The Work-Leisure Tradeoff: Identifying the Heterogeneity

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January 2, 2019

Abstract: Labor force participation is a key determinant of important aggregates in the economy, such as employment and hours worked. Understanding and predicting the behavior of participation in the macroeconomy requires identifying individuals' trade-off for work and leisure correctly, and the underlying heterogeneity. However, since observed work-leisure choices are influenced by various other determinants such as year, age, and cohort effects, it is difficult to identify the heterogeneity in these preference parameters using standard data without imposing some additional assumptions. In addition, observational data suffers from issues such as labor market frictions and unobservables, which may lead to biased inference. We address this challenge by designing a novel survey in which respondents are presented with multiple scenarios, in each of which they are asked to choose between two different job offers. The scenarios vary work hours, wage offers, and the outside option of non-work. These scenarios are individual-specific, and take into account the individual's household income, consumption, and current and past labor market history. Using the variation in this rich data, we estimate a labor supply model to recover the *unique* preference parameters separately for each demographic group (such as gender, education, and income) without imposing any parametric assumptions on the underlying distribution of the heterogeneity in preferences. The elasticities implied by the estimated parameters vary systematically across these demographic groups. For example, the wage elasticity with respect to leisure is negative for only part-time hours for younger females (that is, younger females are willing to increase labor supply in response to an increase in wages, but only in the range of part-time hours). On the other hand, the estimated elasticity is negative for younger males for all (except very long) hours. There is also substantial heterogeneity in estimated elasticities *within* each of the demographic groups. In order to highlight the importance of this heterogeneity, we assess the impact of policy changes in the tax policy and childcare subsidies on labor supply in a labor supply model with and without this heterogeneity.

Keywords: labor supply; gender; household survey.

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Motivation

- Labor supply elasticities are of great interest to both macro and microeconomists.
  - Policy responses
  - Business cycle responses
  - Optimal design of tax and transfer systems

- Much of the literature has focused on the discrepancy between magnitudes
  - Macro vs micro elasticities
  - Intensive vs extensive-margin
  - Which elasticity to use?

Issues

1. Is there only one elasticity of labor supply for everyone or should we consider heterogeneity?
   - Preferences for consumption and leisure are significantly affected by
     - ★ Gender
     - ★ Family composition
     - ★ Education
     - ★ Age
   - Why might this heterogeneity matter?
     - ★ For both the aggregate and the distributional impact of the policy responses.

Issues

2. In order to calculate labor supply elasticities using observational data, we need to make strong assumptions on:
   - the choice set
   - labor market frictions such as offer arrival probabilities and job separation rates
   - determinants of labor demand

- Inference will be based on the validity of these assumptions.

- These confounds interact non-trivially with the underlying heterogeneity.

Issues

3. The variation commonly used to estimate the labor supply elasticities:

   - quasi-experimental
     - ★ "local" – the change in policy only affects a certain demographic group
     - ★ often used to calculate elasticities for the whole population

   - cross-country variation
     - ★ difference in behavior attributed to a single policy
     - ★ change in the economic environment might be affecting different groups in the population differently.

   - Not properly accounting for these variations in the data may lead to biased estimates.

This Paper

We design a novel survey in which respondents are presented with hypothetical job scenarios to estimate preferences over consumption and leisure.

- individual-specific scenarios that vary work hours and wage offers
- elicit job choices allowing for a choice of unemployment
- elicit consumption decisions associated with each job choice
- the value of outside option is also individual-specific

Use these variation in the data to estimate labor supply models

- Recover group-specific preference parameters
- Analyze the elasticities implied by these "pure" preference estimates

This Paper

Advantages of this stated-preference (hypothetical methodology) approach:

- Variation is exogenous
- Fully observe the offer distribution and the choice set
- No need to make any assumptions on labor market frictions or on the labor demand side
- The preferences are identified from the "labor supply" side.

This Paper

How well do stated choices compare with actual choices?

- Stated-choice approach yields meaningful responses when the hypothetical scenarios presented to respondents are **realistic** and **relevant** for them.
- Several papers show that there is **strong correspondence between stated and actual choices** for
  - alternative work arrangements: Mas & Pallais (2017)
  - workplace amenities: Wiswall & Zafar (2018)
  - household financial decisions: Parker & Souleles (2017)

Overview of Results

- There is no "one value" of elasticity in a given economy.
  - There is substantial heterogeneity across demographic groups.
  - Within-group variation is also sizable.
- The shape of the distribution for the elasticities within broad demographic groups imply that using the mean elasticities from aggregate/broadly-defined groups leads to biased policy evaluation.

Outline

1. Related Literature
2. Data
3. A Static Labor Supply Model
4. Estimation & Results
5. [A Life-Cycle Labor Supply Model] - if time permits
6. Conclusion and Roadmap

Related Literature

Vast literature on labor supply elasticities:

- Heckman and MaCurdy (1980); MaCurdy (1983); Altonji (1986); Blundell, Duncan, and Meghir (1998); Blundell, MaCurdy, and Meghir (2007); Meghir and Phillips (2008); Blundell, Bozio, and Larqoue (2011); Keane (2011); Keane and Rogerson (2012); Guner, Kaygusuz, and Ventura (2012); Attanasio, Low, Levell, and Sanchez-Marcos (2017).

Hypothetical-choice methodology:

- Ameriks, Briggs, Caplin, Shapiro, and Tonetti (2015); Mas and Pallais (2017); Fuster, Kaplan, and Zafar (2018); Wiswall and Zafar (2018).

Data

We designed a special module added to the NY Fed's Survey of Consumer Expectations in December 2017.

- SCE is a monthly, online survey to elicit expectations about economic variables.
- Rotating panel of around 1,000 household heads.
- Respondents participate for up to 12 months.
- Geographically representative.
- Sample is more highly educated (college degree or higher).

Survey Design

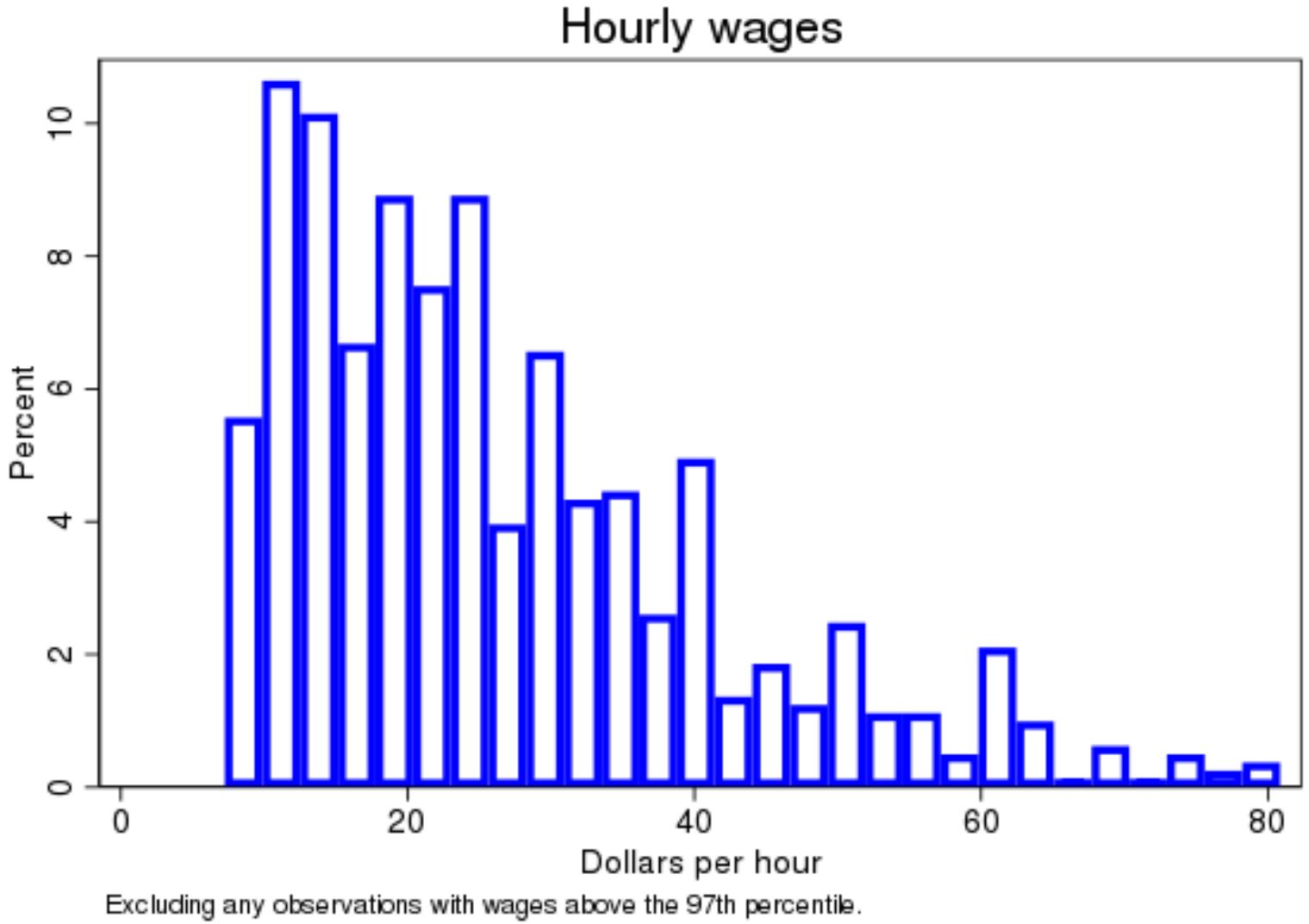
3 stages:

1. Ask about current labor market status, work hours, earnings, family composition, household wealth.
    - Rich information on the underlying heterogeneity.
    - Use the current or most recent job's wage as an anchor for the scenario wages.

Sample Characteristics

	SCE	CPS	p-value
Male	0.50	0.52	0.31
White	0.81	0.77	0.00
Age	45.36	45.67	0.49
	(11.85)	(11.70)	
Bachelor's Degree or higher	0.58	0.37	0.00
Married	0.64	0.61	0.06
Number of Children	0.70	0.90	0.00
Employed	0.82	0.75	0.00
Unemployed	0.04	0.02	0.09
Working PT	0.13	0.13	0.86
Hourly wage — college	36.01	37.50	0.23
	(20.49)	(18.88)	
Hourly wage — no college	23.21	22.25	0.27
	(11.18)	(12.73)	
Observations	838	36,185	

Current or Most Recent Hourly Wage



Survey Design

3 stages:

2. **Consider the "hypothetical" situation where everything about you is the same as your current situation EXCEPT that you are currently not working**
   a. Elicit search behavior and reservation wage.

Survey Design - Search Behavior

For the questions below consider the "hypothetical" situation where everything about you is the same as your current situation EXCEPT that you are currently not working.

You are deciding whether to search for a job or not. Searching for a job involves activities such as spending time looking at job postings, applying to jobs, doing interviews, waiting to hear back for results etc. If you do not search, you will have access to your savings and other household assets and potentially other government benefits (such as Medicaid, SNAP, etc.). If you search, you might receive additional government benefits (such as the Unemployment Insurance).

Consider your current personal situation and assume you are currently NOT working. Would you search for a job?

Please select only one.

- ○ Yes, I would search for BOTH full-time and part-time jobs
- ○ Yes, I would search for full-time jobs only (Note: full-time means working at least 35 hours per week)
- ○ Yes, I would search for part-time jobs only (Note: part-time means working less than 35 hours per week)
- ○ No, I would not search

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0% 25% 50% 75% 100%

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Survey Design - Search Behavior

Group	PT only	PT and FT	FT only	Would not search
Full sample	92	373	266	107
Female	43	209	121	53
Male	49	164	145	54
Working full-time	16	283	246	12
Working part-time	33	67	10	9
College graduates	46	220	170	42
Female, with kids	15	87	44	21
Male, with kids	5	78	63	6

Survey Design

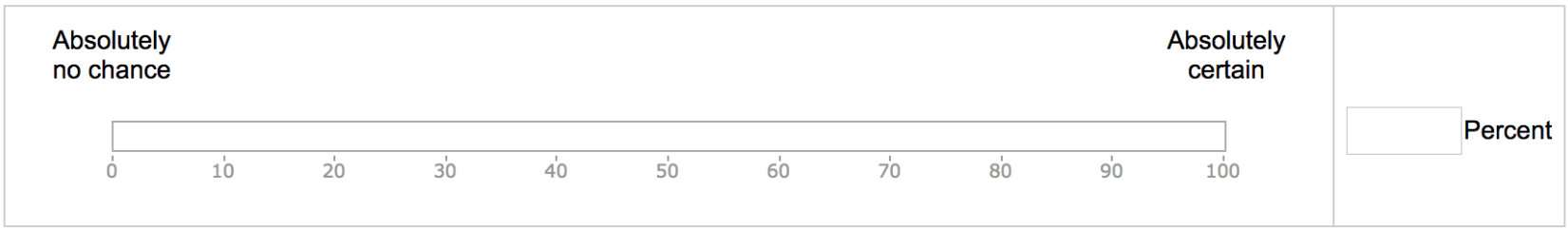
3 stages:

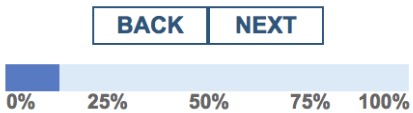
2. **Consider the "hypothetical" situation where everything about you is the same as your current situation EXCEPT that you are currently not working**
   a. Elicit search behavior and reservation wage.
   b. Elicit subjective probability of receiving job offers

Survey Design- Probability of receiving job offers

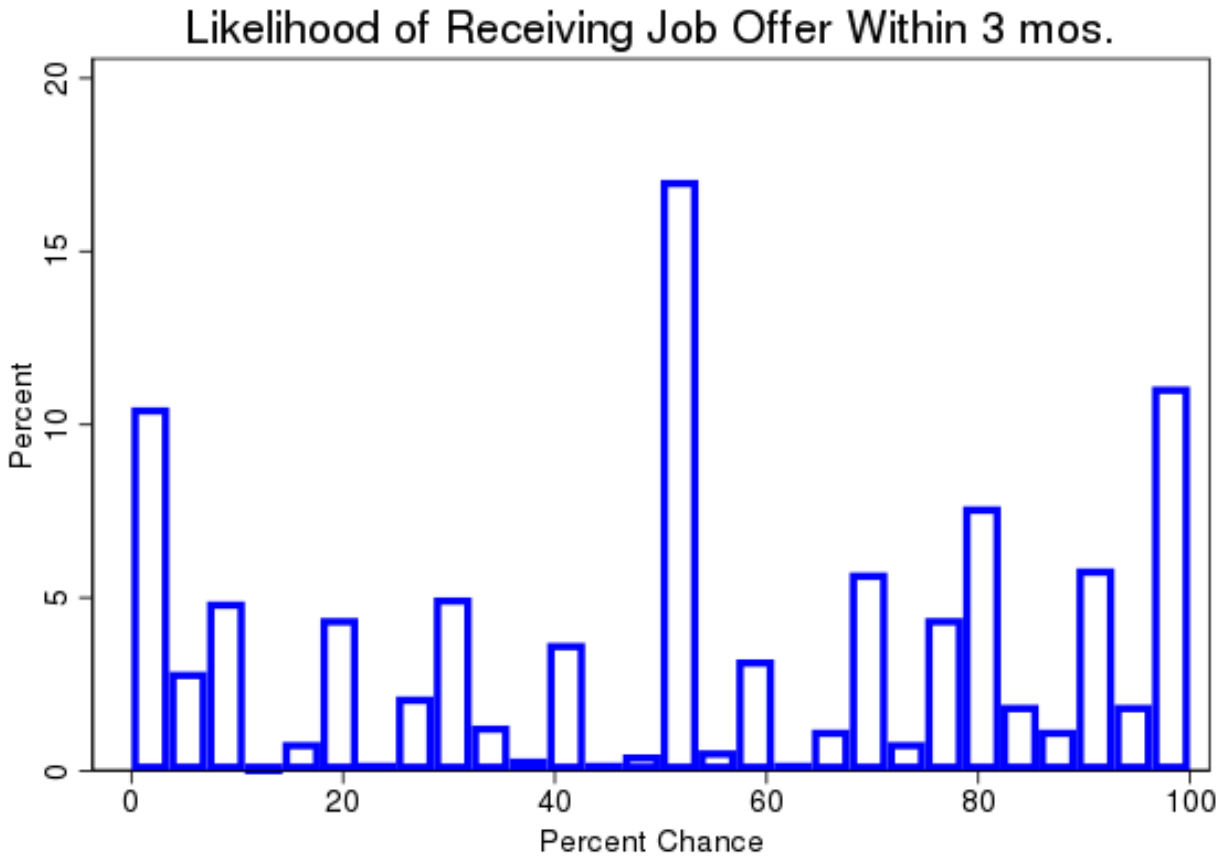
Consider the case where you are searching for jobs. What do you think is the percent chance that you will receive at least one job offer within the next three months?

Please enter your answer by clicking on the scale below or entering your response in the box to the right of the scale.





Survey Design- Probability of receiving job offers



Survey Design - Expected offer wage distribution

Example: For an individual who earns $40/hour:

Consider the case where you are searching for jobs and receive at least one job offer. Think about the job offers that you may receive within the next three months. Of the job offers that you might receive, what percent of them do you think will offer an hourly wage of...

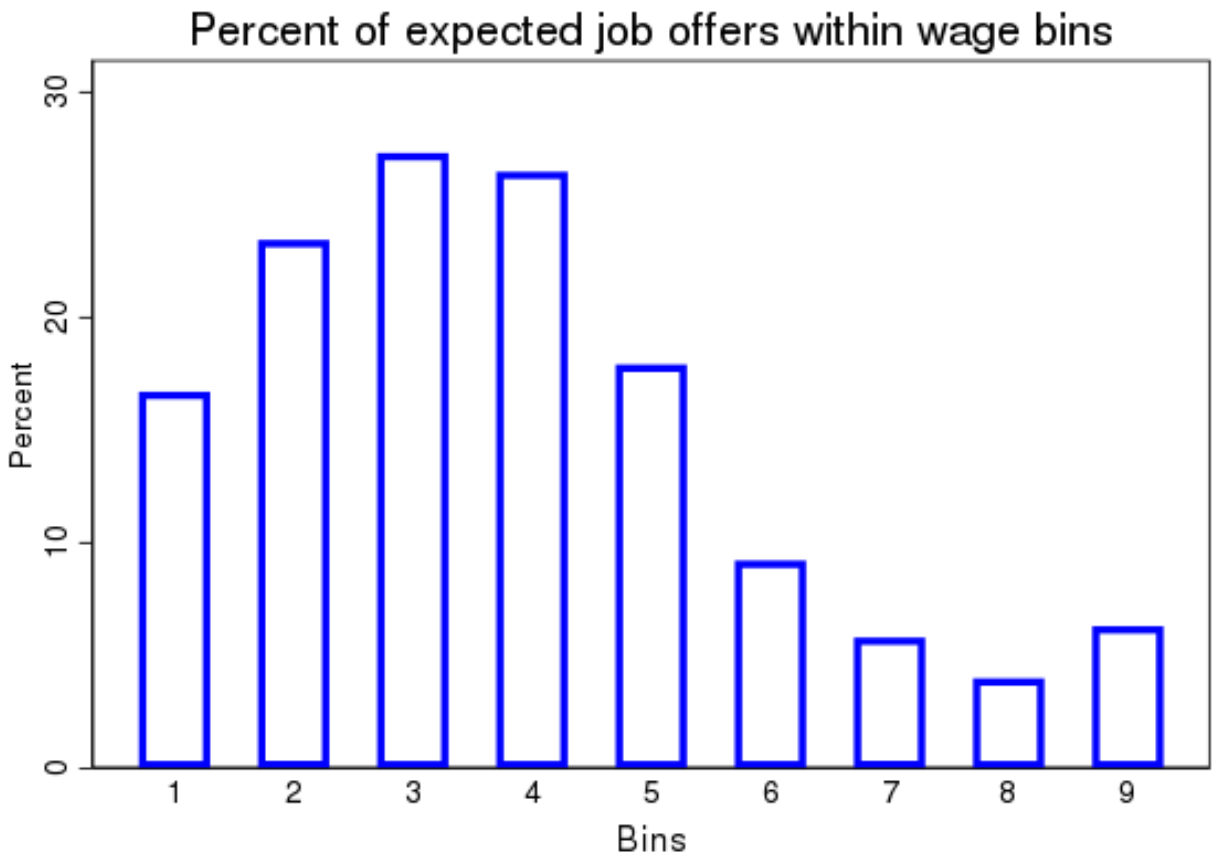
*(Please note: The numbers need to add up to **100**.)*

Less than $20.00		percent
Between $20.00 and $30.00		percent
Between $30.00 and $38.00		percent
Between $38.00 and $42.00		percent
Between $42.00 and $50.00		percent
Between $50.00 and $60.00		percent
Between $60.00 and $70.00		percent
Between $70.00 and $78.00		percent
More than $78.00		percent
TOTAL	0	

BACK | NEXT

0% 25% 50% 75% 100%

Survey Design - Expected offer wage distribution



Survey Design

3 stages:

1. Ask about current labor market status, work hours, earnings, family composition, household wealth.

2. **Consider the "hypothetical" situation where everything about you is the same as your current situation EXCEPT that you are currently not working**
   a. Elicit search behavior, reservation wage, subjective probability of receiving job offers.
   b. Elicit subjective probability of receiving job offers
      - ★ Get Z_{1i}: the lower end of the lowest job offer wage bin for which a person puts a non-zero probability of receiving.
      - ★ Get Z_{2i}: the higher end of the highest job offer wage bin for which a person puts a non-zero probability of receiving.

Survey Design - Subjective probability of receiving job offers

Example: For an individual who earns $40/hour:

Consider the case where you are searching for jobs and receive at least one job offer. Think about the job offers that you may receive within the next three months. Of the job offers that you might receive, what percent of them do you think will offer an hourly wage of...

*(Please note: The numbers need to add up to **100**.)*

Less than $20.00		percent	
Between $20.00 and $30.00		percent	
Between $30.00 and $38.00	15	percent	→ Z1
Between $38.00 and $42.00	35	percent	
Between $42.00 and $50.00	20	percent	
Between $50.00 and $60.00	20	percent	
Between $60.00 and $70.00	10	percent	→ Z2
Between $70.00 and $78.00		percent	
More than $78.00		percent	
TOTAL	100		

Survey Design

3 stages:

1. Ask about current labor market status, work hours, earnings, family composition, household wealth.

2. **Consider the "hypothetical" situation where everything about you is the same as your current situation EXCEPT that you are currently not working**
   a. Elicit search behavior, reservation wage, subjective probability of receiving job offers.
   b. Elicit subjective probability of receiving job offers
      - ★ Get Z_{1i}: the lower end of the lowest job offer wage bin for which a person puts a non-zero probability of receiving.
      - ★ Get Z_{2i}: the higher end of the highest job offer wage bin for which a person puts a non-zero probability of receiving.

3. Hypothetical job scenarios
   - Anchor the wage offers to Z_{1i} and Z_{2i}.

Survey Design - Scenarios

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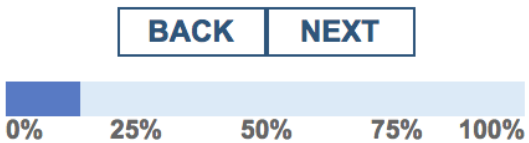
You will next be presented with 10 different scenarios where you will be asked to choose between various work options. Put yourself in the situation where everything about you is the SAME as your current situation. Now assume that you are NOT working.

In each of these scenarios you will be presented with 2 potential jobs. Each job will be characterized by an hourly wage rate and the weekly required work hours. These 2 jobs will **otherwise be identical** in all other aspects (including the likelihood of being laid off, and the wage growth at the job).

You will have the choice of accepting either one of the jobs or rejecting both. If you reject both jobs, you will have access to your household assets and other savings, and you may also get certain government benefits. You will also have the choice of continuing to search for jobs, in which case you may get *additional* government benefits, such as the unemployment insurance.



Survey Design - Scenarios

- Hypothetical job scenarios:
  - Each individual gets 10 scenarios based on the types of job they are willing to search for.
  - Each scenario includes 2 job offers and the option of remaining unemployed.
  - Scenarios vary both wages and hours. Wages are determined based on Z_{1i} and Z_{2i}.
  - The continuation values for each job and staying unemployed is specified.

- Consumption:
  - Ask about the consumption expenditures for each job alternative and the option of staying unemployed.
  - Value of outside option.

Survey Design-Scenarios

This is scenario 9 of 10. Now consider the case where you have received the following 2 job offers:

Options	Hourly Wage Rate	Weekly Work Hours	Weekly Earnings
Job 1	**$51.10**	**40**	**$2,044**
Job 2	**$54.70**	**50**	**$2,735**

As before, these two jobs are **otherwise identical** in all other aspects.

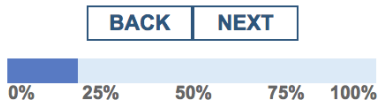
You have the option of choosing one of the jobs, or rejecting both. If you accept either one of the jobs, there is a 2% chance of being laid off from that job in three months, in which case you would start over and decide whether to look for a job or not. If you decide to look for a job (after being laid off from one of the jobs or after choosing to stay unemployed), the likelihood of you receiving at least one offer in the next 3 months will be 43%, and the offers you receive will be picked at random from the set of twenty jobs shown to you earlier. If you are not laid off, you will continue to work at the job at the specified wage rate, with the wage growing at a rate of 0.5% over a 3-month period. Your assets will also grow at a rate of 0.5% over a 3-month period.

When answering these questions, please ignore the effects of price inflation on earnings. That is, assume that one dollar today is worth the same as one dollar in the future.

Which option would you choose?

Please select only one.

- ○ Job 1
- ○ Job 2
- ○ I will stay unemployed, and continue to search.
- ○ I will stay unemployed, and will not search for a job.



Choices - Key Descriptives

	All	Employed	Female	Male
Always stay unemployed	0.00	0.00	0.00	0.00
Always choose one of the jobs	0.61	0.63	0.59	0.63
Always choose highest hours	0.00	0.00	0.00	0.00
Always choose highest earnings	0.08	0.07	0.07	0.09
Consumption $>$ chosen income	0.06	0.04	0.05	0.06

- The choices are highly reasonable with very few extreme choices of always choosing unemployment or always choosing the highest hours.
- Rich variation as a result of the individually-relevant scenario design.

Details on Choices

	All				Female				Male			
Hours	Mean wage	Mean earn.	Mean cons.	Frac. choosing	Mean wage	Mean earn.	Mean cons.	Frac. choosing	Mean wage	Mean earn.	Mean cons.	Frac choosing
Scenario 2												
20	18.72	374.3	334.2	0.03	16.04	320.7	280.9	0.01	22.2	444.1	403.5	0.05
35	22.25	778.8	410.7	0.79	19.54	684.1	353.3	0.80	25.77	902	485.4	0.78
0	-	-	390.3	0.18	-	-	331.6	0.19	-	-	466.9	0.17
Scenario 9												
40	30.39	1215	485.2	0.49	25.35	1014	407.8	0.52	36.95	1478	586.1	0.45
55	33.6	1848	584.1	0.47	28.48	1567	496.7	0.43	40.28	2215	697.9	0.52
0	-	-	390.3	0.05	-	-	331.6	0.06	-	-	466.9	0.03

- Significant gender gap in offer wages.
- Data reflects the difference in preferences.

A Static Labor Supply Model

- Modeling within-period preferences over consumption and leisure.
- Especially useful for generating preferences for intensive-margin allocations.
- Relevant for generating steady-state elasticities.

A Static Labor Supply Model

We define the within-period utility for each individual over consumption and leisure per week:

$$U(c_i, \ell_i) = \frac{c_i^{1-\phi_{g_i}} - 1}{1 - \phi_{g_i}} + \alpha_{g_i} \frac{\ell_i^{1-\theta_{g_i}} - 1}{1 - \theta_{g_i}} + \epsilon_{hi}$$

- ϕ_{g_i} and θ_{g_i} will determine
  - the curvature of the utility function with respect to consumption and leisure
  - the Marshallian and Hicksian elasticities
- $\epsilon_{hi} \sim N(0, \sigma^2_{ug_i})$ is a choice-specific preference shock.
  - needed to derive the likelihood function
  - capture any preference an individual has for a specific length of work hours

Budget constraint:

$$c_i = w_i(H - \ell_i) + N_i$$

The Choice Set

If the individual searches for

- only full-time jobs:

$$h_i \in \{35, 37, 40, 45, 50, 55, 65\}$$

$$\begin{aligned}\text{scenarios} =\{&(35, 45, 0), (35, 37, 0), (35, 45, 0), (40, 50, 0), (40, 50, 0),\\ &(40, 55, 0), (40, 55, 0), (55, 65, 0), (55, 65, 0), (55, 65, 0)\}\end{aligned}$$

- only part-time jobs:

$$h_i \in \{15, 17, 18, 20, 22, 25, 30\}$$

$$\begin{aligned}\text{scenarios} =\{&(15, 22, 0), (15, 17, 0), (15, 22, 0), (18, 25, 0), (18, 25, 0),\\ &(15, 30, 0), (15, 30, 0), (20, 30, 0), (20, 30, 0), (20, 30, 0)\}\end{aligned}$$

- both full-time and part-time jobs:

$$h_i \in \{15, 18, 20, 25, 30, 35, 40, 50, 55, 65\}$$

$$\begin{aligned}\text{scenarios} =\{&(20, 35, 0), (20, 35, 0), (25, 35, 0), (25, 40, 0), (18, 20, 0),\\ &(15, 30, 0), (40, 50, 0), (55, 65, 0), (40, 55, 0), (40, 50, 0)\}\end{aligned}$$

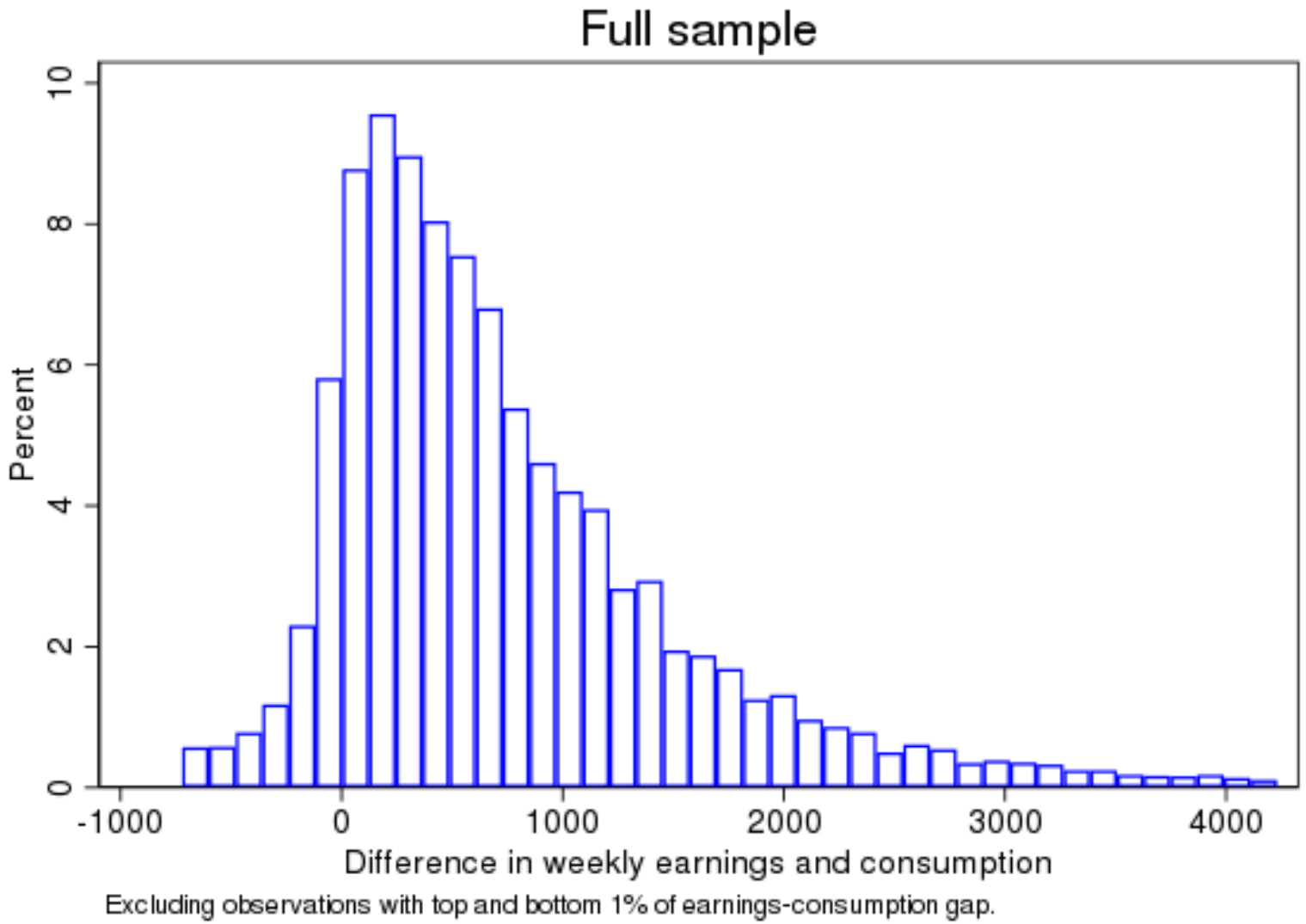
Consumption

- We observe the consumption decision associated with each job choice.
  - Counterfactual and actual choices.
- In order to be able to simulate responses, we still need to specify the process for consumption.
- We fit a flexible polynomial in wages and hours to the consumption choices:

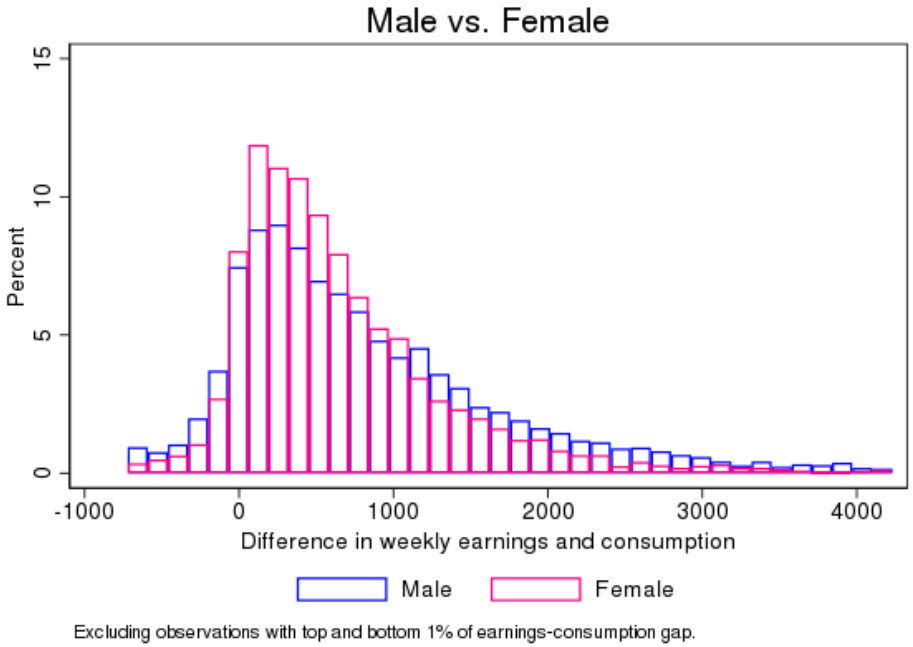
$$c_i = \beta_{0i} + \beta_{1i} w_i + \beta_{2i} h_i + \beta_{3i} w_i h_i + \beta_{4i} w_i^2 + \beta_{5i} h_i^2 + \epsilon_{ci}$$

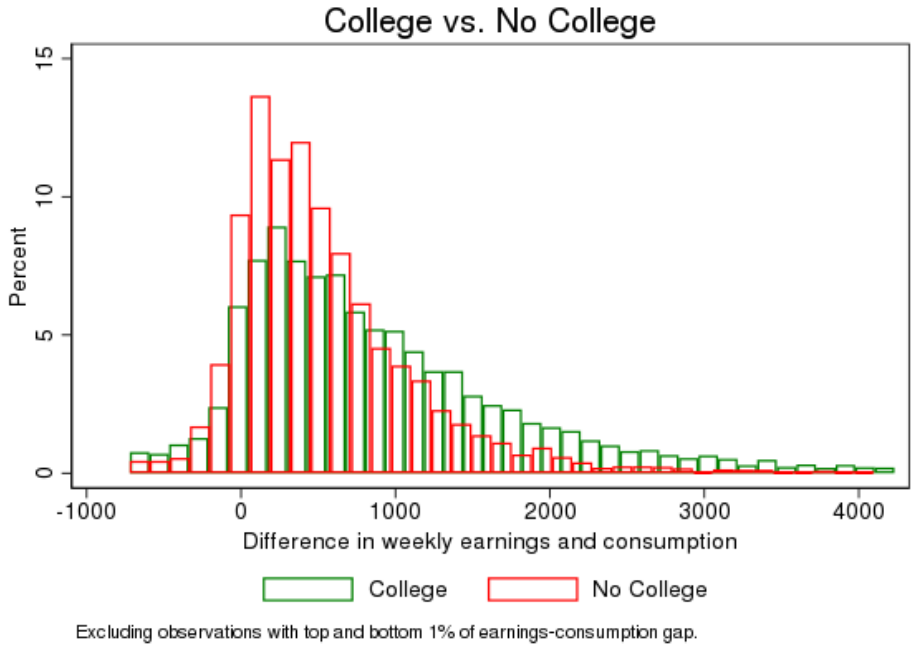
- The R^2s from these individual-level regressions are between 0.82-0.99.

Consumption



Consumption





Estimation

For a demographic group g

- Model Parameters:

$$\Theta = \{\phi_g, \theta_g, \alpha_g, \sigma_g, f_g\}$$

- Likelihood function:

$$\mathcal{L}(\Theta; \text{data}) = \prod_{i=1}^{N_g} \left[\sum_{s=1}^{10} \pi_s \mathcal{L}_{is}(\Theta; data) \right]$$

$$\mathcal{L}_{is}(\Theta; data) = \Pr(d_{is} = 1|\Theta)^{\mathbf{1}\{d_{is}=1\}} \Pr(d_{is} = 2|\Theta)^{\mathbf{1}\{d_{is}=2\}} \Pr(d_{is} = 3|\Theta)^{\mathbf{1}\{d_{is}=3\}}$$

- Standard errors are calculated using re-estimating the model on 200 block bootstrap replicates of the data (where the block corresponds to the individual).

Estimation

$$u_1 = \underbrace{\frac{(c_1 - f)^{1-\phi}}{1-\phi} + \alpha \frac{(H - h_1)^{1-\theta}}{1-\theta}}_{\mathbf{A}} + \epsilon_{h1},$$

$$u_2 = \underbrace{\frac{c_2 - f)^{1-\phi}}{1-\phi} + \alpha \frac{(H - h_2)^{1-\theta}}{1-\theta}}_{\mathbf{B}} + \epsilon_{h2},$$

$$u_3 = \underbrace{\frac{c_3^{1-\phi}}{1-\phi} + \alpha \frac{(H)^{1-\theta}}{1-\theta}}_{\mathbf{C}},$$

where $\epsilon_{h1}, \epsilon_{h2} \sim N(0, \sigma_u^2)$. Then,

$$\begin{aligned} \Pr(d_{is} = 1|\Theta) &= \Pr\left(\epsilon_{h1} \geq \max\{B + \epsilon_{h2}, C\} - A\right) \\ &= \int_{C-A}^{\infty} F(A - B + \epsilon_{h1}) f(\epsilon_{h1})\, d\epsilon_{h1} \end{aligned}$$

Elasticites

- After estimating the model for different demographic groups, we simulate each individual 5000 times and calculate responses. Then we change the wages and simulate the choices once again.

- We'll focus on two elasticities:
  - Marshallian (uncompensated)
  - Hicksian (compensated)

Definition of Labor Supply Elasticities

Marshallian (uncompensated):

- How hours within a period change in response to a wage change?
- Change in labor supply as a result of a tax change, if the tax change is not compensated.
- Includes both the substitution and income effects.

Definition of Labor Supply Elasticities

Hicksian (compensated):

- How hours within a period change in response to a wage change, holding the utility constant?
- Change in labor supply as a result of a tax change, if the tax change is compensated with a lump-sum transfer to keep the utility constant.
- Includes only the substitution effect.
- Using the Slutsky equation:

$$\text{Marshallian elasticity} = \text{Hicksian elasticity} + \text{Income effect}$$

Marshallian Elasticites for Hours of Work

	All	Female	Male	Female with kids	Male with kids
$\eta_h^M : h = 20$	0.580	0.568	0.585	0.260	0.315
$\eta_h^M : h = 30$	0.227	0.213	0.230	-0.038	0.036
$\eta_h^M : h = 40$	0.058	0.043	0.061	-0.179	-0.094
$\eta_h^M : h = 55$	-0.061	-0.082	-0.065	-0.280	-0.187

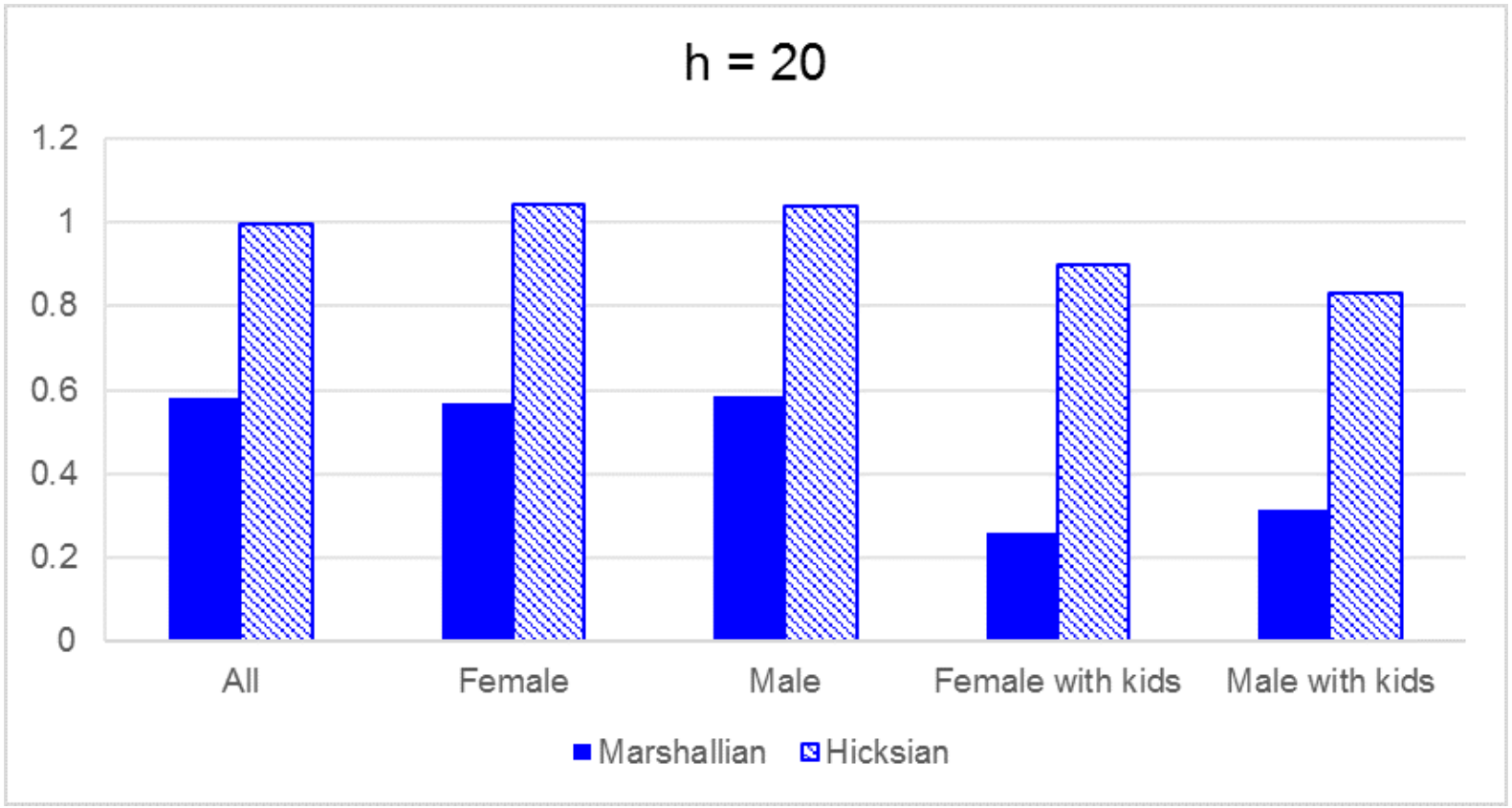
- Group-level elasticities are calculated using the coefficients estimated using data for each group.
- The level of elasticities falls in the range of estimates found in the literature.
- Substantial heterogeneity across groups.

Hicksian Elasticites for Hours of Work

	All	Female	Male	Female with kids	Male with kids
$\eta_h^M : h = 20$	0.996	1.043	1.037	0.899	0.831
$\eta_h^M : h = 30$	0.655	0.670	0.665	0.584	0.536
$\eta_h^M : h = 40$	0.479	0.482	0.478	0.425	0.387
$\eta_h^M : h = 55$	0.323	0.326	0.323	0.294	0.263

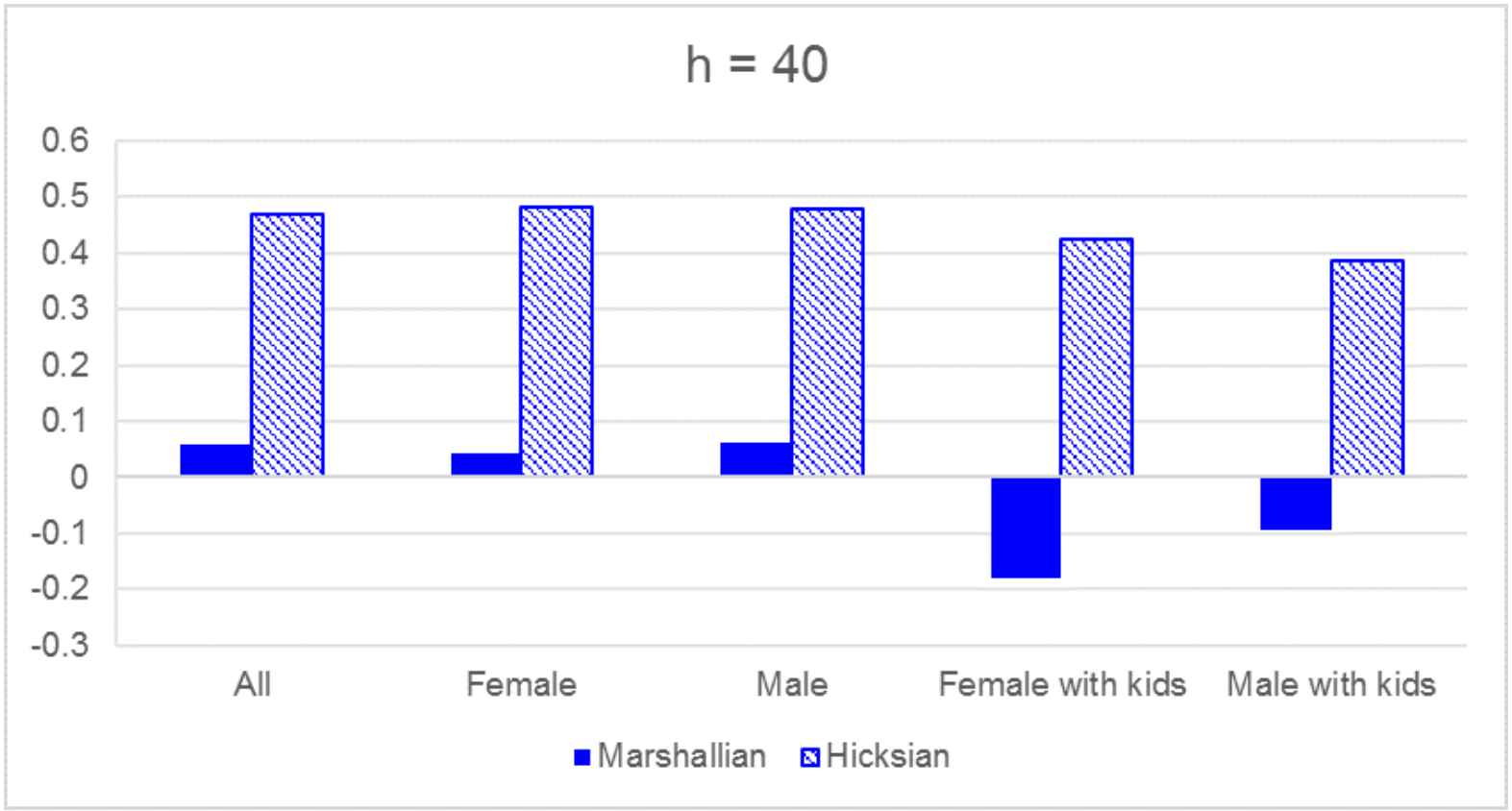
- Less heterogeneity across groups
- Big chunk of the across-group heterogeneity comes through the income-effect.

Marshallian vs Hicksian Elasticities



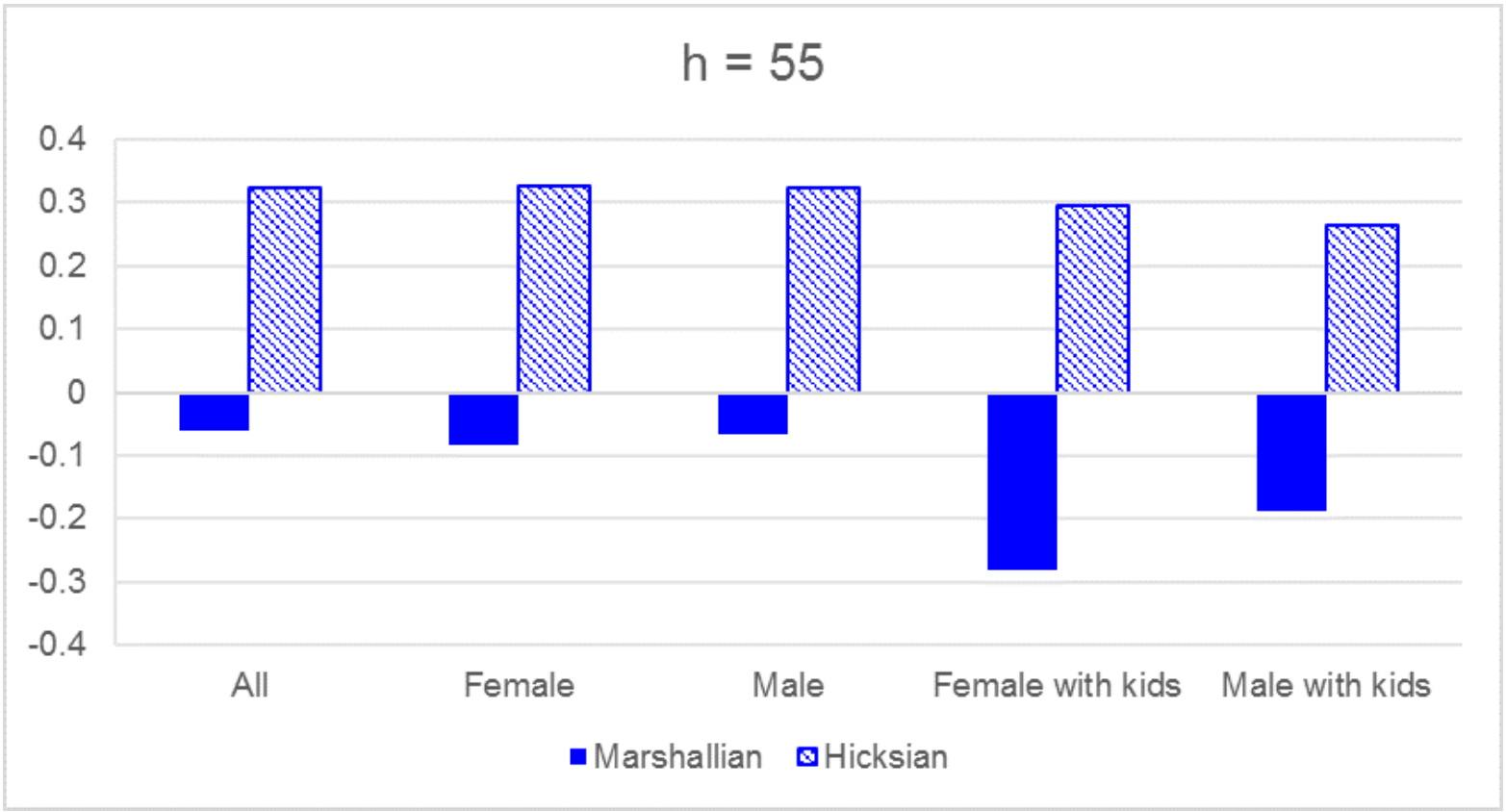
- Moderate income effect at low hours.

Marshallian vs Hicksian Elasticities



- Income effect starts to dominate for women with kids at higher hours.

Marshallian vs Hicksian Elasticities



- Income effect dominates for all groups at higher hours.

Within-group Heterogeneity in Elasticites

The rich variation in our data allows us to:

- Estimate this model at narrowly defined groups.
  - gender X education X marital status X existence of kids
- Simulate elasticities using the parameter estimates from these "disaggregrated" groups.

This enables us to get an idea of the within-group heterogeneity and distribution of elasticities for broader groups.

We also get a sense of the bias in policy evaulation due to ignoring the underlying heterogeneity.

Marshallian Elasticities - Within-group Heterogeneity

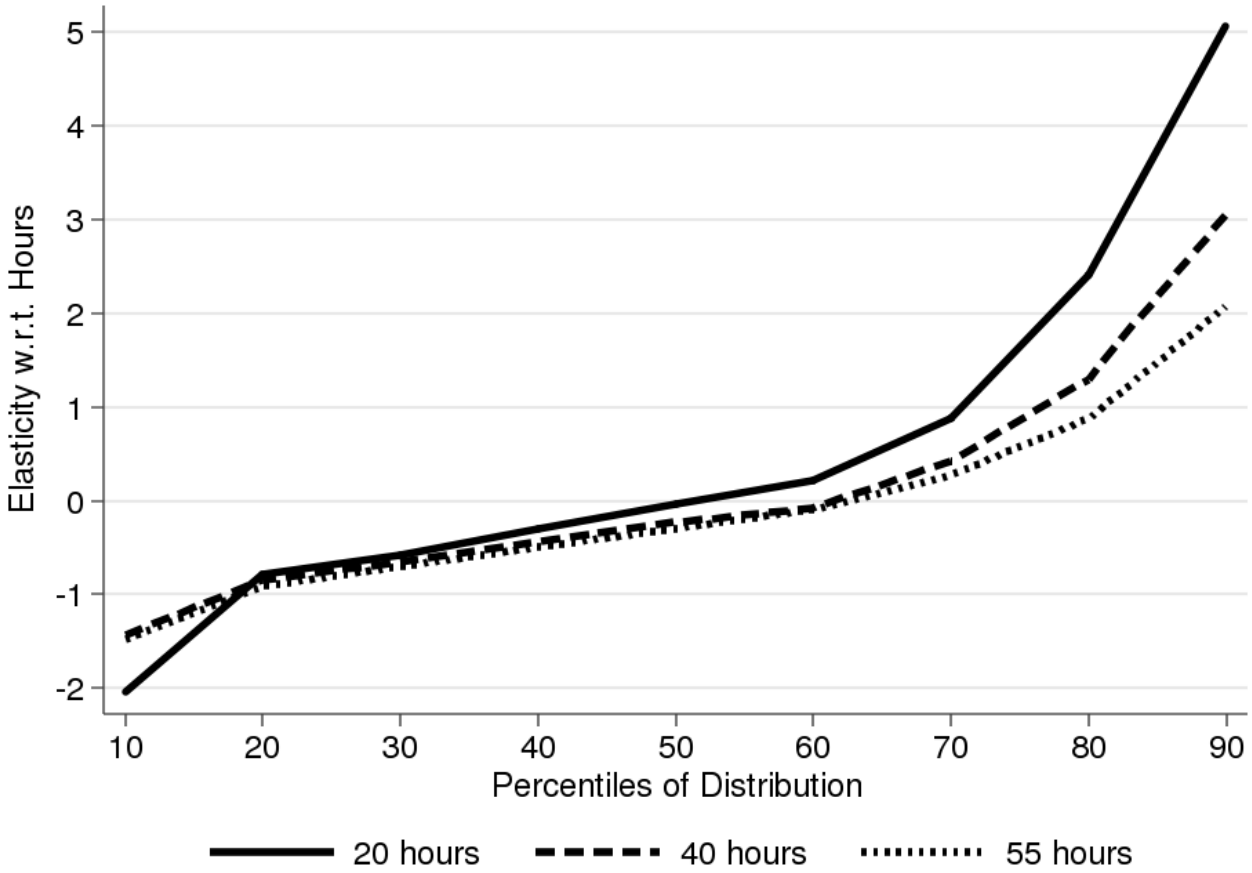
	All	Female	Male	Female with kids	Male with kids
$\eta_h^M : h = 20$	-0.044	-0.117	0.181	-0.176	0.103
	[7.09]	[4.53]	[9.74]	[4.72]	[9.41]
$\eta_h^M : h = 30$	-0.136	-0.241	0.085	-0.275	0.001
	[5.27]	[3.59]	[7.26]	[3.64]	[6.86]
$\eta_h^M : h = 40$	-0.232	-0.331	-0.100	-0.337	-0.099
	[4.49]	[3.12]	[5.53]	[3.21]	[5.16]
$\eta_h^M : h = 55$	-0.299	-0.383	-0.154	-0.361	-0.124
	[3.55]	[2.77]	[4.08]	[2.83]	[3.77]

Medians are reported. The 90-10 range is in brackets.

- Substantial heterogeneity within groups!!!
- Less dispersion at higher hours.
- The median values for each group are substantially different from the group-level aggregate elasticity estimates.
  - Skewness!

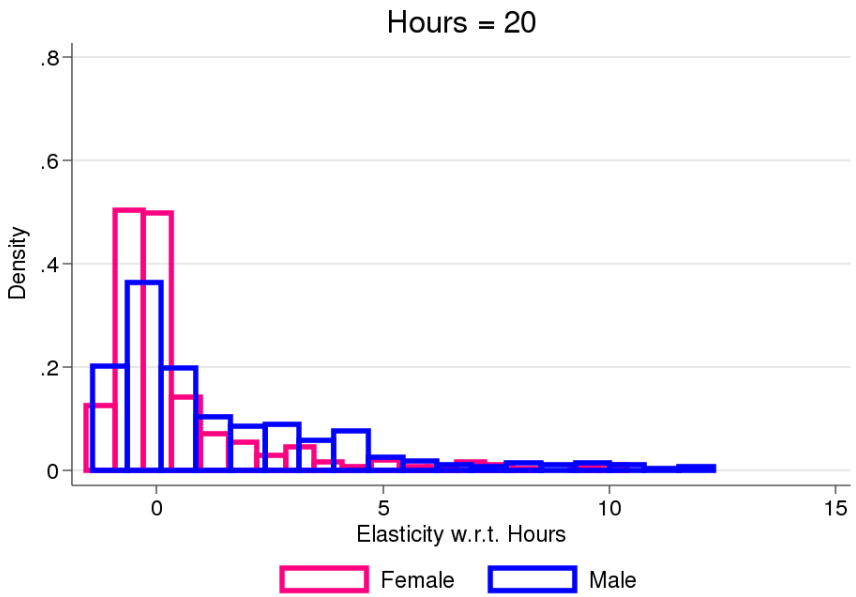
▸ Hicksian

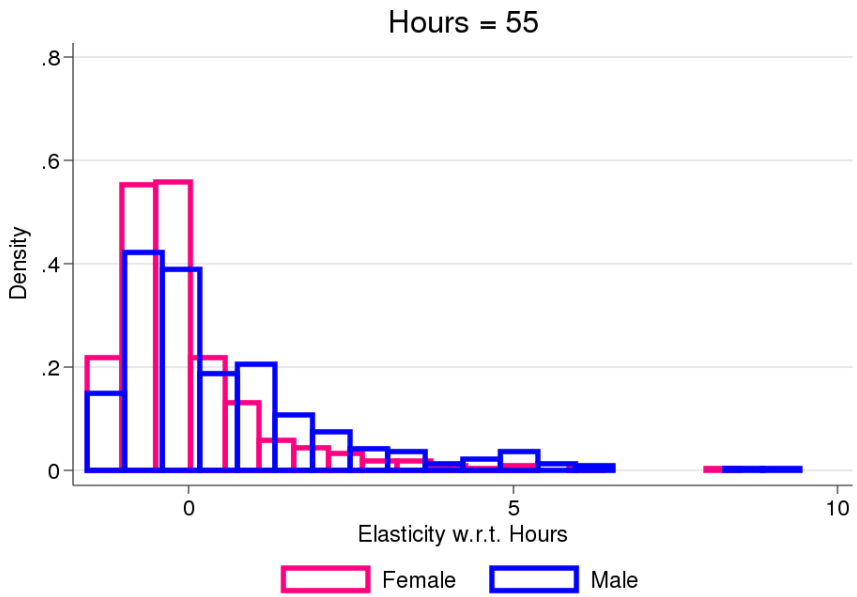
Marshallian Elasticities - Within-group Heterogeneity



- The 90-10 difference becomes smaller at higher hours.
- Higher responses of those working at fewer hours – substitution effect is higher.

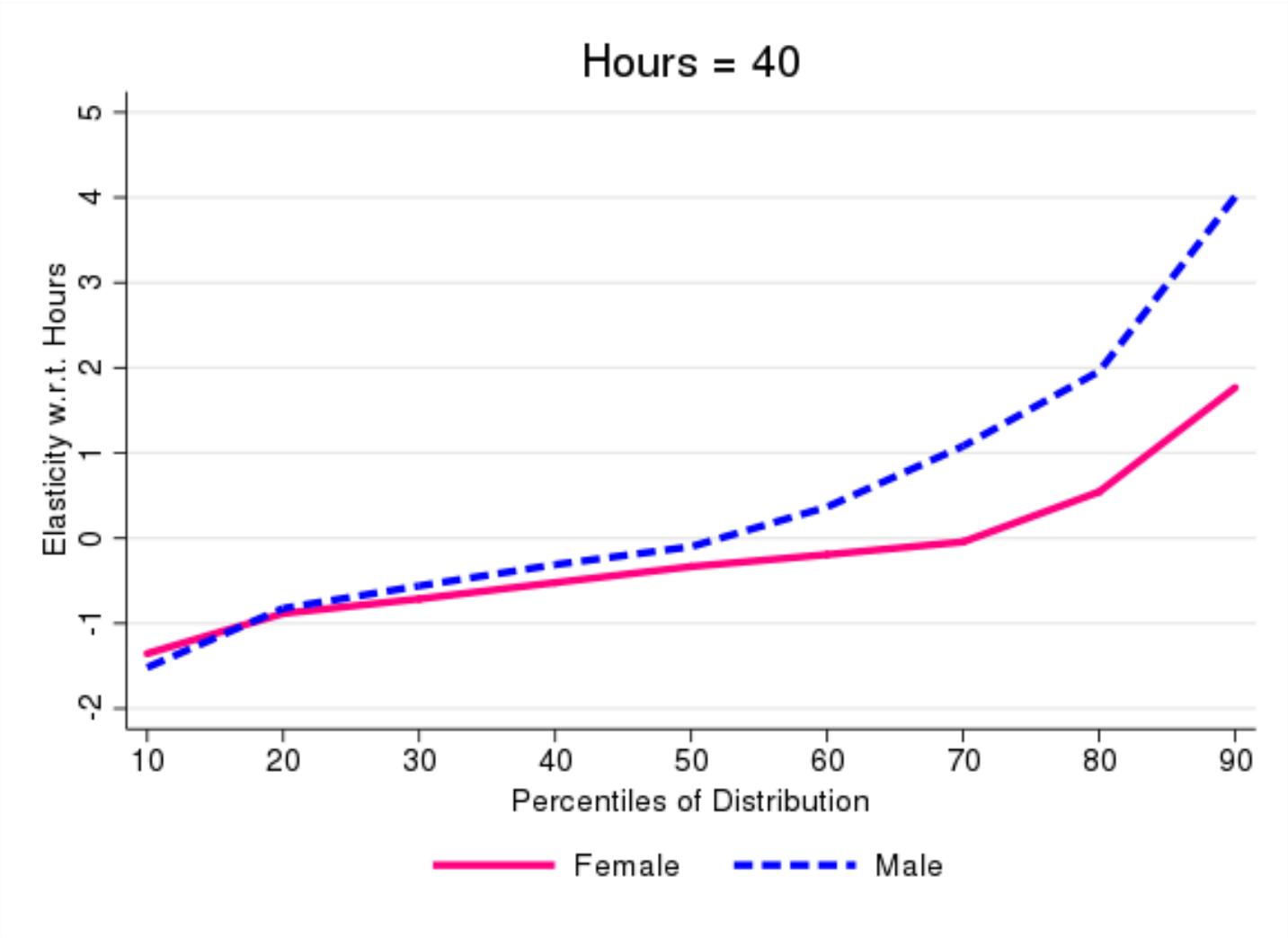
Marshallian Elasticities - Women vs Men





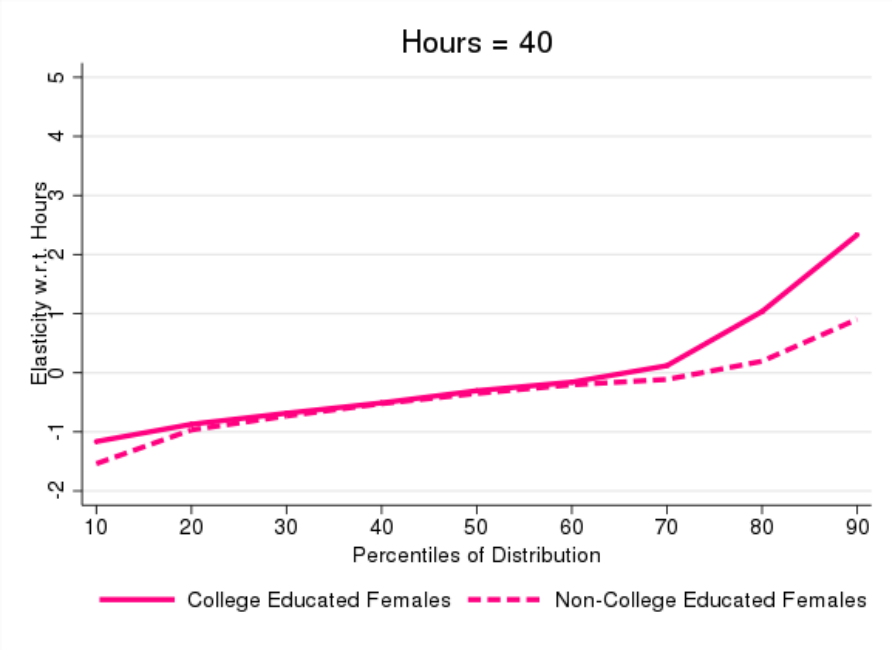
▸ Hicksian

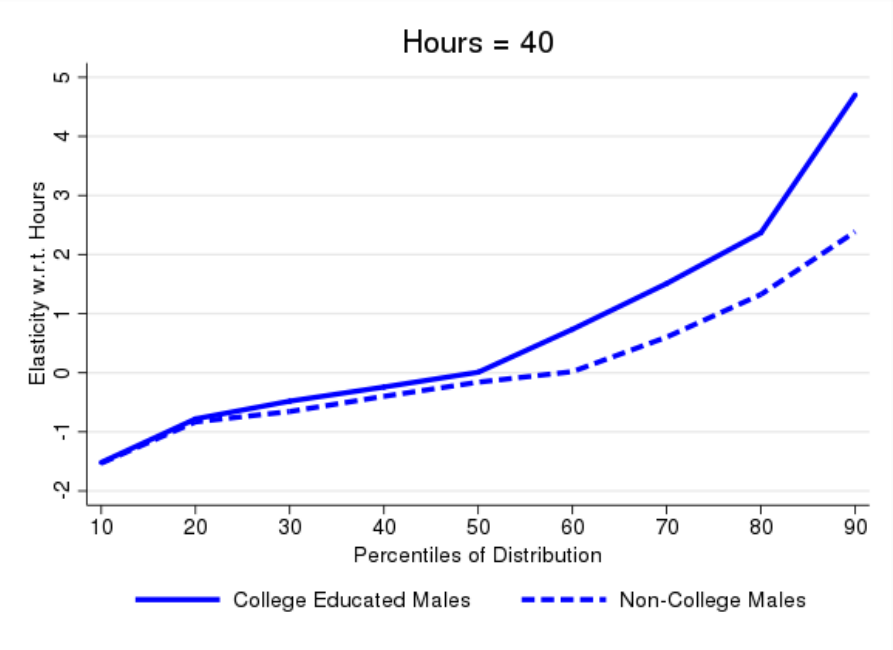
Marshallian Elasticities - Women vs Men



▸ Hicksian

Marshallian Elasticities - By Education





▸ Hicksian

Does Heterogeneity Matter?

A simple exercise:

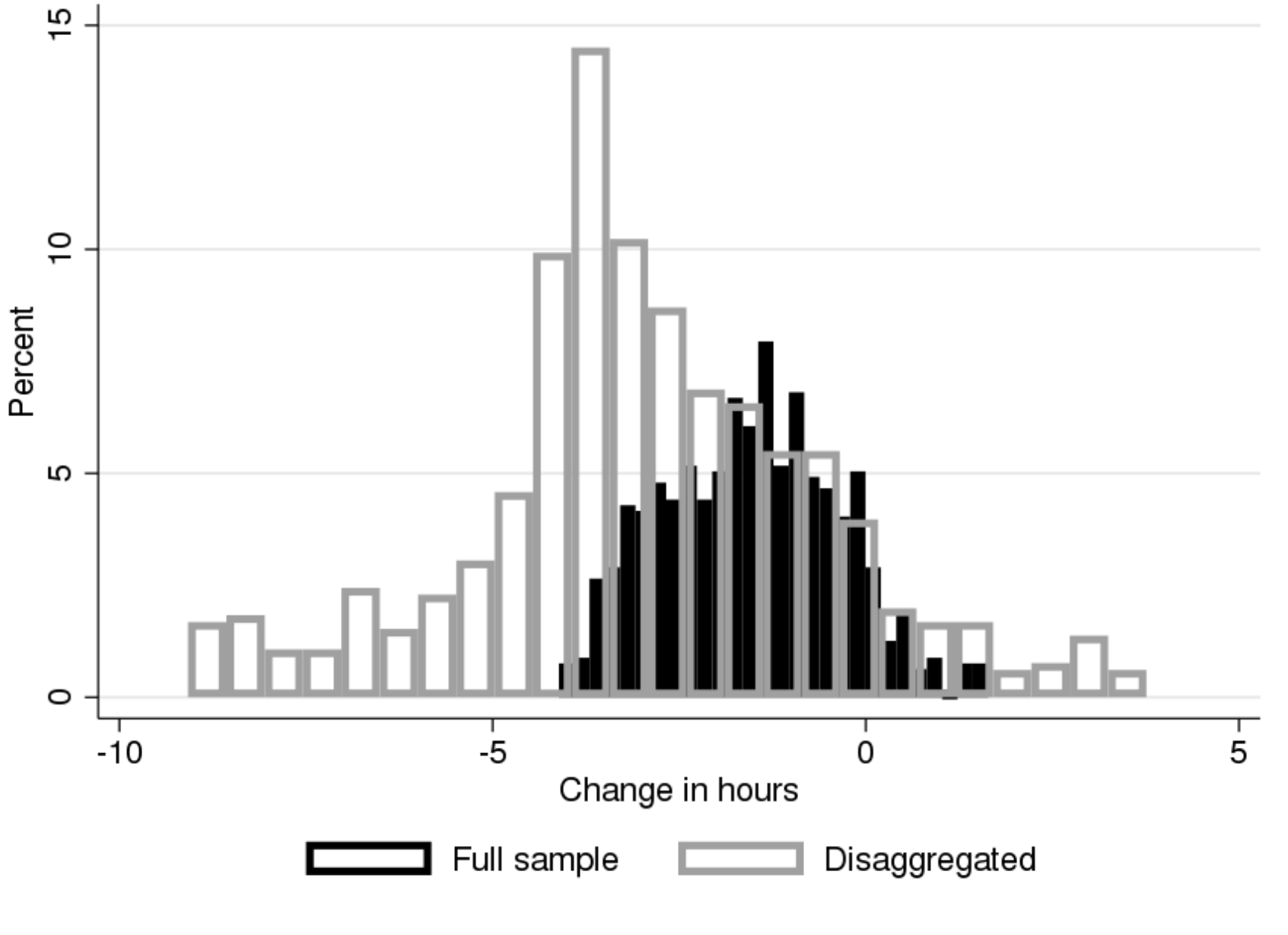
- Consider a case where the government increases the marginal tax rate on labor income by 10 percentage points:

$$\text{earnings} = wh(1-t) \rightarrow w[1-(t+0.10)]h$$

- Simulate responses using the group-level parameter estimates by gender:
  - Distribution of responses
  - Aggregate response

- Simulate responses using the group-level parameter estimates by gender X education X marital status X existence of kids:
  - Distribution of responses
  - Aggregate response

Does Heterogeneity Matter?



Does Heterogeneity Matter?

A simple exercise:

- Consider a case where the government increases the marginal tax rate on labor income by 10 percentage points:

$$\text{earnings} = wh(1-t) \rightarrow w[1-(t+0.10)]h$$

- Simulate responses using the group-level parameter estimates by gender:
  - Total hours worked in the economy declines by 3.9%.

- Simulate responses using the group-level parameter estimates by gender X education X marital status X existence of kids:
  - Total hours worked in the economy declines by 7.1%.

The response of hours is significantly larger if the within-group heterogeneity is taken into account.

Take-aways from the Static Framework

- Substantial heterogeneity *across* demographic groups
  - Comparison of demographic groups using broad definitions are misleading.
- Substantial heterogeneity *within* demographic groups
  - More dispersion at lower hours
- Differences in income effect important both for heterogeneity across and within groups

▸ LC results ▸ Conclusion

A Life-Cycle Labor Supply Model

- Modeling the inter-temporal margin.
- The inter-temporal margin is shown to be crucial for extensive-margin labor supply decisions.
- Incorporate the household-composition changes over the life-cycle.
- Distinction between temporary ("evolutionary") and permanent changes in wage profiles.
  - Frisch elasticity.

A Life-Cycle Labor Supply Model

We consider the problem of a household head who maximizes life-time expected utility from age 25 to age 75:

$$\max \ \mathbb{E} \sum_{s=t}^{75} \beta^{s-t} U(c_s, h_s)$$

- c: consumption
- h: hours of work per week
- Individuals may work from age 25 to 65, and face an exogenous mandatory spell of retirement of 10 years at the end of life.
- The age of death is known with certainty and there is no bequest motive.

Preferences

At time t, the instantenous utility function of a household head is:

$$U(c_{it}, h_{it}) = \frac{c_{it}^{1-\phi_{g_i}}}{1-\phi_{g_i}} + \alpha_{g_i} \frac{h_{it}^{1-\theta_{g_i}}}{1-\theta_{g_i}} + \epsilon_{iht}$$

$$\epsilon_{iht} \sim N(0, \sigma^2_{ug_i})$$

The Choice Set

- $c_{it} \in \mathbb{R}^+$
- If the individual searches for
  - only full-time jobs:

$$h_{it} \in \{35, 37, 40, 45, 50, 55, 65\}$$

$$\begin{aligned}\text{scenarios} =\{&(35, 45, 0), (35, 37, 0), (35, 45, 0), (40, 50, 0), (40, 50, 0),\\ &(40, 55, 0), (40, 55, 0), (55, 65, 0), (55, 65, 0), (55, 65, 0)\}\end{aligned}$$

  - only part-time jobs:

$$h_{it} \in \{15, 17, 18, 20, 22, 25, 30\}$$

$$\begin{aligned}\text{scenarios} =\{&(15, 22, 0), (15, 17, 0), (15, 22, 0), (18, 25, 0), (18, 25, 0),\\ &(15, 30, 0), (15, 30, 0), (20, 30, 0), (20, 30, 0), (20, 30, 0)\}\end{aligned}$$

  - both full-time and part-time jobs:

$$h_{it} \in \{15, 18, 20, 25, 30, 35, 40, 50, 55, 65\}$$

$$\begin{aligned}\text{scenarios} =\{&(20, 35, 0), (20, 35, 0), (25, 35, 0), (25, 40, 0), (18, 20, 0),\\ &(15, 30, 0), (40, 50, 0), (55, 65, 0), (40, 55, 0), (40, 50, 0)\}\end{aligned}$$

Constraints

The intertemporal budget constraint is given by:

$$A_{i,t+1} = (1+r)A_{it} + w_{it}h_{it} + y^s_{it} - cc_t(h_{it}, k_{it})$$

$$A_{i,t+1} \geq 0$$

Wages evolve exogenously:

- The "base" for hourly wage offers follows

$$\ln w_{it} = \alpha^w_0 + \alpha^w_1 t_i + \alpha^w_2 t_i^2 + \alpha^w_3 t_i^3 + \epsilon^w_{it}$$

- The wage offers in each scenario are determined by the subjective probability distribution of offers constructed using this base wage.
  - Use the base wage, Z_{1i}, and Z_{2i} to construct scenario wages.

Constraints

Example: For an individual who earns $40/hour:

Consider the case where you are searching for jobs and receive at least one job offer. Think about the job offers that you may receive within the next three months. Of the job offers that you might receive, what percent of them do you think will offer an hourly wage of...

*(Please note: The numbers need to add up to **100**.)*

Less than $20.00		percent	
Between $20.00 and $30.00		percent	
Between $30.00 and $38.00	15	percent	→ Z1
Between $38.00 and $42.00	35	percent	
Between $42.00 and $50.00	20	percent	
Between $50.00 and $60.00	20	percent	
Between $60.00 and $70.00	10	percent	→ Z2
Between $70.00 and $78.00		percent	
More than $78.00		percent	
TOTAL	100		

Timing

- Each individual is unemployed at age 25.
- In each period, an unemployed individual receives two job offers with probability λ and has the option of choosing one of the jobs, or rejecting both.
  - λ is individual specific.
  - There are 10 scenarios for each individual and we take the probability of facing each scenario from the subjective probability distribution of receiving job offers.
- If the individual accepts either one of the jobs, there is a $\delta = 8\%$ chance of being laid off from that job by the end of the year.
  - If this is the case, the individual starts the following period as unemployed.
  - If the individual is not laid off,
    - ⋆ He will continue to work at the job at the specified wage rate, with the wage growing at a rate of $g = 2\%$ each period.

Value Functions

For an individual who starts the period employed at wage w, with asset A_t and working at hours h:

- If $t = 65$

$$V_t^E(A_t, h_t = h, w_t = w) = u(c_t, h_t = h; w_{t+1} = w(1+g)) + V_t^R(A_{t+1})$$

- If $t < 65$

$$\begin{aligned} V_t^E(A_t, h_t = h, w_t = w) &= u(c_t, h_t = h; w_{t+1} = w(1+g)) \\ &+ \beta \mathbb{E}\Bigg[(1-\delta) V_{t+1}^E(A_{t+1}, h_t = h, w_{t+1} = w(1+g)^2) \\ &+ \delta\Big[(1-\lambda_i) V_{t+1}^U(A_{t+1}) + \lambda\left(\frac{V_{t+1}^{S1}(A_{t+1})}{10} + \cdots + \frac{V_{t+1}^{S10}(A_{t+1})}{10}\right)\Big]\Bigg] \end{aligned}$$

Value Functions

For an individual who starts the period unemployed and doesn't receive any offers:

- If $t = 65$

$$V_t^U(A_t) = u(c_t, h_t = 0) + V_t^R(A_{t+1})$$

- If $t < 65$

$$V_t^U(A_t) = u(c_t, h_t = 0) + \beta \mathbb{E}\left[(1-\lambda_i) V_{t+1}^U(A_{t+1}) + \lambda\left(\frac{V_{t+1}^{S1}(A_{t+1})}{10} + \cdots + \frac{V_{t+1}^{S10}(A_{t+1})}{10}\right)\right]$$

Value Functions

For an individual who starts the period unemployed and receives scenario i for $i \in \{1, \ldots, 10\}$:

If $t = 65$

$$V_t^{Si}(A_t) = \max\{u(c_t, h_{si1}; w_{si1}), u(c_t, h_{si2}; w_{si2}), u(c_t, 0)\} + V_t^R(A_{t+1})$$

If $t < 65$

$$\begin{aligned} V_t^{Si}(A_t) = \max \Bigg\{ & u(c_t, h_{si1}; w_{si1}) + \beta \mathbb{E} \Big[(1-\delta) V_{t+1}^E(A_{t+1}, h_{si1}, w_{si1}(1+g)) \\ & + \delta \big[(1-\lambda_i) V_{t+1}^U(A_{t+1}) + \lambda \left(\frac{V_{t+1}^{S1}(A_{t+1})}{10} + \cdots + \frac{V_{t+1}^{S10}(A_{t+1})}{10} \right) \big] \Big], \\ & + u(c_t, h_{si2}; w_{si2}) + \beta \mathbb{E} \Big[(1-\delta) V_{t+1}^E(A_{t+1}, h_{si2}, w_{si2}(1+g)) \\ & + \delta \big[(1-\lambda_i) V_{t+1}^U(A_{t+1}) + \lambda \left(\frac{V_{t+1}^{S1}(A_{t+1})}{10} + \cdots + \frac{V_{t+1}^{S10}(A_{t+1})}{10} \right) \big] \Big], \\ & + u(c_t, h=0) + \beta \mathbb{E} \Big[(1-\lambda_i) V_{t+1}^U(A_{t+1}) + \lambda \left(\frac{V_{t+1}^{S1}(A_{t+1})}{10} + \cdots + \frac{V_{t+1}^{S10}(A_{t+1})}{10} \right) \Big] \Bigg\} \end{aligned}$$

Estimation

- Simulated Method of Moments
- Two-step estimation:
  1. Estimate the base-wage profiles, stochastic processes for the gender X education groups from the CPS.
  2. Fixing θ, estimate the life-cycle model for each group separately, to get ϕ_{g_i},θ_{g_i}, α_{g_i} and σ_{ug_i}.
     - ⋆ Solve the model using backward recursion, simulate each individual's life-cycle paths 5000 times, calculate moments for the age we see that ID in the sample, match the labor supply moments.

Definition of Elasticities - Dynamic Framework

Frisch:

- Size of anticipated changes in the labor supply induced by short-term (or evolutionary or marginal) changes in wages.
- Relevant concept for changes in wages over the business cycle, or over the life-cycle.
- Keeps the marginal utility of wealth constant.

Marshall:

- Unanticipated change in the wage profile.
- Includes the wealth effect of the change in the wage profile.
- Relevant concept for a change in taxes which is perceived to be permanent.

Extensive-Margin Elasticities

	Disaggregated		Group Level	
	Marshallian Extensive	Frisch Extensive	Marshallian Extensive	Frisch Extensive
All	0.097	0.541	0.1148	0.631
	[0.374]	[1.100]		
Female	0.114	0.579	0.1194	0.661
	[0.430]	[1.189]		
Male	0.082	0.478	0.093	0.564
	[0.328]	[1.048]		
College	0.095	0.448	0.102	0.598
	[0.321]	[1.217]		
No-college	0.103	0.581	0.119	0.645
	[0.325]	[1.226]		
Female, no-college	0.144	0.612	0.134	0.702
	[0.355]	[1.357]		
Male, no-college	0.097	0.538	0.107	0.620
	[0.340]	[1.126]		

Medians are reported. The 90-10 range is in brackets.

- Extensive-margin elasticities are substantially higher than intensive-margin elasticities.

Extensive-Margin Elasticities

	Disaggregated		Group Level	
	Marshallian	Frisch	Marshallian	Frisch
All	0.097	0.541	0.1148	0.631
	[0.374]	[1.100]		
Female	0.114	0.579	0.1194	0.661
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Male, no-college	0.097	0.538	0.107	0.620
	[0.340]	[1.126]		

Medians are reported. The 90-10 range is in brackets.

- Females and those without a college degree are more responsive at the extensive-margin.
  - Within-group heterogeneity is less compared to intensive-margin elasticities.

Extensive-Margin Elasticities

	Disaggregated	
	MARSHALLIAN	FRISCH
All	0.097	0.541
	[0.374]	[1.100]
Female	0.114	0.579
	[0.430]	[1.189]
Male	0.082	0.478
	[0.328]	[1.048]
Age$<$45	0.087	0.455
	[0.380]	[1.043]
Age$\geq$45	0.109	0.609
	[0.371]	[1.138]
Female with kids	0.106	0.563
	[0.391]	[1.049]
Male with kids	0.057	0.377
	[0.225]	[0.861]

Medians are reported. The 90-10 range is in brackets.

- Difference between Marshallian and Frisch elasticities imply strong wealth effects especially for older respondents and females with kids.

Conclusion

- Using a hypothetical choice methodology, we design a novel survey in which respondents are presented with multiple job scenarios that vary both work hours and wages at the individual level.
- The rich data generated by our design allows us to estimate the distribution of preferences, without making any restricted assumptions on preference heterogeneity.
- We provide evidence that there is no one value of elasticity in a given economy.
  - We find that there is substantial heterogeneity across demographic groups.
  - Within-group variation is sizeable.
- The shape of the distribution for the elasticities imply that using the mean elasticity (group-level aggregate) leads to biased policy evaluation.

Roadmap

- Ranking observable characteristics based on their importance of creating the heterogeneity in elasticities.
- Correct for the estimation error - to identify the bias in estimated parameters.
- Account for unobserved heterogeneity.
- Show the bias from group-level estimates
  - using the dynamic framework
  - for a policy change in childcare subsidies
  - for the aggregate responses over business cycle fluctuations
- Consumption - can we test for the separability of preferences between leisure and consumption?

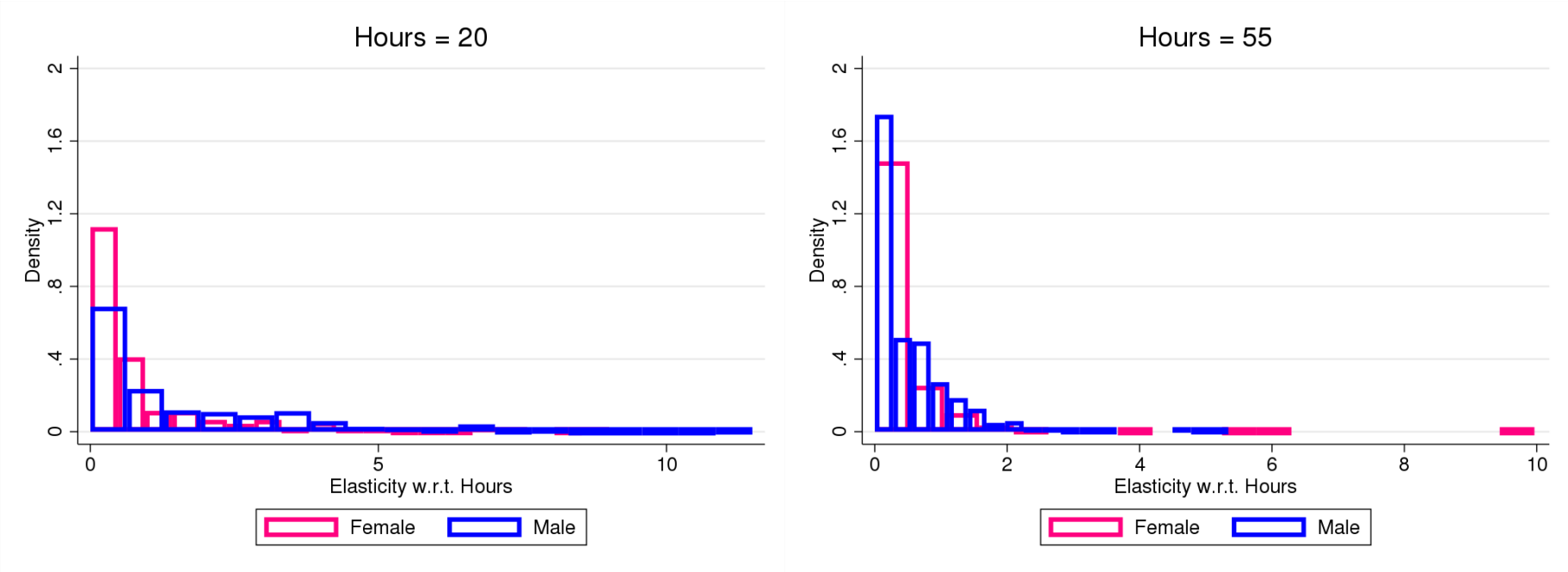
APPENDIX

Hicksian Elasticites for Hours of Work - Individual Level

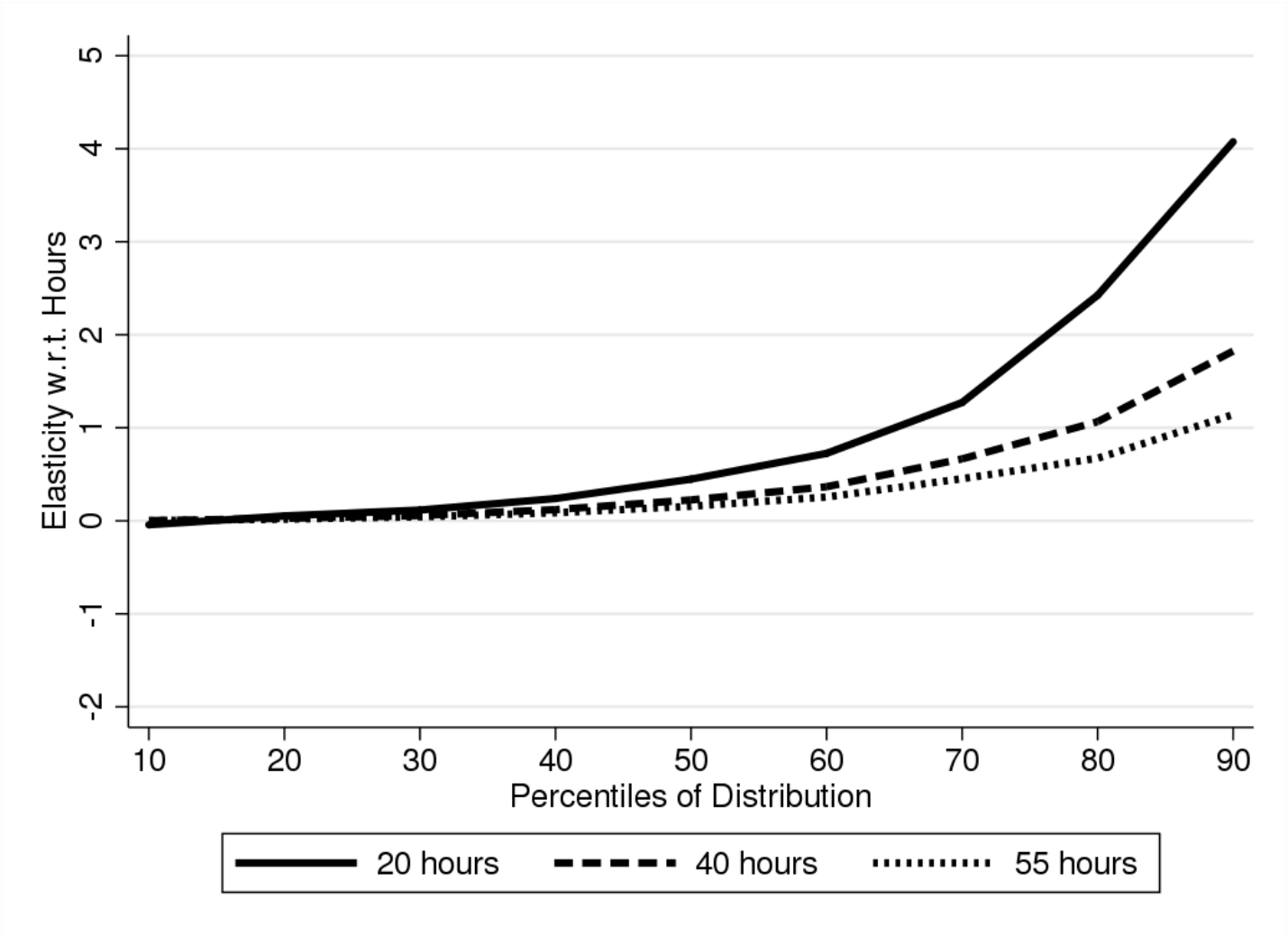
	All	Female	Male	Female with kids	Male with kids
$\eta_h^M : h = 20$	0.448	0.346	0.650	0.255	0.579
	[4.12]	[3.24]	[6.14]	[3.34]	[5.57]
$\eta_h^M : h = 30$	0.310	0.229	0.450	0.173	0.424
	[2.65]	[2.09]	[3.78]	[2.38]	[3.66]
$\eta_h^M : h = 40$	0.225	0.168	0.336	0.124	0.319
	[1.82]	[1.47]	[2.38]	[1.70]	[2.17]
$\eta_h^M : h = 55$	0.156	0.121	0.238	0.087	0.246
	[1.14]	[0.90]	[1.31]	[1.04]	[1.19]

Medians are reported. The 90-10 range is in brackets.

Distribution of the Hicksian Elasticities



Distribution of the Hicksian Elasticities - Heterogeneity



- The 90-10 difference becomes smaller at long hours.

Distribution of the Hicksian Elasticities - Heterogeneity