A new view of cyclical movements in productivity

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Based on joint work with Yan Bai,
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There are three main objects in Macroeconomics

1. An intertemporal Euler Equation

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

Uncontroversial.

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 object of my ~~jeremiad~~ talk for very different reasons than Sophie Osotimehin and Hugo Hopenhayn argued yesterday.

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 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

- But 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

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

- 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

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

$$+ \quad -$$

- 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

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

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

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

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 may be 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	83.17	13.61	1.22	1.99
Y	31.14	31.00	0.77	37.09
N	3.25	11.89	0.01	84.85
C	54.82	16.98	0.34	27.85
I	1.00	85.97	0.41	12.62

- 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: 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 growth 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 if it is hard to adjust the economy away from consumption and into investment and exports, the standard model can be modified to generate a recession.

- The necessary shocks are quite large for a given size recession.

- A variant of the shopping model does the job of reducing the size of the shocks

A suitable variation of the shopping model

Within a period Dixit-Stiglitz taste for variety

- Households value varieties of nontradables: $\left[\int_0^{\mathrm{I}} c_{Ni}^{\frac{1}{\rho}}\, di\right]^{\rho}$
- Under equal consumption of each variety: $c_N\, \mathrm{I}^{\rho} = \left[\int_0^{\mathrm{I}} c_{Ni}^{\frac{1}{\rho}}\, di\right]^{\rho}$
- Households also like tradables that combine through a standard (Armington) aggregator with nontradables and dislike work and search for goods yielding

$$u\left[c(c_N\, \mathrm{I}^{\rho}, c_T),\ d,\ n\right].$$

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

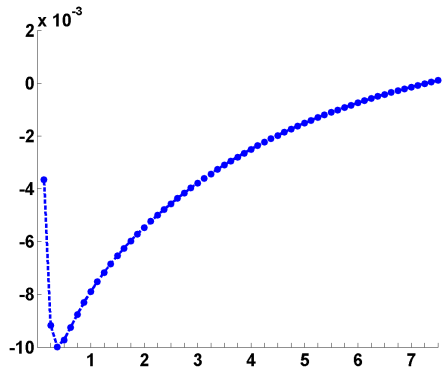
$$\mathrm{I} = d\ \Psi^{d}(Q^{g})$$

$\Psi^{d}(Q^{g})$: Probability (per search unit) of finding a variety.

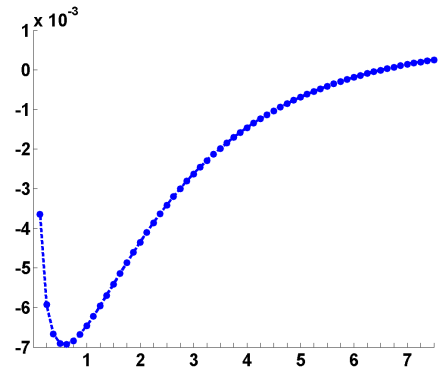
Properties of this environment

- With suitable preferences, when the household wants to cut consumption due to some form of negative wealth effect it does so by
  1. Cutting the consumption of each variety.
  2. Reducing the number of varieties.
- A recession can occur.
- Especially so, if the economy faces dificulties in reallocating resources.

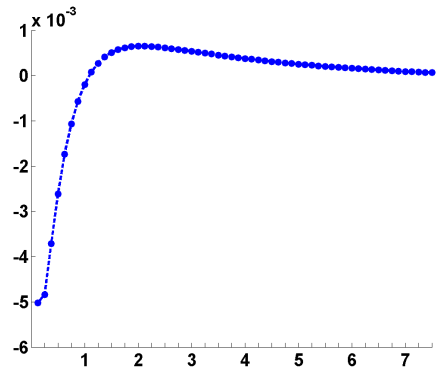
The shock in action in the Baseline economy



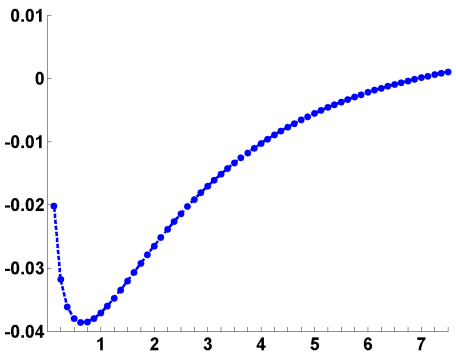
Real output



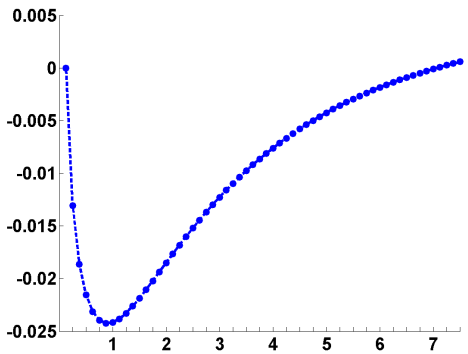
Solow residual



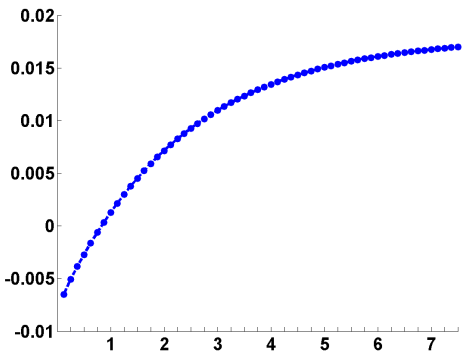
Employment



Total consumption



Cons of each variety



Wealth

Statistics for a 1% Drop in Output from Shocks to β

Model economy	Pref Shock	Employment	TFP	Cons
Baseline economy	**0.88**	-0.50	**-0.69**	-3.86
Without goods market friction	**2.00**	-1.22	**-0.16**	-7.50

- Does Shopping Matter? Yes: Baseline economy without shopping.
- Without shopping, the required size of the shock is much larger.
- This type of recession yields a stock market crash.
- Things are much larger with a recession poverty.

What are the triggers of a reduction in consumption?

1. A silly one. Increase in patience $\uparrow \beta$
2. A more dramatic one. Sheer impoverishment (bad news about the remote future, government lies, northerners get tired)
3. A financial shock that increases the desired wealth to output ratio and increases savings.
   - Although it is a little bit silly to think of financial shocks within a Representative agent economy, it can be done.
   - It works by deriving a wedge that difficults the provision of insurance from the unemployed to the employed members of a household.

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

Huo and Rios-Rull (13a)

- Can the great Recession be the result of tightening financial conditions to 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.
- Housing is no longer as attractive. And 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 may trigger a large recession because of the perhaps associated reductions in
  - Housing prices
  - Stock market

What are the ingredients to address such a question

Already attempted without shopping Midrigan Philippon (2011), Guerrieri Lorenzoni (2009)

- An Aiyagari type structure with uninsurable risk and financial frictions.
- Housing with advantages for owner occupied and a price for land susceptible of capital loses. It is important that houses are sort of inferior goods (the rich cannot buy many fast).
- A labor market with frictions and a wage determination mechanism capable of treating the unskilled worse.
- The shopping structure.
- On all this the Krusell-Smith thing has to be superimposed.
- But it can be done.

A shock that reduces the loan to value ratio

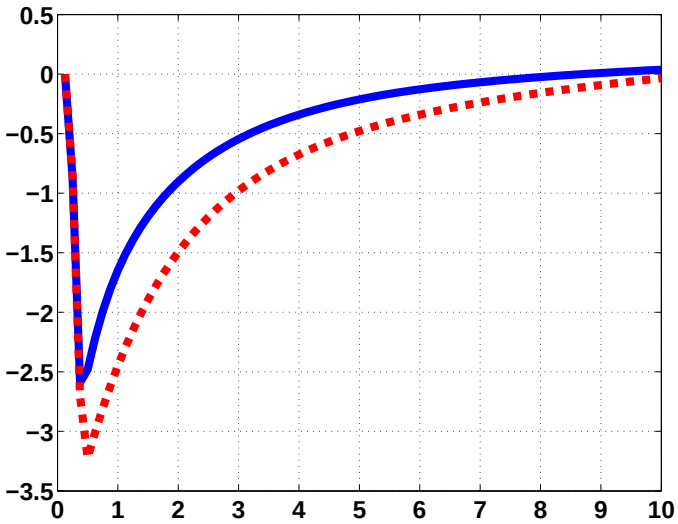
- Immediately agents will

  1. Reduce consumption save more.

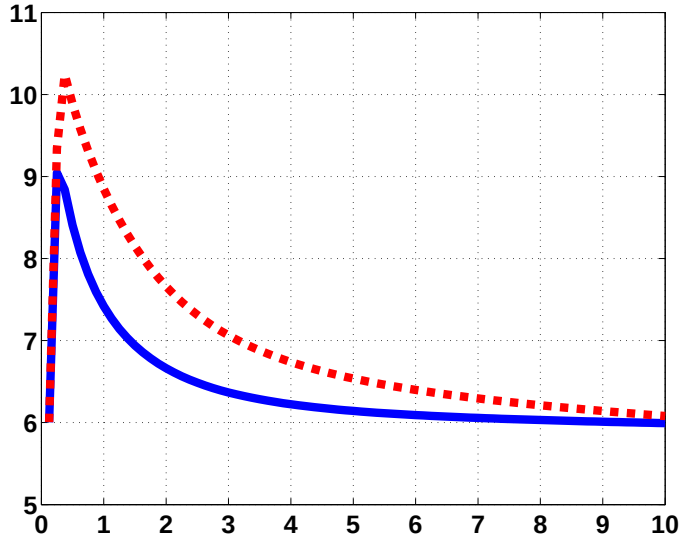
     - Standard precautionary savings reasons.
     - To satisfy the new borrowing limit.

- 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.

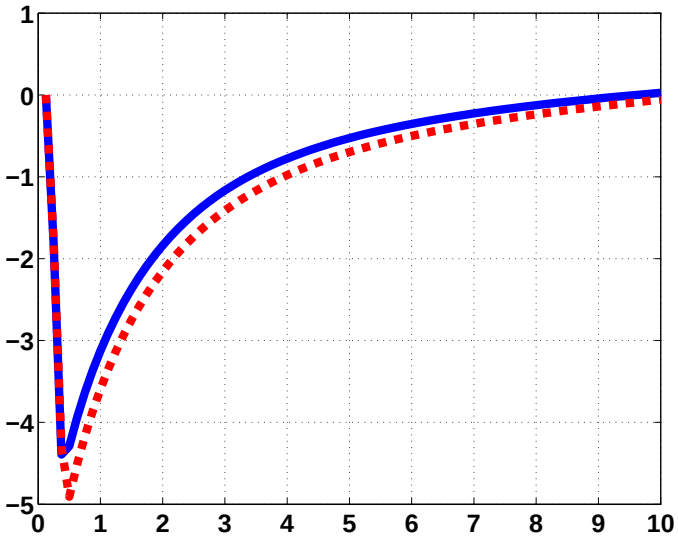
1: Sudden change of λ. —— Flex. w - - - Fixed w



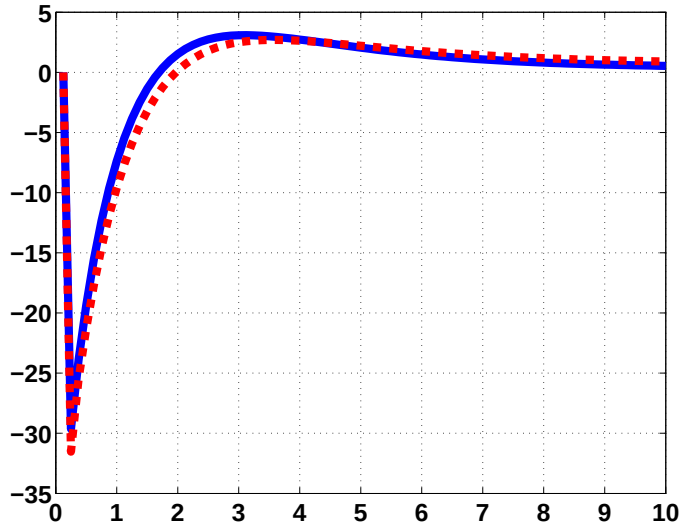
Real output



Unemployment

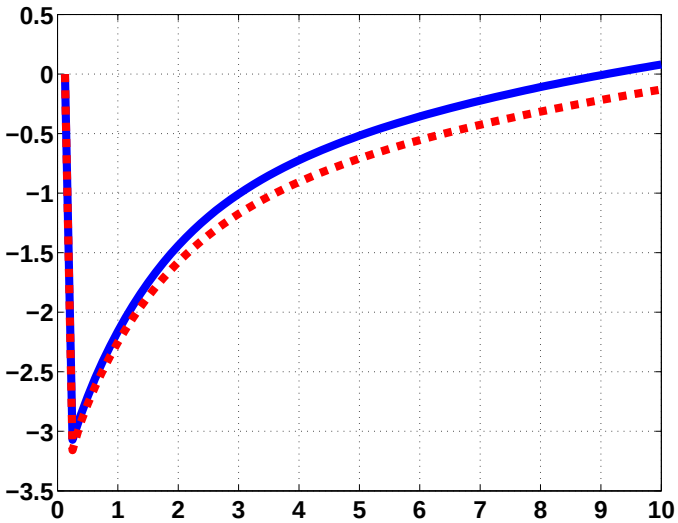


Consumption

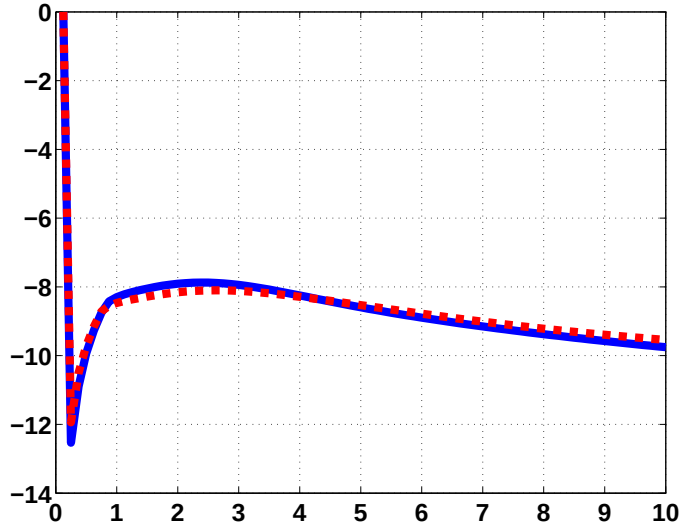


Investment

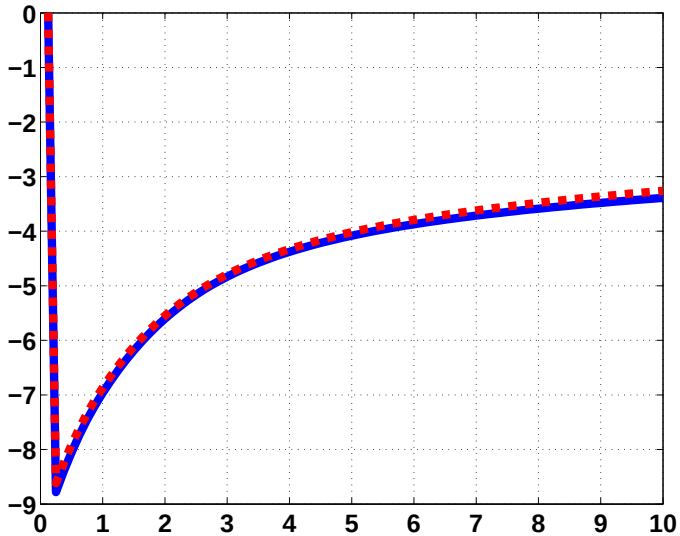
1 Sudden change of λ, —— Flex. w - - - Fixed w



Wealth

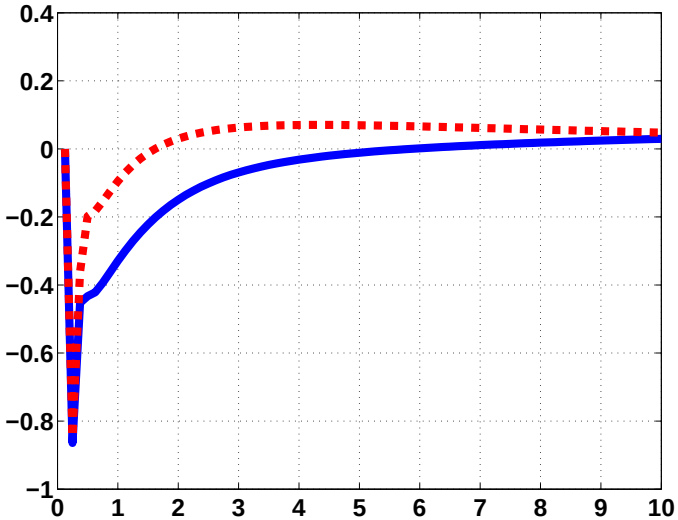


Debt

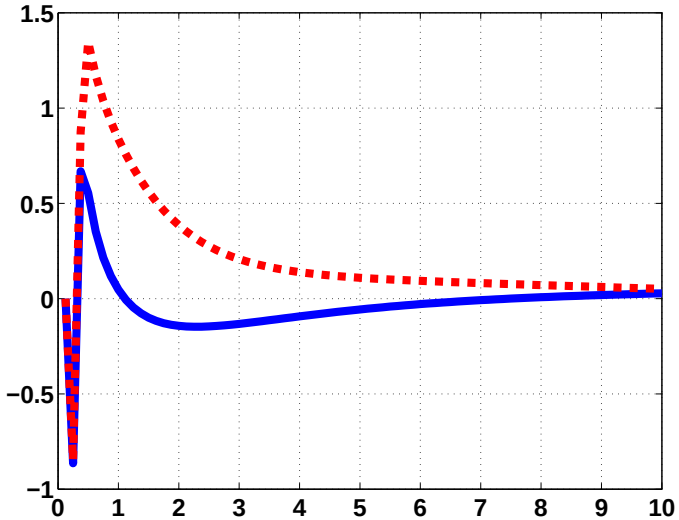


Housing price

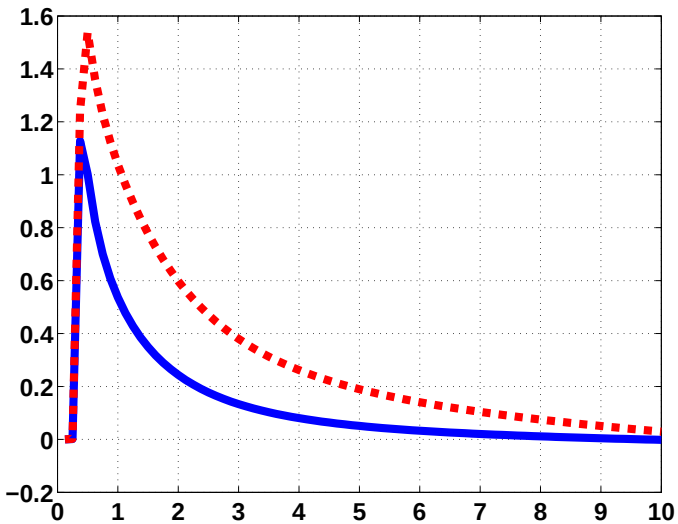
1. Sudden change of λ, —— Flex. w - - - Fixed w



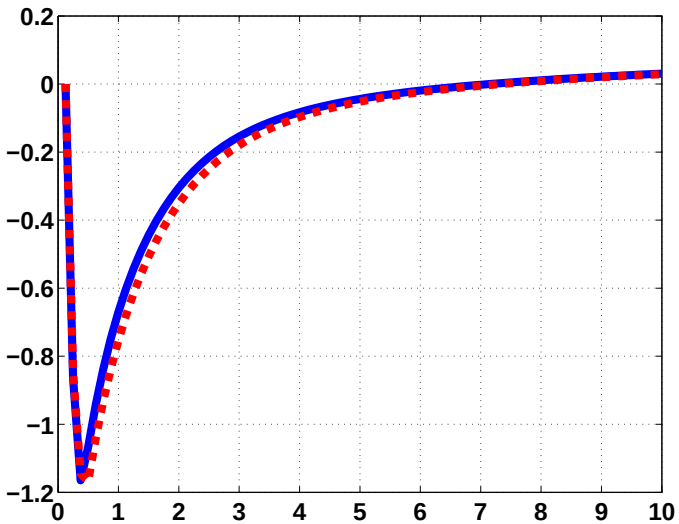
TFP with total hours



Labor Productivity

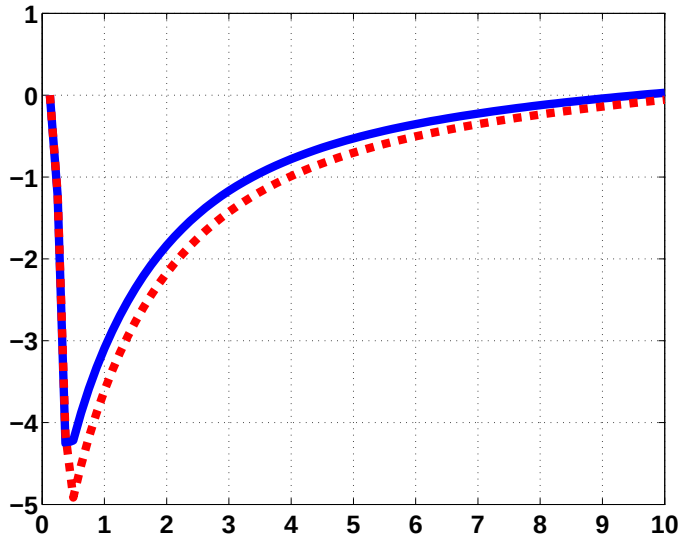


Labor quality

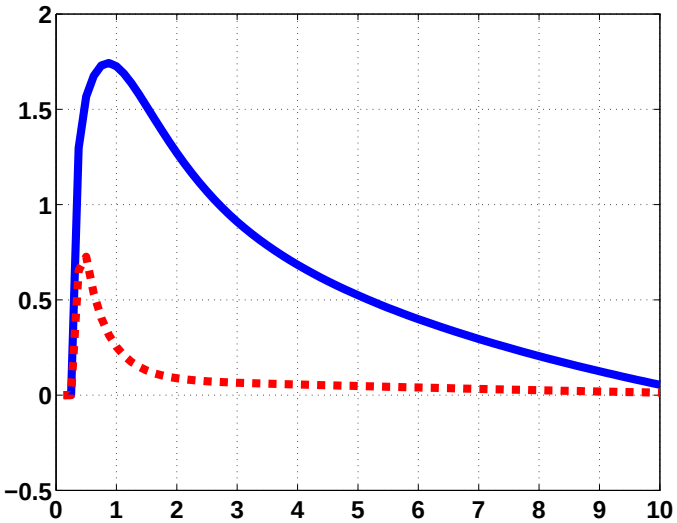


TFP with total labor inputs

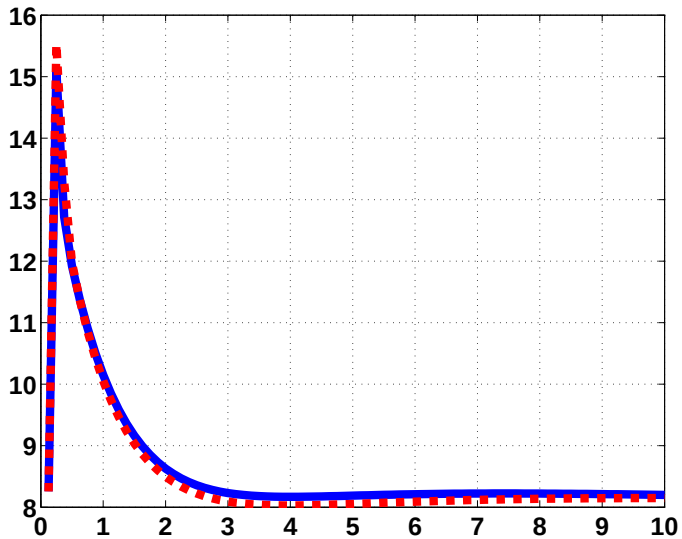
1. Sudden change of λ, —— Flex. w - - - Fixed w



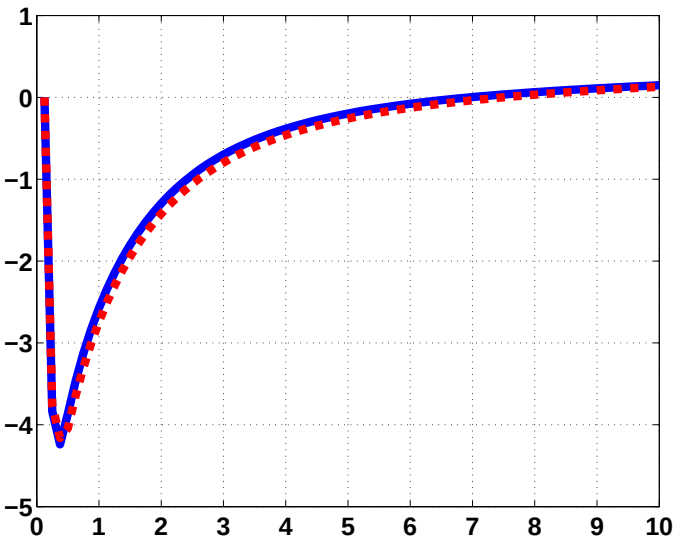
Nontradable sector



Tradable sector

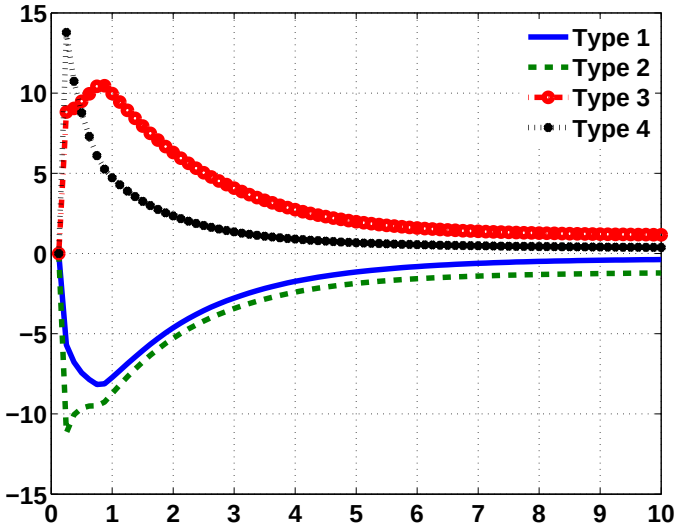


Net export/output ratio

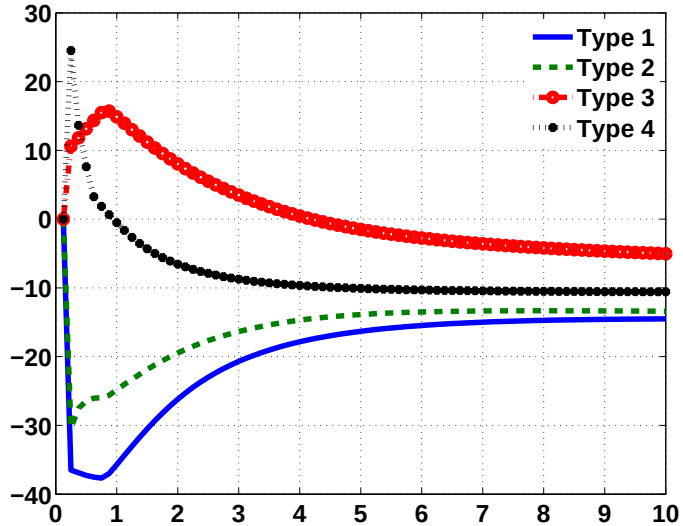


Aggregate search

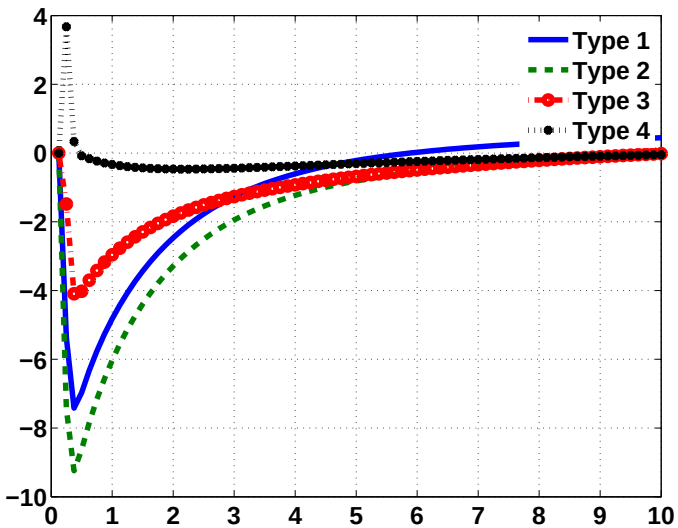
1. Fate of the different types, flexible wage



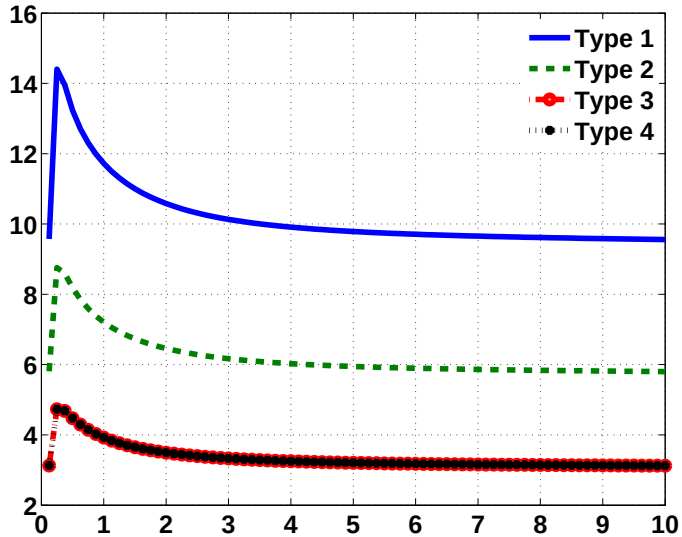
Housing



Debt



Consumption



Unemployment rate

Application VI: The Differences between Shopping and Searching

Huo and Rios-Rull (13b)

- Unemployed, and retired people (Aguiar, Hurst, & Karabarbounis (12)) spend more time actually shopping than employed people do.
- They are looking for better deals. Let's call this searching.
- Yet the richer households enjoy more consumption and spend more time doing so. Let's call this shopping.
- The challenge is to simultaneously account for both.
- This requires that firms discriminate customers by posing cheaper prices for harder to find goods that is what is taken up by the unemployed and the retired.
- A price discrimination feature arises naturally. Firms allocate fewer plants to *islands* with cheaper prices and high tightness that target poor customers that also buy lower quantities. Yielding both the features of the previous application and the observation by (Aguiar, Hurst, & Karabarbounis (12)).

Conclusions

1. I made the case to abandon one of the most revere 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.
5. I hope that some of you incorporate this way of thinking in your research.

Time for a beer

References