Changing Business Cycles: The Role of Women's Employment

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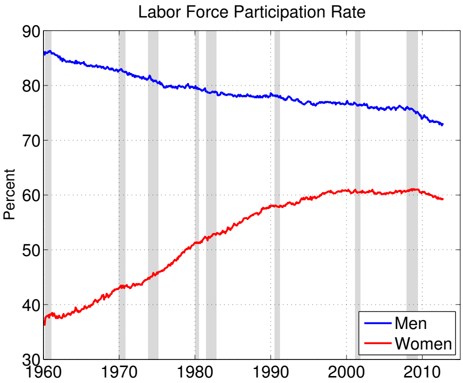
Motivation

- Female LFPR grew rapidly until 1993, then flattened out
- Share of female hours grows from 28% in 1968 to 44% in 1993



Labor force participation rate by gender. Source: Current Population Survey.

Changes in Aggregate Business Cycles

- Important changes in behavior of aggregate hours&employment

I. Non-stationary per capita hours in 1970s-1980s

Inconsistent with standard RBC model and Solow growth facts

- Literature: Gali 1999, Gali&Rabanal 2004, Gali 2005, Fernald 2007, Francis&Ramey 2009, Christiano, Eichenbaum and Vigfusson 2003

II. Great Moderation

Decline in business cycle volatility of output and hours

Change in medium run correlations of output, hours and productivity

- Literature: McConnell&Perez-Quiros 2000, Blanchard&Simon 2001, Stock&Watson 2003, Neville&Ramey 2005, Stiroh 2006, Davis&Kahn 2008, Gali&Gambetti 2009, Jaimovich&Siu 2009

III. Jobless recoveries

Sluggish recovery in employment starting with 1991 cycle

- Literature: Gali, Smets &Wouters 2011, Foote&Rian 2012, Jaimovich&Siu 2014, Stock&Watson 2012

Hypothesis

- Changing trend in female LFPR plays important role

  I. Rising female LFPR

  $\Longrightarrow$ non-stationarity of aggregate per capita hours in 1970s-1980s

  II. Female hours less cyclical/volatile than male hours

  Rise in female hours share and female relative productivity

  $\Longrightarrow$ contribute to decline in volatility of aggregate hours

  contribute to changing correlations between output/hours and productivity

  III. Flattening female participation contributes to jobless recoveries

  i. Men's recoveries always "jobless"

  ii. From 1991 cycle, women's recoveries similar to men's

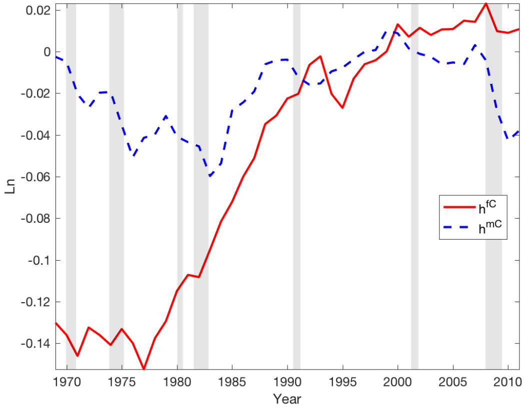
- Goal: Quantify role of changing female trends on aggregate business cycles

Literature

- Rising female participation
  - Medical progress
    - Oral contraception: Goldin and Katz (2002)
    - Maternal health & infant formula: Albanesi and Olivetti (2014, 2016)
  - Technology
    - Gender biased technological change: Galor and Weil (1996), Rendall (2010)
    - Home appliances: Greenwood, Sheshadri and Yorugoklu (2005)
- Flattening female participation
  - Theory/Quantitative
    - Rise in female LFPR via learning about costs for household, S-shape: Fernandez (2013), Fogli and Veldkamp (2011)
    - Income effect from rise in inequality: Albanesi and Prados (2012)
  - Empirical
    - Lack of part time and access to daycare: Blau and Kahn (2013)
    - Regression in attitudes towards gender roles in the 1990s: Fortin (2013)

Non-stationary Per Capita Hours

- No systematic trend for male hours, changing trend in female hours



Logarithm of female and male hours per capita, difference from 1995-2004 average.
Source: Author's calculations based on CPS.

Non-stationary Per Capita Hours

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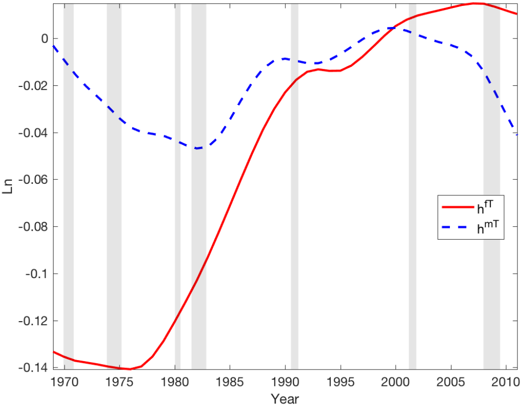
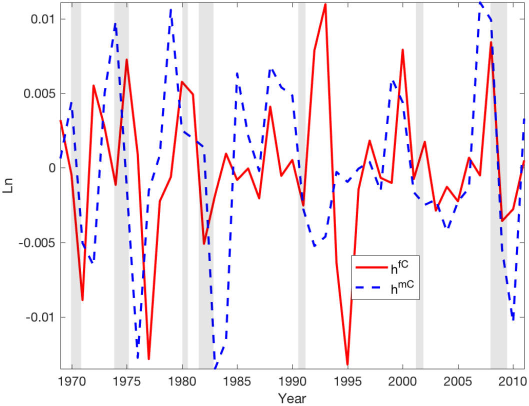


Trend component of female and male hours per capita. Trend component obtained with Hodrick-Prescott filter with $\lambda = 6.5$. Source: Author's calculations based on CPS.

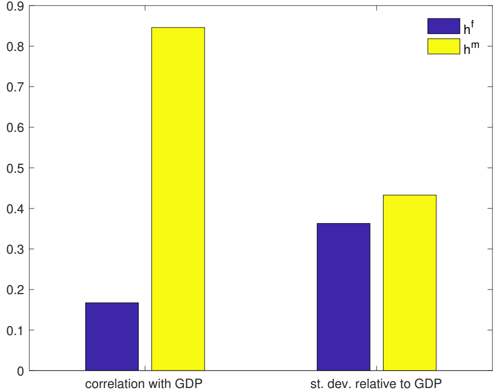
Great Moderation: Female Hours



Cyclical component of female and male hours per capita. Cyclical component obtained with Hodrick-Prescott filter with $\lambda = 6.5$. Source: Author's calculations based on CPS.

Great Moderation: Female Hours

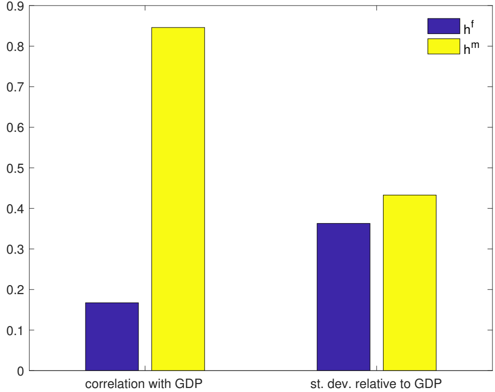
1 Smaller volatility of female hours relative to GDP



Cyclical component of female and male hours per capita, contemporaneous correlation with and relative standard deviation to cyclical component of GDP, 1969-2011. Source: Author's calculations based on CPS.

Great Moderation: Female Hours

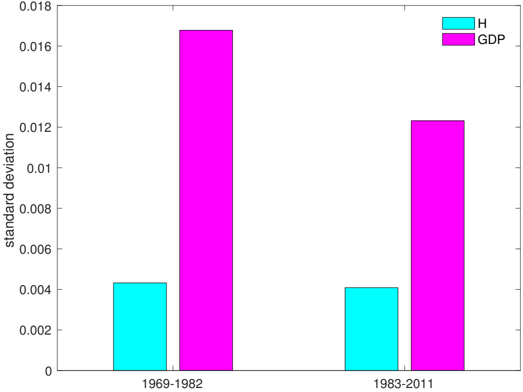
1. Smaller volatility of female hours relative to GDP
2. Lower correlation with GDP



Cyclical component of female and male hours per capita, contemporaneous correlation with and relative standard deviation to cyclical component of GDP, 1969-2011. Source: Author's calculations based on CPS.

Great Moderation: Facts

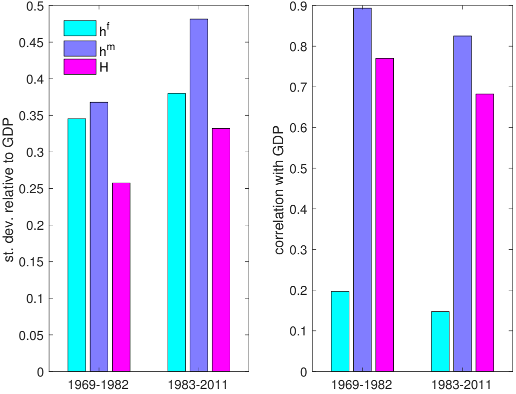
1 Decline in volatility of GDP and hours



Cyclical component of aggregate hours and GDP, standard deviation. Source: Author's calculations based on CPS.

Great Moderation: Facts

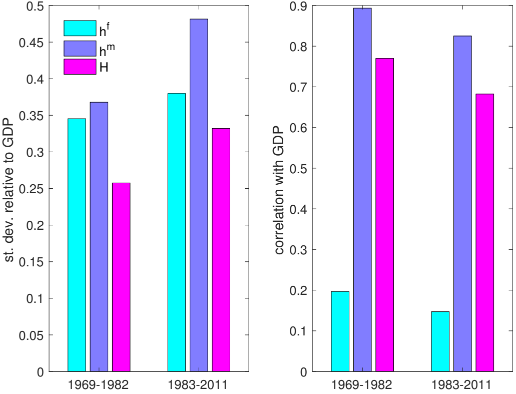
1. Decline in volatility of GDP and hours
2. Rise in volatility of hours relative to GDP



Cyclical component of hours, contemporaneous correlation with and relative standard deviation to cyclical component of GDP. Source: Author's calculations based on CPS.

Great Moderation: Facts

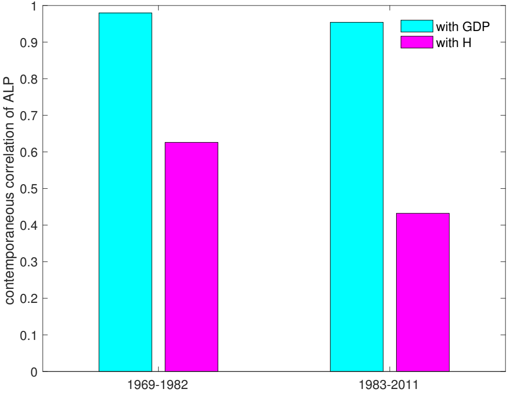
1 Decline in volatility of GDP and hours
2 Rise in volatility of hours relative to GDP
3 Decline in correlation between hours and GDP



Cyclical component of hours, contemporaneous correlation with and relative standard deviation to cyclical component of GDP. Source: Author's calculations based on CPS.

Great Moderation: Facts

1. Decline in volatility of GDP and hours
2. Rise in volatility of hours relative to GDP
3. Decline in correlation between hours and GDP
4. Decline in correlation between average labor productivity, hours and GDP



Contemporaneous correlation of average labor productivity with aggregate hours per capita and GDP, cyclical components. Source: Author's calculations based on CPS.

Great Moderation: Facts

1. Decline in volatility of GDP and hours
2. Rise in volatility of hours relative to GDP
3. Decline in correlation between hours and GDP
4. Decline in correlation between average labor productivity, hours and GDP

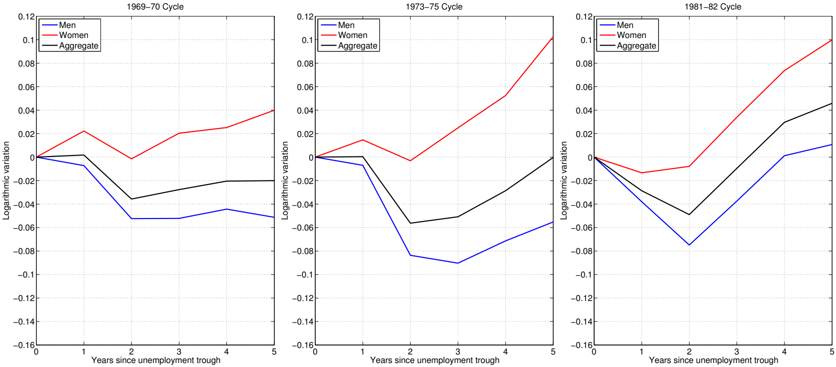
Facts 1, 3 $\rightarrow$ countercyclical female labor supply

Fact 2 $\rightarrow$ higher substitution elasticity of female labor supply

Facts 4 $\rightarrow$ joint growth in female labor supply and relative productivity

Jobless recoveries

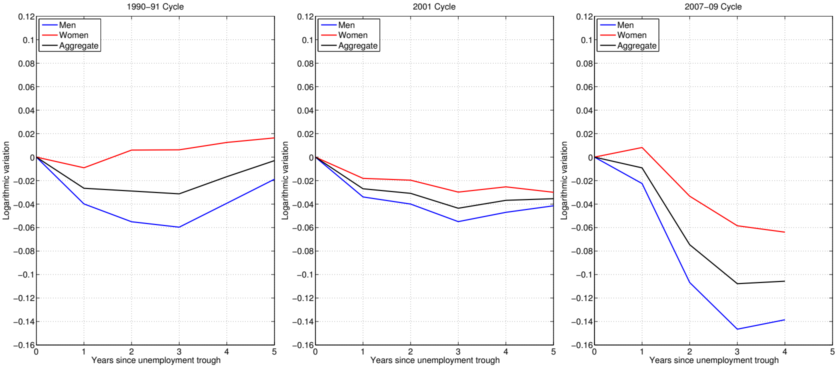
1 Early recessions, female LFPR growing



Log changes in hours per capita in the aggregate and by gender, early cycles. Source: Current Population Survey.

Jobless recoveries

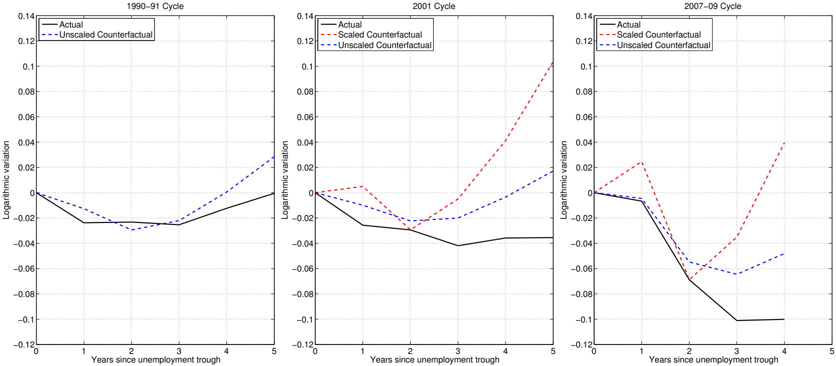
1 Early recessions, female LFPR growing
2 Late recessions, female LFPR flat



Log changes in hours per capita in the aggregate and by gender, recent cycles. Source: Current Population Survey.

Jobless recoveries: Counterfactual

→ Female hours behaving as in early recessions boosts later recoveries



Female hours per capita counterfactual: Female hours per capita replaced with average for early recessions. Source: Current Population Survey.

Quantitative Analysis

Introduce gender differences in labor supply and productivity in standard real DSGE model:

1 Explore implications of gender differentials for output, aggregate hours, Solow residual growth and productivity

2 Estimate with Bayesian methods

- Extract trend and cyclical components of gender specific shocks
- Isolate role of female labor supply shocks and productivity shocks for aggregate variables
- Assess contribution of gender specific shocks vs technology and other aggregate shock for output and hours

3 Compare with basic RBC model with no gender differences

3 Examine different periods with/without trend rise in female LFPR

Model: Households

- Representative household, unit measure:
  $p_t^j =$ fraction of gender $j = f, m$, $\sum_{j=f,m} p_t^j = 1$
- Household utility function:

$$E_0 \sum_{t=0}^{\infty} \beta^t b_{t+s} \left[log\left(C_t - \eta C_{t-1}\right) - \sum_j p_t^j \varphi_t^j \frac{\left(H_t^j\right)^{1+\nu^j}}{1+\nu^j} \right],$$

$C_t =$per capita consumption

$\eta =$ habit

$b_t =$ discount factor shock

$H_t^j =$ per capita hours $j = f, m$

$\varphi_t^j =$ shock to utility cost of working $j = f, m$

$1/\nu^j =$ Frisch elasticity of labor supply $j = f, m$

Model: Households

- Budget constraint:

$$C_t + I_t + T_t \leq \sum_j p_t^j W_t^j H_t^j + r_t^k K_{t-1} - a(u_t)\bar{K}_{t-1}$$

  T_t =lump-sum taxes, w_t^j =real wage $j = f, m$, r_t^k = rental rate

  $K_t := u_t \bar{K}_{t-1}$ = effective capital

  $\bar{K}_t$ = physical capital, u_t = utilization rate, with unit cost $a(u_t)$

  $u = 1$, $a(1) = 0$ and $\chi \equiv \frac{a''(1)}{a'(1)}$ in s.s.

- Capital accumulation equation:

$$\bar{K}_t = (1-\delta)\bar{K}_{t-1} + \mu_t \left(1 - S\left(\frac{I_t}{I_{t-1}}\right)\right) I_t$$

  δ = depreciation rate, μ_t = marginal productivity of investment shock

  $S = S' = 0$, $\zeta \equiv S'' > 0$ in s.s.

Model: Production

- Per capita production function:

$$Y_t = K_t^{\alpha} \left(\tilde{A}_t \tilde{L}_t \right)^{1-\alpha}$$

- Aggregate labor input:

$$\tilde{L}_t = \left[\omega^f \left(\tilde{L}_t^f \right)^{\rho} + \omega^m \left(\tilde{L}_t^m \right)^{\rho} \right]^{1/\rho} \text{ with } \rho \in (-\infty, 1]$$

- Gender labor inputs in per capita efficiency units:

$$\tilde{L}_t^j = a_t^j p_t^j \frac{H_t^j}{H^j}$$

  a_t^j = productivity index, H^j = s.s. hours for $j = f, m$

- $\frac{1}{1-\rho}$ = elasticity of substitution between female & male hours

Model: Production

- Normalized production function:

$$
\begin{aligned}
Y_t &= K_t^{\alpha} \left(A_t L_t\right)^{1-\alpha} \\
L_t &= \left[\omega^f \left(\tilde{a}_t^f \frac{H_t^f}{H^f}\right)^{\rho} + \omega^m \left(\frac{H_t^m}{H^m}\right)^{\rho}\right]^{1/\rho}
\end{aligned}
$$

$$
L_t = \frac{\tilde{L}_t}{a_t^m p_t^m}, \quad A_t = \tilde{A}_t a_t^m p_t^m, \quad \tilde{a}_t^f = \frac{a_t^f}{a_t^m} \frac{p_t^f}{p_t^m}
$$

$\Longrightarrow$ $L_t = L = 1$, $\omega^j =$ labor share for $j = f, m$ in s.s.

- Aggregate resource constraint:

$$
C_t + I_t + G_t + a(u_t)\bar{K}_{t-1} = Y_t
$$

Model: Equilibrium Conditions

- Household labor supply optimality conditions:

$$\frac{W_t^f}{W_t^m} = \frac{\varphi_t^f}{\varphi_t^m} \frac{\left(H_t^f\right)^{\nu^f}}{\left(H_t^m\right)^{\nu^m}}$$

$\Longrightarrow$ $\tilde{\varphi}_t^f \equiv \frac{\varphi_t^f}{\varphi_t^m}$ = *relative* disutility of hours for given ν^j $j = f, m$:

$$\log \tilde{\varphi}_t^f = \log W_t^f - \log W_t^m - \nu^f \log H_t^f + \nu^m \log H_t^m$$

- Mens' labor supply optimality condition:

$$W_t^m = \frac{\varphi_t^m \left(H_t^m\right)^{\nu^m}}{\Lambda_t}$$

$\Longrightarrow$ negative wealth effects on labor supply

H^m covaries with Λ_t = marginal utility of consumption

Model: Equilibrium Conditions

- Firm optimality conditions:

$$\frac{W_t^f H_t^f / H^f}{W_t^m H_t^m / H^m} = \frac{\omega^f}{\omega^m} \left(\tilde{a}_t^f \frac{H_t^f / H^f}{H_t^m / H^m} \right)^\rho$$

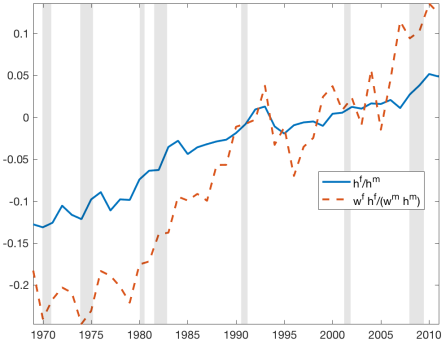
$\Longrightarrow$ $\tilde{a}_t^f$ =*relative* gender productivity for given ρ:

$$\log \tilde{a}_t^f = \frac{1}{\rho} \left[\log W_t^f - \log W_t^m - \log \frac{\omega^f}{\omega^m} \right] + \left(\frac{1}{\rho} - 1 \right) \log \left(\frac{H_t^f / H^f}{H_t^m / H^m} \right)$$

$\rightarrow$ Female/male hours and wages data identify gender specific shocks

Dynamics: Model and Data

1 Distinctive phases in evolution of gender ratios

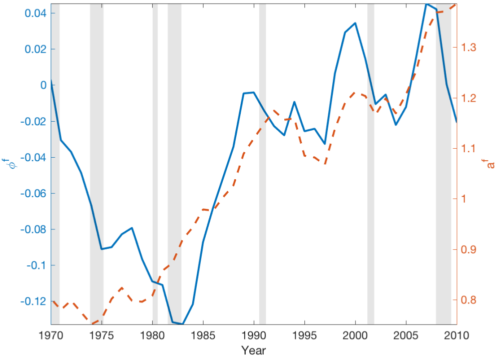


$\frac{H_t^f}{H_t^m}$ and female/male income share ratios. Source: Current Population Survey.

Dynamics: Model and Data

1 Distinctive phases in evolution of gender ratios

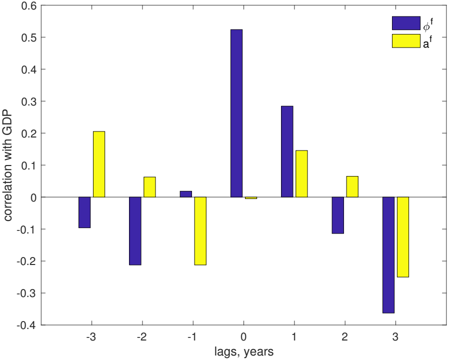
2 Both female shocks exhibit substantial trend and cyclical variation



Female relative productivity shock and labor supply shock, 3 year MA. Calibrated model.
Source: Author's calculations based on Current Population Survey.

Dynamics: Model and Data

1 Distinctive phases in evolution of gender ratios
2 Both female shocks exhibit substantial trend and cyclical variation
3 Labor supply shock strongly procyclical $\Longrightarrow$ female hours countercyclical



Cross-correlation of relative productivity shock and labor supply shock with GDP. Source: Author's calculations based on Current Population Survey.

Dynamics: Model and Data

- Counterfactual female hours: remove cyclical component from $\tilde{\varphi}_t^f$

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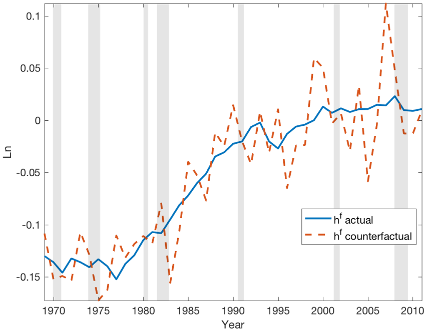
$\rightarrow$ compute model implied h_t^f, without countercyclical driver



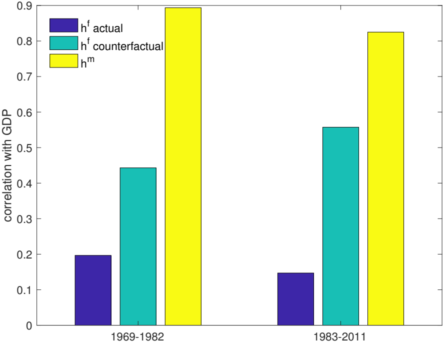
Actual and counterfactual female hours. Source: Author's calculations based on CPS.

Dynamics: Model and Data

- Counterfactual female hours: remove cyclical component from $\tilde{\varphi}_t^f$

$\rightarrow$ compute model implied h_t^f, without countercyclical driver

$\rightarrow$ higher cyclicality of counterfactual hours, especially after 1982



Actual and counterfactual contemporaneous correlations with GDP per capita. Source: Author's calculations based on CPS.

Dynamics: Model and Data

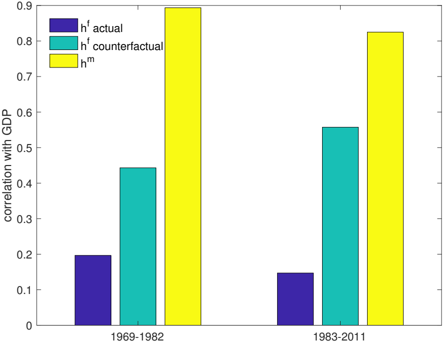
- Counterfactual female hours: remove cyclical component from $\tilde{\varphi}_t^f$

$\rightarrow$ compute model implied h_t^f, without countercyclical driver

$\rightarrow$ higher cyclicality of counterfactual hours, especially after 1982

$\rightarrow$ consistent with Great Moderation Facts 1, 3:

decline in volatility of hours and in correlation between hours and GDP



Actual and counterfactual contemporaneous correlations with GDP per capita. Source: Author's calculations based on CPS.

Dynamics: Solow Residual and Productivity

- Model implied theory of Solow residual and labor productivity
  - Solow residual:

$$\hat{s}_t = (1-\alpha)\hat{z}_t + \alpha\hat{u}_t + (1-\alpha)\left(\omega^f \hat{\tilde{a}}_t^f - \hat{\pi}_t^f\right)$$

  - Aggregate labor productivity (ALP):

$$\begin{aligned} \hat{P}_t &= (1-\alpha)\hat{z}_t + \alpha\left(\hat{u}_t + \hat{\bar{k}}_t\right) - \alpha\left(\hat{H}_t^m + \hat{\pi}_t^f\right) \\ &- \left[1-(1-\alpha)\omega^f\right]\hat{h}_f^f + (1-\alpha)\left(\omega^f \hat{\tilde{a}}_t^f - \hat{\pi}_t^f\right) \end{aligned}$$

1 Female relative productivity grows i.e. $\omega^f \hat{\tilde{a}}_t^f - \hat{\pi}_t^f > 0$

$\Longrightarrow$ female productivity growth boosts Solow residual growth

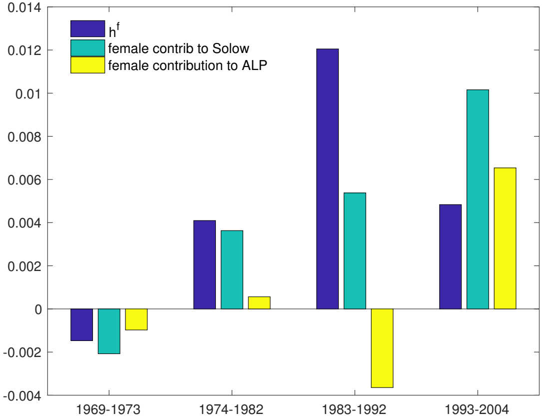
2 Female hours growth fast relative to female productivity
i.e. $(1-\alpha)\left(\omega^f \hat{\tilde{a}}_t^f - \hat{\pi}_t^f\right) < \left[1-(1-\alpha)\omega^f\right]\hat{h}_f^f$

$\Longrightarrow$ relative female hours growth slows ALP growth

Dynamics: Female Hours, TFP and Productivity

Strong growth in female hours and relative productivity in 1983-92

$\rightarrow$ positive female contribution to Solow residual, negative to ALP growth



Average yearly log variations for selected periods. Data and model implied for calibrated parameters. Source: Author's calculations based on Current Population Survey.

Dynamics: Output, Productivity and Hours

- Implications for long run correlations
  - Output:

$$\hat{y}_t = (1-\alpha)\hat{z}_t + \alpha\hat{u}_t + \alpha\left(\hat{u}_t + \hat{\bar{k}}_t\right) + (1-\alpha)\left[\omega^f\left(\hat{\tilde{a}}_t^f + \hat{h}_t^f\right) + \omega^m\hat{H}_t^m\right]$$

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  - Aggregate per capital hours:

$$\hat{H}_t = \hat{h}_t^f + \hat{\pi}_t^f + \hat{H}_t^m$$

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$\Longrightarrow$ Growth in female hours boosts output, TFP and aggregate hours growth, reduces ALP growth

$\Longrightarrow$ Consistent with Great Moderation Fact 4:
lower correlation between output, TFP, aggregate hours and ALP

Estimation: Strategy

- Non-stationary TFP $\hat{z}_t = z_t - \gamma$, all other shocks stationary

$\rightarrow$ log-linearize rescaled model $y = Y/A$, $c = C/A$, $i = I/A$, $k = K/A$

- Trend and cyclical components of female shocks

$$\begin{aligned} \left(\hat{\tilde{\varphi}}_t^f\right) &= \hat{\tilde{\varphi}}_t^{fT} + \hat{\tilde{\varphi}}_t^{fC} \\ \hat{\tilde{a}}_t^f &= \hat{\tilde{a}}_t^{fT} + \hat{\tilde{a}}_t^{fC} \end{aligned}$$

Estimation: Strategy

1 Set some parameters based on independent evidence:

→ aggregate Frisch elasticity$= 0.75$
(Chetty, Guren, Manoli & Weber 2011)

→ female/male Frisch elasticity$= 3$
(Blundell & MaCurdy 1999)

→ elasticity of substitution between female&male hours$= 1.79$
(Autor, Katz & Murphy 2001, Ghosh 2018)

2 Calibrate standard macro parameters and some gender specific parameters for 1995-2005 (steady state)

→ female labor income share$= 0.375$

3 Estimate other parameters with Bayesian methods, using standard priors

Estimation: Parameters

γ	TFP growth rate
ξ	curvature of capital utilization cost
η	consumption habit parameter
ζ	curvature of investment adjustment cost
ρ_x	autocorrelation coefficient for shock $\log x$
σ_x	standard deviation for the error term for shock $\log x$
AR(1) Shocks	$\hat{z}$, μ, b, g, $\tilde{a}^{fT}$, $\tilde{a}^{fC}$, $\tilde{\varphi}^{fT}$, $\tilde{\varphi}^{fC}$, φ^m

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- Estimate over full sample and subsamples

  Steady state phase: 1993-2011 (gender ratios stable)

  Transitional phase: 1969-1992 (gender ratios exhibit trends)

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  Steady state phase: 1993-2011 (gender ratios stable)

  Transitional phase: 1969-1992 (gender ratios exhibit trends)
- Robustness:

  introduce progressive income taxes

  eliminate cyclical component of gender specific shocks

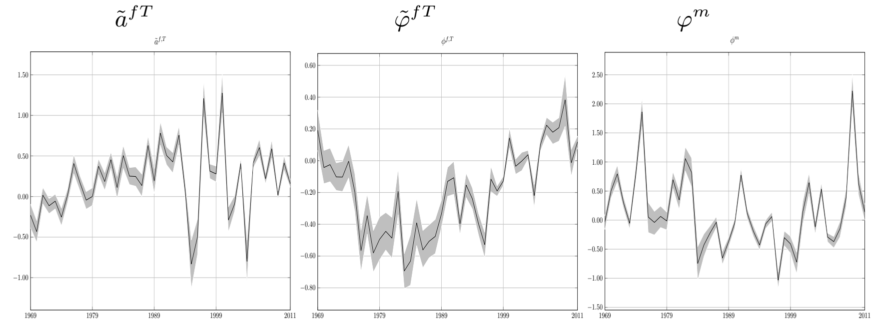
  set aggregate Frisch elasticity to 2.4

  set substitution elasticity between female&male hours to 4

  estimate with GHH preferences

Full Model: Gender Specific Shocks

1. Clear change in trend for female productivity shock in early 1990s
2. Change in trend for labor supply shocks in mid 1980s



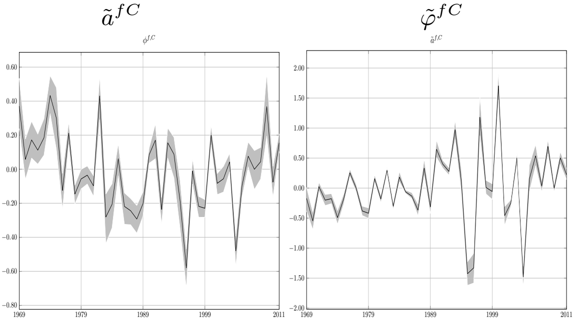
Estimated Paths of Gender Specific Shocks. Sample period: 1969-2011

Full Model: Gender Specific Shocks

1 Clear change in trend for female productivity shock in early 1990s

2 Change in trend for labor supply shocks in mid 1980s

3 Increase in cyclical volatility of female shocks starting in early 1990s (when trend component slows)

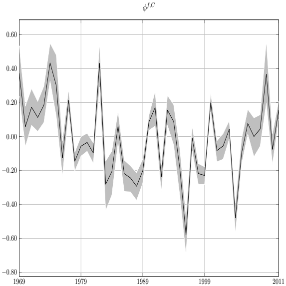


Estimated Paths of Gender Specific Shocks. Sample period: 1969-2011

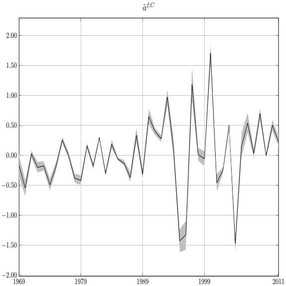
Full Model: Gender Specific Shocks

1. Clear change in trend for female productivity shock in early 1990s
2. Change in trend for labor supply shocks in mid 1980s
3. Increase in cyclical volatility of female shocks starting in early 1990s (when trend component slows)
4. Both female labor supply and productivity shock procyclical

$\tilde{a}^{fC}$



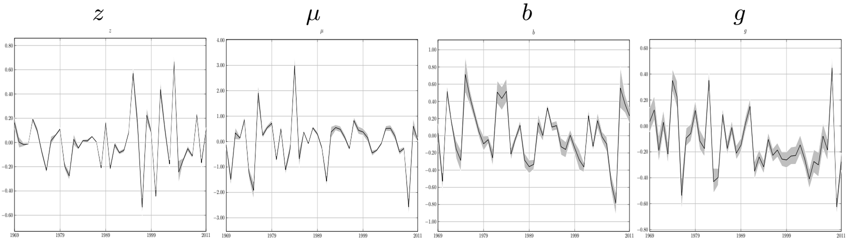
$\tilde{\varphi}^{fC}$



Estimated Paths of Gender Specific Shocks. Sample period: 1969-2011

Full Model: Aggregate Shocks

1. Volatility of z shock increases in mid 1980s
   $\rightarrow$ compensated by procyclical female labor supply shock
2. Volatility of μ, b, g declines in mid 1980s
3. Muted downward trend in g shock, no trend in b shock



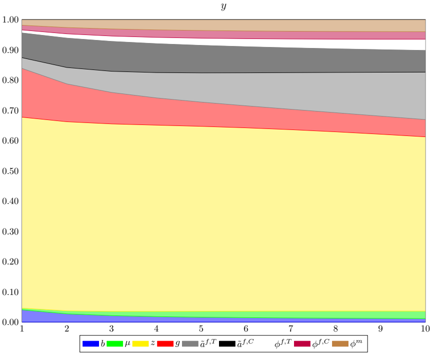
Estimated Paths of Aggregate Shocks. Sample period: 1969-2011

Full Model: Variance Decomposition

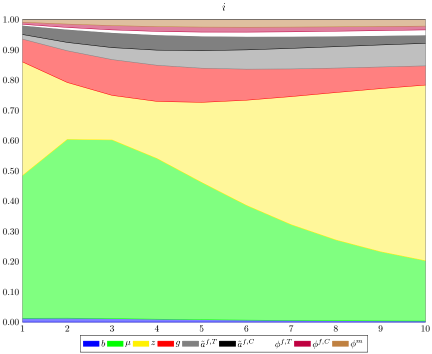
1 Gender specific shocks account for 12-30% of $Var(y)$, 5-10% of $Var(i)$

$\rightarrow$ contribution of female specific trend shocks increases with horizon

y



i

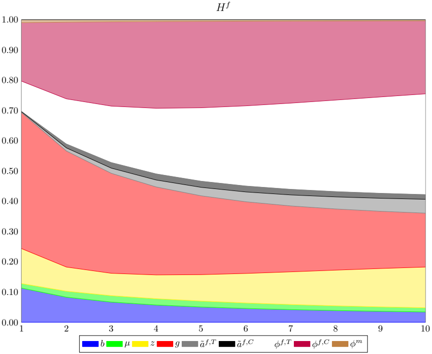


Sample period: 1969-2011

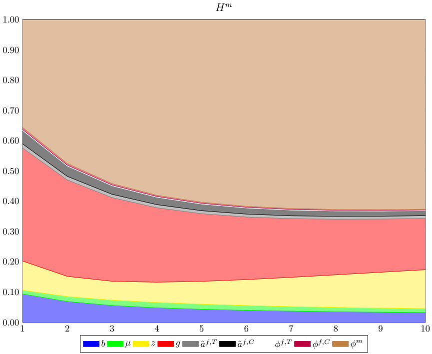
Estimation Results: Variance Decomposition

1 Gender specific labor supply shocks important for hours

H^f



H^m

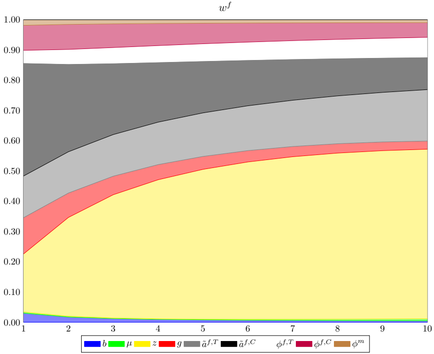


Sample period: 1969-2011

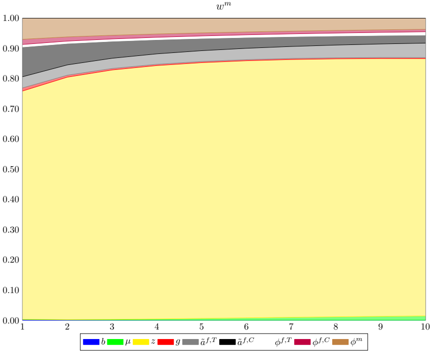
Estimation Results: Variance Decomposition

1. Gender specific labor supply shocks important for hours
2. Female relative productivity shock most important for female wages

w^f



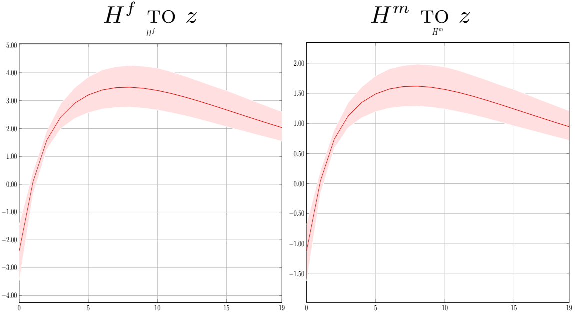
w^m



Sample period: 1969-2011

Full Model: Impulse Responses

1 H^f more responsive than H^m to z, due to higher female Frisch elasticity



Full Model. Positive 1 percent shocks, percent log deviations from steady state.
Sample period: 1969-2011

Full Model: Impulse Responses

1 H^f more responsive than H^m to z, due to higher female Frisch elasticity

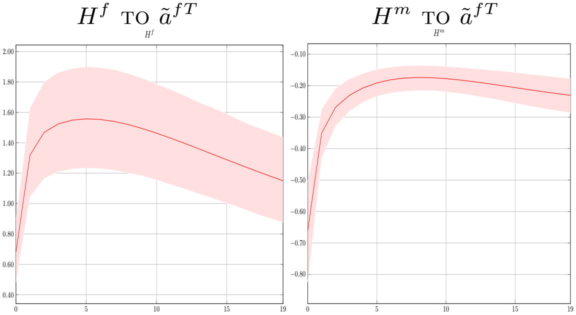
$\rightarrow$ same for g

Full Model: Impulse Responses

1 H^f more responsive than H^m to z, due to higher female Frisch elasticity

$\rightarrow$ same for g

2 Shock to $\tilde{a}^{fT}$ induces substitution to female hours from male hours



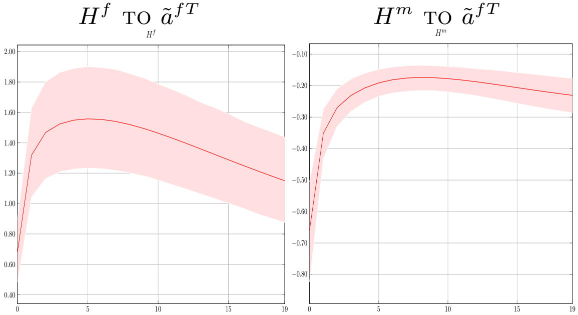
Full Model. Positive 1 percent shocks, percent log deviations from steady state.
Sample period: 1969-2011

Full Model: Impulse Responses

1. H^f more responsive than H^m to z, due to higher female Frisch elasticity

$\rightarrow$ same for g

2. Shock to $\tilde{a}^{fT}$ induces substitution to female hours from male hours
3. Magnitude of response to labor supply shocks similar to productivity shocks



Full Model. Positive 1 percent shocks, percent log deviations from steady state.
Sample period: 1969-2011

Comparison to Basic RBC Model

- Basic RBC model: no gender differences, same aggregate shocks

- Variable φ: $\varphi_t = \varphi_t^T + \varphi_t^C$

  process estimated, prior same as for $\tilde{\varphi}^f$ in full model

  (Chang, Doh, Schorfheide 2007)

- Fixed φ: estimated

Maximized Log-Likelihood at Mode

Full Model	Basic with Variable φ	Basic with Fixed φ
412.1424	224.44	226.7962

Sample period: 1969-2011

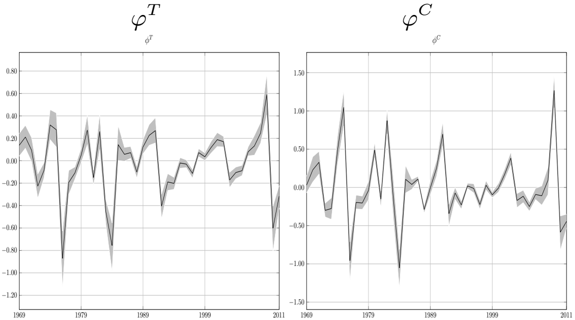
Basic RBC Model

- Variable φ:

1 Volatility of labor supply shocks declines in mid-1980s

2 No clear trend in labor supply shock

- Fixed φ: mode estimate 0.091



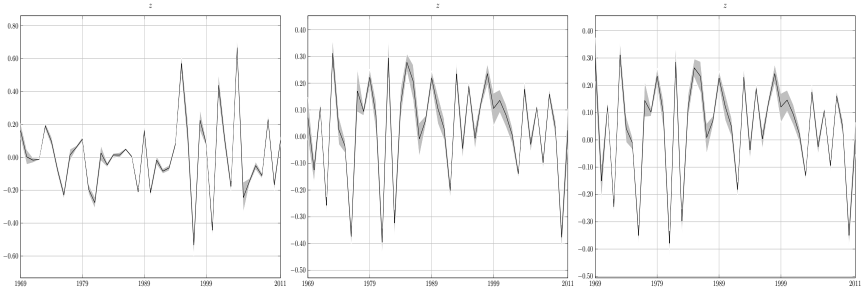
Sample period: 1969-2011

Model Comparison: Aggregate Shocks

1 z: volatility rises in mid 1980s for full model, declines for basic models

$\rightarrow$ no offset from procyclical female labor supply shock in basic models

z



Full Model | Variable φ | Fixed φ

Sample period: 1969-2011

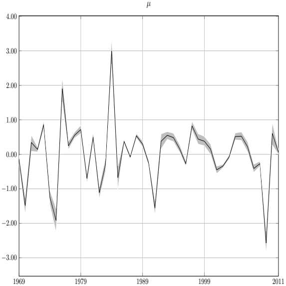
Model Comparison: Aggregate Shocks

1 z: volatility rises in mid 1980s for full model, declines for basic models

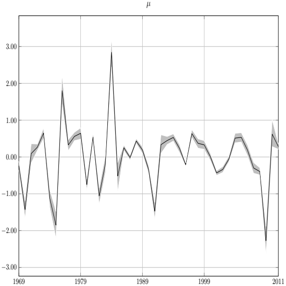
$\rightarrow$ no offset from procyclical female labor supply shock in basic models

2 μ: estimated process consistent across models

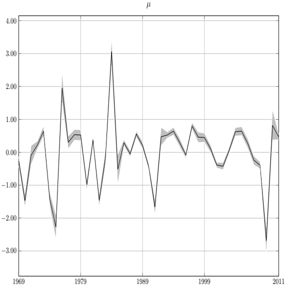
μ



Full Model



Variable φ



Fixed φ

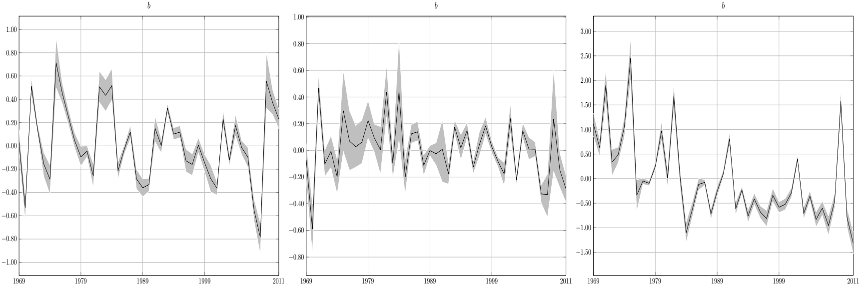
Sample period: 1969-2011

Model Comparison: Aggregate Shocks

1. b (household preference shock): trend decline with fixed φ
2. g (government demand shock): similar but muted

$\rightarrow$ demand shocks stand in for missing labor supply shocks

b



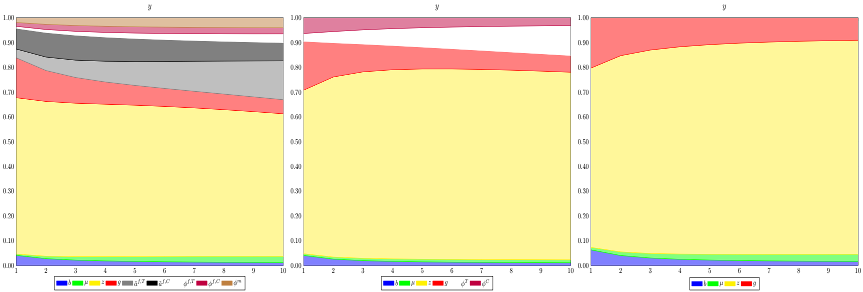
Full Model — Variable φ — Fixed φ

Sample period: 1969-2011

Model Comparisons: Variance Decomposition

1 TFP shock plays larger role in basic models for y, i, u

y



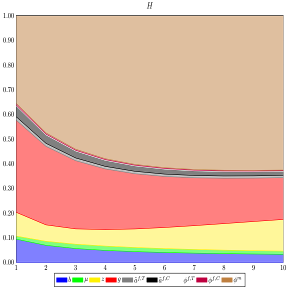
Full Model | Variable φ | Fixed φ

Sample period: 1969-2011

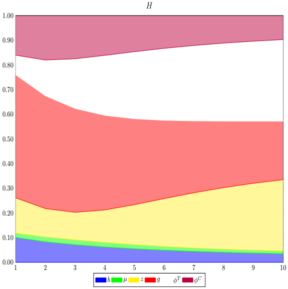
Model Comparisons: Variance Decomposition

1. TFP shock plays larger role in basic models for y, i, u
2. b, g absorb variation of missing gender specific shocks for H

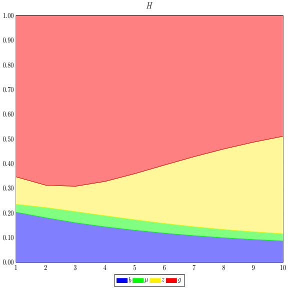
H



Full Model



Variable φ



Fixed φ

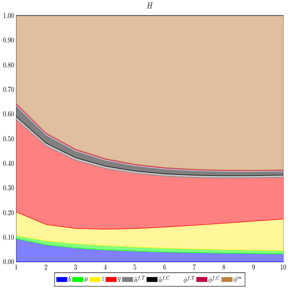
Sample period: 1969-2011

Model Comparisons: Variance Decomposition

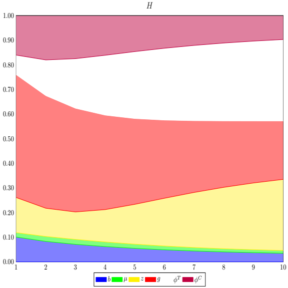
1. TFP shock plays larger role in basic models for y, i, u
2. b, g absorb variation of missing gender specific shocks for H

$\rightarrow$ incorrect inference on source of fluctuations in basic models

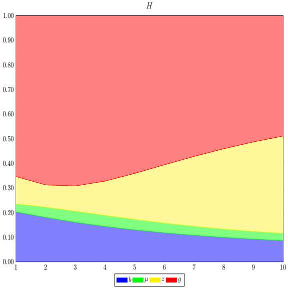
H



Full Model



Variable φ



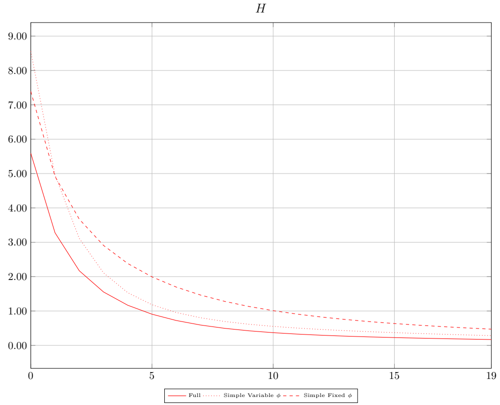
Fixed φ

Sample period: 1969-2011

Model Comparison: Impulse Responses

1 Larger response of H to g in basic models

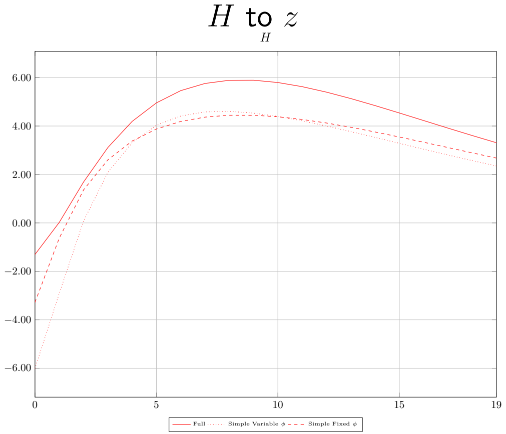
H to g



Sample period: 1969-2011

Model Comparison: Impulse Responses

1. Larger response of H to g in basic models
2. Larger response of H to z in full model, due to higher female Frisch elasticity and smaller negative wealth effects



Standard preferences. Sample period: 1969-2011

Time Comparison: 1969-1992 vs 1993-2011

1. Estimated parameters:

   small variation in aggregate shock parameters across time periods

   lower persistence, higher variance in 1993-2011 for gender specific shocks

Time Comparison: 1969-1992 vs 1993-2011

1. Estimated parameters:

   small variation in aggregate shock parameters across time periods

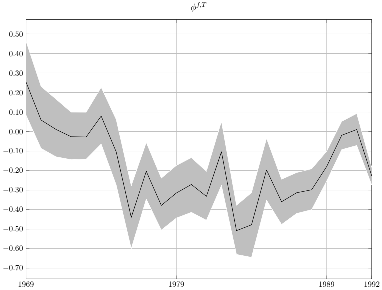
   lower persistence, higher variance in 1993-2011 for gender specific shocks
2. Most notable variation for estimated path for gender specific shocks

Time Comparison: 1969-1992 vs 1993-2011

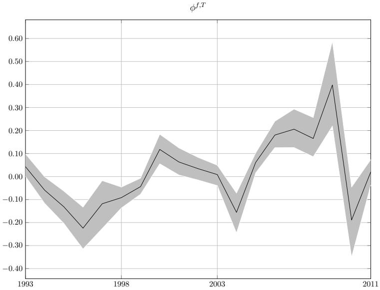
1 Estimated parameters:
   small variation in aggregate shock parameters across time periods
   lower persistence, higher variance in 1993-2011 for gender specific shocks
2 Most notable variation for estimated path for gender specific shocks

$\rightarrow$ trend female labor supply shock flat

$\tilde{\varphi}^{fT}$: 1969-1992



$\tilde{\varphi}^{fT}$: 1993-2011



Time Comparison: 1969-1992 vs 1993-2011

1. Estimated parameters:

   small variation in aggregate shock parameters across time periods

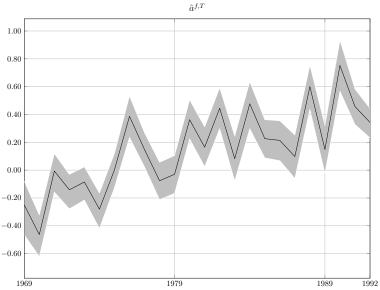
   lower persistence, higher variance in 1993-2011 for gender specific shocks

2. Most notable variation for estimated path for gender specific shocks

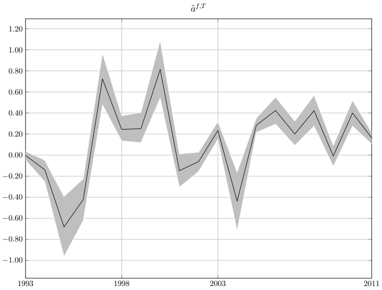
$\rightarrow$ trend female labor supply shock flat

$\rightarrow$ trend female relative productivity shock flat

$\tilde{a}^{fT}$: 1969-1992

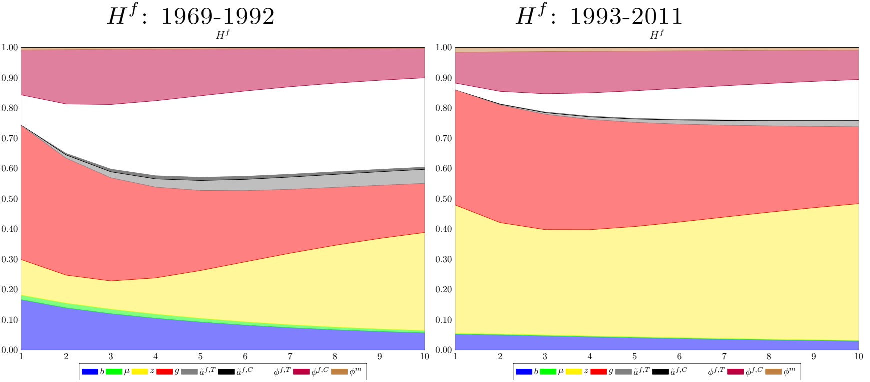


$\tilde{a}^{fT}$: 1993-2011



Time Comparisons: Variance Decomposition

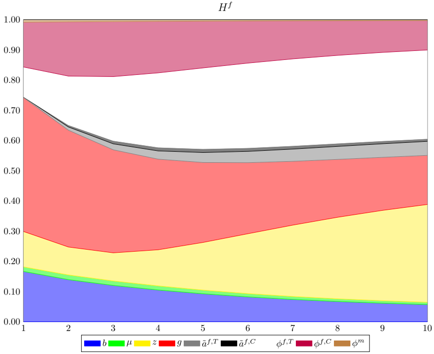
1. H^f: smaller role of trend components of female shocks in 1993-2011
2. H^m: same but muted pattern



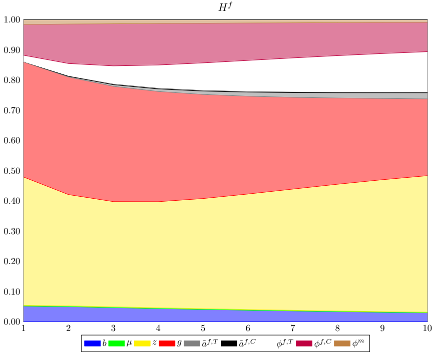
Time Comparisons: Variance Decomposition

1. H^f: smaller role of trend components of female shocks in 1993-2011
2. H^m: same but muted pattern
3. Smaller role of trend female shocks at long horizons in 1993-2011 for y, H

H^f: 1969-1992



H^f: 1993-2011



Great Recession: Jobless Recovery

Counterfactual 2004-2011 simulation:

- H_t^m, aggregate shocks follow 1993-2011 estimated path and process

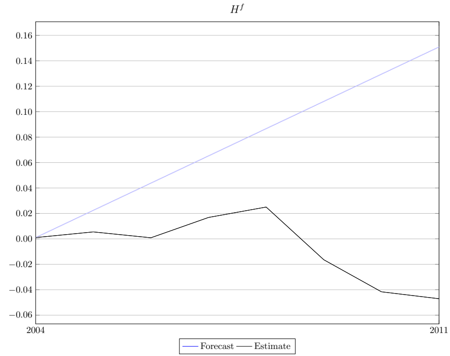
Great Recession: Jobless Recovery

Counterfactual 2004-2011 simulation:

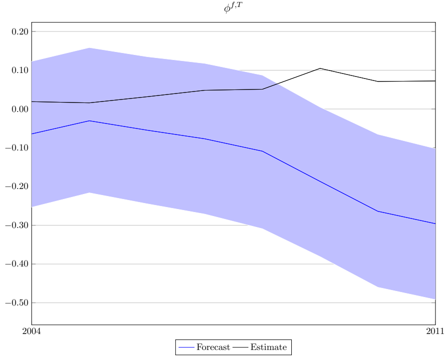
i H_t^m, aggregate shocks follow 1993-2011 estimated path and process

ii $\tilde{\varphi}^{fT}$ set to match 1969-1992 growth rate in H^f starting from 2004 value, with 1969-1992 parameters

H^f



$\tilde{\varphi}^{fT}$



Great Recession: Jobless Recovery

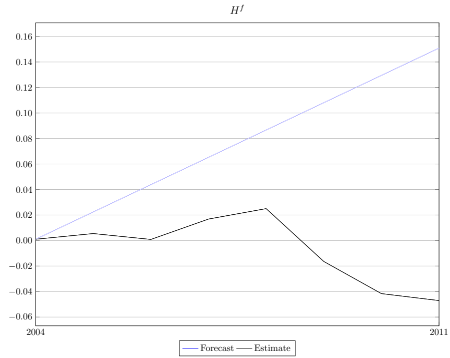
Counterfactual 2004-2011 simulation:

i H_t^m, aggregate shocks follow 1993-2011 estimated path and process

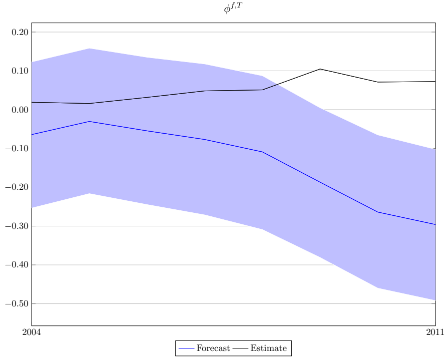
ii $\tilde{\varphi}^{fT}$ set to match 1969-1992 growth rate in H^f starting from 2004 value, with 1969-1992 parameters

iii $\tilde{\varphi}^{fC}$, $\tilde{a}^{fT}$, $\tilde{a}^{fC}$ set to 2004 value, with 1969-1992 parameters

H^f



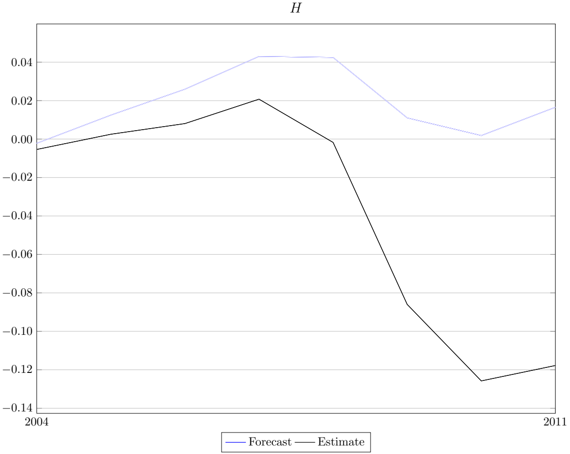
$\tilde{\varphi}^{fT}$



Great Recession: Jobless Recovery

Counterfactual 2004-2011 simulation:

H higher than actual $\rightarrow$ smaller recession, stronger recovery



Discussion

- DSGE model without gender differentiation is misspecified
  - gender specific shocks account for large fraction of variance of output, aggregate hours and investment at medium/long horizons
  - demand shocks absorb missing gender specific trends in basic RBC model
- Great Moderation:
  - model consistent with Facts 1-4
  - decline in volatility of investment & demand shocks in full & basic models
  - increase in volatility of TFP shock offset by higher procyclicality of female labor supply shock in full model
  - decline in volatility of TFP shock in basic model
- Jobless recoveries:
  - female trend shocks account for smaller fraction of variance of female hours & other variables in 1993-2011
  - continued trend growth of female hours would have mostly avoided jobless recovery after 2007-2009 recession