Labor-Market Heterogeneity, Aggregation, and the Policy-(In)variance of DSGE Model Parameters

Online Appendix

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A Aggregate Data Sources

Aggregate capital and labor tax rates are obtained from Chen, Imrohoroglu, and Imrohoroglu (2009). As a measure of hours we use the Aggregate Hours Index (PRS85006033) published by the Bureau of Labor Statistics. The remaining data series are obtained from the FRED2 database maintained by the Federal Reserve Bank of St. Louis. Consumption is defined as real personal consumption expenditures on non-durables (PCNDGC96) and services (PCESVC96). Output is defined as the sum of consumption, consumption expenditures on durables (PCDGCC96), gross private domestic investment (GPDIC), and federal consumption expenditures and gross investment (FGCEC96).

For the estimation of the representative agent model based on U.S. data (see Table E-3 below), output, consumption, and hours are converted into per capita terms by dividing by the civilian non-institutionalized population (CNP16OV). The population series is provided at a monthly frequency and converted to quarterly frequency by simple averaging. Finally we take the natural logarithm of output, consumption, and hours. We restrict the sample to the period from 1965:I to 2006:IV, using observations from 1964 to initialize lags. We remove linear trends from the log output and consumption series and demean the log hours series. To make the log levels of the U.S. data comparable to the log levels of the data simulated from the heterogeneous-agents economy, we adjust (i) detrended log output by the steady-state output level in the heterogeneous-agents economy under the benchmark tax policy, (ii) detrended log consumption by the steady state output level in the heterogenous agent economy plus the log of the average consumption-output ratio in the U.S. data, and (iii) demeaned hours by the steady state of log employment.

B Derivations for the Representative-Agent Model

In this section, we collect the first-order conditions (and their log-linear approximation around the steady state) of the representative-agent model we use to fit the time series generated from the heterogeneous-agents economy.

First-Order Conditions: The first-order conditions (FOCs) associated with the Household Problem are:

$$\begin{aligned}
\lambda_t &= \frac{Z_t}{C_t} \\
\lambda_t &= \beta \mathbb{E}_t[\lambda_{t+1}(1 + (1 - \tau_K) R_{t+1})] \\
H_t^{1/\nu} &= (1 - \tau_H) \frac{\lambda_t}{Z_t} W_t B_t^{1+1/\nu}
\end{aligned}$$

Notice that the preference shock Z_t drops out of the labor supply function:

$$H_t^{1/\nu} = (1 - \tau_H) \frac{1}{C_t} W_t B_t^{1+1/\nu}.$$

The FOCs of the firms problem are provided in (4).

Steady States: We subsequently denote the deterministic steady-state values by

$$\bar{H}, \bar{K}, \bar{\lambda}, \bar{C}, \bar{Y}, \bar{A}, \bar{B}, \bar{W}, \bar{G}, \bar{R}.$$

The steady state value of Z_t is equal to one. It is convenient to express the model in terms of ratios relative to steady-state hours worked. The first-order conditions in the steady state become

$$\begin{aligned}
\bar{R} &= \frac{1/\beta - 1}{1 - \tau_K}, \quad \left(\frac{\bar{H}}{\bar{B}} \right)^{\frac{1}{\nu}} = (1 - \tau_H) \frac{\bar{B}}{\bar{C}} \bar{W}, \\
\frac{\bar{K}}{\bar{H}} &= \left(\frac{\bar{A}(1 - \alpha)}{\bar{R} + \delta} \right)^{\frac{1}{\alpha}}, \quad \bar{W} = \alpha \bar{A} \left(\frac{\bar{K}}{\bar{H}} \right)^{1-\alpha}.
\end{aligned}$$

Hence,

$$\frac{\bar{H}}{\bar{B}} = \left(\frac{(1 - \tau_H)\bar{W}}{\bar{C}/\bar{H}} \right)^{\frac{\nu}{1+\nu}}.$$

Moreover, the production function can be expressed as

$$\frac{\bar{Y}}{\bar{H}} = \bar{A} \left(\frac{\bar{K}}{\bar{H}} \right)^{1-\alpha}.$$

The government budget constraint leads to

$$\frac{\bar{T}}{\bar{H}} = \chi \left(\tau_H \bar{W} + \tau_K \bar{R} \frac{\bar{K}}{\bar{H}} \right), \quad \frac{\bar{G}}{\bar{H}} = (1 - \chi) \left(\tau_H \bar{W} + \tau_K \bar{R} \frac{\bar{K}}{\bar{H}} \right)$$

and the market clearing condition can be written as

$$\frac{\bar{Y}}{\bar{H}} = \frac{\bar{C}}{\bar{H}} + \delta\frac{\bar{K}}{\bar{H}} + \frac{\bar{G}}{\bar{H}}.$$

We can now write the consumption-hours ratio as

$$\begin{aligned}
\frac{\bar{C}}{\bar{H}} &= \bar{A}\left(\frac{\bar{K}}{\bar{H}}\right)^{1-\alpha} - \delta\frac{\bar{K}}{\bar{H}} - (1-\chi)\left(\tau_H\bar{W} + \tau_K\bar{R}\frac{\bar{K}}{\bar{H}}\right) \\
&= \bar{A}\left(\frac{\bar{K}}{\bar{H}}\right)^{1-\alpha} - (\delta + (1-\chi)\tau_K\bar{R})\frac{\bar{K}}{\bar{H}} - (1-\chi)\tau_H\alpha\bar{A}\left(\frac{\bar{K}}{\bar{H}}\right)^{1-\alpha} \\
&= [1-(1-\chi)\tau_H\alpha]\bar{A}\left(\frac{\bar{K}}{\bar{H}}\right)^{1-\alpha} - (\delta + (1-\chi)\tau_K\bar{R})\frac{\bar{K}}{\bar{H}}.
\end{aligned}$$

Hence, the steady state of hours worked is given by

$$\begin{aligned}
\bar{H} &= \bar{B}\left(\frac{(1-\tau_H)\alpha\bar{A}\left(\frac{\bar{K}}{\bar{H}}\right)^{1-\alpha}}{[1-(1-\chi)\tau_H\alpha]\bar{A}\left(\frac{\bar{K}}{\bar{H}}\right)^{1-\alpha} - (\delta + (1-\chi)\tau_K\bar{R})\frac{\bar{K}}{\bar{H}}}\right)^{\frac{\nu}{1+\nu}} \\
&= \bar{B}\left(\frac{(1-\tau_H)\alpha}{[1-(1-\chi)\tau_H\alpha] - (\delta + (1-\chi)\tau_K\bar{R})\bar{A}^{-1}\left(\frac{\bar{K}}{\bar{H}}\right)^{\alpha}}\right)^{\frac{\nu}{1+\nu}} \\
&= \bar{B}\left(\frac{(1-\tau_H)\alpha}{[1-(1-\chi)\tau_H\alpha] - [\delta/(\bar{R}+\delta) + (1-\chi)\tau_K(\bar{R}/(\bar{R}+\delta))](1-\alpha)}\right)^{\frac{\nu}{1+\nu}}
\end{aligned}$$

Log-Linear Approximation: Denote the percentage gap from the steady-state value of each variable by

$$\widehat{H}_t, \widehat{K}_{t+1}, \widehat{\lambda}_t, \widehat{C}_t, \widehat{Y}_t, \widehat{A}_t, \widehat{B}_t, \widehat{W}_t, \widehat{G}_t, \widehat{Z}_t, \widehat{R}_t.$$

We obtain the following equations:

$$
\begin{aligned}
[\bar{R}/(\bar{R}+\delta)]\widehat{R}_t &= \widehat{A}_t + \alpha\widehat{H}_t - \alpha\widehat{K}_t \\
\widehat{W}_t &= \widehat{A}_t + (\alpha-1)\widehat{H}_t + (1-\alpha)\widehat{K}_t \\
\widehat{\lambda}_t &= -\widehat{C}_t + \widehat{Z}_t \\
\widehat{\lambda}_t &= \mathbb{E}_t[\widehat{\lambda}_{t+1} + (1-\beta)\widehat{R}_{t+1}] \\
\nu^{-1}\widehat{H}_t &= -\widehat{C}_t + \widehat{W}_t + (1+\nu^{-1})\widehat{B}_t \\
\bar{Y}\widehat{Y}_t &= \bar{C}\widehat{C}_t + \bar{K}\widehat{K}_{t+1} - (1-\delta)\bar{K}\widehat{K}_t + \bar{G}\widehat{G}_t \\
(1-\chi)\widehat{G}_t &= \frac{\tau_H\alpha[\widehat{W}_t + \widehat{H}_t] + \tau_K(1-\alpha)[\bar{R}/(\bar{R}+\delta)]\widehat{Y}_t}{\tau_H\alpha + \tau_K(1-\alpha)[\bar{R}/(\bar{R}+\delta)]} \\
\widehat{Y}_t &= \widehat{A}_t + \alpha\widehat{H}_t + (1-\alpha)\widehat{K}_t \\
\widehat{A}_t &= \rho_A\widehat{A}_{t-1} + \sigma_A\epsilon_{A,t} \\
\widehat{B}_t &= \rho_B\widehat{B}_{t-1} + \sigma_B\epsilon_{B,t} \\
\widehat{Z}_t &= \rho_Z\widehat{Z}_{t-1} + \sigma_Z\epsilon_{Z,t}.
\end{aligned}
$$

If $\chi = 0$ then $\bar{G} = 0$ and we compute the level of government spending rather than percentage deviations from a steady state that is zero.

The return on capital R_t is before taxes and net of depreciation. We can define

$$R_t^\delta = R_t + \delta.$$

Its steady state is given by

$$\bar{R}^\delta = \frac{1/\beta - 1}{1-\tau_k} + \delta.$$

The steady state ratio can be expressed as

$$\frac{\bar{R}}{\bar{R}^\delta} = \frac{\bar{R}}{\bar{R}+\delta} = \frac{1/\beta - 1}{1/\beta - 1 + (1-\tau_K)\delta} = \frac{1-\beta}{1-\beta+\beta(1-\tau_K)\delta}.$$

In terms of percentage deviations from the steady state

$$\hat{R}_t^\delta = \frac{\bar{R}}{\bar{R}^\delta}\hat{R}_t.$$

Thus, the log-linearized equilibrium conditions involving R_t can be rewritten as

$$
\begin{aligned}
\hat{R}_t^\delta &= \hat{A}_t + \alpha\hat{H}_t - \alpha\hat{K}_t \\
\hat{\lambda}_t &= \mathbb{E}_t\left[\hat{\lambda}_{t+1} + (1-\beta)\frac{\bar{R}^\delta}{\bar{R}}\hat{R}_t^\delta\right] \\
&= \mathbb{E}_t\left[\hat{\lambda}_{t+1} + (1-\beta[1-(1-\tau_K)\delta])\hat{R}_t^\delta\right].
\end{aligned}
$$

In the procedure $dsgess(\cdot)$ the variable *rmallst* corresponds to $\bar{R}$ and *rst* corresponds to $\bar{R}^{\delta}$. In the procedure $dsgesolv(\cdot)$ the variable R corresponds to $\hat{R}_t^{\delta}$. The measurement equation is set up under the assumption that we observe R_t^{δ}.

C Welfare Measures

The social welfare is defined as:

$$\mathcal{W} = \int V(a,x) d\mu(a,x),$$

where $\mu(a,x)$ is the steady-state joint distribution of asset holdings and idiosyncratic productivity and $V(a,x)$ is the value function associated with the optimal decisions, i.e.,

$$V(a,x) = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \bigg\{ \ln c(a_t,x_t) - B\frac{h(a_t,x_t)^{1+1/\gamma}}{1+1/\gamma} \bigg\}.$$

$c(a,x)$ and $h(a,x)$ are the optimal decision rules for an individual whose asset holdings are a and idiosyncratic productivity is x. This is a utilitarian social welfare function that measures the *ex ante* welfare in the steady state—i.e., the welfare of an individual before the realization of initial assets and productivity, which is drawn from the steady-state distribution $\mu(a,x)$. We measure the welfare gain or loss due to a policy change by the constant percentage change in consumption each period for all individuals which is required to equate the social welfare before and after the policy change. Specifically, we compute Δ that solves

$$\int \left\{ \mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t \bigg\{ \ln\big((1+\Delta)c_0(a_t,x_t)\big) - B\frac{h_0(a_t,x_t)^{1+1/\gamma}}{1+1/\gamma} \bigg\} \right] \right\} d\mu_0(a_t,x_t)$$
$$= \int \left\{ \mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t \bigg\{ \ln c_1(a_t,x_t) - B\frac{h_1(a_t,x_t)^{1+1/\gamma}}{1+1/\gamma} \bigg\} \right] \right\} d\mu_1(a_t,x_t)$$

where c_0, h_0, and μ_0 are consumption, labor supply, and steady-state distribution before the policy change and c_1, h_1, and μ_1 are those after the policy change. A positive Δ implies that average welfare improves upon a policy change. With the logarithmic utility, the welfare gain Δ can be expressed as

$$\Delta = \exp\big((\mathcal{W}_1 - \mathcal{W}_0)(1-\beta)\big) - 1,$$

where $\mathcal{W}_0$ and $\mathcal{W}_1$ represent social welfare before and after the policy change, respectively. In the representative-agent model the distribution $\mu(a,x)$ is degenerate and the computation of the welfare effect simplifies considerably:

$$\Delta = \exp\left(\ln\left(\bar{C}_1/\bar{C}_0\right) - B\frac{\bar{H}_1^{1+1/\gamma} - \bar{H}_0^{1+1/\gamma}}{1+1/\gamma}\right) - 1,$$

where $\bar{C}_0$ and $\bar{H}_0$ are the steady-state values of consumption and labor supply in the benchmark economy, while $\bar{C}_1$ and $\bar{H}_1$ are those in an economy with a different policy.

D Structural Break Tests

To examine the detectability of coefficient changes across policy regimes we conduct the following experiment. Suppose an econometrician has access to 100 observations from the benchmark policy regime as well as 100 observations from one of the following alternative regimes: labor tax cut, capital tax raise, and more transfers. The econometrician knows the "true" policy coefficients for the benchmark and the alternative policy regime and estimates two versions of the representative agent model.

In the first version, $\mathcal{M}_0$, the non-policy parameters are assumed to be identical across regimes, whereas in the second version the non-policy parameters are allowed to differ. The second version of the model, $\mathcal{M}_1$, is estimated under a prior distribution that restricts potential changes in the non-policy parameters to be small. Let

$$r_A,\ \nu,\ \ln\bar{A},\ \ln\bar{B},\ \rho_A,\ \rho_B,\ \sigma_A,\ \sigma_B,\ \sigma_\zeta$$

denote the non-policy parameters under the benchmark regime. Then the parameters under the alternative policy regime are given by

$$r_A e^{\delta_r},\ \nu e^{\delta_\nu},\ \ln\bar{A}+\delta_A,\ \ln\bar{B}+\delta_B,\ \Phi(\Phi^{-1}(\rho_A)+\delta_{\rho_A}),\ \Phi(\Phi^{-1}(\rho_B)+\delta_{\rho_B}),\ \sigma_A e^{\delta_{\sigma_A}},\ \sigma_B e^{\delta_{\sigma_B}},\ \sigma_\zeta e^{\delta_{\sigma_\zeta}}.$$

Here we use $\Phi(\cdot)$ to denote the cumulative density function of a standard normal random variable. Note that for $\delta = 0$ the parameters are identical across regimes. According our prior, all δ's are independent. Moreover, δ_A and δ_B are normally distributed according to $N(0, 0.05^2)$. The prior for the remaining discrepancies is $N(0, 0.1^2)$. The following table provides the log marginal likelihood values for the specifications $\mathcal{M}_1$ and $\mathcal{M}_2$:

Policy Change	$\mathcal{M}_0$	$\mathcal{M}_1$
None	2796.19	2789.68
Labor Tax Cut	2724.08	2787.15
Capital Tax Raise	2728.52	2724.03
More Transfers	2753.42	2801.42

If the alternative policy is either a labor tax cut or and increase in transfer, the switching coefficient model $\mathcal{M}_1$ is favored by the posterior odds. If the alternative policy is a capital tax raise, the constant coefficient model is preferred. These results are consistent with our earlier result that the representative agent model delivers relatively accurate predictions of the effects of a capital tax change, but has difficulties capturing labor market effects.

E Additional Tables and Figures

Table E-1 compares the quintiles of the wealth distribution in the U.S. data (Panel Study of Income Dynamics, PSID) to the quintiles of the wealth distribution in the data simulated from the heterogenous agent economy under the benchmark calibration. Family wealth in the PSID reflects the net worth of houses, other real estate, vehicles, farms and businesses owned, stocks, bonds, cash accounts, and other assets. For each quintile group of the wealth distribution, we calculate the wealth share, ratio of group average to economy-wide average, and the earnings share. The household sample in the PSID cannot capture the right tail of the wealth distribution of the U.S. economy. Despite this shortcoming, the wealth share held by the top 20% of the distribution in the PSID, 76.2%, is fairly close to that in the Survey of Consumer Finance (SCF), 79.6%. See Chang and Kim (2006) for the detailed comparison of the wealth distributions between the PSID and SCF.

Table E-2 compares second moments of selected U.S. post-war time series to moments of the corresponding series in the simulated data from the heterogeneous agent economy. Data definitions for the U.S. time series are provided in Section B of this Appendix. Since the representative-agent model accommodates a deterministic balanced-growth path, we remove a linear trend from the U.S. time series of log output and consumption. Since the model economy allows for an aggregate productivity shock only and our calibration of the technology shock probably underestimates its variability, the aggregate output of the model exhibits only about three-quarters of the volatility of actual output. Consumption is as volatile as that in the data. A striking difference is the standard deviation of hours. It is three times more volatile in the actual data than it is in the simulated data. This is in part due to the low-frequency movement in labor supply, not captured in the model economy. In fact, the volatility of hours in the model-generated data is about half as volatile as the standard deviation of actual Hodrick-Prescott-filtered hours, which removes the low frequency variation. Output, consumption, and hours are all positively correlated. The correlations between output and hours as well as between consumption and hours are slightly stronger in the simulated data than they are in the U.S. data.

Table E-3 displays posterior estimates for the parameters of the representative agent model obtained from U.S. data. We remove a linear trend from the output and consumption data, normalize mean output such that it corresponds to mean output in the heterogeneous agents economy, and adjust the level of consumption such that we maintain the average consumption-output ratio in the U.S. data. It turns out that the estimated aggregate labor supply elasticity ($\hat{\nu} = 0.38$) based on U.S. data is much smaller than the estimates obtained from the simulated data.[15] Two salient features of the aggregate labor market of the U.S. economy are a high volatility of quantities (hours) relative to prices (productivity) and a lack of systematic correlation between hours and productivity. These features lead to estimates that imply a low aggregate labor supply elasticity and fairly large preference shocks. A variance decomposition based on the estimated (with U.S. data) DSGE model parameters implies that almost all of the variation in hours worked is due to preference shocks.

Figure E-1 plots time series of U.S. labor income and capital tax rates.

Table E-4 provides a variance decomposition of output, consumption, and hours based on the representative agent model that is estimated with data from the heterogeneous agent economy.

In order to shed light on how policy changes affect the aggregate labor supply estimates, Figure E-2 depicts pseudo aggregate labor supply schedules based on the steady-state reservation wage distribution, i.e., the inverse function of the cumulative reservation wage distribution, for the various fiscal policy regimes. Each curve represents the employment rate (on the x-axis) at a given wage rate (y-axis). The vertical line denotes the steady-state level of

[15] A more detailed empirical analysis based on post-war U.S. data can be found in Rios-Rull, Schorfheide, Fuentes-Albero, Kryshko, and Santaeulalia-Llopis (2009).

employment under each policy regime. The panels of Figure E-2 illustrate how the elasticity around each steady state varies with the fiscal policy. The aggregate labor supply schedule in the heterogeneous-agents economy becomes steeper toward the full employment level, as the economy moves toward the right tail of the reservation wage distribution. This pattern is mirrored in the labor-supply elasticity estimates generated with the representative-agent model.[16]

Tables E-5 to E-8 provide results that are obtained when the real interest rate is used as an observable.

Additional References

Rios-Rull, Jose-Victor, Frank Schorfheide, Cristina Fuentes-Albero, Maxym Kryshko, and Raul Santaeulalia-Llopis (2009): "Methods versus Substance: Measuring the Effects of Technology Shocks," *NBER Working Paper*, **15375**.

[16]The representative-agent-based estimate of the labor supply elasticity is not identical to the slope of the reservation wage distribution in the heterogeneous-agents economy. The calculation based on the slope of the reservation wage distribution assumes that the entire wealth-earnings distribution remains unchanged, whereas the aggregate productivity shock shifts the wealth-earnings distribution over time.

Table E-1: CHARACTERISTICS OF WEALTH DISTRIBUTION

	Quintile					
	1st	2nd	3rd	4th	5th	Total
PSID						
Share of wealth	-.52	.50	5.06	18.74	76.22	100
Group average/population average	-.02	.03	.25	.93	3.81	1
Share of earnings	7.51	11.31	18.72	24.21	38.23	100
Benchmark Model						
Share of wealth	-1.56	3.27	11.38	24.74	62.17	100
Group average/population average	-.08	.16	.57	1.24	3.11	1
Share of earnings	9.74	15.76	19.97	23.72	30.81	100

Notes: The PSID statistics reflect the family wealth and earnings levels published in the 1984 survey. Family wealth in the PSID reflects the net worth of houses, other real estate, vehicles, farms and businesses owned, stocks, bonds, cash accounts, and other assets.

Table E-2: Second Moments of Simulated and U.S. Data

	Model 3000 obs.	U.S. Data 1964-2006
$\sigma(\ln Y)$	.033	.041
$\sigma(\ln C)$	.020	.021
$\sigma(\ln H)$	.013	.042
$\sigma((\ln H)_{HP})$	.007	.018
$\text{corr}(\ln Y, \ln C)$	0.84	0.83
$\text{corr}(\ln Y, \ln H)$	0.80	0.56
$\text{corr}(\ln C, \ln H)$	0.37	0.51

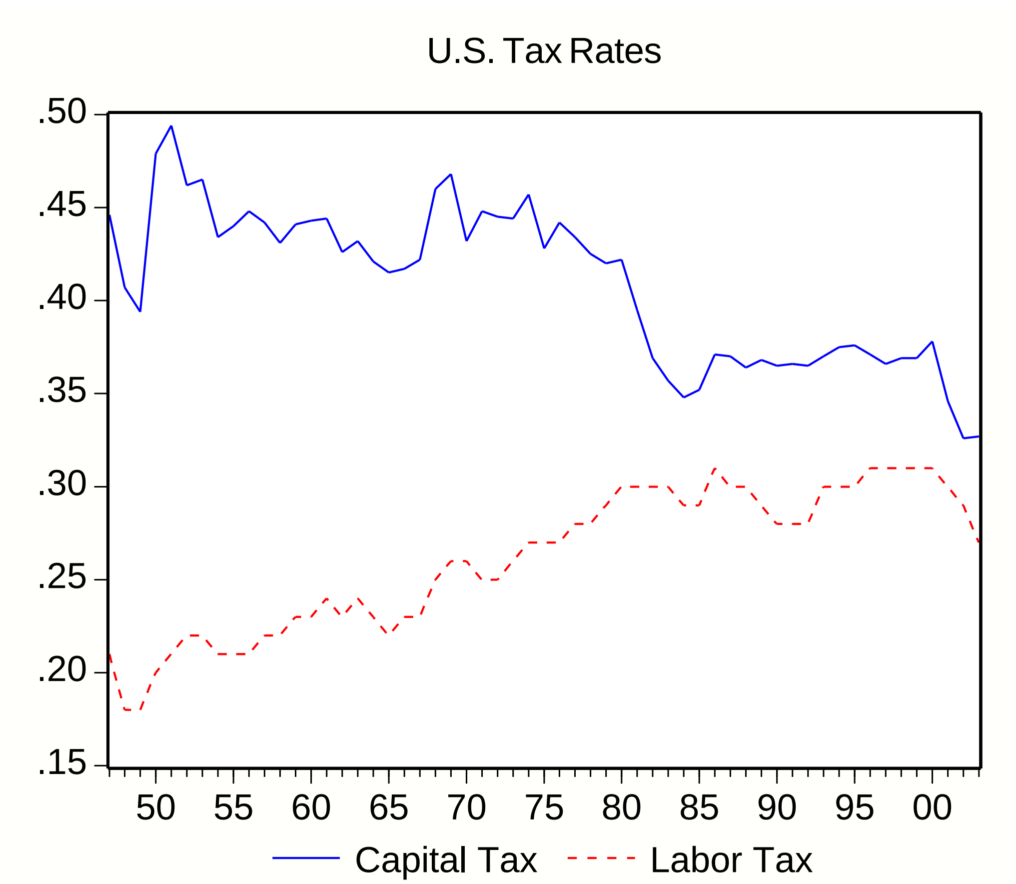
Notes: $\sigma(\cdot)$ is sample standard deviation, $\text{corr}(\cdot)$ is sample correlation, and $(\ln H)_{HP}$ denotes HP-filtered (smoothing parameter 1,600) log hours. Unless noted otherwise, we extract a linear trend from the U.S. data before computing the sample moments.

Table E-3: Parameter Estimates Obtained from U.S. Data

	Prior			Posterior	
	Domain	Mean	S.D.	Mean	90% Intv
r_A	Gamma	4.00	2.00	7.18	[5.60, 9.11]
ν	Gamma	1.00	0.50	0.38	[0.14, 0.61]
$\ln \bar{A}$	Normal	0.00	10.0	0.60	[0.58, 0.63]
$\ln \bar{B}$	Normal	0.00	10.0	-1.49	[-1.57, -1.42]
ρ_A	Beta	0.50	0.25	0.97	[0.95, 0.99]
ρ_B	Beta	0.50	0.25	0.98	[0.97, 0.99]
σ_A	Inv. Gamma	.012	.007	.006	[.006, .007]
σ_B	Inv. Gamma	.012	.007	.007	[.007, .008]
σ_Z	Inv. Gamma	.012	.007	.019	[.010, .029]

Notes: The following parameters are fixed during the estimation: $\delta = 0.025$, $\rho_Z = 0.99$, $\tau_H = 0.2$, $\tau_K = 0.2$, and $\chi = 0.5$. r_A is the annualized discount rate $r_A = 400 \times (1/\beta - 1)$. The estimation sample ranges from 1965:Q1 to 2006:Q4 ($T = 168$).

Figure E-1: U.S. Capital and Labor Tax Rates



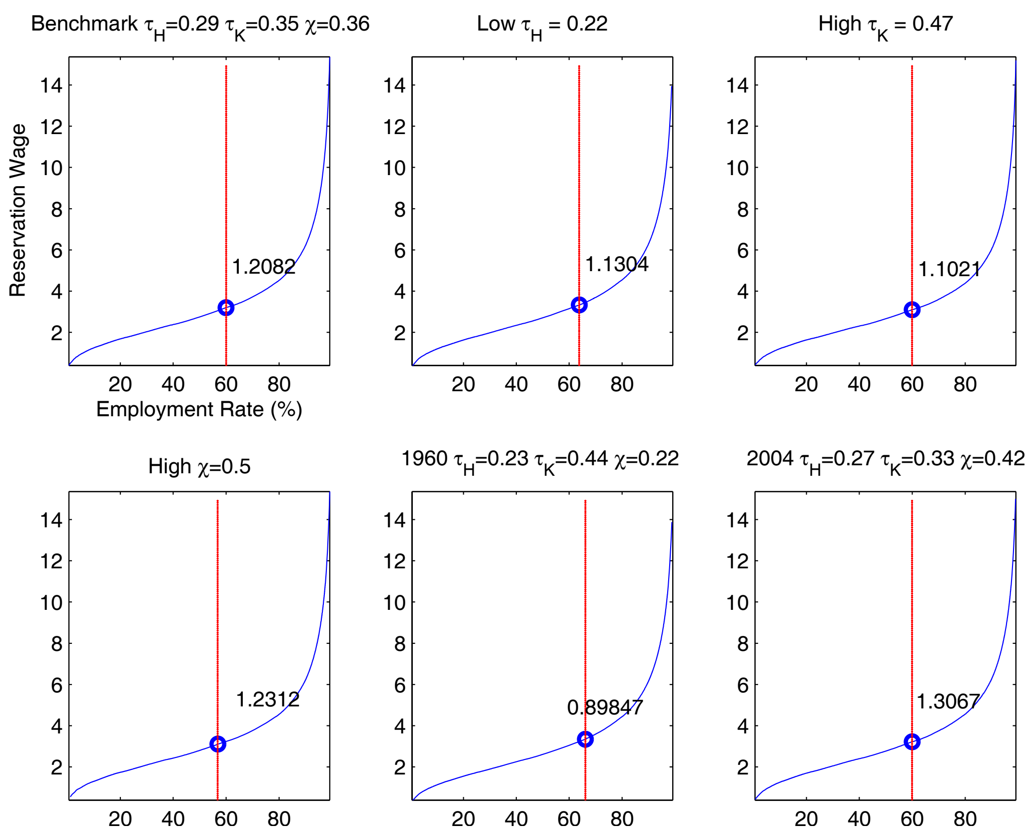
Notes: The data are taken from Chen, Imrohoroglu, and Imrohoroglu (2009).

Table E-4: RELATIVE IMPORTANCE OF PREFERENCE SHOCKS

	B		Z	
	Mean	90% Intv.	Mean	90% Intv.
Benchmark Economy, $T = 200$				
Output	5	[2, 8]	5	[4, 6]
Consumption	3	[0, 7]	6	[4, 7]
Hours	33	[18, 45]	5	[3, 7]
Benchmark Economy, $T = 2,500$				
Output	9	[8, 10]	5	[4, 5]
Consumption	9	[8, 10]	4	[4, 5]
Hours	43	[41, 46]	4	[4, 4]
U.S. Data				
Output	43	[20, 68]	13	[3, 24]
Consumption	46	[20, 75]	10	[3, 18]
Hours	98	[96, 99]	1	[0, 3]

Notes: The entries correspond to percentages.

Figure E-2: Aggregate Labor Supply based on Reservation Wage Distribution



Notes: Each curve represents the employment rate (on the x-axis) at a given wage rate (y-axis). The vertical line denotes the steady-state level of employment under the benchmark and the no-transfer policy regimes. The numbers in the plots indicate the elasticity of employment with respect to wages around the steady-state employment rate.

Table E-5: Estimates under Alternative Policies: $H - C - R$ Data Set

	Bench-mark	Labor Tax Cut	Capital Tax Raise	More Transfers	1960 Policy	2004 Policy
			Parameter Estimates, $T = 200$			
r_A	2.63	2.42	2.55	2.66	2.37	2.59
	[2.56, 2.71]	[2.33, 2.52]	[2.44, 2.64]	[2.60, 2.74]	[2.28, 2.46]	[2.50, 2.68]
ν	1.73	1.13	1.69	2.67	1.07	1.71
	[1.40, 2.05]	[0.92, 1.33]	[1.34, 2.03]	[2.09, 3.28]	[0.86, 1.27]	[1.37, 2.05]
$\ln \bar{A}$	0.44	0.41	0.44	0.47	0.40	0.44
	[0.44, 0.45]	[0.41, 0.42]	[0.44, 0.45]	[0.46, 0.47]	[0.39, 0.41]	[0.44, 0.45]
$\ln \bar{B}$	-1.43	-1.43	-1.43	-1.42	-1.42	-1.43
	[-1.44, -1.42]	[-1.44, -1.42]	[-1.45, -1.42]	[-1.44, -1.41]	[-1.43, -1.41]	[-1.45, -1.42]
ρ_A	0.90	0.95	0.93	0.92	0.95	0.94
	[0.89, 0.91]	[0.94, 0.95]	[0.92, 0.93]	[0.92, 0.93]	[0.94, 0.95]	[0.93, 0.94]
ρ_B	0.84	0.91	0.89	0.90	0.92	0.93
	[0.75, 0.91]	[0.88, 0.94]	[0.83, 0.93]	[0.89, 0.92]	[0.90, 0.94]	[0.90, 0.95]
σ_A	.005	.006	.006	.005	.006	.006
	[.005, .006]	[.006, .006]	[.005, .006]	[.005, .006]	[.005, .006]	[.005, .006]
σ_B	.003	.003	.003	.003	.003	.003
	[.003, .003]	[.002, .003]	[.003, .003]	[.003, .003]	[.002, .003]	[.003, .003]
σ_ζ	.003	.003	.003	.002	.002	.003
	[.002, .003]	[.002, .003]	[.003, .004]	[.002, .002]	[.002, .002]	[.002, .003]

Notes: The following parameters are fixed during the estimation of the representative-agent model: τ_H, τ_K, χ, $\delta = 0.025$, $\rho_Z = 0.99$. r_A is the annualized discount rate $r_A = 400 \times (1/\beta - 1)$. As parameter estimates we report posterior means and 90% credible intervals (in brackets).

Table E-6: Predictions of Policy Effects, $T = 200$: $H - C - R$ Data Set

		Labor Tax Cut	Capital Tax Raise	More Transfers	1960 Policy	2004 Policy
H	"True"	6.06	-0.23	-5.45	9.44	-0.21
	90% Intv.	[2.78, 3.21]	[-0.34, -0.29]	[-3.40, -2.95]	[4.80, 5.52]	[-0.22, -0.19]
	Score	8.8E-127	3.9E-010	2.3E-063	1.1E-083	2.8E-001
C	"True"	7.33	-2.73	3.04	1.73	3.86
	90% Intv.	[7.44, 7.86]	[-3.45, -3.29]	[1.63, 2.08]	[2.23, 2.96]	[3.57, 3.61]
	Score	5.8E-003	1.3E-040	1.2E-018	6.8E-005	9.9E-133
Y	"True"	3.44	-2.89	-2.19	2.57	0.81
	90% Intv.	[2.78, 3.21]	[-3.94, -3.80]	[-3.40, -2.95]	[2.15, 2.87]	[0.33, 0.37]
	Score	2.7E-004	3.7E-114	1.6E-013	4.2E-001	2.2E-308

Notes: The benchmark policy is $\tau_H = 0.29$, $\tau_K = 0.35$, $\chi = 0.36$. The entries in the table refer to percentage changes relative to the benchmark policy. "True" effects are computed from the means of the ergodic distributions of the heterogeneous-agents economy. 90% Intv. are predictive intervals computed from the posterior of the representative-agent model based on observations under the benchmark policy.

Table E-7: ESTIMATES UNDER ALTERNATIVE POLICIES: $Y - H - R$ DATA SET

	Bench-mark	Labor Tax Cut	Capital Tax Raise	More Transfers	1960 Policy	2004 Policy
	Parameter Estimates, $T = 200$					
r_A	2.56	2.37	2.47	2.59	2.29	2.52
	[2.45, 2.67]	[2.25, 2.49]	[2.34, 2.61]	[2.49, 2.69]	[2.16, 2.42]	[2.40, 2.64]
ν	2.79	1.55	3.01	3.71	1.65	2.56
	[2.14, 3.46]	[1.20, 1.89]	[2.14, 3.85]	[2.65, 4.75]	[1.23, 2.06]	[1.90, 3.17]
$\ln \bar{A}$	0.45	0.42	0.45	0.47	0.41	0.45
	[0.42, 0.47]	[0.39, 0.44]	[0.42, 0.47]	[0.45, 0.49]	[0.38, 0.43]	[0.42, 0.47]
$\ln \bar{B}$	-1.40	-1.41	-1.40	-1.40	-1.40	-1.41
	[-1.42, -1.38]	[-1.43, -1.39]	[-1.42, -1.37]	[-1.42, -1.37]	[-1.41, -1.38]	[-1.43, -1.38]
ρ_A	0.98	0.98	0.98	0.98	0.98	0.98
	[0.98, 0.98]	[0.97, 0.98]	[0.98, 0.98]	[0.98, 0.98]	[0.98, 0.98]	[0.98, 0.98]
ρ_B	0.97	0.98	0.98	0.98	0.98	0.98
	[0.97, 0.98]	[0.97, 0.98]	[0.98, 0.99]	[0.97, 0.98]	[0.97, 0.99]	[0.98, 0.99]
σ_A	.006	.006	.006	.005	.006	.006
	[.005, .006]	[.006, .007]	[.005, .006]	[.005, .006]	[.006, .007]	[.005, .006]
σ_B	.003	.003	.003	.003	.003	.003
	[.003, .003]	[.002, .003]	[.003, .003]	[.003, .004]	[.002, .003]	[.003, .003]
σ_ζ	.003	.003	.004	.002	.003	.003
	[.003, .003]	[.003, .003]	[.003, .004]	[.002, .002]	[.003, .003]	[.003, .003]

Notes: The following parameters are fixed during the estimation of the representative-agent model: τ_H, τ_K, χ, $\delta = 0.025$, $\rho_Z = 0.99$. r_A is the annualized discount rate $r_A = 400 \times (1/\beta - 1)$. As parameter estimates we report posterior means and 90% credible intervals (in brackets).

Table E-8: PREDICTIONS OF POLICY EFFECTS, $T = 200$: $Y - H - R$ DATA SET

		Labor Tax Cut	Capital Tax Raise	More Transfers	1960 Policy	2004 Policy
H	"True"	6.06	-0.23	-5.45	9.44	-0.21
	90% Intv.	[3.24, 3.71]	[-0.40, -0.35]	[-3.94, -3.45]	[5.61, 6.41]	[-0.26, -0.22]
	Score	5.8E-074	4.5E-020	1.1E-031	4.5E-045	1.0E-003
C	"True"	7.33	-2.73	3.04	1.73	3.86
	90% Intv.	[7.92, 8.38]	[-3.46, -3.24]	[1.09, 1.58]	[3.09, 3.90]	[3.52, 3.57]
	Score	2.9E-009	2.1E-020	1.9E-030	3.5E-013	1.1E-120
Y	"True"	3.44	-2.89	-2.19	2.57	0.81
	90% Intv.	[3.24, 3.71]	[-3.96, -3.76]	[-3.94, -3.45]	[3.00, 3.80]	[0.28, 0.33]
	Score	3.8E-001	3.2E-057	3.8E-024	2.8E-004	6.3E-268

Notes: The benchmark policy is $\tau_H = 0.29$, $\tau_K = 0.35$, $\chi = 0.36$. The entries in the table refer to percentage changes relative to the benchmark policy. "True" effects are computed from the means of the ergodic distributions of the heterogeneous-agents economy. 90% Intv. are predictive intervals computed from the posterior of the representative-agent model based on observations under the benchmark policy.