Appendix:
How the Baby Boomers' Retirement Wave Distorts Model-Based Output Gap Estimates

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Appendix A: Data Sources

Average Weekly Hours in the Nonfarm Business Sector

- Source: US. Bureau of Labor Statistics, Series ID: PRS85006023. This hours measure is multiplied with the employment-population ratio to measure hours per capita.
- Employment: Civilian Employment (based on civilian noninstitutional population, persons 16 years and older), Source: US. Bureau of Labor Statistics, Series ID: LNS12000000.
- Population: Civilian Noninstitutional Population (persons 16 years of age and older), Source: US. Bureau of Labor Statistics, Series ID: LNU00000000.

Hours per Capita in the Private Business Sector

- Source: US. Bureau of Labor Statistics, available at: https://www.bls.gov/lpc/special_requests/us_total_hrs_emp.xlsx, one needs to add up the hours series for the nonfarm business sector and for the farm sector.
- Population: Civilian Noninstitutional Population (see description above).

Total Hours per Capita all Sectors

- Source: US. Bureau of Labor Statistics, available at: http://www.bls.gov/lpc/special_requests/us_total_hrs_emp.xlsx.
- Population: Noninstitutional Population (sum of civilian noninstitutional population and armed forces)
  - Civilian Noninstitutional Population (see description above).
  - Armed Forces: Data until end of 2011 is taken from data constructed by Cociuba et al. (2012); Data from 2012 onwards is taken from the Defense Manpower Data Center: https://www.dmdc.osd.mil/appj/dwp/dwp_reports.jsp (Active Duty Military Personnel by Service by Rank/Grade).

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Total Hours per Capita all Sectors, Demographically Adjusted

- Until the fourth quarter of 2007 the series from Francis and Ramey (2009) is used. It is available on Valerie A. Ramey's website: http://econweb.ucsd.edu/ vramey/research/Francis-Ramey_JMCB_Data_09.xls. I have replicated the series and got almost identical numbers.
- Data for Total Hours per Capita all Sectors is described above.
- Data for the demographical adjustment (from 2008 onwards):
  - Population shares of different age groups: US Census Bureau, Annual Data is interpolated to quarterly:
    - 2008-2009: https://www.census.gov/popest/data/intercensal/national/nat2010.html.
    - 2010-2016: https://factfinder.census.gov/bkmk/table/1.0/en/PEP/2016/PEPAGESEX
    - 2017 (Projection): https://www.census.gov/population/projections/files/summary/NP2014-T9.xls.
  - Average hours of different age groups: I use Census data from the integrated public use microdata series (IPUMs) based on the yearly American Community Survey from 2007-2014 (Ruggles et al., 2015).
    - Calculating average hours worked per week: For each individual I multiply the number of hours per week (UHRSWORK) with the number of weeks worked and divide the result by 52. Afterwards, I take the mean for all individuals of each age group.
    - The exact number of weeks worked (WKSWORK1) is only available until 2007. Afterwards, only intervals of the number of weeks worked are available in IPUMS (WKSWORK2). For 2007 both WKSWORK1 and WKSWORK2 are available. I compute for 2007 for each age group the mean of WKSWORK1 for each interval WKSWORK2. I then use this number as a proxy of the number of weeks worked for each interval in WKSWORK2 for the years after 2007.
    - For 2016 and 2017 I approximate average hours worked by the different age groups with the values from 2015.
    - Annual data is linearly interpolated to quarterly.

Appendix B: Model Equations

The model is so well known that I only describe the log-linearized equations and refer the reader for more details to Del Negro and Schorfheide (2013) and Del Negro et al. (2015). All variables in the following are expressed in log deviations from their non-stochastic steady state.

$\tilde{z}_t$ denotes the linearly detrended log productivity process and follows an autoregressive process: $\tilde{z}_t = \rho_z \tilde{z}_{t-1} + \sigma_z \epsilon_{z,t}$. Non-stationary variables are detrended by $Z_t = e^{\gamma t + \frac{1}{1-\alpha}\tilde{z}_t}$, where γ denotes the steady state growth rate. z_t denotes the growth rate of Z_t in deviations from γ and follows the process $z_t = \ln(Z_t/Z_{t-1}) - \gamma = \frac{1}{1-\alpha}(\rho_z - 1)\tilde{z}_{t-1} + \frac{1}{1-\alpha}\sigma_z \epsilon_{z,t}$.

The consumption Euler equation can be derived from combining the households' first order conditions for consumption and bond holdings and is given by:

$$c_t = c_1(c_{t-1} - z_t) + (1 - c_1)E_t[c_{t+1} + z_{t+1}] + c_2(L_t - E_t[L_{t+1}]) - c_3(R_t - E_t[\pi_{t+1}] + \epsilon_t^b). \quad (1)$$

The parameters are $c_1 = (he^{-\gamma})/(1 + he^{-\gamma})$, $c_2 = [(\sigma_c - 1)(w_* L_*/c_*)]/[\sigma_c(1 + he^{-\gamma})]$ and $c_3 = (1-he^{-\gamma})/[(1+he^{-\gamma})\sigma_c]$. h governs the degree of habit formation, σ_c is the inverse of the intertemporal elasticity of substition and parameters with a $*$ subscript denote steady state values. ϵ_t^b denotes an AR(1) shock process on the premium over the central bank controlled interest rate. Consumption is a weighted average of past and expected future consumption due to habit formation. Consumption depends on hours worked, L_t, because of their nonseparability in the utility function. The real interest rate and the shock term affect aggregate demand by inducing intertemporal substitution in consumption.

The investment Euler equation is given by:

$$i_t = i_1(i_{t-1} - z_t) + (1 - i_1)E_t[i_{t+1} + z_{t+1}] + i_2 q_t + \epsilon_t^i, \quad (2)$$

where $i_1 = 1/(1 + \beta e^{(1-\sigma_c)\gamma})$ and $i_2 = 1/((1 + \beta e^{(1-\sigma_c)\gamma})e^{2\gamma}\phi)$. β denotes the discount factor, ϕ the elasticity of the capital adjustment cost function, q_t Tobin's Q and ϵ_t^i an investment specific technology shock that follows an AR(1) process. Current investment is a weighted average of past and expected future investment due to the existence of capital adjustment costs. It is positively related to the real value of the existing capital stock. This dependence decreases with the elasticity of the capital adjustment cost function.

The law of motion for physical capital is given by:

$$k_t = k_1(k_{t-1} - z_t) + (1 - k_1)i_t + k_2 \epsilon_t^i, \quad (3)$$

where $k_1 = (1 - i_*/k_*)$ and $k_2 = i_*/k_*(1 + \beta e^{(1-\sigma_c)\gamma})e^{2\gamma}\phi$.

The introduction of financial frictions leads to a replacement of the standard arbitrage condition between the return to capital and the riskless rate with the two following conditions:

$$E_t\left[\tilde{R}_{t+1}^k - R_t\right] = b_t + \zeta_{sp,b}\left(q_t^k + k_t - n_t\right) + \sigma_{w,t} \quad (4)$$

and

$$\tilde{R}_t^k - \pi_t = q_1 r_t^k + q_2 q_t^k - q_{t-1}^k, \quad (5)$$

where $q_1 = r_*^k / \left(r_*^k + (1-\delta)\right)$ and $q_2 = (1-\delta)/\left(r_*^k + (1-\delta)\right)$. $\tilde{R}_t^k$ denotes the gross nominal return on capital for entrepreneurs and n_t denotes equity of entrepreneurs. $\sigma_{w,t}$ denotes an AR(1) shock process that captures mean-preserving changes in the cross-section dispersion of entrepreneurial equity. Equation (4) determines the spread between the expected return on capital and the riskless interest rate. Equation (5) shows that the real value of the existing capital stock is a positive function of the rental rate of capital and a negative function of the real interest rate and the external finance premium. The net worth of entrepreneurs evolves according to the following law of motion:

$$n_t = \zeta_{n,\tilde{R}^k}\left(\tilde{R}_t^k - \pi_t\right) - \zeta_{n,R}\left(R_{t-1} - \pi_t\right) + \zeta_{n,qK}\left(q_{t-1}^k + k_{t-1}\right) + \zeta_{n,n} n_{t-1} - \frac{\zeta_{n,\sigma_w}}{\zeta_{sp,\sigma_w}}\sigma_{w,t-1}. \quad (6)$$

Capital used in production depends on the capital utilization rate and the physical capital stock of the previous period as new capital becomes effective with a lag of one quarter:

$$k_t^s = k_{t-1} + u_t - z_t. \tag{7}$$

k_t^s denotes effective capital and u_t the capital utilization rate.

Household income from renting capital services to firms depends on r_t^k and changing capital utilization is costly so that the capital utilization rate depends positively on the rental rate of capital:

$$u_t = (1-\psi)/\psi r_t^k, \tag{8}$$

where $\psi \in [0,1]$ is a positive function of the elasticity of the capital utilization adjustment cost function.

Real marginal costs are given by:

$$mc_t = w_t + \alpha L_t - \alpha k_t, \tag{9}$$

where α is the income share of capital in the production function. The capital-labor ratio is the same across all firms:

$$k_t = w_t - r_t^k + L_t. \tag{10}$$

The production process is assumed to be determined by a Cobb-Douglas production function with fixed costs:

$$y_t = \Phi(\alpha k_t^s + (1-\alpha)L_t) + (\Phi - 1)/(1-\alpha)\tilde{z}_t. \tag{11}$$

The resource constraint is given by:

$$y_t = c_y c_t + i_y i_t + u_y u_t + \epsilon_t^g - 1/(1-\alpha)\tilde{z}_t, \tag{12}$$

where output y_t is the sum of consumption, c_t, and investment, i_t, weighted with their steady state ratios to output $c_y = c_*/y_*$ and $i_y = i_*/y_*$, the capital-utilization adjustment cost which depends on the capital utilization rate, u_t, and the steady state ratio of this cost to output $u_y = r_*^k k_*/y_*$, and an exogenous government spending shock ϵ_t^g. ϵ_t^g follows an AR(1) process and is also affected by the technology shock.

Monopolistic competition, Calvo-style price contracts, and indexation of prices that are not free to be chosen optimally combine to yield the following Phillips curve:

$$\pi_t = \pi_1 \pi_{t-1} + \pi_2 E_t[\pi_{t+1}] + \pi_3 mc_t + \epsilon_t^p, \tag{13}$$

with $\pi_1 = \iota_p / \left(1 + \beta e^{(1-\sigma_c)\gamma}\iota_p\right)$, $\pi_2 = \beta e^{(1-\sigma_c)\gamma} / \left(1 + \beta e^{(1-\sigma_c)\gamma}\iota_p\right)$, $\pi_3 = 1/\left(1 + \beta e^{(1-\sigma_c)\gamma}\iota_p\right)$ $\left(1 - \beta e^{(1-\sigma_c)\gamma}\xi_p\right)(1-\xi_p) / (\xi_p(\Phi-1)\epsilon_p + 1)$. This Phillips curve contains not only a forward-looking but also a backward-looking inflation term because of price indexation. Firms that cannot adjust prices optimally either index their price to the lagged inflation rate or to the steady-state inflation rate. Note, this indexation assumption ensures also that the long-run Phillips curve is vertical. ξ_p denotes the Calvo parameter, ι_p governs the degree of backward indexation, ϵ_p determines the curvature of the Kimball aggregator. The mark-up shock ϵ_t^p follows an ARMA(1,1) process.

A monopolistic labor market yields the condition that the wage mark-up μ_t^w equals the real wage minus the marginal rate of substitution mrs_t:

$$\mu_t^w = w_t - mrs_t = w_t - \left[\sigma_l L_t + \frac{1}{1-he^{-\gamma}}(c_t - he^{-\gamma}(c_{t-1} - z_t))\right], \tag{14}$$

where σ_l characterizes the curvature of the disutility of labor.

The wage Phillips-Curve ist given by:

$$w_t = w_1(w_{t-1} - z_t) + (1-w_1)E_t[w_{t+1} + z_{t+1} + \pi_{t+1}] - w_2\pi_t - w_3\pi_{t-1} - w_4\mu_t^w + \epsilon_t^w, \tag{15}$$

where $w_1 = 1/(1+\beta e^{(1-\sigma_c)\gamma})$, $w_2 = (1+\beta e^{(1-\sigma_c)\gamma}\iota_w)/((1+\beta e^{(1-\sigma_c)\gamma}))$, $w_3 = \iota_w/(1+\beta e^{(1-\sigma_c)\gamma})$, and $w_4 = 1/(1+\beta e^{(1-\sigma_c)\gamma})(1-\beta e^{(1-\sigma_c)\gamma}\xi_w)(1-\xi_w)/(\xi_w((\phi_w-1)\epsilon_w+1))$. The parameter definition is analogous to the price Phillips curve.

The monetary policy rule reacts to inflation, the output gap and the change in the output gap and incorporates partial adjustment:

$$R_t = \rho R_{t-1} + (1-\rho)(\phi_\pi \pi_t + \phi_x x_t) + \phi_{\Delta x}(x_t - x_{t-1}) + r_t^m. \tag{16}$$

r_t^m is a monetary policy shock that follows an AR(1) process. The output gap x_t is defined as the log difference between output and potential output.

Potential output is described by an allocation without nominal rigidities, i.e. with flexible prices and wages, without financial frictions, and without inefficient price and wage mark-up shocks and financial friction shocks. This allocation is obtained by setting $\xi_p = 0$, $\xi_w = 0$, $\epsilon_t^p = 0$ and $\epsilon_t^w = 0$ and replacing equations (4), (5), and (6) with

$$q_{f,t} = q_1 E_t\left[r_{f,t+1}^k\right] + (1-q_1)E_t\left[q_{f,t+1}\right] - r_{f,t} + \epsilon_t^b, \tag{17}$$

where $q_1 = r_*^k / \left(r_*^k + 1 - \delta\right)$. The f subscript denotes that this allocation refers to flexible prices and wages and $r_{f,t}$ denotes the real natural interest rate. This allocation is efficient except for the constant inefficiency caused by monopolistic competition.

In addition to equations (1) to (17) measurement equations that relate the model variables to the data are added and these are given by:

$$\begin{aligned}
\textit{output growth} &= \gamma + 100\left(y_t - y_{t-1} + z_t\right) && (18)\\
\textit{consumption growth} &= \gamma + 100\left(c_t - c_{t-1} + z_t\right) && (19)\\
\textit{investment growth} &= \gamma + 100\left(i_t - i_{t-1} + z_t\right) && (20)\\
\textit{real wage growth} &= \gamma + 100\left(w_t - w_{t-1} + z_t\right) && (21)\\
\textit{hours} &= L_* + 100 L_t && (22)\\
\textit{inflation} &= \pi_* + 100\pi_t && (23)\\
\textit{federal funds rate} &= R_* + 100 R_t && (24)\\
\textit{spread} &= SP_* + 100 E_t\left[\tilde{R}_{t+1}^k - R_t\right]. && (25)
\end{aligned}$$

π_*, R_*, L_* and SP_* denote the steady state level of inflation, the federal funds rate, hours and the spread.

I further include four measurement equations that link model-based interest rate expectations with those from financial market participants to account for the zero lower bound on nominal interest rates and the effects of forward guidance:

$$\textit{federal funds rate expectations}_{\,t+k} = R_* + 100 E_t\left[R_{t+k}\right], \qquad k = 1, ..., 4. \tag{26}$$

To make estimation feasible with these four additional measurement equations I augment the model with four anticipated monetary policy shocks. The monetary policy shock process is thus given by:

$$r_t^m = \rho_r r_{t-1}^m + \epsilon_t^r + \sum_{k=1}^{4} \epsilon_{t,t-k}^r. \tag{27}$$

ϵ_t^r is a standard monetary policy shock, where $\epsilon_t^r \sim N(0, \sigma_r^2)$, and $\epsilon_{t,t-k}^r$ are anticipated monetary policy shocks, where $\epsilon_{t,t-k}^r \sim N(0, \sigma_{k,r}^2)$. They are known to agents at time $t-k$, but affect the policy rule only at time t.

Appendix C: Estimated Parameters

Table 1: Estimated Structural Parameters

Prior				Posterior (Mean, 90% Interval)			
Param.	Density	Mean	St. Dev.	Hours BS	Hours Tot.	H. Demo. Adj.	Avg. H. NFBS
ξ_p	Beta	0.50	0.10	0.6988 [0.6218,0.7801]	0.6449 [0.5583,0.7366]	0.6665 [0.5754,0.7592]	0.6341 [0.5420,0.7220]
ι_p	Beta	0.50	0.15	0.2556 [0.1317,0.3762]	0.2655 [0.1382,0.3885]	0.2613 [0.1368,0.3793]	0.3016 [0.1717,0.4296]
ξ_w	Beta	0.50	0.10	0.6890 [0.6029,0.7779]	0.6772 [0.5882,0.7703]	0.7017 [0.6134,0.7916]	0.6777 [0.5914,0.7651]
ι_w	Beta	0.50	0.15	0.3387 [0.1641,0.5022]	0.3166 [0.1449,0.4785]	0.2772 [0.1251,0.4345]	0.3504 [0.1618,0.5342]
ψ	Beta	0.50	0.15	0.4632 [0.3340,0.5925]	0.4758 [0.3333,0.6260]	0.5070 [0.3592,0.6531]	0.4680 [0.3295,0.6092]
Φ	Normal	1.25	0.12	1.1565 [1.0618,1.2470]	1.33131 [1.1996,1.4281]	1.3723 [1.2531,1.4943]	1.3707 [1.2552,1.4902]
ϕ	Normal	4.00	1.50	3.6872 [2.4282,4.9197]	3.9104 [2.5912,5.1572]	4.0620 [2.7924,5.3420]	3.7233 [2.4257,4.9976]
σ_c	Normal	1.50	0.37	0.7984 [0.6452,0.9410]	0.7740 [0.5830,0.9652]	0.7147 [0.5571,0.8641]	0.7689 [0.5631,0.9721]
h	Beta	0.70	0.10	0.6032 [0.5281,0.6867]	0.5988 [0.5108,0.6949]	0.6292 [0.5490,0.7101]	0.5932 [0.4961,0.6922]
σ_l	Normal	2.00	0.75	1.8824 [1.1065,2.6566]	1.9061 [1.0571,2.7151]	2.1465 [1.2978,2.9883]	2.3521 [1.4437,3.2509]
ϕ_π	Normal	1.50	0.25	1.4069 [1.2666,1.5371]	1.4061 [1.2678,1.5398]	1.4062 [1.2637,1.5461]	1.4163 [1.2779,1.5606]
ρ	Beta	0.75	0.10	0.7797 [0.7426,0.8171]	0.7730 [0.7364,0.8109]	0.7858 [0.7499,0.8196]	0.7756 [0.7374,0.8129]
ϕ_x	Normal	0.12	0.05	0.0153 [0.0000,0.0276]	0.0174 [0.0001,0.0308]	0.0171 [0.0000,0.0312]	0.0194 [0.0000,0.0352]
$\phi_{\Delta x}$	Normal	0.12	0.05	0.2181 [0.1736,0.2647]	0.2298 [0.1800,0.2765]	0.2298 [0.1795,0.2791]	0.2323 [0.1830,0.2822]
π_*	Gamma	0.75	0.40	0.9465 [0.6816,1.2198]	0.9628 [0.6892,1.2373]	0.9562 [0.6806,1.2144]	0.9515 [0.6808,1.2244]
r_*	Gamma	0.25	0.10	0.2399 [0.1197,0.3562]	0.2608 [0.1302,0.3859]	0.2711 [0.1471,0.3963]	0.2591 [0.1252,0.3842]
L_*	Normal	0.00	2.00	0.6250 [-1.9669,3.2319]	0.2070 [-2.1017,2.5656]	0.2010 [-2.0856,2.4917]	0.2522 [-2.0604,2.5348]
γ	Normal	0.40	0.10	0.4803 [0.4341,0.5244]	0.4242 [0.3842,0.4651]	0.3912 [0.3532,0.4270]	0.4392 [0.4009,0.4796]
α	Normal	0.30	0.05	0.1432 [0.1160,0.1717]	0.1327 [0.1032,0.1611]	0.1376 [0.1073,0.1678]	0.1299 [0.1021,0.1566]
SP_*	Gamma	2.00	0.10	1.7790 [1.6466,1.9090]	1.7689 [1.6403,1.8991]	1.7618 [1.6344,1.8931]	1.7797 [1.6491,1.9099]
$\zeta_{sp,b}$	Beta	0.05	0.005	0.0577 [0.0505,0.0647]	0.0577 [0.0504,0.0650]	0.0574 [0.0502,0.0645	0.0572 [0.0501,0.0643]

Notes: The table shows priors and posterior estimates for different observable hours measures. Hours BS: hours in the private business sector, Hours Tot.: hours in all sectors, H. Demo. Adj.: hours in all sectors demographically adjusted, Avg. H. NFBS: average weekly hours in the nonfarm business sector multiplied with employment-population ratio. The discount factor β is indirectly given through the steady state real interest rate: $\beta = (1/(1 + r_*/100))$. The following parameters are fixed: $\delta = 0.025$, $g_* = 0.18$, $\phi_w = 1.5$, $\epsilon_w = 10$, $\epsilon_p = 10$. The steady-state default probability of entrepreneurs is $\bar{F}_* = 0.03$ and their survival rate is $\gamma_* = 0.99$.

Table 2: Estimated Shock Process Parameters

Prior				Posterior (Mean, 90% Interval)			
Param.	Density	Mean	St. Dev.	Hours BS	Hours Tot.	H. Demo. Adj.	Avg. H. NFBS
σ_z	InvG	0.10	2.00	0.6042 [0.5511,0.6552]	0.5326 [0.4856,0.5798]	0.5267 [0.4791,0.5712]	0.5240 [0.4459,0.5709]
σ_b	InvG	0.10	2.00	0.0206 [0.0168,0.0243]	0.0215 [0.0176,0.0253]	0.0224 [0.0175,0.0251]	0.0223 [0.0182,0.0263]
σ_g	InvG	0.10	2.00	2.7358 [2.5141,2.9560]	2.8214 [2.5887,3.0487]	2.8073 [2.5736,3.0319]	2.6618 [2.4469,2.8757]
σ_i	InvG	0.10	2.00	0.3702 [0.3105,0.4257]	0.3644 [0.3088,0.4174]	0.3602 [0.3094,0.4121]	0.3723 [0.3105,0.4347]
σ_r	InvG	0.10	2.00	0.1745 [0.1491,0.1999]	0.1803 [0.1548,0.2053]	0.1811 [0.1557,0.2066]	0.1759 [0.1496,0.2015]
σ_p	InvG	0.10	2.00	0.1621 [0.1372,0.1874]	0.1616 [0.1370,0.1862]	0.1569 [0.1332,0.1792]	0.1673 [0.1424,0.1919]
σ_w	InvG	0.10	2.00	0.4178 [0.3677,0.4664]	0.4198 [0.3704,0.4699]	0.4075 [0.3588,0.4557]	0.4190 [0.3667,0.4698]
σ_{σ_w}	InvG	0.05	4.00	0.0640 [0.0580,0.0696]	0.0639 [0.0580,0.0694]	0.0635 [0.0578,0.0693]	0.0628 [0.0572,0.0685]
$\sigma_{1,r}$	InvG	0.10	2.00	0.0743 [0.0621,0.0866]	0.0751 [0.0627,0.0869]	0.0745 [0.0620,0.0870]	0.0761 [0.0632,0.0894]
$\sigma_{2,r}$	InvG	0.10	2.00	0.0578 [0.0453,0.0697]	0.0570 [0.0454,0.0684]	0.0574 [0.0457,0.0691]	0.0586 [0.0457,0.0716]
$\sigma_{3,r}$	InvG	0.10	2.00	0.0353 [0.0306,0.0398]	0.0353 [0.0307,0.0398]	0.0355 [0.0308,0.0399]	0.0357 [0.0310,0.0402]
$\sigma_{4,r}$	InvG	0.10	2.00	0.0445 [0.0375,0.0509]	0.0430 [0.0363,0.0495]	0.0429 [0.0363,0.0494]	0.0427 [0.0362,0.0490]
ρ_z	Beta	0.50	0.20	0.9828 [0.9716,0.9941]	0.9784 [0.9652,0.9919]	0.9692 [0.9494,0.9888]	0.9748 [0.9581,0.9923]
ρ_b	Beta	0.50	0.20	0.9867 [0.9793,0.9939]	0.9874 [0.9801,0.9951]	0.9878 [0.9805,0.9953]	0.9879 [0.9808,0.9957]
ρ_g	Beta	0.50	0.20	0.9817 [0.9686,0.9951]	0.9827 [0.9712,0.9954]	0.9821 [0.9699,0.9953]	0.9853 [0.9751,0.9962]
ρ_i	Beta	0.50	0.20	0.8970 [0.8607,0.9335]	0.8916 [0.8549,0.9283]	0.8936 [0.8580,0.9300]	0.8958 [0.8604,0.9326]
ρ_r	Beta	0.50	0.20	0.4138 [0.3491,0.4793]	0.4091 [0.3482,0.4696]	0.3997 [0.3382,0.4626]	0.4233 [0.3603,0.4854]
ρ_p	Beta	0.50	0.20	0.9850 [0.9739,0.9968]	0.9706 [0.9480,0.9942]	0.9415 [0.8963,0.9860]	0.9808 [0.9652,0.9970]
ρ_w	Beta	0.50	0.20	0.9566 [0.9372,0.9767]	0.9606 [0.9421,0.9792]	0.9559 [0.9357,0.9770]	0.9507 [0.9297,0.9723]
ρ_{σ_w}	Beta	0.75	0.15	0.9929 [0.9860,0.9996]	0.9925 [0.9857,0.9994]	0.9932 [0.9868,0.9995]	0.9930 [0.9865,0.9995]
η_p	Beta	0.50	0.20	0.7386 [0.6262,0.8576]	0.7556 [0.6471,0.8675]	0.7637 [0.6625,0.8689]	0.8057 [0.7195,0.8974]
η_w	Beta	0.50	0.20	0.8376 [0.7670,0.9082]	0.8492 [0.7827,0.9221]	0.8553 [0.7861,0.9276]	0.8197 [0.7393,0.9008]
$\eta_{g,z}$	Beta	0.50	0.20	0.3298 [0.0684,0.5650]	0.3608 [0.0877,0.6288]	0.3564 [0.0801,0.6152]	0.5375 [0.2386,0.8358]

Notes: The table shows priors and posterior estimates for different observable hours measures. Hours BS: hours in the private business sector, Hours Tot.: hours in all sectors, H. Demo. Adj.: hours in all sectors demographically adjusted, Avg. H. NFBS: average weekly hours in the nonfarm business sector multiplied with employment-population ratio. The different σ-parameters denote the standard deviation of the structural shocks and the ρ-parameters the autocorrelation parameters. z: technology, b: risk-premium, g: government spending, i: marginal efficiency of investment, r: monetary policy, p: price mark-up, w: wage mark-up, σ_w: spread. η_p and η_w denote the additional MA-parameters in the price and wage mark-up ARMA shock processes. $\eta_{g,z}$ denotes the reaction of government spending to the technology shock. $\sigma_{k,r}$, $k = 1, ..., 4$, denote the standard deviations of anticipated monetary policy shocks.

Appendix D: Business Cycle Moments

Table 3: Business Cycle Moments of Different Hours per Capita Measures

Series	Std. Dev.	Rel. Std. Dev.	Corr. w. y_t	1^{st} Order Autocorr.
		Hamilton Projection Filter		
Output	3.20	1.00	1.00	0.90
Hours BS	3.55	1.11	0.84	0.89
Hours Tot.	2.89	0.90	0.86	0.89
H. Demo. Adj.	2.63	0.82	0.83	0.90
Avg. H. NFBS	2.57	0.80	0.85	0.90
		Hodrick-Prescott Filter		
Output	1.45	1.00	1.00	0.87
Hours BS	1.78	1.23	0.86	0.92
Hours Tot.	1.43	0.98	0.86	0.91
H. Demo. Adj.	1.42	0.98	0.86	0.91
Avg. H. NFBS	1.29	0.89	0.87	0.90
		Linearly Detrended		
Output	4.29	1.00	1.00	0.97
Hours BS	4.87	1.13	0.77	0.99
Hours Tot.	4.27	0.99	0.83	0.99
H. Demo. Adj.	3.26	0.76	0.82	0.98
Avg. H. NFBS	3.41	0.79	0.83	0.98

Notes: The table shows business cycle moments of output and hours based on different detrending methods. The Hamilton Projection Filter refers to Hamilton (2018). Hours BS: hours in the private business sector, Hours Tot.: hours in all sectors, H. Demo. Adj.: hours in all sectors demographically adjusted, Avg. H. NFBS: average weekly hours in the nonfarm business sector multiplied with employment-population ratio.

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