SUPPLEMENTAL APPENDIX

The 40-Hour Work Week

Eunseong Ma*

Yonsei University

May 2026

A The Computational Algorithm

A.1 Stationary Economy

The computational algorithm used for the steady-state economy is summarized. In this step, the stationary measure, $\overline{\mu}$ is determined. The detailed steps are as follows.

Step 1. Make guesses for endogenous parameters such as β, κ, and so forth.

Step 2. Construct grids for asset holdings, a and logged individual labor productivity, $\hat{z} = \ln z$. The number of grids for a and $\widehat{z}$ are denoted as N_a and N_z, respectively. The following are selected: $N_a = 151$ and $N_z = 21$. a falls in the range of $[-0.5, 300]$. More asset grid points are assigned on the smaller values of a, while $\widehat{z}$ is equally distributed in the range of $[-3\sigma_z/\sqrt{1-\rho_z^2}, 3\sigma_z/\sqrt{1-\rho_z^2}]$.

Step 3. Approximate the transition probability matrices for individual labor productivity, $\mathbf{Q^z}$, using the Tauchen (1986) algorithm.

Step 4. Solve the individual value functions. In this step, the optimal decision rules for saving $a'(a,z)$ and hours worked $h(a,z)$, the value functions, $V(a,z)$, are obtained. The detailed steps are as follows:

*School of Economics, Yonsei University, 50 Yonsei-ro, Seodaemun-gu, Seoul 03722, South Korea. Email: masilver@yonsei.ac.kr.

(a) Compute the steady-state real wage rate based on the firm's first-order condition, where the steady-state capital return, $\overline{r}$, is chosen to be 1 percent.

(b) Have an initial guess for the value function, $V_0(a,z)$ for each grid point.

(c) Solve the consumption-saving problem for each employment status:

$$V_1^E(a,z) = \max_{a' \geq \overline{a}, h \geq \underline{h}} \Bigg\{ \ln\left(\overline{w} z g(h) + (1+\overline{r})a - a'\right)$$

$$-\psi \tfrac{h^{1+1/\gamma}}{1+1/\gamma} + \beta \sum_{z'} \mathbf{Q^z}(z,z') V_0(a',z') \Bigg\},$$

and

$$V_1^N(a,z) = \max_{a' \geq \overline{a}} \Bigg\{ \ln\left((1+\overline{r})a - a' + \overline{\xi}\right) + \beta \sum_{z'} \mathbf{Q^z}(z,z') V_0(a',z') \Bigg\}.$$

(d) Compute $V_1(a,z)$ as $V_1(a,z) = \max\left\{V_1^E(a,z), V_1^N(a,z)\right\}$.

(e) If V_0 and V_1 are close enough for each grid point, go to the next step. Otherwise, update the value functions ($V_0 = V_1$), and go back to (c).

Step 5. Obtain the time-invariant measure, $\overline{\mu}$, with finer grid points for assets holding. Compute the optimal decision rules for asset holdings with the new grid points using cubic spline interpolation. $\overline{\mu}$ can be computed using the new optimal decision rules and the transition probability matrices for individual labor productivity.

Step 6. Compute aggregate variables using $\overline{\mu}$. If targeted moments are sufficiently close to the assumed ones, then the steady-state equilibrium of the economy is found. Otherwise, reset the endogenous parameters, and go back to Step 4.

A.2 Economy with Aggregate Shocks

The following is a summary of the computational algorithm used for the economy with aggregate shocks. To solve the dynamic economy, the distribution across households, μ, which will affect prices, should be tracked. Instead, following Krusell and Smith (1998), the first moment of the distribution and the parametric forecasting function are used. The steps are as follows.

Step 1. Construct grids for aggregate state variables such as aggregate shocks and the mean capital, and individual state variables such as the individual labor productivity and asset holdings. Construct 7 grid points for the aggregate capital, K, and aggregate shocks, λ.

The grid points for K and λ are equally spaced. The grids for individual state variables are the same as those in the steady-state economy.

Step 2. Parameterize the forecasting functions for K' and w.

Step 3. Given the forecasting functions for K' and w, solve the optimization problems for the individual households.[1] Solve the optimization problems for households and obtain the policy functions for asset holdings, $a'(a, z; K, \lambda)$, and consumption $c(a, z; K, \lambda)$, and the hours decision rule, $h(a, z; K, \lambda)$.[2]

Step 4. Generate simulated data for 3,500 periods using the value functions for individuals obtained in Step 4. The details are as follow.

(a) Set the initial conditions for K, λ, and $\mu(a, z)$.

(b) Obtain the market-clearing wage, w. Choose $\hat{w}$ as a guess for w. Given the forecasting functions and the evaluated value function obtained in Step 4, obtain the hours decision rule, $h(a, z)$. Check if the labor supply is equal to labor demand, i.e., $\int zg(h(a, z))d\mu = L^D$.[3] If not, update $\hat{w}$.

(c) Given the forecasting functions, the evaluated value function obtained in Step 3, and obtained w, solve the optimization problems for individual households to obtain the policy functions for asset holdings, $a'(a, z)$, and the hours decision rule, $h(a, z)$.

(d) Obtain aggregate variables based on the type distribution, μ, where $C = \int c(a, z)d\mu$, $L = \int zg(h(a, z))d\mu$, $K' = \int a'(a, z)d\mu$, $H = \int h(a, z)d\mu$, $Y = \lambda K^\alpha L^{1-\alpha}$, and $I = K' - (1 - \delta)K$.

(e) Obtain the next period measure $\mu'(a, z)$ using $a'(a, z)$ and transition probabilities for z.

Step 5. Obtain the new coefficients for the forecasting functions by the OLS estimation using the simulated time series.[4] If the new coefficients are close enough to the previous ones, the simulation is done. Otherwise, update the coefficients, and go to Step 3.

Table A.1 summarizes the estimated coefficients, the goodness of fit, and the accuracy of the forecasting rules. It is clear that R^2s for all forecasting functions are very large. The accuracy

[1] Given the wage rate, w, the real interest rate, r, can be obtained from the firm's profit maximization.

[2] As in the steady-state economy, the transition probabilities for z and λ are approximated using the Tauchen (1986) method.

[3] Given the wage rate, labor demand, N^D, can be obtained from the firm's first order condition.

[4] I drop the first 500 periods to eliminate the impact of the arbitrary choice of initial aggregate state variables.

Table A.1: ESTIMATES AND ACCURACY OF FORECASTING RULES

Dependent Variable	Coefficient Cons.	$\ln K$	$\ln \lambda$	R^2	Den Haan (2010) Error Mean (%)	Max (%)
$\log K'$	0.11518	0.94886	0.10142	1.0000	0.0087	0.0530
$\log w$	-0.13602	0.37335	0.85732	1.0000	0.0280	0.1733

of forecasting rules was checked, based on the statistics proposed by Den Haan (2010). It is found that mean Den Haan (2010) errors are sufficiently small (not exceeding 0.03 percent), and maximum errors are also reasonably small (less than 0.2 percent) for the two forecasting functions.

B Micro-level Data

B.1 Current Population Survey (CPS)

For information on income and occupation status, the Annual Social and Economic Supplement (ASEC) of the CPS was used, which covers the years from 1976 to 2019. The ASEC of the CPS contains detailed questions covering economic characteristics surveyed in every March and provides estimates based on a survey of around 65,000 households. The basic unit of observations for the CPS is a household. Data for the CPS are downloaded from Integrated Public Use Microdata Series (IPUMS).[5] The key variables in the CPS are the following.

- Usual hours worked: the number of hours per week that respondents usually worked if they worked during the previous calendar year. Individuals were asked this question if: 1) they reported working at a job or business at any time during the previous year or 2) they acknowledged having done "any temporary, part-time, or seasonal work even for a few days" during the previous year.

- Hours worked last week: the total number of hours the respondent worked during the previous week. For employers and the self-employed, this includes all hours spent attending to their operation(s) or enterprise(s). For employees, this is the number of hours they spent at work. For unpaid family workers, this is the number of hours spent doing work directly related to the family business or farm (not including housework).

[5] https://cps.ipums.org/cps/index.shtml.

- Weeks worked last year: the number of weeks, in single weeks, that the respondent worked for profit, pay, or as an unpaid family worker during the preceding calendar year. Respondents were prompted to count weeks in which they worked even for a few hours and to include paid vacation and sick leave as work.
- Annual hours = weekly usual hours $\times$weeks worked last year
- Hourly wages: for salaried workers, hourly wages are constructed as usual weekly earnings divided by usual hours worked per week. For hourly workers, hourly wages correspond to respondents' reported hourly pay in their current job.

B.2 Panel Study of Income Dynamics (PSID)

The PSID samples for period 1970–1997 were used to calculate hours distributions reported in Figure A.6. The 1994 survey is used for the income and wealth distribution reported in Table A.7. The key variables in the PSID are the following.

- Usual hours worked for head: the average hours worked per week on the main job last year.
- Income: total taxable income of head and wife.
- Labor earnings: head's labor income
- Wealth: the sum of values net of debt value.

B.3 Survey of Consumer Expectations (SCE)

The SCE data are used to calculate the distribution of hours gaps reported Figure 8. The Job Search Supplement provides additional information on labor market outcomes, with approximately 1,000 respondents completing the survey. The sample is restricted to male respondents between the ages of 25 and 55 over the period 2013–2018. The key variables from the SCE are as follows:

- Desired hours worked: The number of hours per week the respondent would prefer to work in a suitable or additional job.
- Usual hours worked: The number of hours per week the respondent usually works at their main or current job.

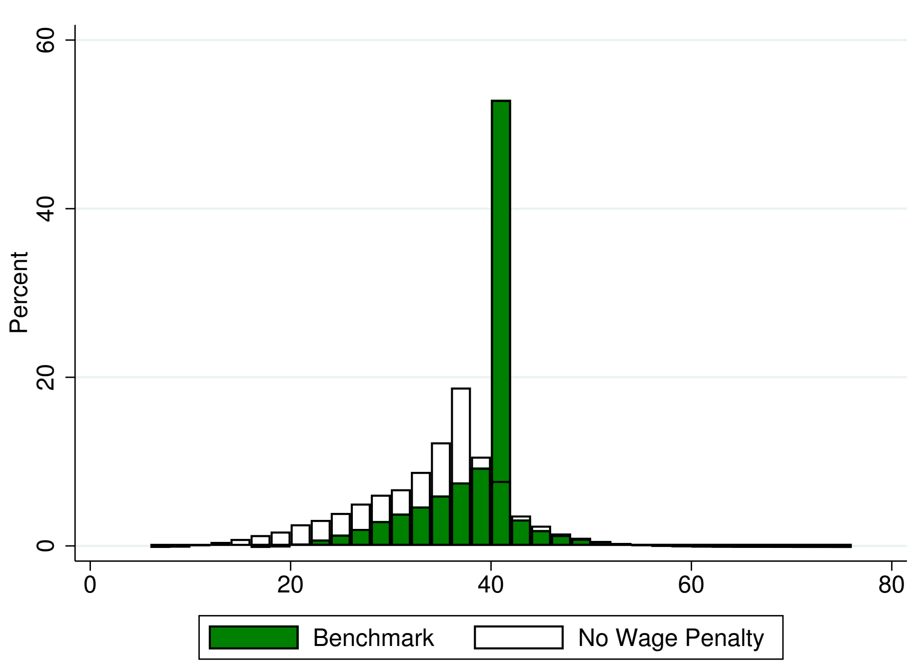


Figure A.1: WEEKLY HOURS DISTRIBUTION: BENCHMARK VS. NO WAGE PENALTY

Note: Weekly hours distributions in the benchmark model and the model without wage penalty ($\kappa = 0$).

C Other Findings

C.1 Role of Wage Penalty

To elucidate the impact of the wage penalty function on the creation of a spike distribution at 40 hours, the benchmark model is compared to a model without a wage penalty, i.e., $\kappa = 0$.[6] Figure A.1 illustrates the hours worked distribution in both model economies: the benchmark economy and the model with no wage penalty. Qualitatively, the figure demonstrates the critical role played by the wage penalty function in generating the spike distribution at 40 hours. In the model with no wage penalty, only 8 percent of households adhere to the 40-hour work week, compared to approximately 50 percent in the benchmark economy. It is worth noting that the distribution of households working overtime in the no wage penalty model is nearly indistinguishable from that in the benchmark model.[7] This suggests that if households were not subject to the wage penalty, most of those currently adhering to the 40-hour work week would choose to work fewer hours.

[6]In this analysis, instead of recalibrating the model to align with targeted moments, factor prices are allowed to fluctuate under the condition of $\kappa = 0$ to capture the general equilibrium effect. This approach provides insights into how households would adjust their hours worked were the friction associated with the 40-hour work week removed.

[7]They are not perfectly identical due to the general equilibrium effect.

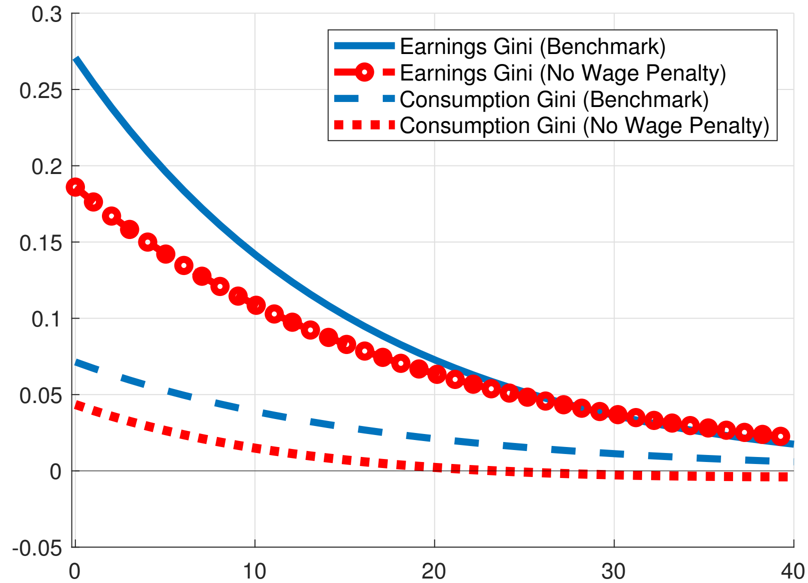


Figure A.2: RESPONSES OF EARNINGS AND CONSUMPTION GINI COEFFICIENTS

Note: The figure shows the responses of earnings and consumption Gini coefficients to negative aggregate productivity shocks in the models with and without a wage penalty. The y-axis represents the percentage deviation from the long-run average, while the x-axis denotes quarters after aggregate productivity shocks.

Quantitatively, the elimination of the wage penalty has a substantial impact. The employment rate rises to 76.4 percent without the wage penalty, indicating increased employment. However, workers, on average, put in fewer hours, leading to an approximate 11 percent reduction in hours per worker. As a result, output and consumption decrease by around 2 percent in the no wage penalty scenario, compared to the benchmark model. Notably, the welfare cost of the wage penalty is significant, with households willing to pay approximately 1 percent of their lifetime consumption to eliminate this friction.

C.2 Distributional Implications

The 40-hour work week can have a significant impact on distributional consequences over the business cycle, particularly regarding labor earnings inequality. When a wage penalty is in effect, the importance of the intensive margin diminishes, as households are less inclined to alter their working hours due to associated costs. This effect is particularly pronounced among productive households who are actively engaged at this margin, potentially resulting in increased cyclical variation in earnings inequality. This subsection further explores this issue.

Figure A.2 illustrates the responses of earnings and consumption Gini coefficients to negative aggregate productivity (λ_t) shocks in both the benchmark model and the model without a wage penalty. Regarding earnings inequality, the impact is more pronounced in the model incorporating the 40-hour work week friction. In the benchmark model, the earnings Gini increases by approximately 0.25 percent upon impact, compared to a mere 0.17 percent increase in the frictionless model. Similarly, concerning consumption inequality, the distributional effect is more pronounced in the presence of the 40-hour work week friction. The subsequent analysis argues that the disparity in the inequality responses primarily stems from the constrained adjustment of the intensive margin among productive households.

Figure A.3 illustrates the relative responses of employment (the extensive margin of labor supply), hours per employed worker (average hours—the intensive margin), and labor earnings between high and low productivity households (4th to 1st productivity quartiles) to negative λ_t shocks in both the benchmark model and the model with no wage penalty. Notably, in terms of the relative employment responses (see the first column of Figure A.3), the response is positive to adverse λ_t shocks in both models, as poor households actively adjust the extensive margin due to reduced wages. Although the relative employment response between the two productivity groups is slightly larger in the benchmark model, there remains minimal disparity between the two models.

Regarding the relative intensive margin response (see the second column of Figure A.3), it decreases after the unfavorable λ_t shock in both models. This decrease occurs as the intensive margin becomes the dominant factor for productive households, prompting them to reduce hours worked in response to a fall in wages. Notably, there is a significant disparity in the relative average hours responses between the two model economies. The relative response is much smaller in the presence of the 40-hour work week friction: it decreases by 0.2 percent in the benchmark model, while it decreases even further in the frictionless model. This discrepancy arises because the intensive margin of labor supply is notably constrained for productive households under the 40-hour work week friction. In other words, some productive households affected by the wage penalty are reluctant to reduce their work time below the mandated 40-hour threshold. The significance of limited adjustments in the intensive margin for high-productivity households leads to a larger relative response of earnings in the benchmark model, as shown in the third column of A.3. Therefore, the intensive margin plays a crucial role in explaining distributional consequences over business cycles.

This finding contributes to a deeper understanding of distributional dynamics over the business cycle. While prior studies, notably exemplified by Castaneda, Díaz-Giménez and Ríos-Rull (1998), have primarily emphasized the significance of employment (the extensive margin of labor supply) fluctuations among individuals at the lower end of the distribution,

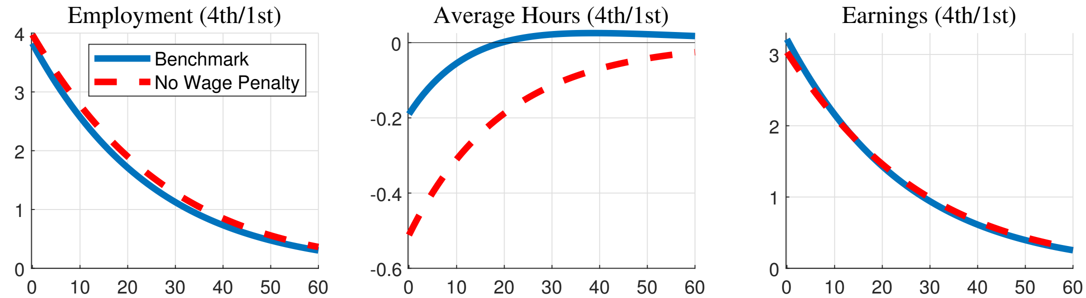


Figure A.3: RELATIVE RESPONSES BETWEEN HIGH AND LOW PRODUCTIVITY HOUSEHOLDS

Note: The relative responses of employment, hours per employees, and earnings between high and low productivity households (4th to 1st productivity quartiles) to a negative aggregate productivity shock.

this study sheds light on the often neglected role of households at the top, particularly in relation to their constrained intensive margin. This insight underscores the necessity for a more comprehensive understanding of inequality dynamics, encompassing not only the disparities between the poor and the rich but also the distinctions between the extensive and intensive margins of labor supply.

C.3 Different Degrees of Heterogeneity

To examine how different degrees of household heterogeneity influence macro and micro labor supply elasticities, I consider two alternative model economies. The first economy reduces the standard deviation of idiosyncratic income shocks, σ_z, to 0.16, lowering income inequality by approximately 10 percent relative to the benchmark (income Gini falling to 0.54) while keeping wealth inequality—measured by the wealth Gini coefficient—unchanged at 0.74. In the second, the persistence of idiosyncratic income shocks, ρ_z, is lowered to achieve the same income Gini (0.54) as in the first economy. Unlike the first adjustment, however, this change also reduces wealth inequality, lowering the wealth Gini to 0.68 relative to both the benchmark and the first alternative.

Table A.2 reports the macro and micro labor supply elasticities across the three economies. Relative to the benchmark, both alternative models with reduced heterogeneity produce higher macro elasticities. Specifically, the model with lower σ_z generates a macro elasticity of 1.58, with a notable increase in the extensive margin elasticity (1.28). Similarly, the model with lower ρ_z also yields a higher macro elasticity of 1.47 and a larger extensive margin elasticity of 1.22. The finding that lower heterogeneity generates higher labor supply elasticity—primarily through the extensive margin—is well established in the literature, including studies by Chang and Kim (2006) and Rogerson and Wallenius (2009). This occurs because a less unequal economy

Table A.2: IMPLIED MACRO AND MICRO ELASTICITIES: DIFFERENT HETEROGENEITY

		$\rho_z = 0.975$		$\rho_z = 0.975$		$\rho_z = 0.960$		$\rho_z = 0.900$	
		$\sigma_z = 0.201$		$\sigma_z = 0.160$		$\sigma_z = 0.201$		$\sigma_z = 0.100$	
		$\kappa > 0$	$\kappa = 0$	$\kappa > 0$	$\kappa = 0$	$\kappa > 0$	$\kappa = 0$	$\kappa > 0$	$\kappa = 0$
Macro	Total	1.30	1.34	1.58	1.52	1.47	1.39	2.99	2.54
	Ext	1.02	0.81	1.28	0.90	1.22	0.83	2.69	1.97
	Int	0.28	0.53	0.30	0.62	0.25	0.56	0.30	0.57
Micro	All	0.58	1.00	0.60	1.00	0.59	1.00	0.57	1.00
	39–41	0.05	0.97	0.06	0.97	0.05	0.96	0.09	0.97

Note: The table displays the computed macro and micro elasticities for the models with different degrees of heterogeneity. Micro elasticity is estimated using Equation 5, while macro elasticity is derived from the regression model in Equation 6. The term "All" refers to the micro elasticity calculated using the entire sample, whereas "39-41" represents micro elasticity computed exclusively for households within the specified hours bin.

has a greater concentration of households around the market wage, resulting in a higher proportion of marginal workers. Comparing the two alternative models (which share the same income Gini) reveals that lower wealth inequality leads to a lower macro elasticity. This suggests that, holding income inequality constant, reducing wealth inequality tends to dampen macro labor supply responsiveness. Nevertheless, in both alternative model economies, the micro labor supply elasticity remains low—around 0.6—with almost no variation across specifications. This is primarily due to the friction imposed by the 40-hour workweek, as evidenced by the fact that households working 39 to 41 hours exhibit virtually zero micro elasticity. In contrast, when the wage penalty is removed, the model yields a substantial increase in the intensive margin elasticity—approximately doubling—and the micro elasticity rises to around 1.0, equal to the preference parameter. This highlights the key role of wage frictions in constraining micro-level labor supply adjustments.

Lastly, I also consider an extreme case where $\rho_z = 0.9$ and $\sigma_z = 0.1$. Although these values are much lower than empirically plausible estimates, they serve to further test the robustness of the main findings. The final column of Table A.2 reports the results for this case. In this economy, the resulting wealth and income Gini coefficients are 0.46 and 0.36, respectively—significantly lower than both the data and the benchmark model. The macro labor supply elasticity rises markedly to around 3.0, reflecting the limited heterogeneity. In contrast, the micro elasticity remains low, around 0.6, and the pattern of near-zero elasticity for households clustered around the 40-hour threshold persists. When the wage penalty is removed in this economy, the intensive margin elasticity approximately doubles, and the micro elasticity increases to around 1.0—equal to the preference parameter. This further highlights the central role of the 40-hour workweek friction in constraining micro-level labor supply responses, even in environments with minimal heterogeneity.

Taken together, these findings underscore the robust role of the 40-hour workweek in shaping labor market adjustments across both the extensive and intensive margins—even under alternative calibrations of the idiosyncratic income process. Variations in the persistence and dispersion of idiosyncratic shocks significantly influence macro labor supply elasticity, while micro elasticity remains largely unresponsive due to the institutional friction imposed by the 40-hour threshold. These results help reconcile the well-known gap between macro and micro labor supply elasticities by highlighting how labor market institutions, rather than heterogeneity alone, can drive this divergence.

D Extended Models

D.1 A Model with Piecewise Wage Penalty Function

The benchmark model includes a wage penalty that imposes a one-sided friction only on households working fewer than 40 hours per week, capturing the disincentives for part-time work. However, as shown by Bick, Blandin and Rogerson (2022), a notable share of households also cluster around 50 hours per week, suggesting that frictions may exist not only below but also above the 40-hour threshold. To account for this empirical pattern, they introduce a step-function wage penalty with three distinct regions, corresponding to different segments of the hours distribution. This formulation allows for asymmetries in wage penalties across low, medium, and high hours worked. I extend the framework by incorporating additional frictions for households working more than 40 hours, while preferences and household budget constraints remain unchanged from the benchmark model. In particular, the wage penalty function is reformulated as a piecewise function to allow different penalty intensities across the three regions:

$$g(h) = \begin{cases} h - \kappa_1(\overline{h}_{40} - h), & \text{if } h < \overline{h}_{40}, \\ h - \kappa_2(h - \overline{h}_{40}), & \text{if } \overline{h}_{40} \leq h < \overline{h}_{50}, \\ h - \kappa_3(h - \overline{h}_{50}) + \Delta, & \text{if } h \geq \overline{h}_{50}, \end{cases}$$

Table A.3: PARAMETERS OF THE PIECEWISE WAGE PENALTY MODEL

σ	γ	α	δ	ρ_λ	σ_λ	ρ_z	σ_z
1	1	0.33	0.025	0.95	0.01	0.975	0.201
β	$\overline{\psi}$	$\overline{\xi}$	$\overline{h}$	$\underline{a}$	κ_1	κ_2	κ_3
0.9765	18.9	0.105	0.24	-0.5	0.18	0.04	0.3

where $\overline{h}_{40}$ and $\overline{h}_{50}$ denote weekly hour thresholds at 40 and 50 hours respectively, and κ_2 and κ_3 are additional friction parameters corresponding to the intermediate and upper regions, respectively. Δ ensures that $g(h)$ is continuous at $\overline{h}_{50}$.[8]

The calibration strategy closely follows that of the benchmark model. The time discount factor β is chosen to yield a quarterly return to capital of 1 percent (4 percent annualized) in the steady state. The risk aversion parameter, σ, is set to 1, and the curvature parameter, γ, is also set to 1. The social norm for hours worked, $\overline{h}$, is calibrated to 0.24. The disutility of working, ψ, is chosen so that the average hours conditional on working are 0.23. The home production parameter, $\overline{\xi}$, is calibrated so that the steady-state employment rate is 70 percent. The borrowing limit, $\underline{a}$, is set to match quarterly average earnings in the model economy. Parameters related to labor productivity z and the production technology are consistent with those in the benchmark model. $\kappa_1 = 0.18$ is calibrated to match the fraction of households working around 40 hours. The additional penalty parameters κ_2 and $\kappa_3$are calibrated to match the empirical mass of households working between 40 and 50 hours and the secondary spike at 50 hours, respectively. Table A.3 summarizes the parameter values used in the model with the piecewise wage penalty function.

Figure A.4 plots the distribution of weekly and annual hours in the extended model. Thanks to the piecewise wage-penalty function, the model replicates the empirical spikes at both 40 and 50 hours remarkably well. Table A.4 reports the implied labor supply elasticities. The macro labor supply elasticity is approximately 1.2, with nearly 80 percent attributable to the extensive margin.[9] In contrast, the micro elasticity remains low (around 0.7), and is substantially smaller for households clustered at the 40-hour (0.08) and 50-hour (0.06) thresholds. Removing the wage penalty modestly increases the macro elasticity and raises the intensive margin's contribution to about 40 percent. The implied micro-level elasticity in this case rises to 1, matching the preference parameter and exceeding that in the model with the wage penalty. These results confirm that the extended wage-penalty specification still meaningfully affects the composi-

[8]Specifically, $\Delta = \kappa_2(h_{50} - h_{40}) - h_{50}$.

[9]It should be noted that hours volatility relative to output remains close to 0.6, nearly unchanged from the benchmark model.

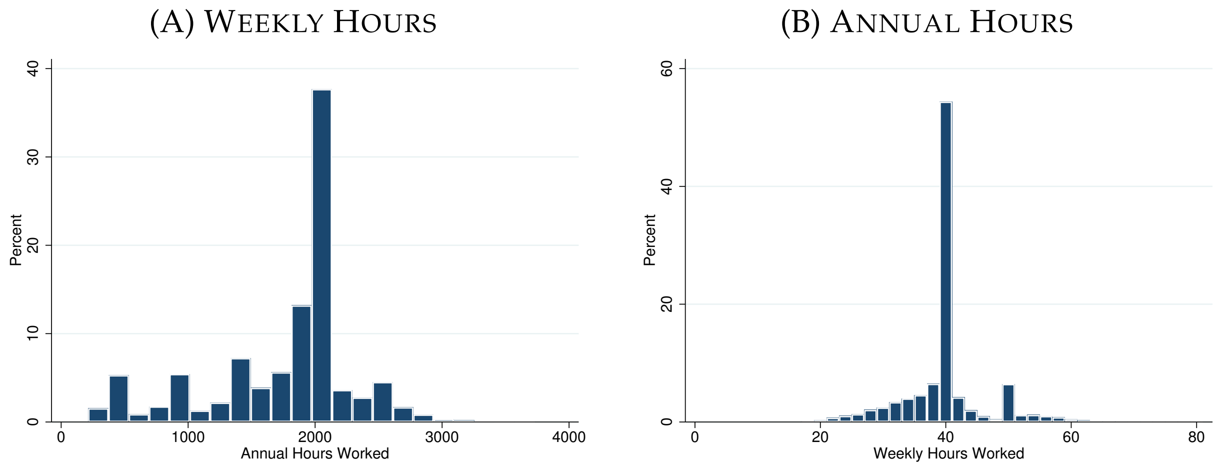


Figure A.4: Weekly and Annual Hours Distribution: Model with Piecewise Wage Penalty

Note: Weekly and annual hours for individual workers in the model with the piecewise wage penalty function

Table A.4: Implied Macro and Micro Elasticities: Model with Piecewise Wage Penalty

		Model w/ Piecewise Wage Penalty	Model w/o Piecewise Wage Penalty
Macro	Total	1.15	1.34
	Extensive	0.93	0.81
	Intensive	0.23	0.53
Micro	All Households	0.69	1.00
	38–42 Hours Bin	0.08	0.99
	48–52 Hours Bin	0.06	0.99

Note: The table displays the computed macro and micro elasticities for both models with and without piecewise wage penalty. Micro elasticity is estimated using Equation 5, while macro elasticity is derived from the regression model in Equation 6. "All Households" refers to the micro elasticity calculated using the entire sample, whereas "38–42 Hours Bin" and "48–52 Hours Bin" represent micro elasticity computed for households within the specified hours bin.

tion of labor market adjustment across margins and helps reconcile the gap between macro- and micro-level labor supply elasticities.

D.2 A Two-Shock Model

The benchmark model fails to replicate the observed degree of cross-sectional dispersion in hours worked. While it captures key macroeconomic dynamics, it falls short in matching the rich heterogeneity in individual labor supply behavior observed in the data. This discrepancy stems from the model's reliance on a single source of heterogeneity—idiosyncratic productivity shocks. In such a framework, differences in labor supply arise solely from variation in earnings ability, which proves insufficient to account for the broad range of hours worked across individuals, especially the significant dispersion and clustering seen around specific thresholds like 40 and 50 hours.

A natural extension is to incorporate additional dimensions of heterogeneity that directly influence households' willingness to work. Following Chang et al. (2020) and Bick, Blandin and Rogerson (2022), I introduce preference heterogeneity by allowing for individual-specific, time-varying shocks to the disutility of labor, denoted by ψ_t. These shocks reflect differences in tastes for leisure, household responsibilities, health status, or other factors that influence the subjective cost of supplying labor. The shocks follow a log-AR(1) process and are allowed to be correlated with productivity shocks z_t, thereby introducing a richer structure in how productivity and preferences jointly shape labor supply. Formally, the preference shock evolves according to:

$$\ln \psi' = \rho_\psi \ln \psi + \varepsilon_\psi,$$

where the innovation vector follows a bivariate normal distribution:

$$\begin{pmatrix} \varepsilon_z \\ \varepsilon_\psi \end{pmatrix} \sim \mathcal{N}\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_z^2 & \sigma_{z\psi} \\ \sigma_{z\psi} & \sigma_\psi^2 \end{pmatrix} \right).$$

This specification allows the model to generate greater dispersion in hours worked, addressing a key shortcoming of the benchmark model. However, the introduction of preference heterogeneity complicates the ability to replicate the pronounced empirical mass of households working exactly 40 hours. In the benchmark model, this spike is generated by a wage penalty parameter κ that discourages deviations from the full-time threshold. But with heterogeneous ψ_t, many households—particularly those with high disutility—prefer significantly fewer hours, and matching the 40-hour spike would require unrealistically large penalties. To overcome this, I introduce an additional friction: a utility cost that penalizes upward deviations from a normative hours target $\bar{h}$, set to 40 hours per week. This cost is governed by the parameter κ^U and directly enters the period utility function as:

$$u(c_t, h_t) = \frac{c_t^{1-\sigma} - 1}{1-\sigma} - \psi_t \frac{h_t^{1+1/\gamma}}{1+1/\gamma} - \kappa^U \max(h_t - \bar{h}, 0).$$

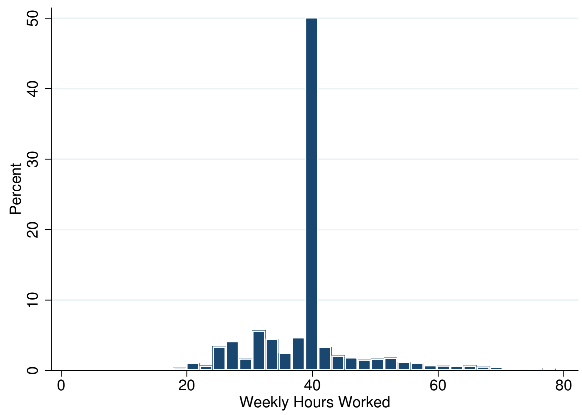
This modification preserves the benchmark structure while improving the model's ability to generate bunching around the full-time threshold.

Table A.5 summarizes the parameter values used in the two-shock model with productivity and preference shocks. The calibration strategy closely follows that of the benchmark model.

Table A.5: PARAMETERS OF THE TWO-SHOCK MODEL

σ	γ	α	δ	ρ_λ	σ_λ	ρ_z	σ_z	$\underline{a}$
1	1	0.33	0.025	0.95	0.01	0.975	0.165	-0.5
β	$\overline{\psi}$	$\overline{\xi}$	$\overline{h}$	κ	κ^U	ρ_ψ	σ_ψ	$\sigma_{z\psi}$
0.9742	37	-0.002	0.24	0.23	2.7	0.975	0.185	-0.33

(A) WEEKLY HOURS



(B) ANNUAL HOURS

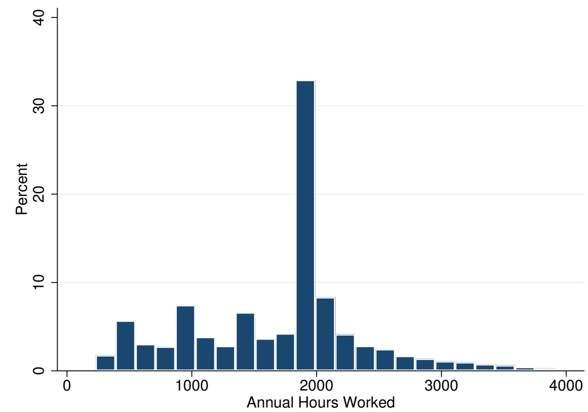


Figure A.5: WEEKLY AND ANNUAL HOURS DISTRIBUTION: TWO-SHOCK MODEL

Note: Weekly and annual hours for individual workers in the two-shock model economy.

The time discount factor β is chosen to yield a quarterly return to capital of 1 percent (4 percent annualized) in the steady state. The risk aversion parameter σ is set to 1, and the curvature parameter γ is also set to 1. The social norm for hours worked, $\bar{h}$, is calibrated to 0.24. The average disutility of working, $\bar{\psi}$, is set so that the average hours conditional on working equal 0.23. The home production parameter $\bar{\xi}$ is chosen so that the steady-state employment rate is 70 percent. The borrowing limit $\underline{a}$ is calibrated to match quarterly average earnings in the model economy. Parameters related to labor productivity z and the production technology are consistent with those in the benchmark model, with the exception of the standard deviation of productivity shocks, σ_z, which is recalibrated to match the empirical Gini coefficient of earnings.

For the preference shock ψ_t, I assume the same persistence as the productivity shock, and calibrate its standard deviation to match the empirical dispersion in annual hours worked, as measured by the coefficient of variation. The covariance between productivity and preference shocks is set to $\sigma_{z\psi} = -0.33$, in line with Bick, Blandin and Rogerson (2022). The benchmark wage penalty parameter is maintained at $\kappa = 0.25$, ensuring consistency with empirical wage schedules, while the utility cost parameter κ^U is calibrated to match the empirical share of households whose hours cluster near the 40-hour threshold.

Table A.6: IMPLIED MACRO AND MICRO ELASTICITIES: TWO-SHOCK MODELS

		Two-shock Model w/ Frictions	Two-shock Model w/o Frictions
Macro	Total	1.20	1.34
	Extensive	1.10	0.89
	Intensive	0.10	0.44
Micro	All Households	0.16	1.00
	38–42 Hours Bin	0.06	0.99

Note: The table displays the computed macro and micro elasticities for both the two-shock model and the model without the 40-hour work week frictions (the wage penalty and the associated utility costs). Micro elasticity is estimated using Equation 6, while macro elasticity is derived from the regression model in Equation 5. "All Households" refers to the micro elasticity calculated using the entire sample, whereas "38–42 Hours Bin" represents micro elasticity computed for households within the specified hours bin.

Figure A.5 displays the distribution of weekly hours worked in the two-shock model. With the addition of preference shocks, the model successfully replicates both the empirical spike at 40 hours and the overall dispersion in hours worked. For example, the model generates a coefficient of variation of 0.40 in annual hours, which is comparable to the data, although the peak near 2,000 annual hours is slightly lower than observed empirically. Table A.6 reports the implied labor supply elasticities. The macro-level labor supply elasticity is approximately 1.2, with nearly 90 percent attributable to the extensive margin.[10] In contrast, the micro-level elasticity is substantially smaller, around 0.16, and even lower for households clustered around the 40-hour threshold (0.06). Removing the 40-hour work week frictions, including both the wage penalty and the associated utility costs, modestly increases the macro labor supply elasticity and reduces the contribution of the extensive margin to about 66 percent. At the same time, the implied micro-level elasticity remains relatively large and aligned with the preference parameter.

These findings underscore the robust role of the 40-hour work week in shaping labor market adjustments across margins, even in the two shock model with dispersed hours worked, and in helping to reconcile the discrepancy between macro- and micro-level labor supply elasticities.

E Welfare Measures

The impact of economic fluctuations on an individual household's welfare is quantified using the consumption-equivalent welfare measure denoted as ω. This measure is determined by the

[10] Aggregate hours volatility is slightly lower in this model, yielding a cyclical variance ratio of hours to output of 0.41.

following equality:

$$\mathbb{E}[V(a,z;K',\lambda')|\overline{K},\overline{\lambda}] = V(a,\beta,z;\overline{K},\overline{\lambda},\omega). \tag{A.1}$$

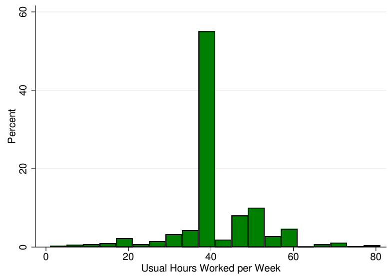
where

$$V(a,z;\overline{K},\overline{\lambda},\omega) = \max_{c_t,h_t} \mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t \left(\frac{\{(1-\omega)\,c_t\}^{1-\sigma} - 1}{1-\sigma} - \psi \frac{h_t^{1+1/\gamma}}{1+1/\gamma} \right) \right]$$

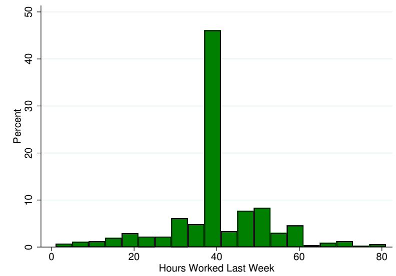
subject to the budget constraint (1) with the steady-state factor prices, $\overline{w}$ and $\overline{r}$. It is crucial to note that the expectation is conditioned on the steady-state aggregate variables, $\overline{\lambda}$, and $\overline{K}$, on the left-hand side of Equation (A.1). This implies a comparison of the welfare of the steady-state economy with that of the volatile economy, assuming equal aggregate capital. In this context, the average capital values of the fluctuating economy and the steady-state economy are nearly identical. As a result, the conditional compensating variation, ω, effectively represents the direct welfare effect of volatile aggregate productivity while keeping aggregate capital fixed at its steady-state level.

F Additional Figures and Tables

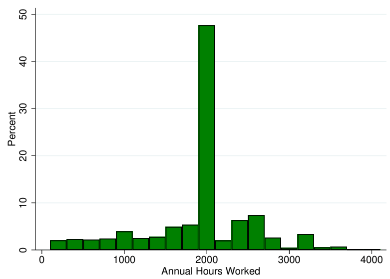
(A) CPS: Usual Hours for Head Only



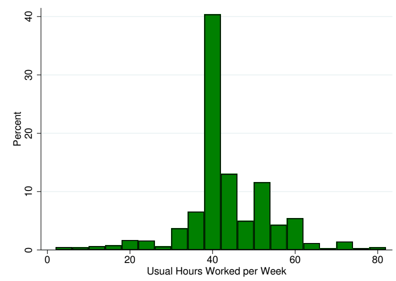
(B) CPS: Last Week Hours



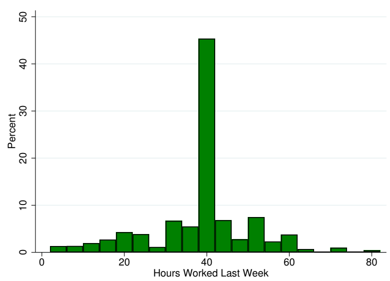
(C) CPS: Annual Hours



(D) PSID: Usual Hours



(E) CPS: Last Week Hours for Single Job



(F) CPS: Last Week Hours for Multiple Jobs

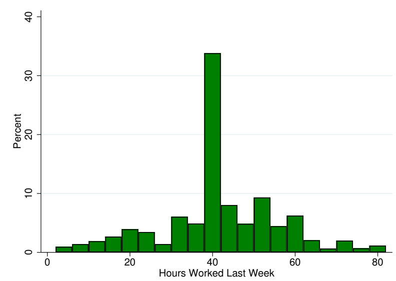


Figure A.6: ROBUSTNESS CHECK I: HOURS DISTRIBUTION

Note: Usual weekly hours for individual workers from the CPS over 1976-2019. Usual weekly hours from the PSID.

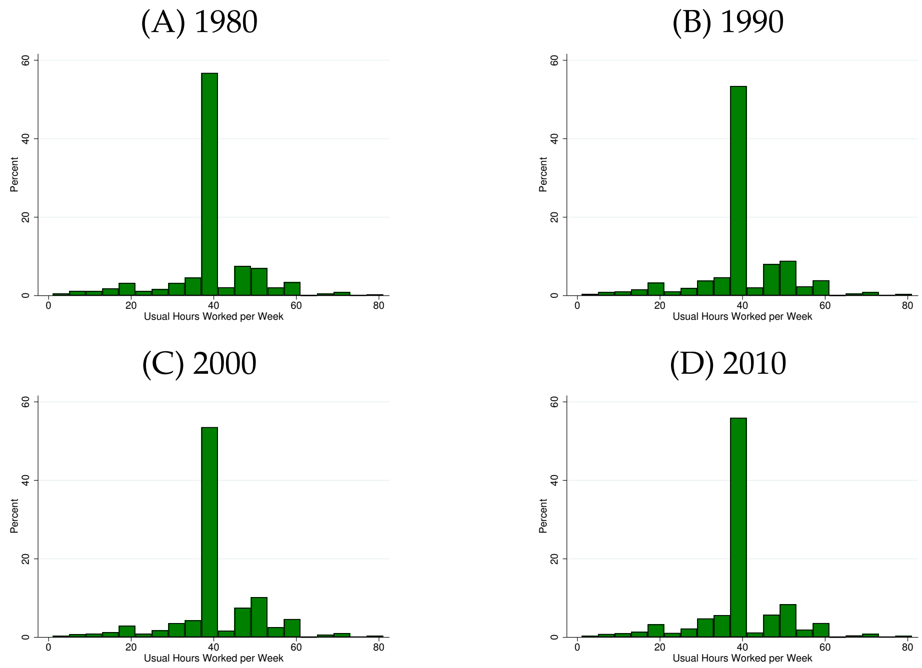


Figure A.7: ROBUSTNESS CHECK II: USUAL HOURS DISTRIBUTION ACROSS TIME

Note: Usual weekly hours for individual workers from the CPS.

Table A.7: WEALTH AND INCOME DISTRIBUTIONS

	Quintile					Gini
	1st	2nd	3rd	4th	5th	
WEALTH DISTRIBUTION						
Data						
PSID 1994	-0.82	1.54	6.47	16.26	76.55	0.76
Model						
Benchmark	-0.94	0.82	5.85	18.36	75.92	0.74
No Wage Penalty	-0.91	0.64	5.76	18.32	76.19	0.75
INCOME DISTRIBUTION						
Data						
PSID 1994	-0.04	4.98	13.36	24.04	57.66	0.58
Model						
Benchmark	0.24	5.93	11.89	21.54	60.40	0.59
No Wage Penalty	0.00	4.23	11.26	21.05	63.47	0.62

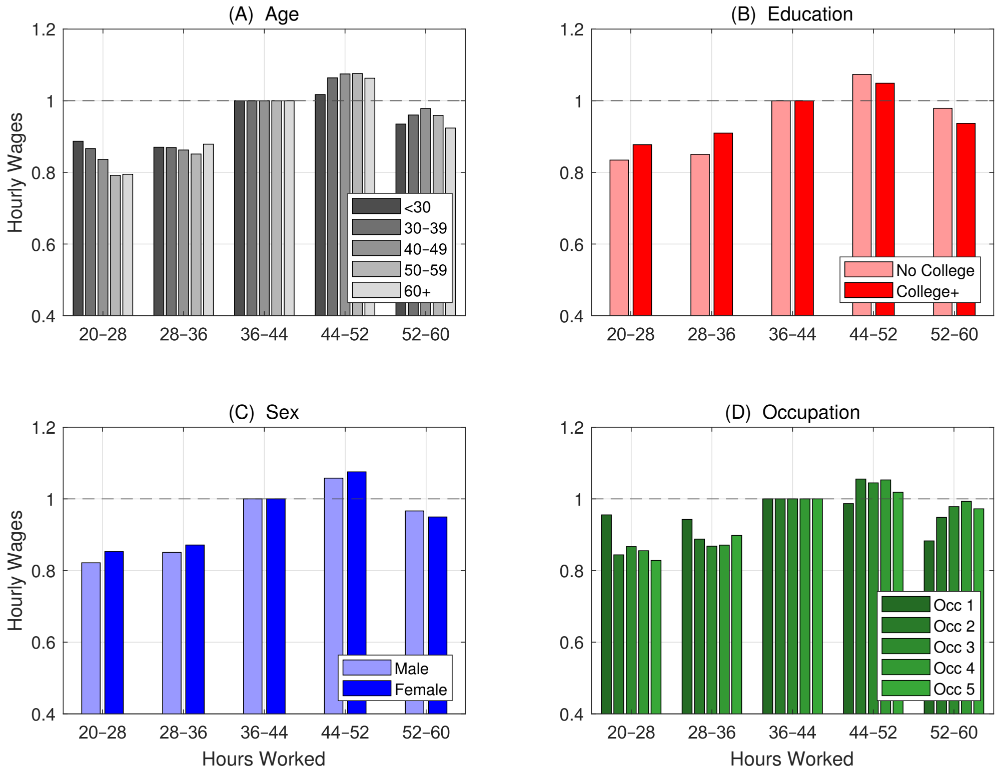


Figure A.8: WAGE-HOURS PROFILE BY CHARACTERISTICS

Note: Hourly wages are normalized to one in the 36–44-hour bin for each group and are residualized after controlling for individual characteristics. The five occupational categories are: (i) Managerial and Professional (Occ 1); (ii) Technical, Sales, and Administrative Support (Occ 2); (iii) Service (Occ 3); (iv) Farming, Forestry, Fishing, Operatives, and Laborers (Occ 4); and (v) Precision Production, Craft, and Repair (Occ 5).

References

Bick, Alexander, Adam Blandin, and Richard Rogerson. 2022. "Hours and Wages*." *The Quarterly Journal of Economics*, 137(3): 1901–1962.

Castaneda, Ana, Javier Díaz-Giménez, and José-Víctor Ríos-Rull. 1998. "Exploring the income distribution business cycle dynamics." *Journal of Monetary Economics*, 42(1): 93–130.

Chang, Yongsung, and Sun-Bin Kim. 2006. "From Individual to Aggregate Labor Supply: A Quantitative Analysis based on a Heterogeneous Agent Macroeconomy." *International Economic Review*, 47(1): 1–27.

Chang, Yongsung, Sun-Bin Kim, Kyooho Kwon, and Richard Rogerson. 2020. "Cross-sectional and aggregate labor supply." *European Economic Review*, 126: 103457.

Den Haan, Wouter J. 2010. "Assessing the accuracy of the aggregate law of motion in models with heterogeneous agents." *Journal of Economic Dynamics and Control*, 34(1): 79 – 99. Computational Suite of Models with Heterogeneous Agents: Incomplete Markets and Aggregate Uncertainty.

Krusell, Per, and Anthony A. Smith. 1998. "Income and Wealth Heterogeneity in the Macroeconomy." *Journal of Political Economy*, 106(5): 867–896.

Rogerson, Richard, and Johanna Wallenius. 2009. "Micro and Macro Elasticities in a Life Cycle Model with Taxes." *Journal of Economic Theory*, 144(6): 2277–2292.

Tauchen, George. 1986. "Finite state markov-chain approximations to univariate and vector autoregressions." *Economics Letters*, 20(2): 177–181.