

# Financial Frictions, Asset Prices, and the Great Recession

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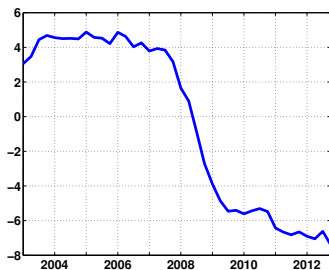
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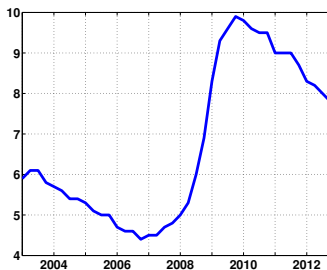
## We have had a Great Recession

- Both in the U.S. and in (mostly Southern) Europe
- Large decline in output, employment, consumption, and investment.
- Households deleveraging process: private debt and housing prices plunged.
- Total factor productivity (TFP) dropped.

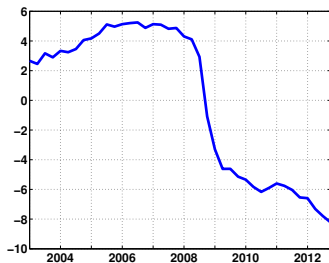
## Facts on the last recession: I



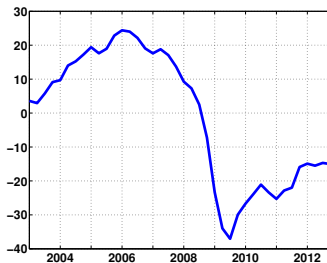
Real output



Unemployment



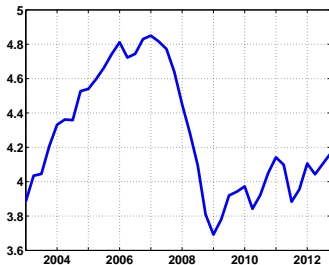
Consumption



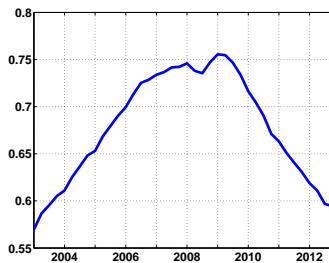
Investment

*Note:* Except for unemployment, figures show percentage deviation from a linear trend.

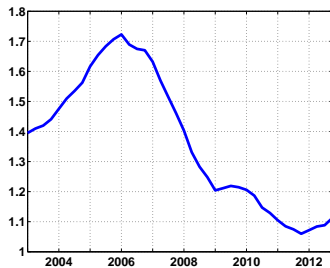
## Facts on the last recession: II



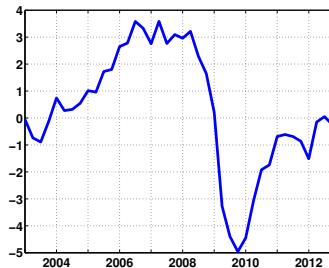
Wealth to output



Debt to output



Housing value to output



Labor Quality adjusted Productivity

## Culprit: Financial Shocks?

- When looking for triggers of the Great Recession some form of financial breakdown comes out in most popular explanations.
- Financing difficulties contribute to cut spending both of firms and households.
- Most of the action occurs via a demand reduction.
- Can a residual channel via lower productivity play a role?
- Are price rigidities central to the generation of a large demand induced recession?

## This paper

- Explores recessions that are triggered by shocks to households ability to borrow.
- What are the theoretical elements needed
- In the context of a modern macro model
  - Production with Savings [?], [?]
  - A lot of wealth [?]
  - Heterogeneity so that the financial frictions are not imposed [?], [?], [?].
- What are the quantitative importance of the elements needed

# Elements Needed in the context of a Macro-Growth Model

- 1 Households differing in wealth and job market prospects.
  - 2 A financial system used widely by not-too-rich households to buy houses (loans have to be collateralized).
  - 3 Asset prices that respond to market conditions: endogenous housing and stock market prices.
  - 4 Some difficulties in the transformation of consumption goods into investment/exporting.
  - 5 Some endogenous mechanism that moves measured TFP. [?]
- We extend [?], [?], [?] and [?] in various ways to include a production sector and housing and asset prices that allows us to talk about the U.S. recession.

## Findings: The answer is yes, provided there are (from +to-)

- 1 Real frictions that difficult the switch from production of consumption goods to exports or investment.
- 2 Houses which are inferior goods and not wanted by the super-rich.
- 3 Frictions in the goods markets that generate movements in measured GDP.
- 4 Households that differ in job prospects.
- 5 Some labor market frictions that limit wage adjustments.



## Findings: The Recession that we generate

- Shares most of the features of the Great Recession:
  - 1 A large decline in output, employment, consumption and investment.
  - 2 Large reductions in assets (housing and stocks) prices.
  - 3 Lower than the data due to inexistence of default, foreclosures, and adjustment costs in house purchases.

# Model

# The Model Characteristics

- Enhanced Aiyagari Economy:
  - 1 Multisector: Tradables and nontradables.
  - 2 Houses (land) that need to be purchased to be enjoyed.
  - 3 Endogenous productivity movements (frictions in goods markets).
  - 4 Various job market frictions.

## Households: Preferences

- Continuum of households that live forever ( $\beta$ ), are subject to uninsurable idiosyncratic and aggregate shocks.
- H'holds care about quantities and number of varieties of nontradables.

$$c_N = \left( \int_0^{I_N} c_{Ni}^{\frac{1}{\rho}} di \right)^{\rho} = c_{Ni}^{\rho} I_N^{\rho}$$

- Households have to search for varieties, its number is a *choice*.

$$I_N = d \Psi^d(Q^g)$$

- $\Psi^d(Q^g)$ : Probability (per search unit) of finding a variety (goods market frictions).
- Households also like tradables and housing and dislike goods searching

$$u [c_A(c_N I_N^{\rho}, c_T), h, d]$$

## Households: Endowments and Wealth

- Household skill type is  $\epsilon$ , follows a Markov chain  $\Gamma_{\epsilon, \epsilon'}$ . Moves slowly and accommodates opportunities to get rich.
- Households either have a job  $e = 1$  or not  $e = 0$ .
  - Type-dependent exogenous job destruction rate  $\delta_n^\epsilon$ .
  - Job finding rate is type independent and depends on job creation by firms (workers are rationed, it is like no matching function in labor market but hiring costs) ([?]).
- Households have assets  $a$ . These assets can be allocated to (frictionless) houses and/or to financial assets with a collateral constraint. The poor will have some housing wealth and a mortgage, the rich houses and shares of the economy's mutual fund.

## Goods markets

- Search frictions in the markets for nontradables:
- Households look for varieties.
- Random search.
- Richer people consume and search more.
- Cuts in consumption cut search which cuts productivity.
- Perfect competition and frictionless markets for tradables.

## Labor market

- Workers are rationed.
- Firms hire as many workers as they wish paying hiring costs. (like a vacancy filling probability of 1, with hiring costs).
- Employment:  $N = N_N + N_T$ .
- Same job finding probability across types:  $\Phi^e = \frac{V}{1-N}$ .
- Wages are determined via the following formula

$$\log w - \log \bar{w} = \varepsilon_w (\log Y - \log \bar{Y})$$

It simplifies things.

[?].

## Assets markets: Financial assets and houses

- Total housing  $\bar{H}$  is in fixed supply.
- Negative financial assets ( $b' < 0$ ) are (undefaultable) mortgages.
  - Its interest rate is predetermined:  $\frac{1}{1+r^*} - \varsigma(\theta)$ , if  $b < 0$ .
  - Mortgages have to be collateralized by housing: if  $b < 0$  then

$$|b| \leq [1 - \lambda(\theta)] p_h(S) h \left[ \frac{1}{1+r^*} - \varsigma(\theta) \right]$$

- Positive financial assets ( $b > 0$ ) are shares of a mutual fund.
  - Its return,  $r(S, S')$ , is stochastic. Possible capital gains and loses.

$$R(S, S', b) = \begin{cases} 1 + r(S, S'), & \text{if } b \geq 0 \\ 1, & \text{if } b < 0. \end{cases}$$



## State variables

- A household is characterized by  $\{\epsilon, e, a\}$ .
- Let  $X$  denote the measure over types  $x = \{\epsilon, e, a\}$ .
- The vector of aggregate state variables is

$$S = \{\theta, B, K_N, K_T, N_N, N_T, X\}$$

Here  $B$  is the net foreign asset position.  $K$  and  $N$  are predetermined factor inputs.

- Hence either we do Krusell-Smith or the transition after an unforeseen shock. Today, we do the latter.

## Households' problem

$$V(S, \epsilon, e, a) = \max_{c_{N,i}, c_T, I_N, h, d} u(c_A, h, d) + \beta \sum_{\epsilon', e', \theta'} \Pi_{\theta, \theta'}^\theta \Pi_{e'|e, \epsilon}^w(S') \Pi_{\epsilon, \epsilon'}^\epsilon V[S', \epsilon', e', a'(S', b, h)] \quad \text{s.t.}$$

$$\int_0^{I_N} p_i(S) c_{N,i} + c_T + p_h(S) h + b = a + 1_{e=1} w(S) \epsilon + 1_{e=0} \underline{w} \quad \text{BC}$$

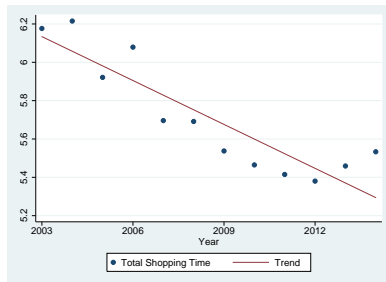
$$a'(S', b, h) = p_h(S') h + R(S, S', b) b \quad \text{AA}$$

$$b \geq -\lambda(\theta) p_h(S) h \left[ \frac{1}{1+r^*} - \varsigma(\theta) \right] \quad \text{FC}$$

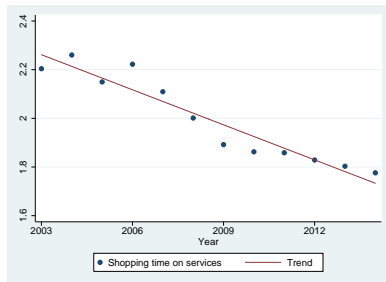
$$I_N = d \Psi^d[Q^g(S)] \quad \text{SC}$$

$$S' = G(S, \theta') \quad \text{RE}$$

# American Time Use Survey Data on Shopping Time



Total shopping time



Shopping time on services

## Nontradables: Monopolistic Competition by Varieties

- Each firm/variety has any locations each.
- Some inputs are location specific. Others (type 2 labor) are not.
- Prices are posted before location is filled
- The demand function is given by

$$\Psi^f [Q^g(S)] \int c[p_i(\epsilon, e, a), S, x] d(x, S)$$

- The firm has to make sure that it can satisfy the demand at all locations.

## Nontradable firms' problem

$$\Omega^N(S, k, n) = \max_{\substack{i, v, p_i \\ \ell_1, \ell_2}} \Psi^f[Q^g(S)] p_i \int c(p_i, S, \epsilon, e, a) dx - w(S)\ell - i - \kappa v \\ + \sum_{\theta'} \Pi_{\theta, \theta'}^\theta \frac{\Omega^N(S', k', n')}{1 + r^*}$$

subject to

$$\ell_2 \geq \Psi^f[Q^g(S)] \int f^\ell[c(p_i, S, x), k, \ell_1] \frac{d(x, S)}{D(S)} \quad \text{DC}$$

$$\ell_1 + \ell_2 = n \bar{\epsilon}(S) \quad \text{SL}$$

$$k' = (1 - \delta_k)k + i - \phi^N(k, i) \quad \text{LMK}$$

$$n' = [1 - \bar{\delta}_n(S)]n + v \quad \text{LML}$$

$$S' = G(S, \theta') \quad \text{RE}$$

## Tradable firms' are competitive and have adjustment costs

- Its output is used for exports, investment, and (part of) consumption.
- Decreasing returns.

$$\Omega^T(S, k, n) = \max_{i, v} F^T(k, \ell) - w(S)\ell - i - \kappa v - \phi^{T, n}(n', n) + \sum_{\theta'} \Pi_{\theta, \theta'}^{\theta} \frac{\Omega^T(S', k', n')}{1 + r^*}$$

subject to

$$k' = (1 - \delta_k)k + i - \phi^{T, k}(k, i)$$

$$\ell = n\bar{\epsilon}(S)$$

$$n' = [1 - \bar{\delta}_n(S)]n + v$$

$$S' = G(S).$$

## Mutual fund

- Financial wealth in the economy is

$$L_+ = \int_{b>0} b(S, \epsilon, e, a) dx$$

- Mortgages in the economy are

$$L_- = \int_{b<0} -b(S, \epsilon, e, a) dx$$

- Net foreign asset position of the country (the mutual fund owns all firms)

$$B = L_+ - \left( \Omega^N(S) - \pi^N(S) + \Omega^T(S) - \pi^T(S) + \frac{1}{1+r^*} L_- \right)$$

- The realized rate of return is

$$1 + r(S, S') = \frac{\Omega^N(S') + \Omega^T(S') + (1 + r^*)B + L_-}{L_+}$$

## Equilibrium

An equilibrium is a set of decision rules and values for households, firms' values and decision rules, and a set aggregate variables of aggregate states, such that:

- Households' and firms' policy functions and value functions solve the corresponding program problems.
- Aggregate searching consistence

$$D(S) = \int d(S, \epsilon, e, a) dx,$$

- Nontradable prices satisfies

$$p(S) = p_i(S, K_N, N_N) dx,$$

- Housing market clears

$$\int h(S, \epsilon, e, a) dx = H.$$



# Equilibrium

- Average separation probability and labor force quality

$$\bar{\delta}_n(S) = \frac{\sum_{\epsilon} \delta_n(\epsilon) n(\epsilon)}{N}, \quad \bar{\epsilon}(S) = \frac{\sum_{\epsilon} \epsilon n(\epsilon)}{N}$$

- Rate of return to the mutual fund satisfies

$$1 + r(S, S') = \frac{\Omega^N(S') + \Omega^T(S') + (1 + r^*)B + \int_{b < 0} b(S, x)}{\int_{b > 0} b(S, x)}$$

- Wage satisfies

$$\log w(S) - \log \bar{w} = \varepsilon_w (\log Y(S) - \log \bar{Y})$$

- The law of motion  $G(S)$  is consistent with households' decisions and employment dynamics.

# Mapping the Model to Data

## Functional forms

- Preferences

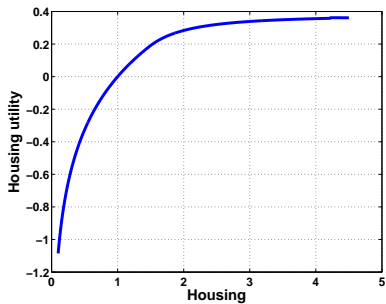
$$u(c_A, h, d) = \frac{1}{1 - \sigma_c} \left( c_A - \xi_d \frac{d^{1+\gamma}}{1 + \gamma} \right)^{1 - \sigma_c} + v(h)$$

- where there is an Armington aggregator for consumption

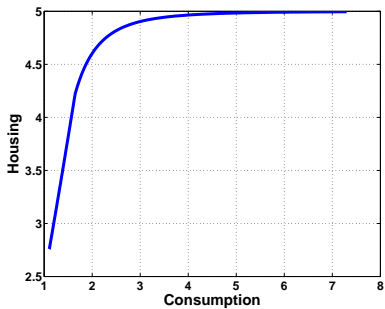
$$c_A = \left[ \omega (c_N I_N^\rho)^{\frac{\eta-1}{\eta}} + (1 - \omega) c_T^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}$$

- and houses are inferior goods as a proxy for segmentation of housing markets

$$v(h) = \begin{cases} \xi_h \log(h), & \text{if } h < \hat{h}_1 \\ \frac{\xi_h}{1 - \sigma_h} h^{1 - \sigma_h}, & \text{if } \hat{h}_1 \leq h \leq \hat{h}_2. \\ \xi_h \sqrt{\hat{h} - h}, & \text{if } h > \hat{h}_2. \end{cases}$$



Housing utility function



Engel Curve: consumption vs housing

## Functional forms

- Production function

$$F^N(k, \ell_1, \ell_2) = z_N k^{\alpha_0} \ell_1^{\alpha_1} \ell_2^{\alpha_2}, \quad F^T(k, \ell) = z_T k^{\theta_0} \ell^{\theta_1}$$

- Capital adjustment cost in the nontradable goods sector

$$\phi^N(i, k) = \frac{\varepsilon^N}{2} \left( \frac{i}{k} - \delta_k \right)^2 k$$

- Capital and employment adjustment cost in the tradable goods sector

$$\phi^{T,k}(i, k) = \frac{\varepsilon^{T,k}}{2} \left( \frac{i}{k} - \delta_k \right)^2 k, \quad \phi^{T,n}(n', n) = \frac{\varepsilon^{T,n}}{2} \left( \frac{n'}{n} - 1 \right)^2 n$$

- Matching technology

$$M(D, T) = \nu D^\mu T^{1-\mu}$$

## Exogenously determined parameters

- A period is half a quarter.

Parameter	Value
Risk aversion for consumption, $\sigma_c$	2.0
Satiation level for housing, $\bar{h}$	5.0
Curvature of shopping, $\gamma$	1.5
Elasticity of substitution bw tradables and nontradables, $\eta$	0.80
Price markup, $\rho$	1.1
Loan to value ratio, $\lambda$	0.80
Interest rate for international bonds, $r^*$	4%

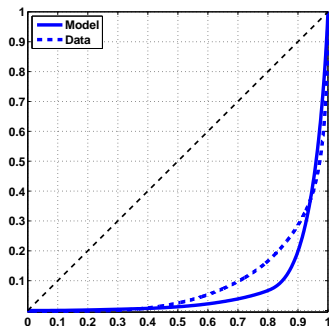
## Endogenously determined parameters: aggregate

Target	Value	Parameter	Value
Wealth to output ratio	4.00	$\beta$	0.97
Housing value to output ratio	1.70	$\xi_h$	0.54
Debt to output ratio	0.40	$\epsilon_4$	37.41
Fraction of housing held by bottom 70%	0.25	$\hat{h}_1$	1.48
Fraction of housing held by bottom 80%	0.39	$\hat{h}_2$	4.22
Fraction of housing held by bottom 90%	0.58	$\sigma_h$	2.92
Share of tradables	0.30	$\omega$	0.98
Occupancy Rate	0.81	$\nu$	0.81
Capital to output ratio	2.00	$\delta_k$	0.01
Labor Share in nontradables	0.64	$\alpha_0$	0.27
$\alpha_1 = \alpha_2$	—	$\alpha_1$	0.36
Labor Share in tradables	0.66	$\theta_1$	0.66
$1.4\theta_0 + \theta_1 = 1$	—	$\theta_0$	0.23
Vacancy cost to output ratio	0.02	$\kappa$	0.42
Home production to lowest earning ratio	0.50	$\bar{w}$	0.07
Units Parameters			
Output	1	$z_N$	0.93
Relative price of nontradables	1	$z_T$	0.48
Market tightness in goods markets	1	$\xi_d$	0.03

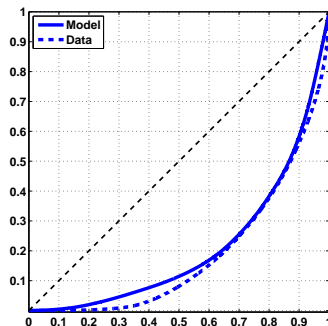
Target	Value	Parameter	Value
Job duration for type 1	1.5 year	$\delta_n^1$	0.083
Job duration for type 3	5 year	$\delta_n^3$	0.025
Job duration for type 4	5 year	$\delta_n^4$	0.025
Unemployment rate	6%	$\delta_n^2$	0.048
Wealth Gini index	0.82	$\Pi_{1,4}^\epsilon$	0.0007
Earnings Gini index	0.64	$\Pi_{4,1}^\epsilon$	0.0058
Earning autocorrelation	0.91	$\Pi_{1,1}^\epsilon$	0.9656
Earning stdev	0.20	$\Pi_{2,2}^\epsilon$	0.9770



Network



Housing



## Experiments: once and for all set of surprises in the environment

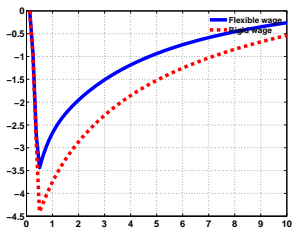
- 1 Over the next three months the down payment changes from 20% to 40% .
  - 2 The borrowing interest rate's surcharge goes from zero to 0.5%.
  - 3 Both at the same time.
  - 4 The inverse process. Credit expansion.
- All of these with fixed and flexible wages.

# Long Run Properties

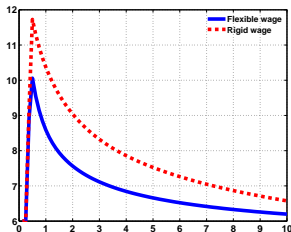
- Typically like in all  $[?] - [?] - [?] - [?]$  type models, in the long run output and wealth end up being higher.
- But in our economies the transition is associated to a recession.

Experiment: worsening of  
both  $\lambda$  and borrowing cost  $\zeta$ .  
From .8 to .6 and from 0. to 0.5%  
over 3 months.

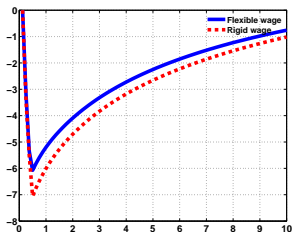
# Comparison: Flexible ( $EI=.45$ ) vs fixed ( $EI=.15$ ) wages



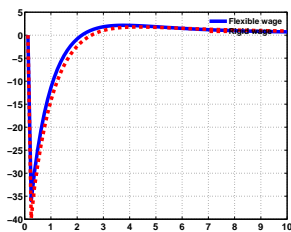
Real output



Unemployment



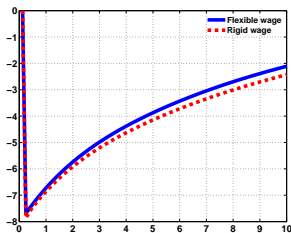
Consumption



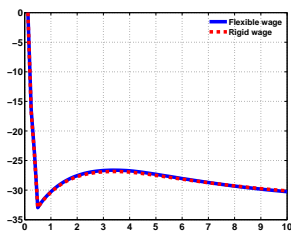
Investment

— Flexible wage    - - - Fixed wage

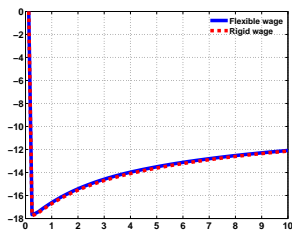
# Comparison: Flexible ( $EI=.45$ ) vs fixed ( $EI=.15$ ) wages



Wealth



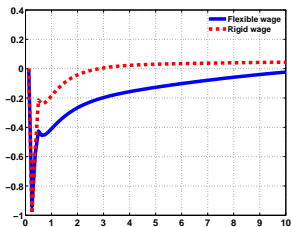
Debt



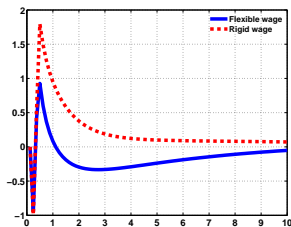
Housing price

— Flexible wage    - - - Fixed wage

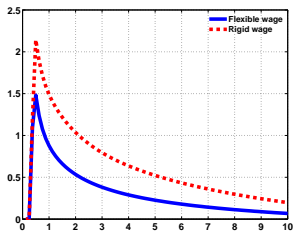
# Comparison: Flexible (EI=.45) vs fixed (EI=.15) wages



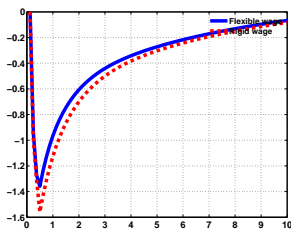
TFP with total hours



Labor Productivity



Labor quality

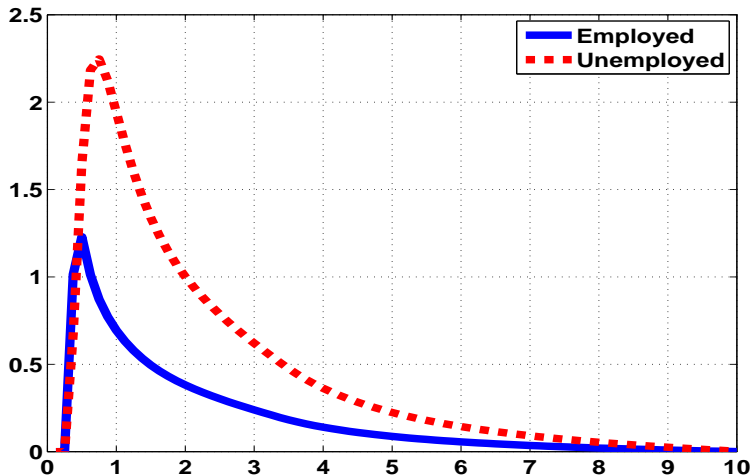


TFP with total labor inputs

— Flexible wage    - - - Fixed wage

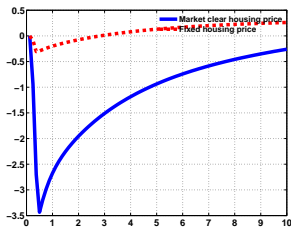
## Experiment 1: worsening of both $\lambda$ and borrowing cost

Change of labor quality in both pools when wages are flexible

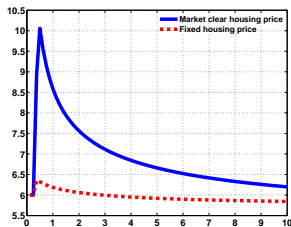




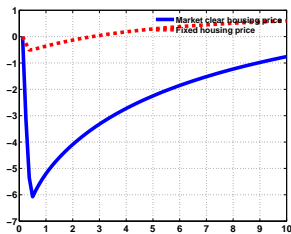
# A comparison: Baseline vs constant house prices



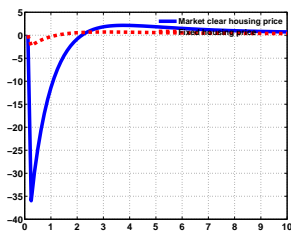
Real output



Unemployment



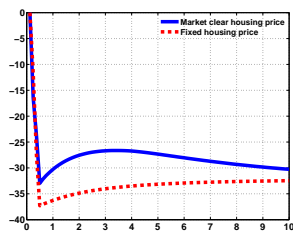
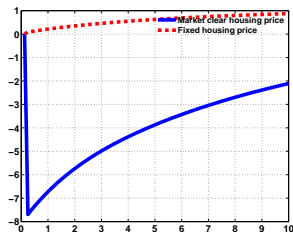
Consumption



Investment

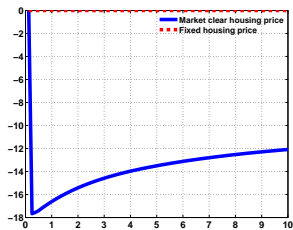
**—** Flexible wage    **- - -** Fixed wage

# A comparison: Baseline vs constant house prices



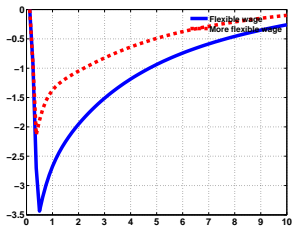
Wealth

Debt

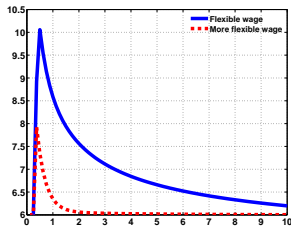


Housing price

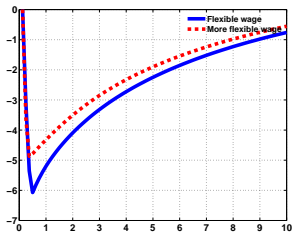
— Flexible wage    - - - Fixed wage



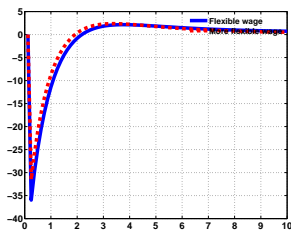
Real output



Unemployment



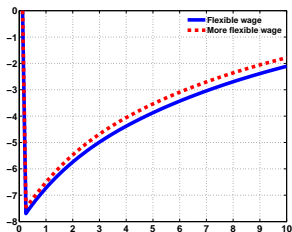
Consumption



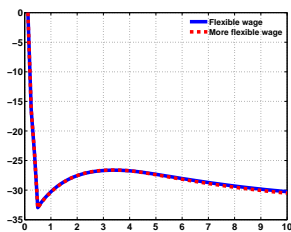
Investment

—— Flexible wage    
 - - - Fixed wage

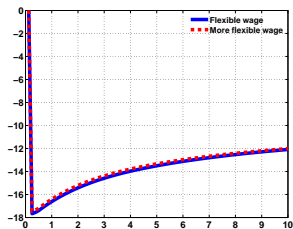
# Comparison: Flexible ( $EI=.45$ ) vs very flexible ( $EI=1.$ ) wages



Wealth



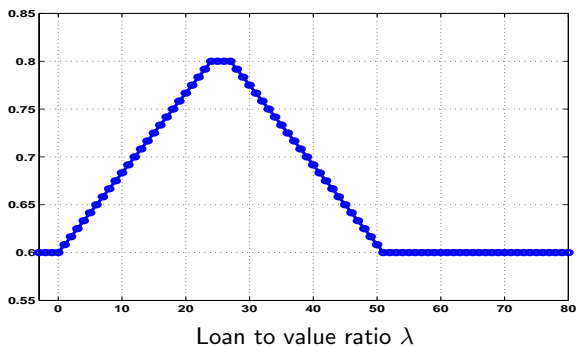
Debt



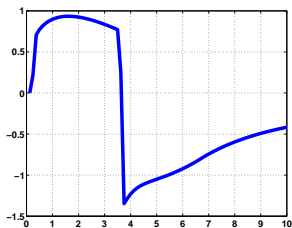
Housing price

— Flexible wage    - - - Fixed wage

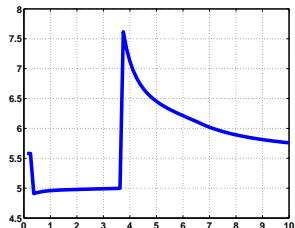
## Results: a boom and bust cycle



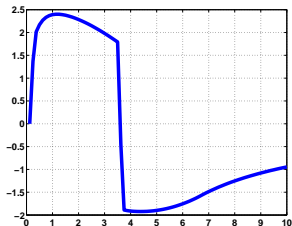
# Results: a boom and bust cycle



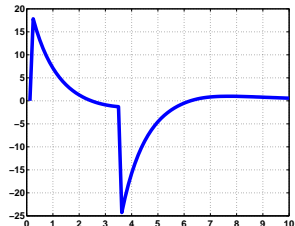
Real output



Unemployment

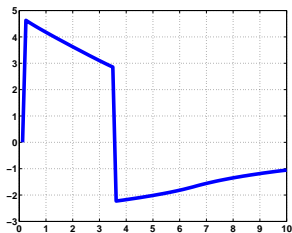


Consumption

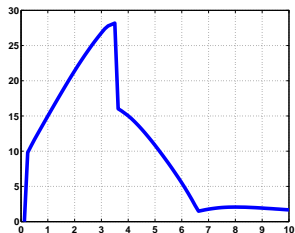


Investment

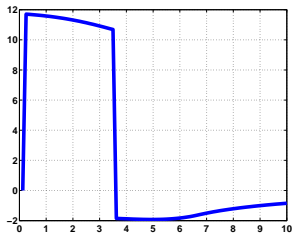
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Wealth

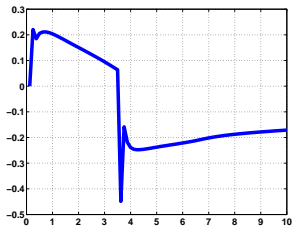


Debt

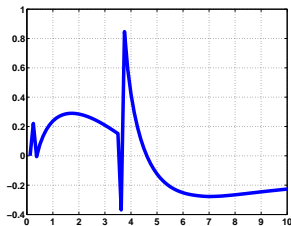


Housing price

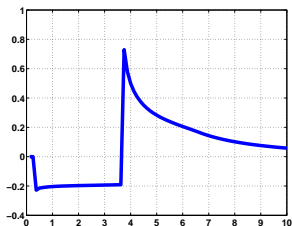
# Results: a boom and bust cycle



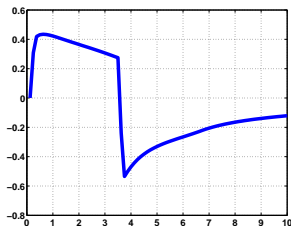
TFP with total hours



Labor Productivity



Labor quality



TFP with total labor inputs



## Allowing Default: a Larger Increase of Borrowing Cost

- Borrowing interest rate's surcharge goes from zero to 1%.
- Housing price drops more than 20%, and agents may be underwater.
- Allow borrowers to default, but savers suffer from the capital loss.

## Allowing Default

- Total saving in financial wealth in the economy is

$$L_{+,t} = \int_{b>0} b_t(\epsilon, e, a) dx$$

- Mortgages in the economy are

$$L_{-,t} = \int_{b<0} -b_t(\epsilon, e, a) dx$$

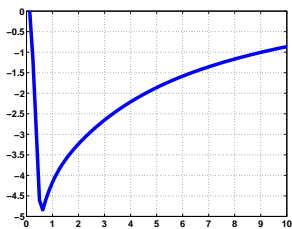
- Net foreign asset position of the country

$$B_t = L_{+,t} - \left( \Omega_t^N - \pi_t^N + \Omega_t^T - \pi_t^T + \frac{1}{1+r^*} L_{-,t} \right)$$

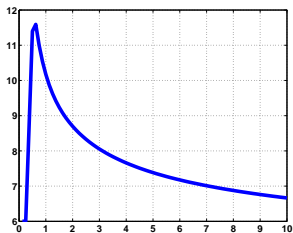
- The realized rate of return in next period is

$$1 + r_{t+1} = \frac{\Omega_{t+1}^N + \Omega_{t+1}^T + (1+r^*)B_t}{L_+} - \frac{\int_{b<0} \mathbb{I}\{p_{h,t+1}h_t + b_t(\epsilon, e, a) > 0\} b_t(\epsilon, e, a) dx}{L_+}$$

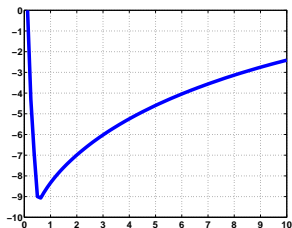
## Results: allowing default



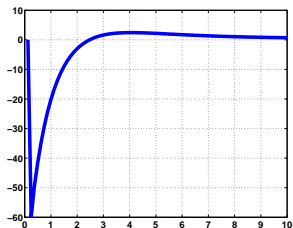
Real output



Unemployment

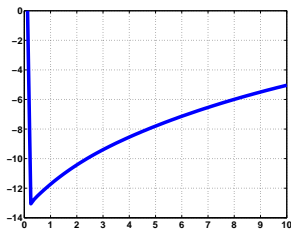


Consumption

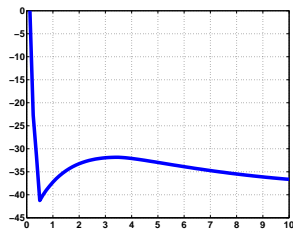


Investment

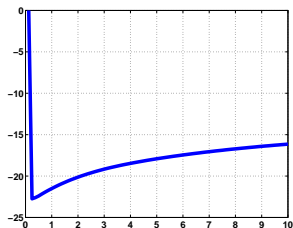
## Results: allowing default



Wealth

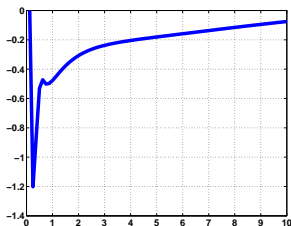


Debt

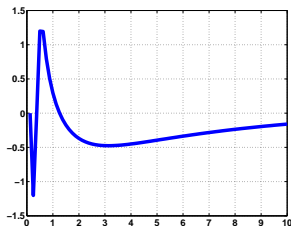


Housing price

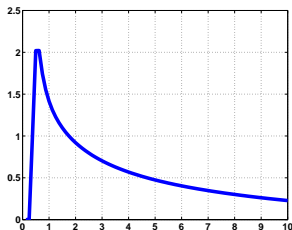
## Results: allowing default



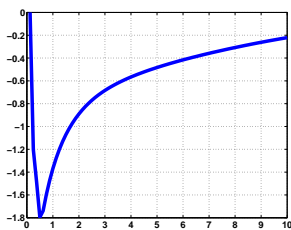
TFP with total hours



Labor Productivity



Labor quality



TFP with total labor inputs

# Conclusions

- We have a recession generated purely by increased difficulties to borrow on the part of households
- The recession comes together with
  - TFP loses
  - Drop in Housing prices (movements too sharp because of lack of house frictions)
  - Drop in Stock Market
- The literature is trying hard to get this ([?], [?]) with limited success.
- Still ways to go:
  - Foreclosures; slow housing frictions; Long term Mortgages.
  - Slow expanding export industries.
  - Model of banking cycles.

Thank you very much

## The working of financial shocks that hit the production side

- [?], [?]
- Firms cannot borrow as much.
- Not all good projects will be undertaken.
- Cash rich firms expand at the expense of cash poor firms.
- In fact there is some of this in the data: Since 2007 employment of the young firms went down by 24.5% and in 2012 it was at the historically lowest level.
- Firms make themselves vulnerable by being close to their credit limit to improve their bargaining position over wages [?]



## Why was there a financial shock? (what was the trigger?)

- Increased variance in the cross-sectional returns of firms [?], [?] [?], [?] [?].
- Straight shocks to credit constraints [?], [?], [?].

## What have we learned

- It is hard to get a large recession only from the product side and only from lower investment.
- The largest success (to my knowledge) ([?]) works by having the financial shocks increase the probability of default and inducing firms to pursue very conservative use of inputs despite their almost normal productivity.
- Still it is hard to have a reduction of marginal cash to create a large recession ([?]).
- It may have played a larger role in the expansion of new firms ([?]).

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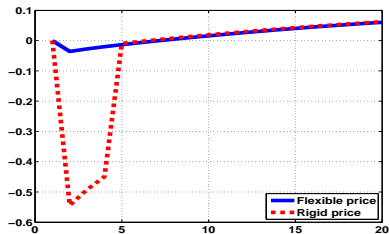
Christiano, Lawrence, Roberto Motto, and Massimo Rostagno. 2014.

NYU, Penn, UCL, CAERP

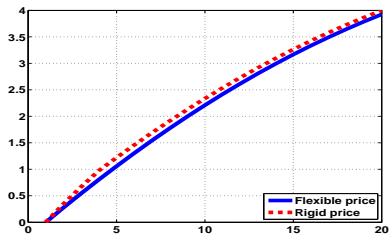
Risk Shocks, Financial Frictions, Asset Prices, & the Great Recession

# Price Rigidity in a Search Economy I

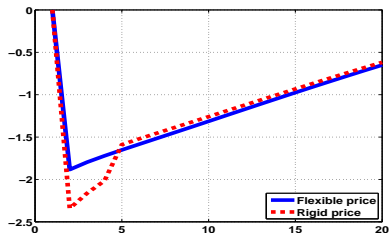
Figure: Aggregate Economy Response: with Price Rigidity



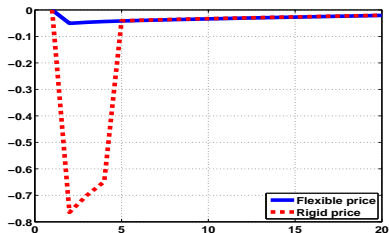
Output



Wealth

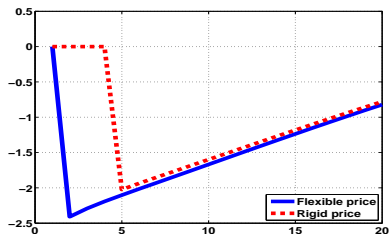


Consumption of Goods

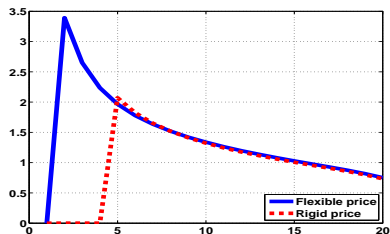


Consumption of Services

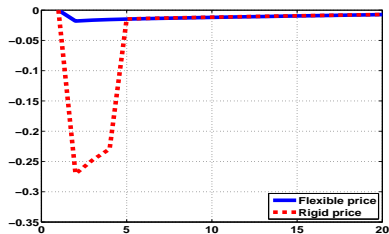
# Price Rigidity in a Search Economy II



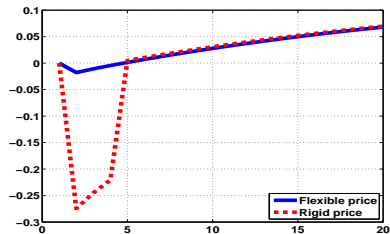
Average price



Price dispersion

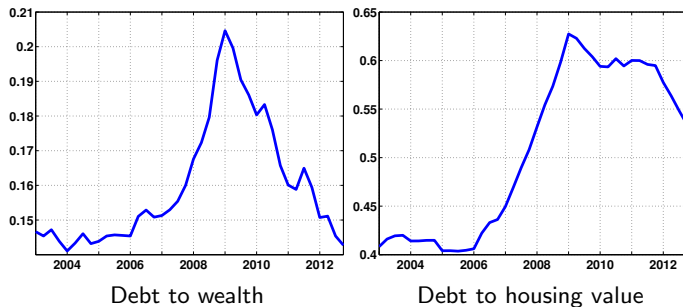


Labor



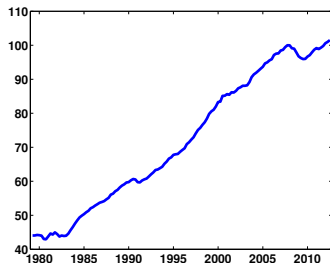
Productivity

## Facts on the last recession: IV [Return](#)

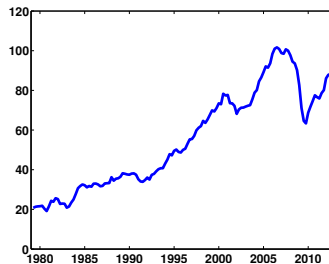


## Facts: Continued

[← Return](#)



Real output

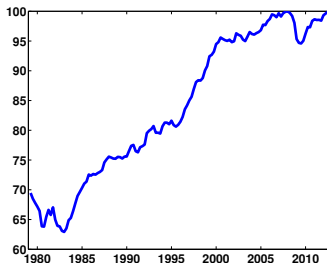


Consumption

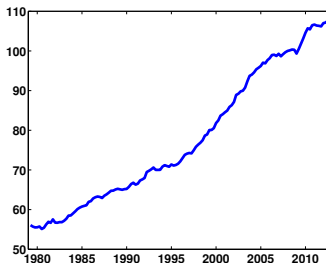
Investment

# Facts: Continued

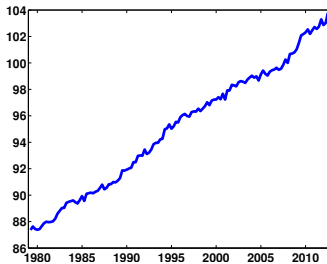
[← Return](#)



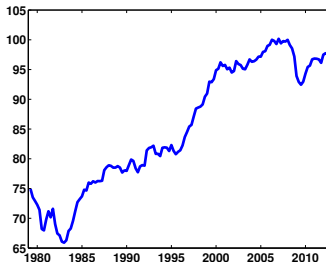
TFP with total hours



Labor productivity



Labor quality



TFP with total labor inputs

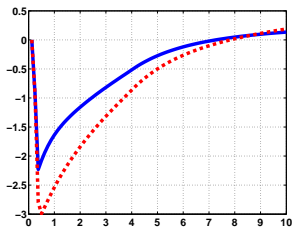


## Facts: Continued

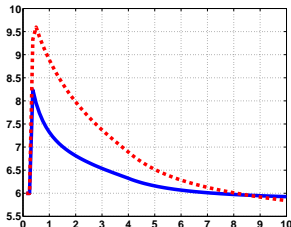
- 'Real output', 'consumption' and 'investment' are 'Gross Domestic Product', 'Personal Consumption Expenditures' and 'Gross Private Domestic Investment' from BEA.
- 'TFP with total hours' is calculated by Fernald (2012).
- 'Labor productivity' is total output divided by total hours.
- 'Labor quality' follows Aaronson and Sullivan (2001), which are extended by Bart Hobijn and Joyce Kwok (FRBSF).
- 'TFP with total labor inputs' is total output divided by the product of total hours and labor quality.
- These variables shown at the beginning are deviations from their linear trends. These variables shown in the appendix have their values in 2007 q4 normalized to 100.

# Experiment 1: gradual change of $\lambda$ from 0.75 to 0.675

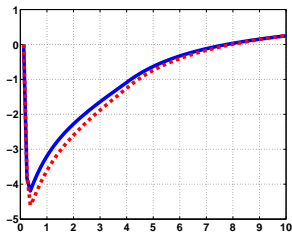
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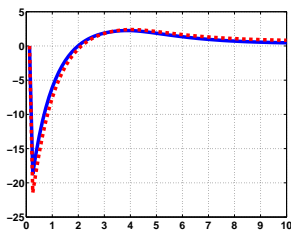
Real output



Unemployment



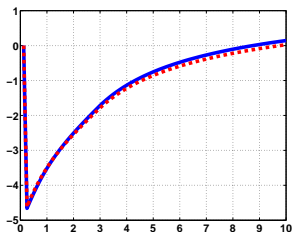
Consumption



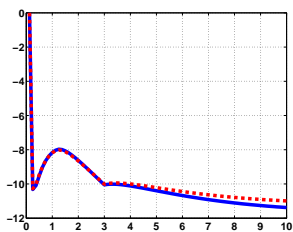
Investment

— Flexible wage    - - - Fixed wage

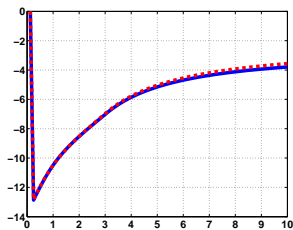
# Experiment 1: gradual change of $\lambda$ from 0.75 to 0.675



Wealth



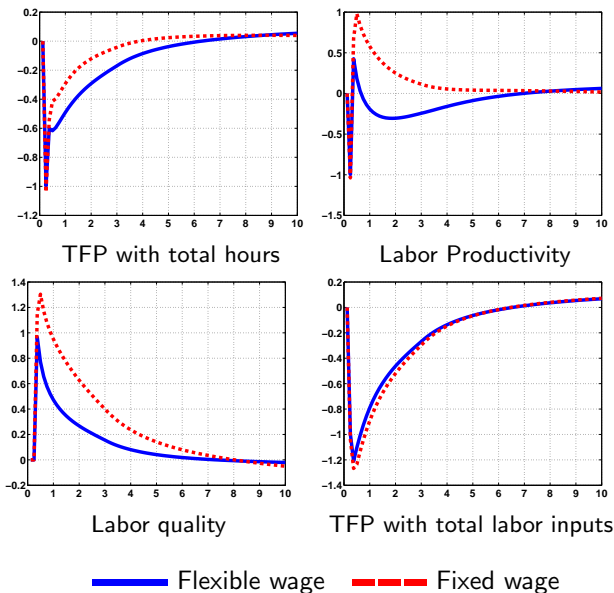
Debt



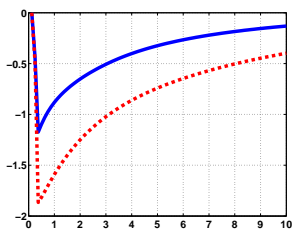
Housing price

— Flexible wage    - - - Fixed wage

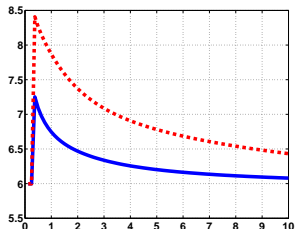
# Experiment 1: gradual change of $\lambda$ from 0.75 to 0.675



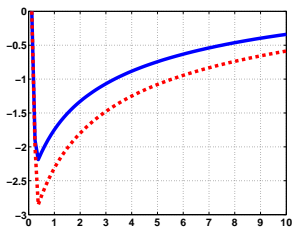
## Experiment 2: gradual change of borrowing cost from 0 to 0.3%



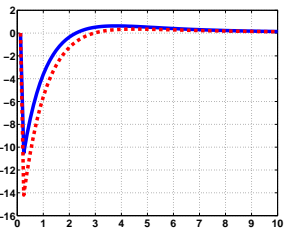
Real output



Unemployment



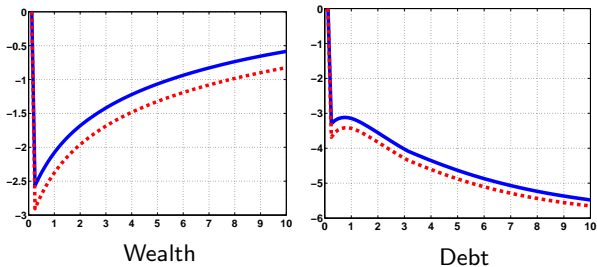
Consumption



Investment

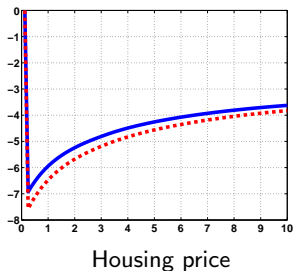
— Flexible wage    - - - Fixed wage

## Experiment 2: gradual change of borrowing cost from 0 to 0.3%



Wealth

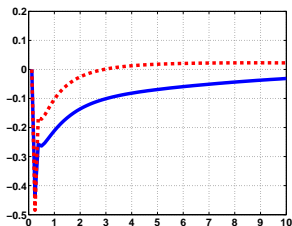
Debt



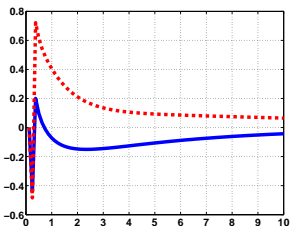
Housing price

— Flexible wage    - - - Fixed wage

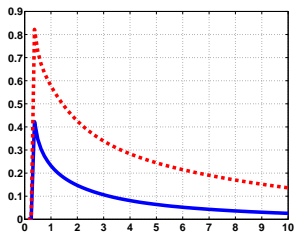
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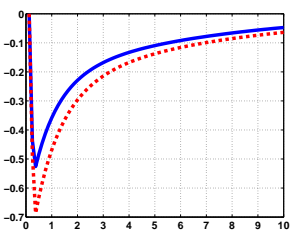
TFP with total hours



Labor Productivity



Labor quality



TFP with total labor inputs

— Flexible wage    - - - Fixed wage

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- Firms make themselves vulnerable by being close to their credit limit to improve their bargaining position over wages [?]



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- Increased variance in the cross-sectional returns of firms [?], [?] [?], [?] [?].
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