$$\ln C_t - V(E_t) \tag{2}$$

Three variants for $V(E_t)$:

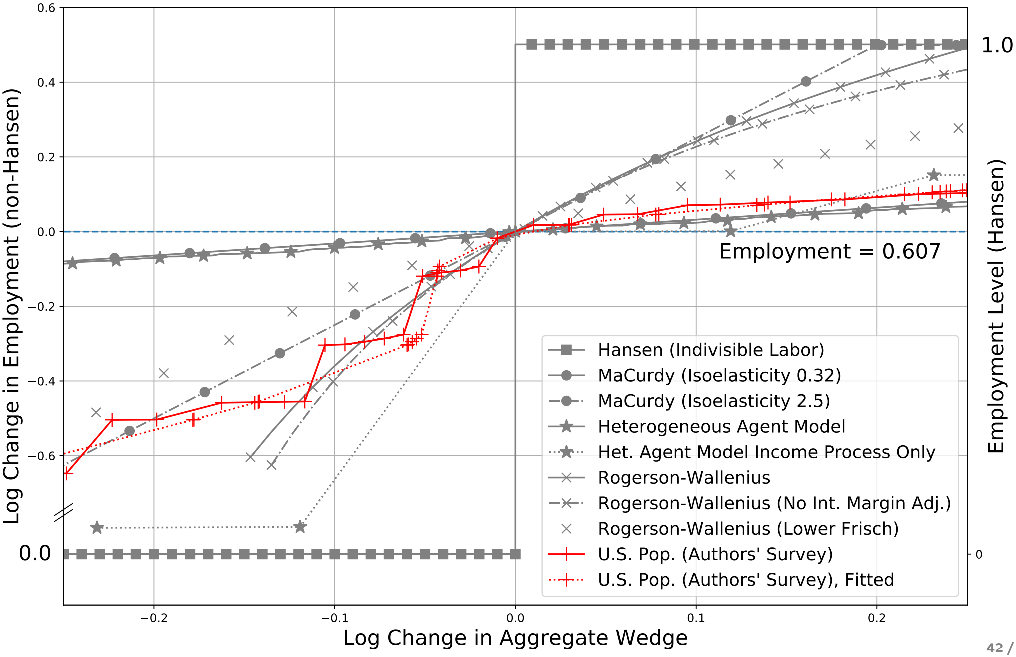
- Our fitted polynomial approximating the empirical global curve
- Iso-elasticity 0.32
- Iso-elasticity 2.5

$$(1 - \theta_t) F_L(L_t, K_{t-1}) = \frac{-U_L(C_t, L_t)}{U_C(C_t, L_t)} \tag{3}$$

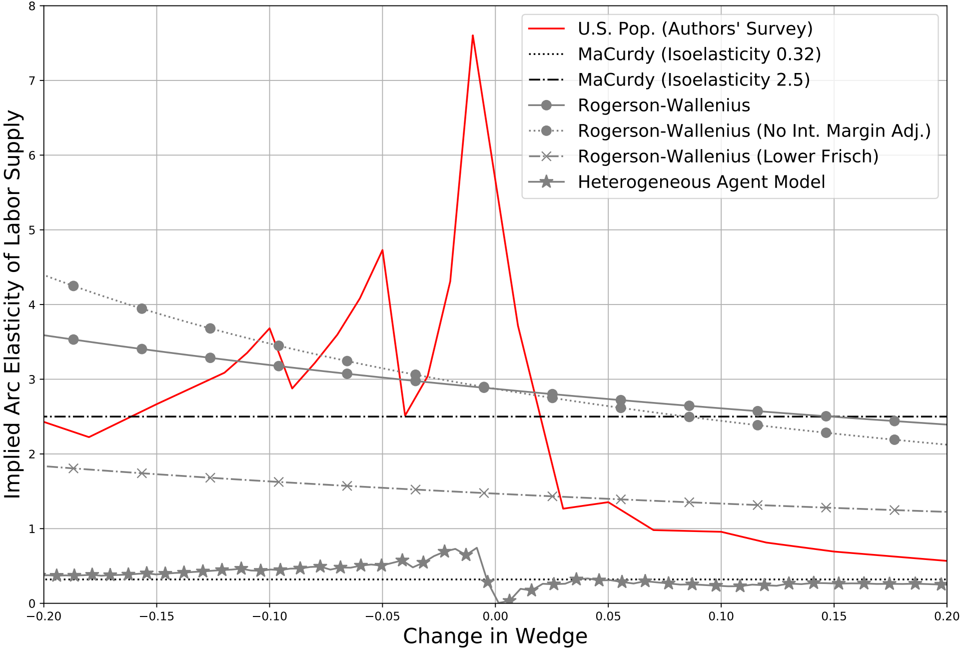
$$= V'(E_t) \cdot C_t \tag{4}$$

$(1 - \theta_t)$: measure of disequilibrium (symptom of frictions), mismeasurement or model misspecification

- See Chari, Kehoe, McGrattan (2007), Shimer (2009)
- Apply to US business cycles post-1960

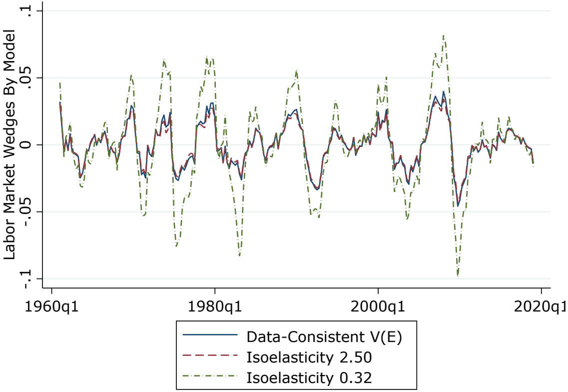


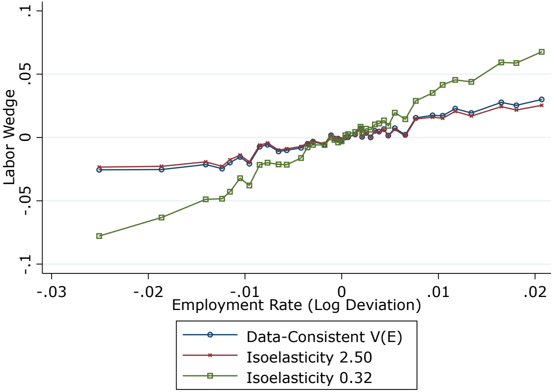
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
0.0
1.0
0
Log Change in Employment (non-Hansen)
Employment Level (Hansen)
Employment = 0.607
Hansen (Indivisible Labor)
MaCurdy (Isoelasticity 0.32)
MaCurdy (Isoelasticity 2.5)
Heterogeneous Agent Model
Het. Agent Model Income Process Only
Rogerson-Wallenius
Rogerson-Wallenius (No Int. Margin Adj.)
Rogerson-Wallenius (Lower Frisch)
U.S. Pop. (Authors' Survey)
U.S. Pop. (Authors' Survey), Fitted
−0.2
−0.1
0.0
0.1
0.2
Log Change in Aggregate Wedge



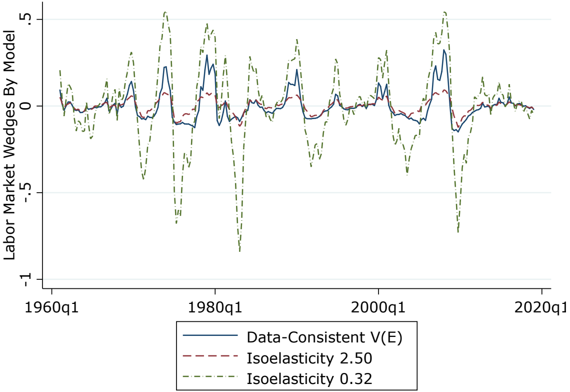
U.S. Pop. (Authors' Survey)
MaCurdy (Isoelasticity 0.32)
MaCurdy (Isoelasticity 2.5)
Rogerson-Wallenius
Rogerson-Wallenius (No Int. Margin Adj.)
Rogerson-Wallenius (Lower Frisch)
Heterogeneous Agent Model
Implied Arc Elasticity of Labor Supply
Change in Wedge
0
1
2
3
4
5
6
7
8
−0.20
−0.15
−0.10
−0.05
0.00
0.05
0.10
0.15
0.20

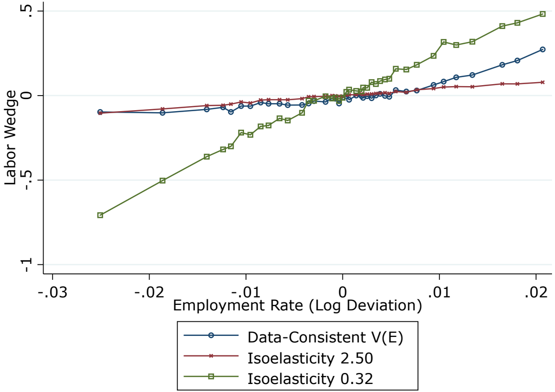
Labor Wedges: Time Series and Binned Scatter Plot



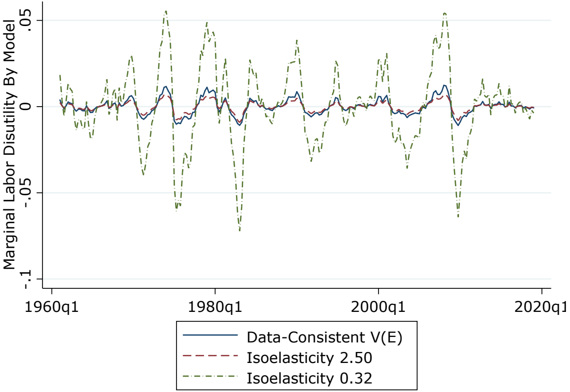


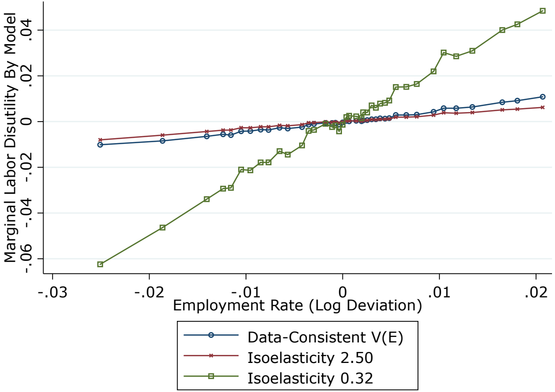
Labor Wedges: Amplify Emp-Fluct Entering $V'(E)$ x10



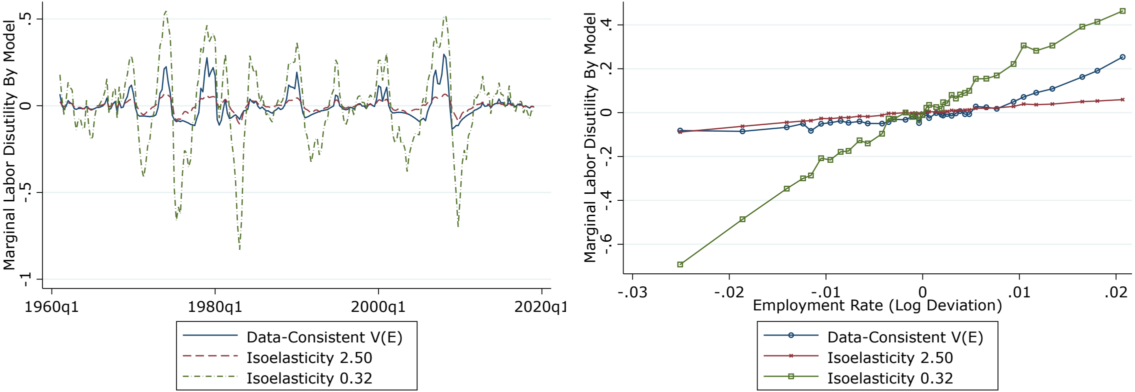


Marginal Disutility of Labor





Marginal Dis'y of Labor: Amplify Emp-Fluct Entering $V'(E)$ x10



This Paper

1. **Propose basic framework for EM-ALSC**

$1-\mathcal{T}_t$: **Prevailing aggregate wedge:** linear, homogeneous mark-up/down on labor income

$1-\tau^*_{it}$: **Micro reservation wedge:** hypothetical $1-\mathcal{T}_t$ rendering i indifferent b/w working and not:

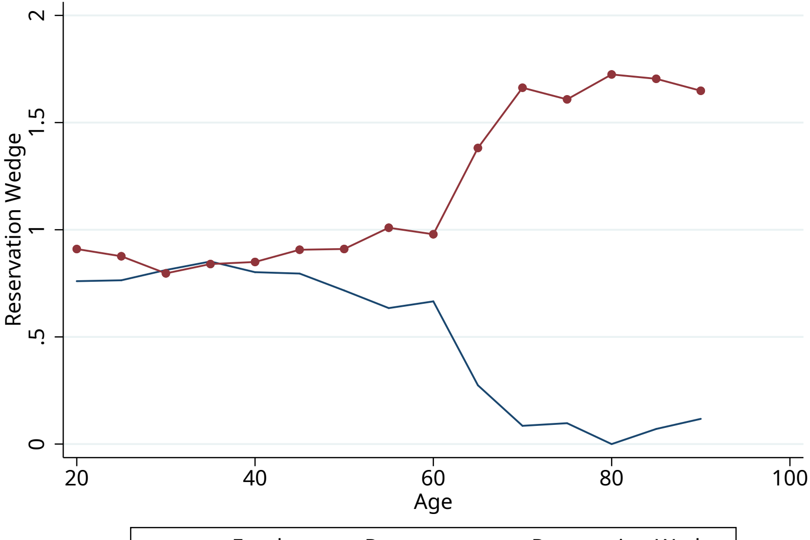
- Frischian i.e. λ_{it}-constant pertubation in $1-\mathcal{T}_t$

$F_t(1-\tau^*)$: **Aggregation** of individual RW's ⇒ short-run EM-ALSC:

$$E_t = P(1-\tau^*_{it} \leq 1-\mathcal{T}_t) = F_t(1-\mathcal{T}_t)$$

2. **Model meta-analysis:** recast in RW framework to uncover & make comparable ALSCs
3. **Custom survey of U.S. pop'n:** directly measure RW distribution (US EM-ALSC)
   - Large local elasticities of 3 and up
   - Non-constant, asymmetric arc-elasticities: smaller elasticities upwards
4. **Macro implications of empirical EM-ALSC** used as calibration target
   - No existing model provides tight fit
   - Fit one model's $F_t(1-\tau^*)$ tightly to the empirical analogue
   - Labor wedge exercise: considerably less cyclical

Reservation Wedges in the United States, by Age



Survey Question: Employed

Suppose, for reasons unrelated to you, your employer offers you the following choice: Either you take unpaid time off from work for one month, or you stay in your job for that month and only receive a fraction of your regular salary. No matter what choice you take, after the month is over, your salary will return to normal.

In this hypothetical scenario, you cannot take an additional job to make up for the lost income during that month.

Assume this choice is real and you have to make it. At what point would the cut in your salary be just large enough that you would choose the unpaid month of time off over working for the month at that lower salary?

For example, an answer of 5% means that a 5% wage cut would be the point where you would choose to take unpaid time off for the month instead of working for 5% lower pay during that month. But if the wage cut was less than 5%, you would instead choose to work for that than take unpaid time off. Choose any percentage between 1% to 100%, where the cut wage cut is just large enough that you would prefer to not work at all for no pay than work at reduced pay for that month.

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Survey Question: Unemployed

Suppose you have found the kind of job you are looking for and the employer would like to hire you. The regular start date for the job is one month away. As an alternative, your employer offers you the option to start working immediately, rather than waiting a month.

However, if you chose to start work immediately, for that first month, you will only receive a fraction of the regular salary. The job is otherwise exactly the same. No matter what choice you take, after the month is over, the salary will then resume at the regular salary. In this hypothetical scenario, you cannot take an additional job to make up for the lost income during that month.

.... At what point would the cut in your salary be just large enough that you would choose the waiting a month without working and without the salary over starting the job immediately for the first month at that lower salary?

For example, an answer of 5% means that a 5% wage cut...

Appendix: Specific Intensive-Margin: Hours Choice

Suppose MaCurdy preferences, with flexible hours choice $h^j \in [0, \infty)$. FOC for hours is:

$$\Psi h_{it}{}^{1/\eta} = (1 - \mathcal{T}_t) w_{it} \lambda_{it}$$

- Without reoptimization of hours:

$$\overbrace{\frac{\Psi h^*_{it}{}^{1+1/\eta}}{1+1/\eta}}^{v_{it}} = (1 - \tau^*_{it}) \overbrace{w_{it} h^*_{it}}^{y_{it}} \lambda_{it}$$

$$\Leftrightarrow 1 - \tau^*_{it} = \frac{\Psi_{it} h^*_{it}{}^{1+1/\eta}}{(1+1/\eta) w_{it} \lambda_{it}} = \frac{1}{1+1/\eta} > 0$$

- With reoptimization, note that it holds that:

$$\Psi h^*_{it}{}^{1/\eta} = (1 - \mathcal{T}_t) \lambda_{it} w_{it} h^*_{it}$$

...and so the RW is trivial – no meaningful extensive margin:

$$h^*_{it} = 0 \Leftrightarrow 1 - \tau^*_{it} = 0 \quad \forall i$$

$\Rightarrow$ Need non-convexity/fixed cost (e.g. Rogerson and Wallenius (2008)) or limited job menu.

Back

B. Intertemporal Substitution (Frisch) Elasticities	
10. Carrington (1996)	0.43
11. Gruber and Wise (1999)	0.23
12. Bianchi, Gudmunndsson, and Zoega (2001)	0.42
13. Card and Hyslop (2005)	0.38
14. Brown (2009)	0.18
15. Manoli and Weber (2011)	0.25
Unweighted Mean	0.32

Chetty, Guren, Manoli, Weber (2012)

Application: Conditions for Constant Elasticity

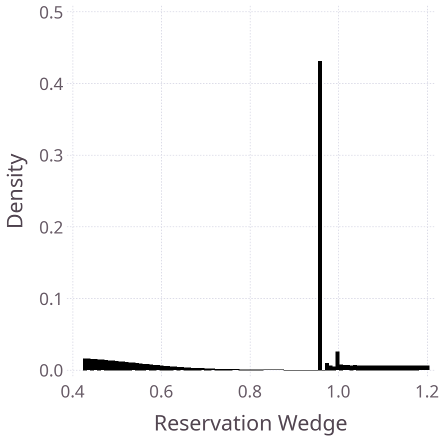
Specifically, the distributional assumptions for the property in power-law terms specify a standard power law distribution $F(X) = P(x < X) = a \cdot \left(\frac{x}{X_{\mathbf{min}}}\right)^{-\gamma+1}$ with shape parameter $\gamma > 0$. A comparison with our wedge-based power-law-like distribution (**??**) and a rearrangement clarify that we require the *inverse* of our wedge to follow a power distribution:

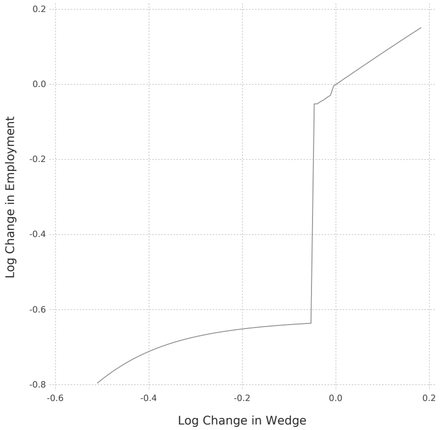
$$G_{1-\tau^*}(1-\tau^*) = P(X < 1-\tau^*) = \left(\frac{1-\tau^*}{(1-\tau^*)_{\max}}\right)^{\alpha_{\mathbf{1}-\tau^*}} \quad (5)$$

$$\Leftrightarrow P\left(\frac{1}{1-\tau^*} < \frac{1}{X}\right) = \left(\frac{\frac{1}{1-\tau^*}}{\frac{1}{(1-\tau^*)_{\mathbf{max}}}}\right)^{-\alpha_{\mathbf{1}-\tau^*}} \quad (6)$$

which is a power-law distribution of $\frac{1}{1-\tau^*}$ with minimum $\frac{1}{(1-\tau^*)_{\mathbf{max}}}$, and shape parameter $\gamma = \alpha_{1-\tau^*} + 1$.

Appendix: Two-State Heterogeneous Agent





Appendix: 3 states from Heterogeneous Agent Model