

Balance Sheet Recessions

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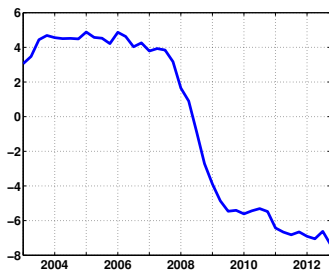
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Joint with Zhen Huo
with other work with Yan Bai and Kjetil Storesletten
Wednesday 6th August, 2014

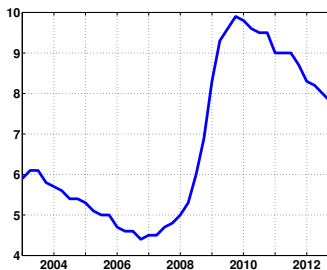
We have had a Great Recession

- 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.

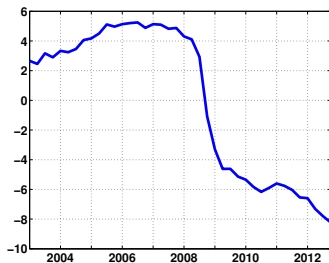
Facts on the last recession: I



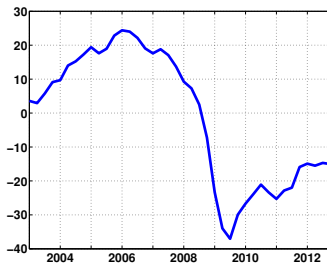
Real output



Unemployment



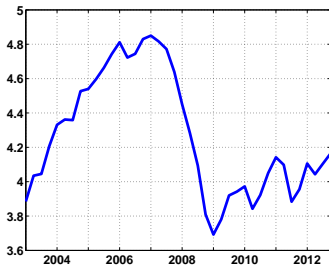
Consumption



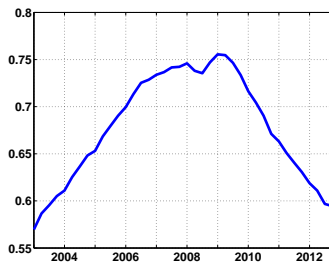
Investment

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

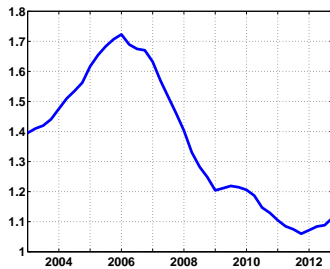
Facts on the last recession: II



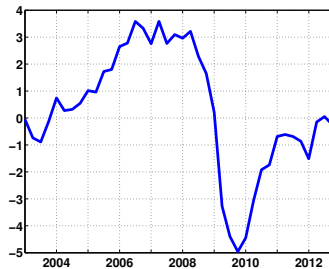
Wealth to output



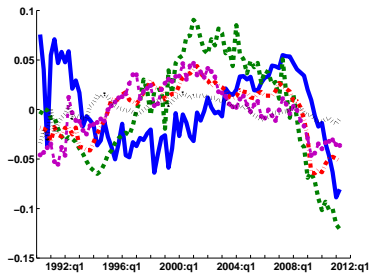
Debt to output



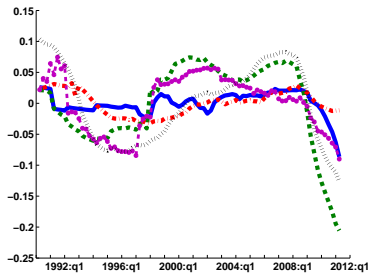
Housing value to output



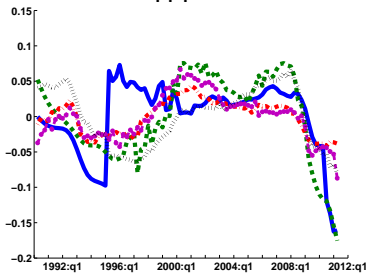
Labor Quality adjusted Productivity



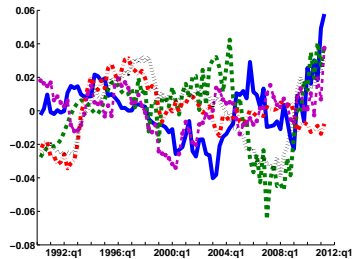
TFP



Employment



Consumption



Net Export/output ratio



Can we provide a theory of a recession based on reductions in household consumption?

- Many commentators think the Great Recession was triggered by a financial shock.
- Such a shock induced people to save more triggering a recession.
- Can this happen in an economy that can save via investment and exports and where prices and wages are (reasonably) flexible?
- In the context of standard macro theory, the answer is no: adverse wealth shocks generate (painful) expansions due to the willingness to work.
- I will provide a yes answer based on
 - Adjustment costs to production.
 - Mild (Mortensen-Pissarides) labor frictions.
 - Goods markets frictions that generate endogenous and procyclical TFP.

Standard Macroeconomic Theory has three main Objects

- 1 An intertemporal Euler Equation

$$u_c(c, n) = \beta E \{(1 + r') u_c(c, n)\}$$

Mostly uncontroversial, yet subject to the equity premium puzzle.

- 2 A static first order condition.

$$u_c(c, n) = w u_n(c, n)$$

It does terrible (labor-wedge, models predict low movement in hours).

- It is substituted often by unemployment models a la Mortensen-Pissarides or by fixed wages so that it does not apply.

- 3 A Production Function

$$Y = z F(K, N)$$

The main object in this talk.

The production function

- In a standard RBC or New Keynesian model the production function requires that either productivity or inputs change output.

$$Y = z F(K, N)$$

- So either productivity (z) moves or inputs (i.e. labor) move. (There are some exceptions that use the notion of factor intensity: inputs are improperly measured.)
- If z does not move, decreasing returns to scale require that labor productivity and wages drop if labor increases.
- Given observations of Capital and Labor and using the (former) long run stability of labor share, a Cobb-Douglas form is the popular choice.

$$Y = z K^{1-\alpha} N^{\alpha}$$

- This implies that we the production functions becomes a definition of z , the Solow residual.

The production function

- In the data, the residual z is strongly correlated with output. Hence, standard theory says, there have to be TFP shocks.
- We have been looking for productivity shocks for thirty years with limited success.
- Moreover, the notion that all goods produced are sold underlies these notions. What about services? Short lived manufacturing goods?
- The aggregate production function is thinking that the world is like the XIX century.

My main point

- There are other ways of thinking about the changing gap between a stable combination of inputs, $F(K, N)$, and output Y .
- It requires something that moves cyclically and that is improperly measured.

$$Y = \square F(K, N)$$

- The contribution of households (or firms) who participate actively in the consumption (or investment) process and whose engagement is necessary for output to occur:
 - Restaurants need diners.
 - Podologists need toes.
 - Even the U.S. mail needs letters and packages.

Technical ingredient: A search friction

- To get variation in the necessary *Solow like* residual households vary search efforts which ultimately varies productivity.
- So households (and in general, purchasers) bear the load of making productivity increase.

The basic idea in the context of the Lucas (1978) tree model

- Preferences

$$E \left\{ \sum_t \beta^t u(c_t, \theta_t) \right\}.$$

- Technology

$$c_t \leq z_t.$$

- Only constraint is the budget constraint

$$p_t s_{t+1} + c_t = s_t (p_t + z_t)$$

- Equilibrium

$$Y_t = C_t = z_t, \quad s_t = 1.$$

- Only business cycles are productivity shocks z_t
- Demand shocks θ_t induce changes in prices but cannot change allocations.

Household search in the Lucas model

A slightly different environment

- Preferences

$$E \left\{ \sum_t \beta^t u(c_t, d_t, \theta_t) \right\}.$$

+ -

- Output (fruit) not only have to paid for, but also has to be found. Trees and search effort D_t look for each other.

- Matching Function: Fraction of trees that are found is

$$M(1, D_t) \rightarrow \frac{M(1, D_t)}{D_t} \text{ probability that a unit of search finds a tree.}$$

- Without shocks to productivity there is one unit of fruit per tree, but output is the amount of fruit that is found.

$$Y_t = C_t = M(1, D_t) = \text{Productivity}$$

Equilibrium

How does the level of search effort get determined?

- Short answer. Competitive (directed) search a la 'Moen' suffices.
- Provides the missing equilibrium condition.
- It renders the equilibrium Pareto optimal, and more importantly, unique.
- In general there are other possibilities that are more relevant in heterogeneous agents environments.

Analysis of outcomes

- In this world preference, i.e. demand, shocks, induce more willingness to search on the part of households which increases output and hence

Business cycles.

- The econometrician cannot tell the two worlds apart. Traditionally, the shocks are labeled productivity shocks. But they may as well be called demand shocks.

Applications of these ideas: The standard RBC model

Bai, Rios-Rull, Storesletten (12)

- We embed the simple theory in a standard stochastic growth model where (silly) demand shocks and TFP shocks coexist.
- We estimate the contribution of both demand shocks and “true” productivity shocks to aggregate fluctuations.

Result: There is essentially no role for productivity shocks.

Embedding shopping in an RBC model

Some issues have to be dealt with.

- 1 What is average capacity: 81%.
- 2 Firms are also subject to shopping friction: Endogenous theory of relative price of investment.
- 3 The book value and the market value of firms are not the same. Neither are labor share in NIPA and in the production function.
- 4 Competitive search with markets indexed by price, market tightness, and quantity induces optimality.
- 5 The measured Solow residual has various different components (true technology, demand effects, composition effects of labor and adjustments due to the definition of labor share).

Bayesian Estimation of 4 shocks in the model

And the imposition of traditional first moments plus some extensions (Tobin Q and capacity)

- We estimate the processes for 4 shocks using Bayesian methods using four series: the Solow residual, output, labor, and consumption.
- ① Consumption demand shocks θ_d
- ② Investment demand shocks ζ
- ③ Direct TFP shock z
- ④ Shock to the MRS θ_n

	Variance Decomposition (%)			
	θ_d	ζ	z	θ_n
Solow	83	14	1	2
Y	31	31	1	37
N	3	12	0	85
C	55	17	0	28
I	1	86	0	13

- Productivity Shocks play a minor role even for productivity itself even through the eyes of what is essentially an RBC model.

Application II. International Business cycles

Bai and Rios-Rull (13)

- Backus Smith (1993) puzzle: households consume more domestic goods when they are more expensive.
 - The $corr(RER, cH/cF)$ are small and mostly negative in the data.
 - Yet, standard models (e.g. RBC) predict a perfect correlation.
- Consider an environment where it is demand shocks that trigger expansions.
 - Home demand shocks increase productivity and work at home, and, to a lesser extent, abroad.
 - The home good will be more valuable.
 - Still the home country runs a current account deficit. Hence the Backus Smith puzzle is taken care of.
 - We also obtain
 - Countercyclical terms of trade.
 - Volatile net exports.
 - Lower international cons corr than output's.

Application III: The Shimer Puzzle

Duras (13)

- Mortensen-Pissarides model generates too little employment volatility and too much wage volatility. Because labor share is high, workers have a high bargaining power. If so they would reap all the benefits of the new jobs created after an improvement of economic conditions.

Adds a third type of proposed solution to the two existing ones

- 1 High value of not working leads to low bargaining power of workers who will reap a smaller fraction of the benefits of new jobs (Hagedorn Manovskii and Lester-Darin (13)).
- 2 The losses if negotiations between workers and firms are not symmetric over the cycle (Christiano Eichenbaum Trabandt (13) and Duras (13)).
- 3 Workers have more to lose than just wages when economic conditions improve
 - 1 They value consumption more and hence have a higher marginal utility of wealth in expansions.
 - 2 The amount of utils that they have to give up to consume varies.

Application IV: Can Recessions be the Result of Impoverishment or of a general increase in Savings?

What is going on in Southern Europe? Huo & Rios-Rull (13)

- In the standard model the answer is no. Poorer people work harder.
- In the previous shopping model the answer is no. Shopping is like work. Effort helps extract more output from the economy.
- However, a combination of
 - Difficulties to adjust the economy away from consumption and into investment and exports.
 - Mild labor market rigidity (Mortensen-Pissarides).
 - A variant of the shopping model where negative wealth effects reduce search and hence productivity.
- Generate balance sheet recessions in the spirit of the Great Recession.

A suitable variation of the shopping model

Within a period Dixit-Stiglitz taste for variety

- Households value varieties of nontradables: $\left[\int_0^I c_{Ni}^{\frac{1}{\rho}} di \right]^\rho$

Under equal consumption of each variety this yields: $c_N I^\rho$

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

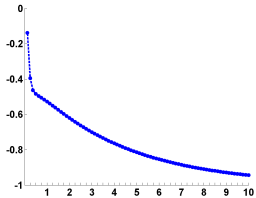
$$I = d \Psi^d(Q^g)$$

$\Psi^d(Q^g)$: Probability (per search unit) of finding a variety.
 $u(c_N I^\rho, d)$, d is search effort disutility.

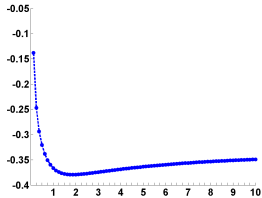
- When households want to increase consumption they increase *both* the number of varieties and the quantity of each variety. So less wealth leads to less consumption and to less productivity because of less search.

Properties of this environment

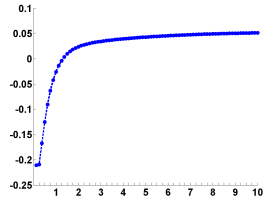
- Representative agent environment.
- Wealth is in capital and foreign asset position.
- Export sector that can grow slowly.
- Search Frictions in Goods and Labor Markets.
- We will hit the environment with a wealth destruction shock and see its effects.



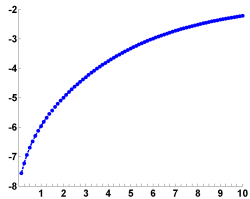
Output



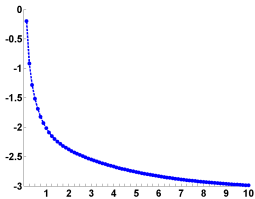
Solow residual



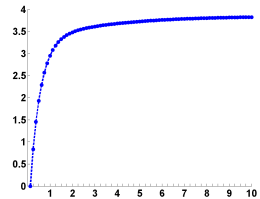
Employment



Investment

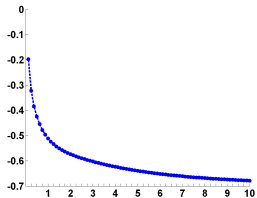


Output of nontradable

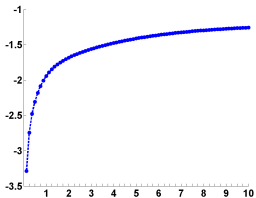


Output of tradable

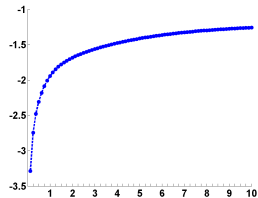
■ ■ ■ Wealth Destruction Shock



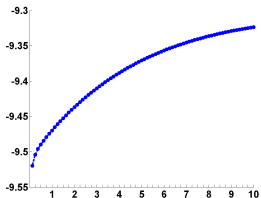
Number of varieties



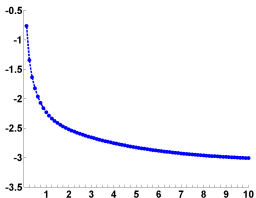
Price for nontradables



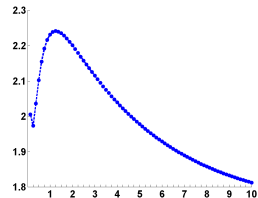
Wage



Wealth



Consumption



Net export/output ratio

■ ■ ■ Wealth Destruction Shock

A 1% Drop in Output from a Wealth Destruction Shock

- The Wealth Destruction Shock causes a recession even with the ability to invest and to export.

Model economy	% Wealth Destruction	Employment	TFP	Cons
Baseline economy	9.5	-0.21	-.37	-3.1
Without goods market friction	18.7	-.39	-.05	-4.6

- Goods Market Frictions Matter. Without shopping, the required size of the shock is much larger.
- However, the recession is too small.
- Moreover, where is wealth destruction coming from?

Application V: The Great Recession in the U.S. Financial Shocks on Households plus capital loses

Huo and Rios-Rull (14)

- Can the Great Recession be the result of Financial Shocks? Shocks that affect mainly households.
 - Perhaps due to a colossal mistake in the calculation of banks. Or to the end of implicit government guarantees. Worse terms for mortgages and for loans when in distress.
- After the adverse financial shock, housing is no longer as attractive; households want to increase savings to adjust to a larger wealth to income ratio. A reduction in consumption ensues (and an increase in the willingness to work at each wage).
- This triggers a large recession because of associated reductions in
 - Housing prices
 - Stock market

What are the ingredients to address such a question?

- The economy has to have households that can be adversely affected by financial difficulties.
 - The wealth to output ratio in 2007 was 4.7.
 - Enormous wealth concentration (as in the U.S.). The median household has negative financial wealth (it has a mortgage and equity in the house.)
- Asset Prices, (houses and stocks) have to respond to market conditions and exacerbate the recession.
- Job losses that affect especially low income households that make things worse.
- Of course, goods markets frictions that make TFP procyclical and real rigidities that make it difficult to turn the economy from consumption to export oriented on short notice.

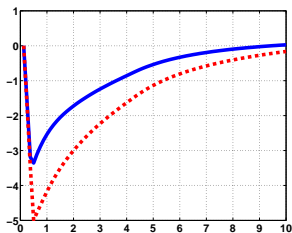
To model those ingredients, we pose

- An Aiyagari type structure with uninsurable risk and financial frictions. Wealth is very concentrated. The median household has negative financial assets (mortgage plus home equity).
- Housing with advantages for owner occupied and a price for land (in fixed supply) susceptible of capital losses. It is important that houses are inferior goods (the rich do not want to buy many fast).
- A productive structure where it is difficult to reallocate nontradables to tradables.
- A labor market with frictions and a wage determination mechanism capable of inducing a decline in employment and treating the unskilled worse.
- Goods markets frictions that reduce TFP and reallocation difficulties that lowers the value of firms.
- On all this the Krusell-Smith thing has to be superimposed.

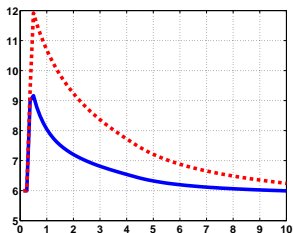
The financial shock reduces the loan to value ratio

- Immediately households will
 - Reduce consumption and save more.
 - Directly, for some to satisfy the new borrowing limit.
 - Indirectly for the rest, because of standard precautionary savings reasons.
 - Reduce their houses holdings that dumps house prices and further reduces consumption.
- A recession ensues. That is exacerbated by the endogenous procyclical productivity.
- Let's see what a sudden tightening of credit standards implies
 - Down payment goes from 25 to 32.5% in 6 months.
 - Borrowing mark-up goes up from 0 to .3%.

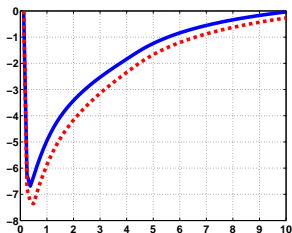
Down Payment from 25% to 32.5 and loan cost up .3%



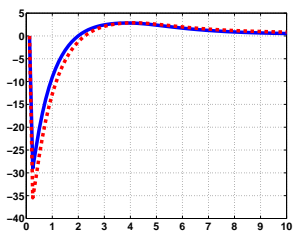
Real output



Unemployment



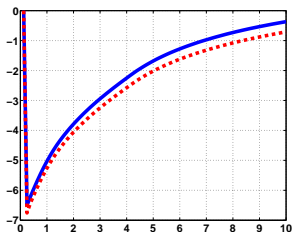
Consumption



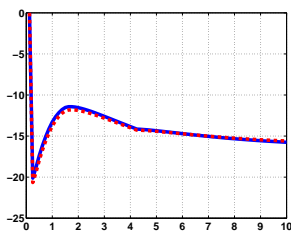
Investment

— Flexible wage - - - Fixed wage

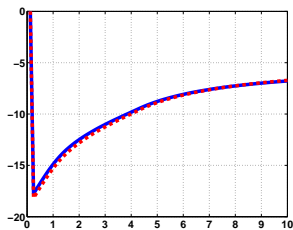
Down Payment from 25% to 32.5 and loan cost up .3%



Wealth



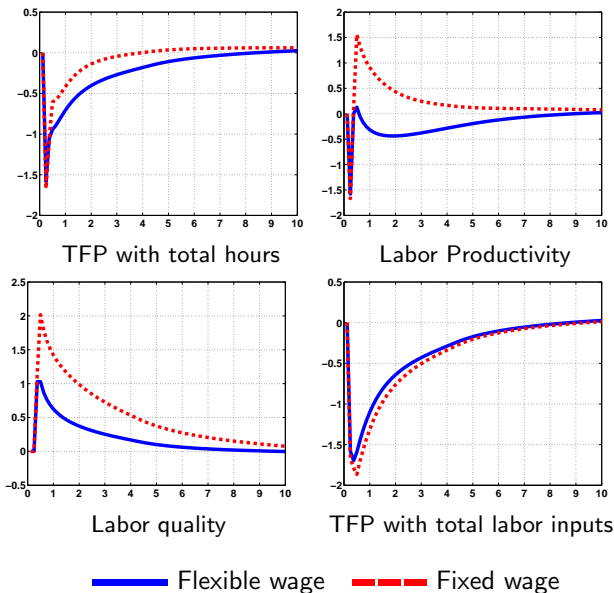
Debt



Housing price

— Flexible wage - - - Fixed wage

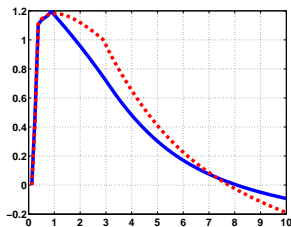
Down Payment from 25% to 32.5 and loan cost up .3%



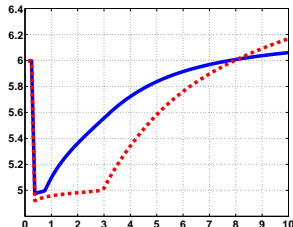
The Financial Shock causes a Great Recession

- This environment is still limited:
 - Houses are frictionless.
 - Bankruptcies and Foreclosures do not exist.
 - Investment and Exports are perfect substitutes.
- Yet, we have provided a quantitatively sound account of the Great Recession triggered only by financial tightness.
- Can Our theory also account for the expansion before 2007 smaller impact as Iacoviello (2014) documents?

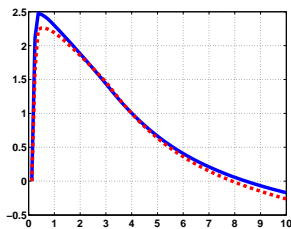
What about an Expansion: Down payment from 25% TO 17.5%?



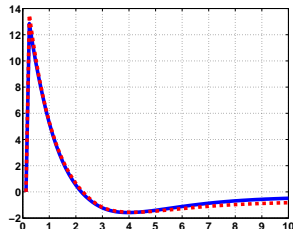
Real output



Unemployment



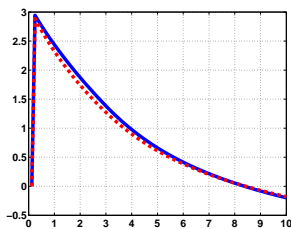
Consumption



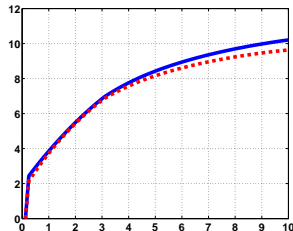
Investment

— Flexible wage - - - Fixed wage

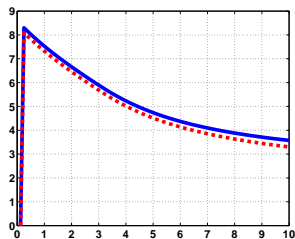
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Wealth



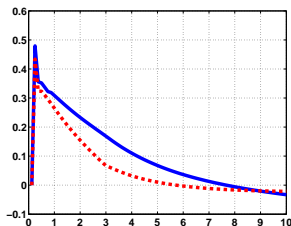
Debt



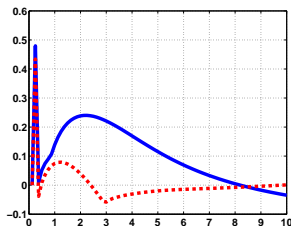
Housing price

— Flexible wage - - - Fixed wage

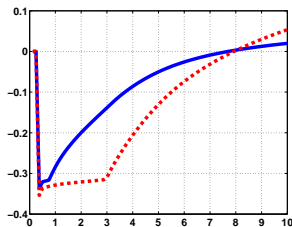
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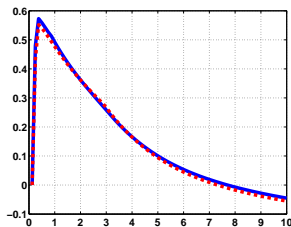
TFP with total hours



Labor Productivity



Labor quality



TFP with total labor inputs

— Flexible wage - - - Fixed wage

Conclusions

- 1 I made the case to abandon one of the most revered object in macro, but one that severely corsets our understanding of business cycles only to pay lip service to growth theory.
 - It provides a way out of our addictive dependence on productivity shocks.
- 2 I have provided a theoretically solid alternative.
- 3 It competes well (it beats) standard RBC models in its own territory.
- 4 It helps to make sense of recessions due to household impoverishment/adverse financial shocks as in Southern Europe.
- 5 It accounts for the main facts of the Great Recession.
- 6 It works very well with heterogeneous agent models.
- 7 I hope that some of you incorporate this in your research.