Unemployment (fears), Precautionary Savings, and Aggregate Demand

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Introduction

- A FT-esque story:
  - Uncertainty (or fear) encourages agents to stop spending.
  - This contracts economic activity and contributes to further uncertainty
  - $\Rightarrow$ even less spending, and more uncertainty, and so on.

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- A FT-esque story:
  - Uncertainty (or fear) encourages agents to stop spending.
  - This contracts economic activity and contributes to further uncertainty
  - $\Rightarrow$ even less spending, and more uncertainty, and so on.
  - It is surprisingly hard to make this story operate in an internally consistent framework

Introduction

- Several papers have done so with promising results.
- In particular, theoretical research has focussed on incomplete market models with endogenous unemployment fluctuations (Krusell and Smith together with Mortensen and Pissarides)
- However, they do so by exploiting the precautionary aspects in some markets (money), while ignoring it in other (investments).
- Our view: investigating this properly requires discounting *all* investments correctly and equally, which is typically not done.
    - A notable exception is Krusell, Mukoyama and Sahin (2010), which does so under special conditions.

Introduction

- Let's give this idea a soft start.
- The following equation should be pretty familiar to everybody

$$u'(c_t) = \beta E_t[(1 + r_{t+1})u'(c_{t+1})]$$

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- In a search model this turns into something like

$$u'(c_t) = \beta E_t[\frac{d_{t+1} + (1-\delta)J_{t+1}}{J_t}u'(c_{t+1})]$$

- Or just

$$J_t = \beta E_t\left[\frac{u'(c_{t+1})}{u'(c_t)}(d_{t+1} + (1-\delta)J_{t+1})\right]$$

Introduction

- Thus, using a bit of hand waving we can write

$$J_t = \beta E_t \left[\frac{u'(c_{t+1})}{u'(c_t)} \left(z_{t+1} - \frac{W_{t+1}}{P_{t+1}} + (1-\delta) J_{t+1} \right) \right] \quad \text{(demand)}$$

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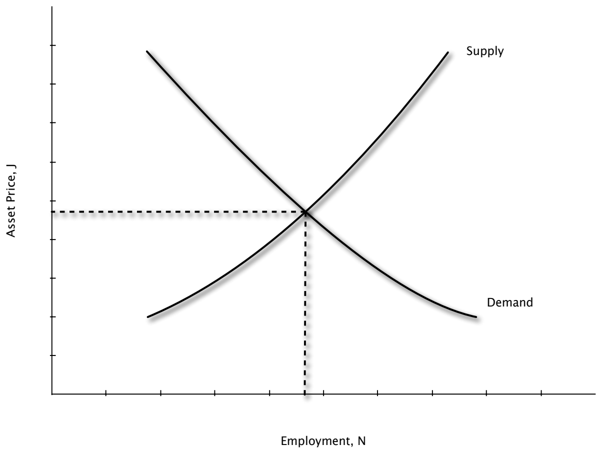
$$k = h(n_{t+1}) J_t \qquad \text{(supply)}$$

- Now consider the effect of a TFP shock in the representative agents case with no wage rigidity.

Representative agent (flexible wages)



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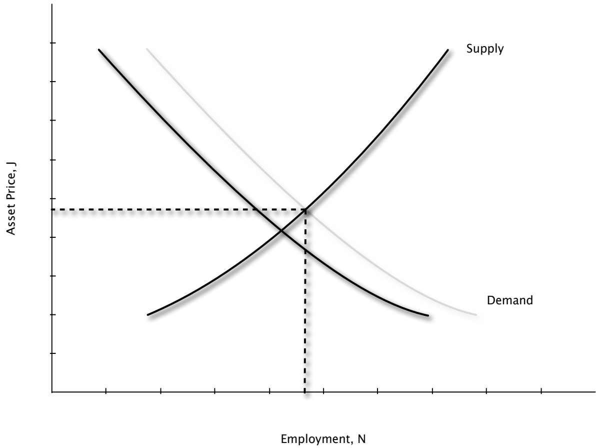

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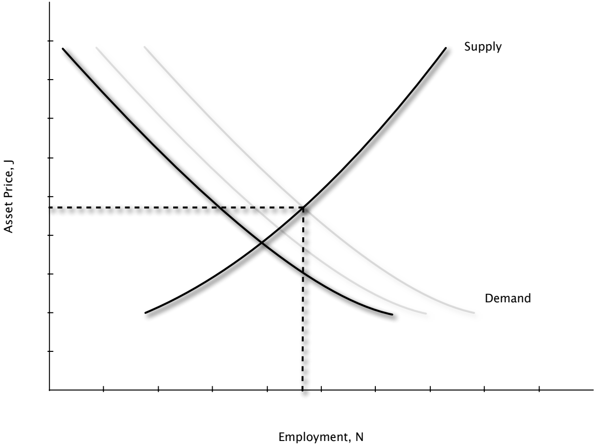

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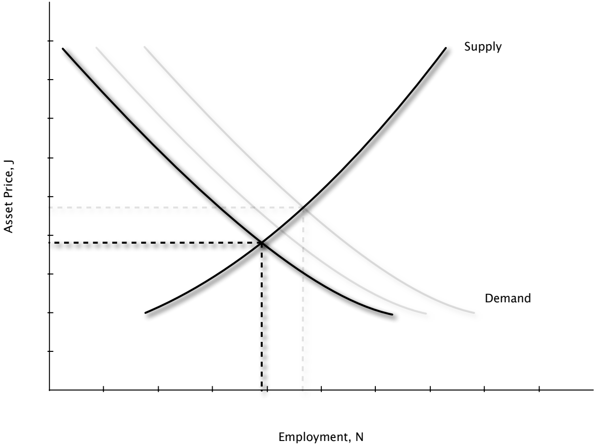
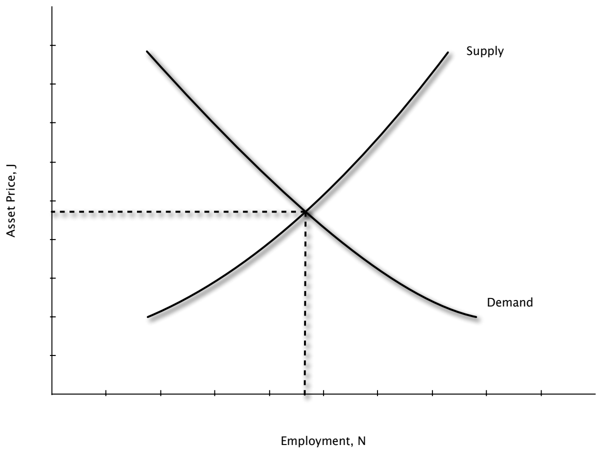


Introduction

- So what about those unemployment fears?
- Let's look what happens in an incomplete markets version of the model

Heterogenous agents (flexible wages)



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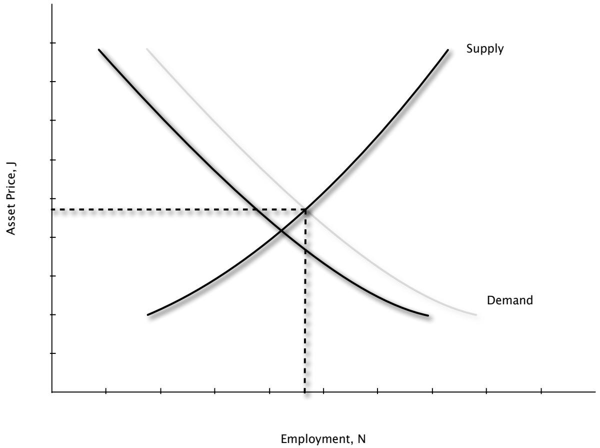

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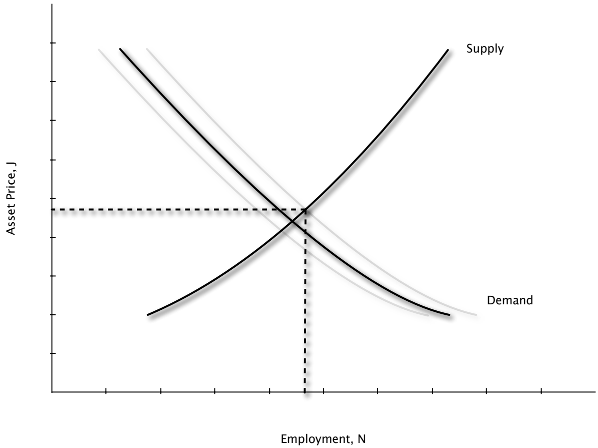

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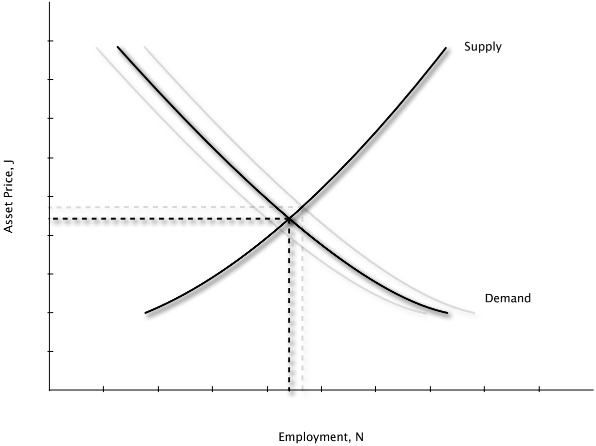


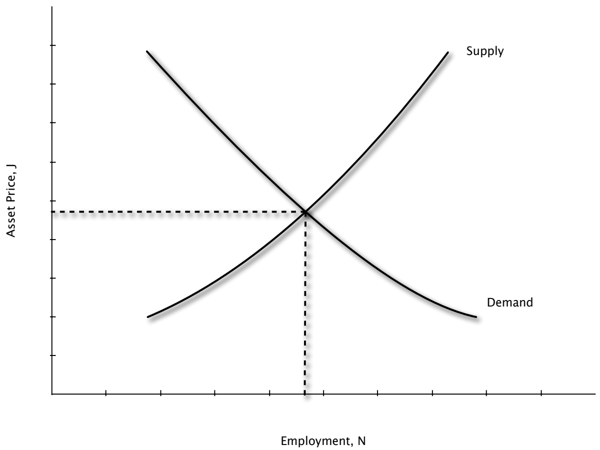
Introduction

- Fears do not propagate but dampens the recession.
- Important extensions: Money.
- The motive to save may now translate into money holdings instead

$$u'(c_t) = \beta E_t \left[\frac{P_t}{P_{t+1}} u'(c_{t+1}) \right] + v' \left(\frac{M_t}{P_t} \right)$$

- If in the aggregate $M_t = M$, a rise in the desire to hold money (precautionary motive) causes a fall in the price level
- If nominal wages are sticky, this will have an adverse effect on equity demand.
- Let's look at the rep. agent case again.

Representative agent (sticky wages)



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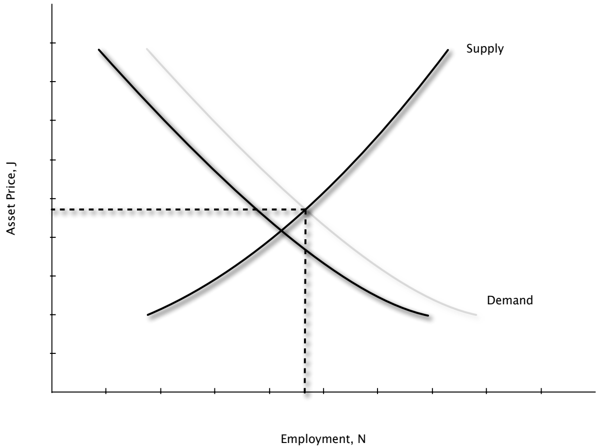

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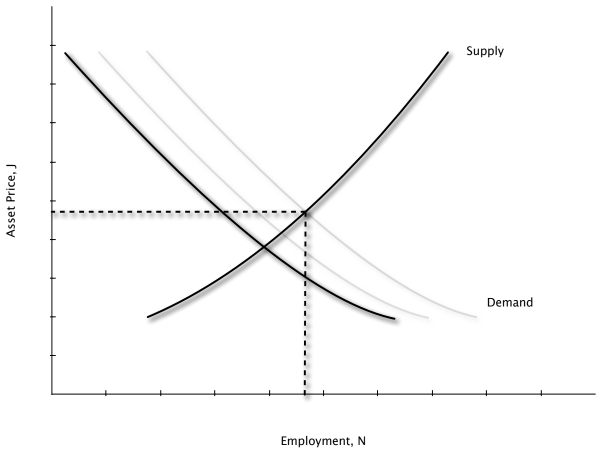

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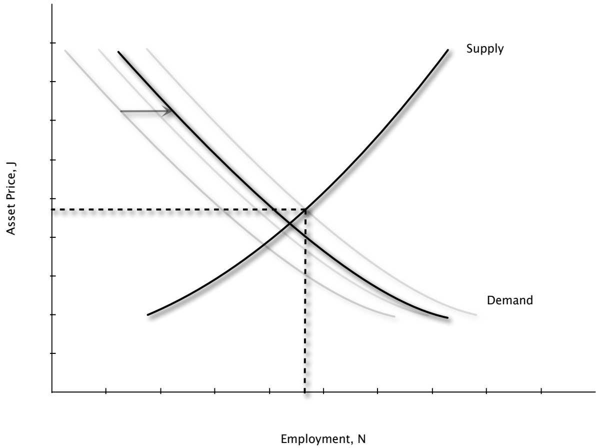

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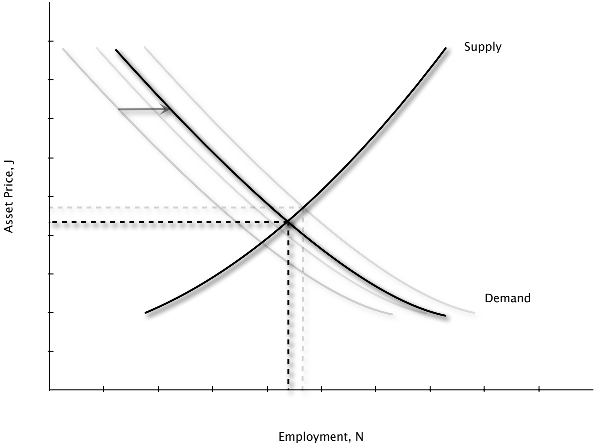

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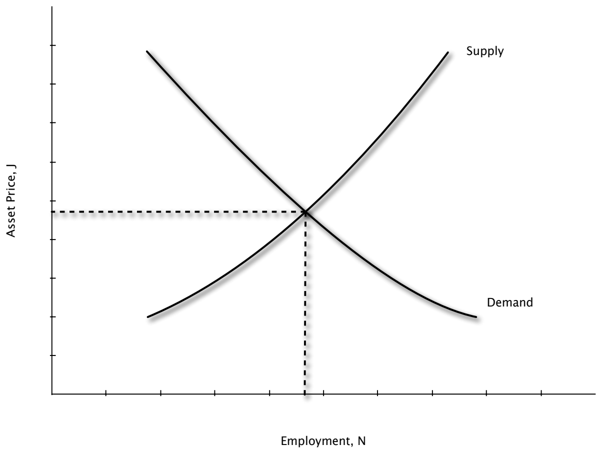

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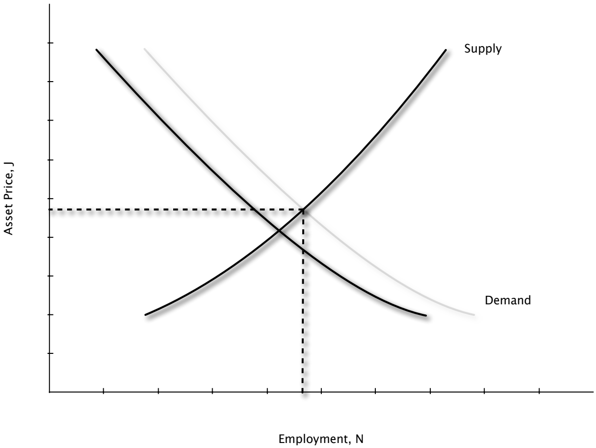

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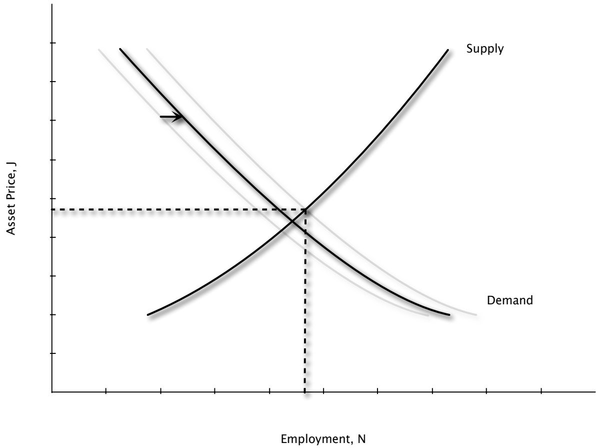

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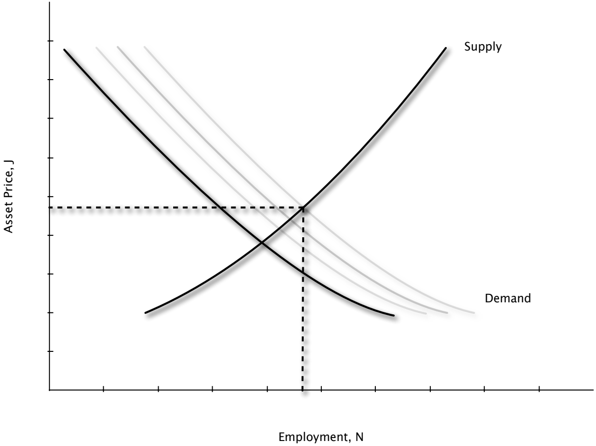

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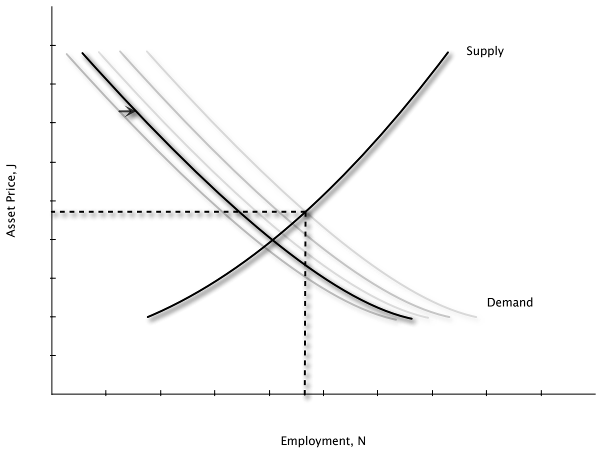

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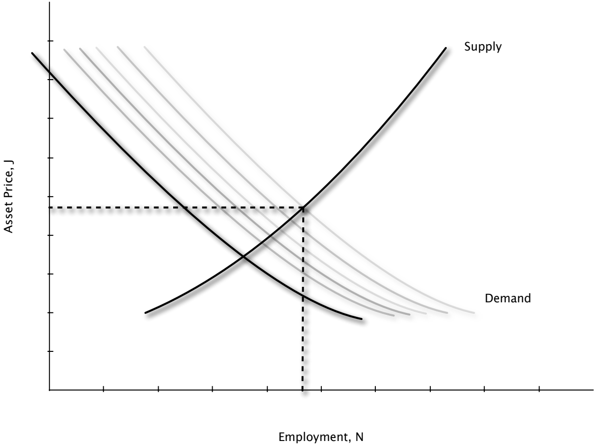

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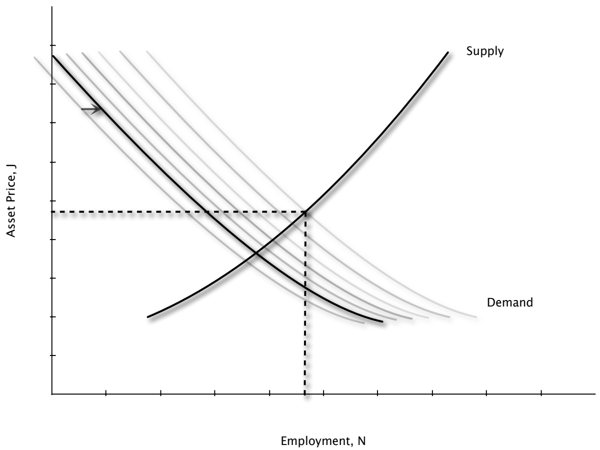

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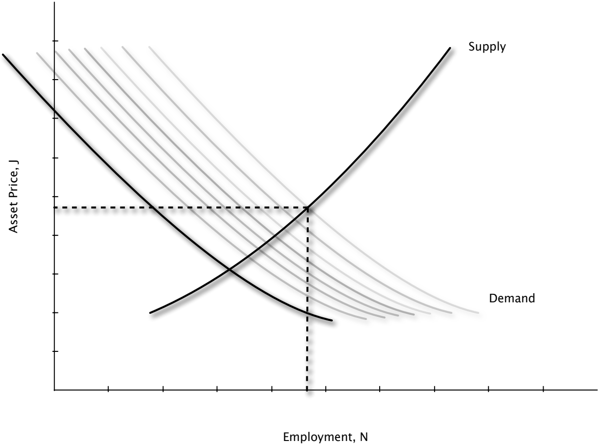

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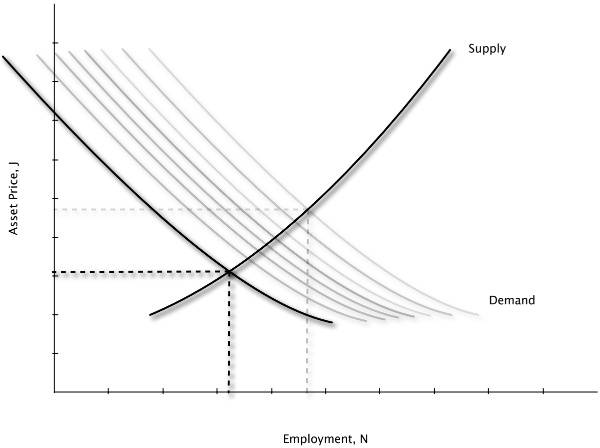

Introduction

- Opposite effect of "precautionary" money holdings in representative viz. heterogeneous agent model.
- Each time uncertainty increases there is a desire to save
- When investments and money are discounted correctly this desire spreads to both
- The rise in investment expands output
- But the rise in the desire to hold money lowers prices and lowers profits
  - Portfolio shift from investment to money

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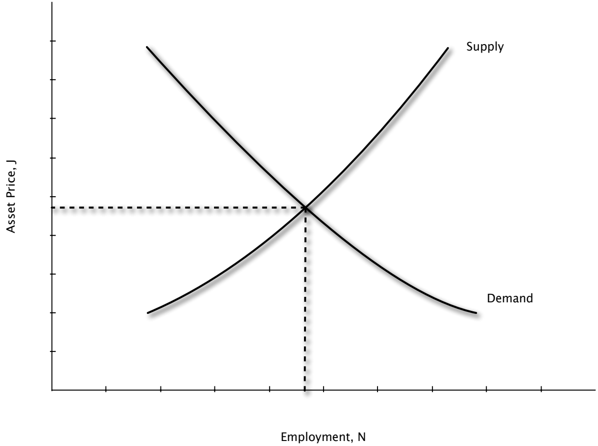
  Most previous studies ignore this channel by not discounting investment profits appropriately
  - Precautionary motive only shows up in money (and prices), but not in investment

Heterogenous agents (sticky wages; wrong discounting)



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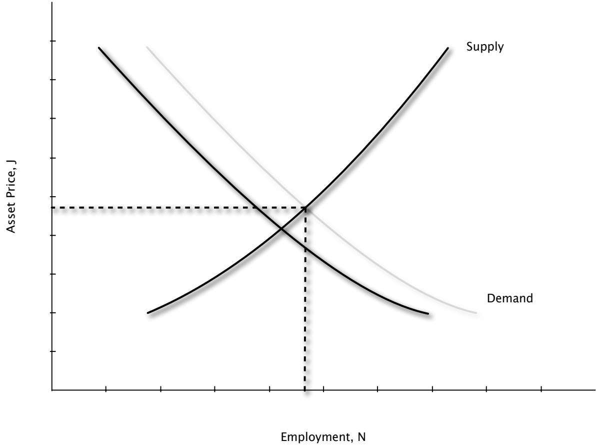

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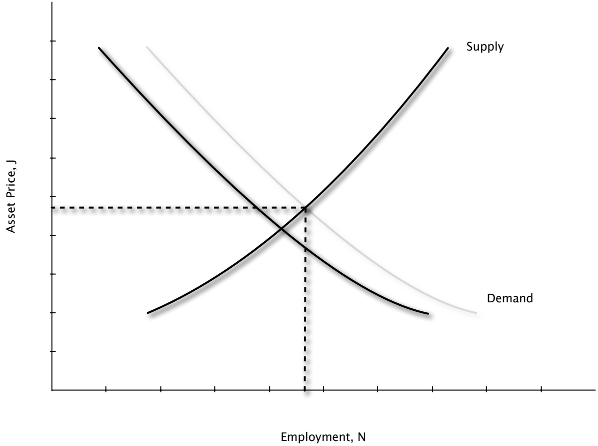

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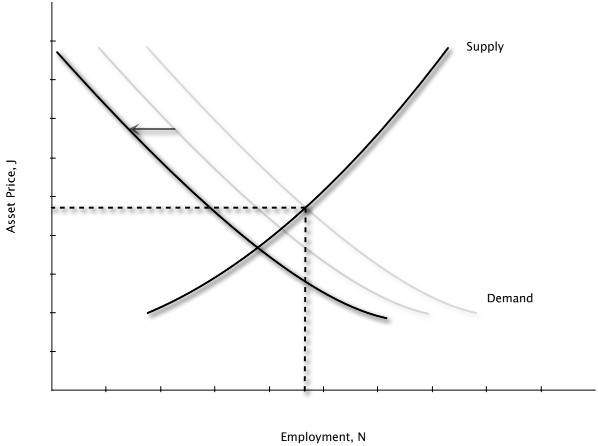

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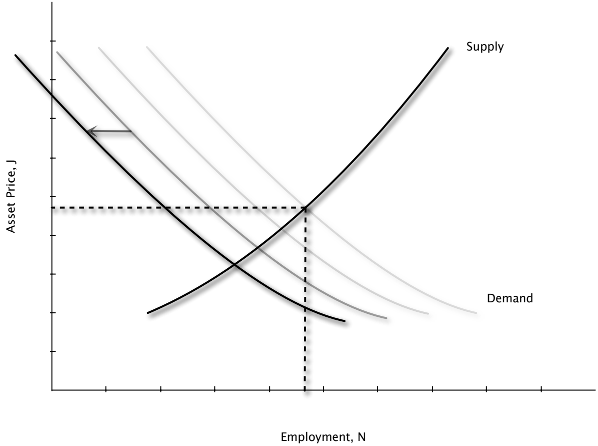

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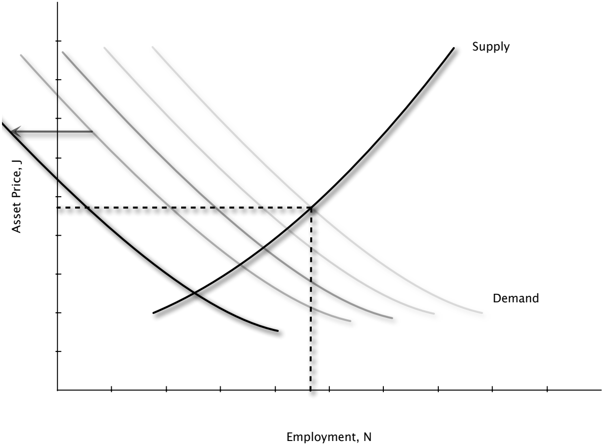

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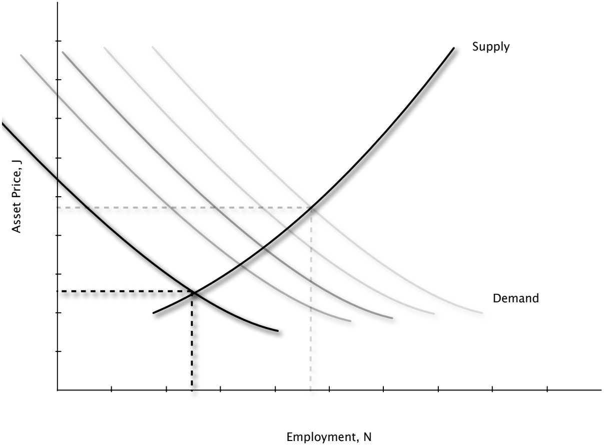

Introduction

- What underlies our result that the precautionary "portfolio shift" channel dominates?
  1. A little bit of wage stickiness
  2. Short-selling constraint on equity that binds for a large fraction of households
  3. Agents are "poor" pre-unemployment. That is, as in US data, the median unemployed agent holds sufficient liquid wealth to sustain three months of unemployment at the onset of the unemployment spell (Gruber, 1998).

Road map

1. Model
2. Solution method
3. Results
4. Empirical support

Model: Key ingredients

- Search frictions in labor market
- Heterogeneous agents and incomplete markets
- (Some) nominal wage stickiness

Existing firms

- Dividends

$$D_t = P_t \exp(z_t) - W_t$$

- Wages

$$W_t = \omega_0 \left(\frac{z_t}{\bar{z}} \right)^{\omega_1} \bar{z} \left(\frac{P_t}{\bar{P}} \right)^{\omega_2} \bar{P}$$

Individual workers

Employed and unemployed workers

- Employed get nominal wage W_t
- Unemployed search for jobs and receive unemployment benefits, $B_t = \mu W_t$.
- Idiosyncratic risk
  - Exogenous (constant) job loss probability, δ
  - Lower chance of getting a job in a recession (through job finding)
- Agents can invest in
  - Money, $M_{i,t}$
  - Equity, $q_{i,t} \geq 0$ (i.e., firm ownership/jobs)

Individual workers: Optimisation problem

Optimisation problem

$$\max_{c_{i,t}, q_{i,t+1}, M_{i,t}} \left\{ E_0 \left[\sum_{t=0}^{\infty} \beta^t u(c_{i,t}) + v\left(\frac{M_{i,t}}{P_t}\right) \right] \right\}$$

s.t.

$$\begin{aligned} P_t c_{i,t} + J_t(q_{i,t+1} - (1-\delta) q_{i,t}) + M_{i,t} \\ = (1-\tau_t) W_t e_{i,t} + \mu W_t (1 - e_{i,t}) + D_t q_{i,t} + M_{i,t-1}, \\ q_{i,t+1} \geq 0 \end{aligned}$$

with

$$u(c) = \frac{c^{1-\gamma} - 1}{1-\gamma}, \text{ and } \quad v\left(\frac{M}{P}\right) = \zeta_0 \frac{\left(\frac{M}{P}\right)^{1-\zeta_1} - 1}{1-\zeta_1}$$

First-order condition for money

$$u'(c_{i,t}) = \beta E_t \left[\frac{P_t}{P_{t+1}} u'(c_{i,t+1}) \right] + v' \left(\frac{M_{i,t}}{P_t} \right)$$

First-order condition for equity

- If $q_{i,t} \geq 0$ constraint not binding, then

$$\frac{J_t}{P_t} = \beta E_t \left[\frac{u'(c_{i,t+1})}{u'(c_{i,t})} \left(\frac{D_{t+1}}{P_{t+1}} + (1-\delta) \frac{J_{t+1}}{P_{t+1}} \right) \right]$$

- Return on productive investment discounted with *individual* MRS

Creation of new jobs/firms/equity

Matching function

$$h_t = \psi v_t^{\eta-1} u_t^{\eta-1}$$

with v_t denoting vacancies and u_t unemployment.

Equity market

Demand

- Equity purchases from workers wanting to buy (FOC)

Supply

- Equity sales from workers wanting to sell (FOC)
- Plus creation of new equity/firms/jobs

$$\kappa = \psi \left(\frac{v_t}{u_t} \right)^{\eta - 1} \frac{J_t}{P_t}$$

$$h_t = \psi \left(\frac{\psi}{\kappa} \frac{J_t}{P_t} \right)^{\eta/(1-\eta)} u_t$$

Equilibrium in the equity market

$$\int_{e_i,q_i,M_i} J_t/P_t(q(e_i,q_i,M_i;s_t) - (1-\delta)q_i) I_{\{(q(\cdot)-(1-\delta)q_i)\geq 0\}} dF_t(e_i,q_i,M_i)$$

$$= \int_{e_i,q_i,M_i} J_t/P_t(q(e_i,q_i,M_i;s_t) - (1-\delta)q_i) I_{\{(q(\cdot)-(1-\delta)q_i)\leq 0\}} \times dF_t(e_i,q_i,M_i) + v_t\kappa$$

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or

$$\int_{e_i,q_i,M_i} J_t/P_t(q(e_i,q_i,M_i;s_t)-(1-\delta)q_i)dF_t(e_i,q_i,M_i)=\kappa v_t$$

Equilibrium in the equity market

This can be stated succinctly: The net demand for equity must equal the number of new firms created

$$\int_{e_i, q_i, M_i} (q(e_i, q_i, M_i; s_t) - (1 - \delta) q_i) dF_t(e_i, q_i, M_i) = h_t$$

- In the model, it is clear how to deal with discounting of productive investment

Algorithm to solve the model

- Solve individual portfolio problem (money & equity), such that demand for assets depends on P_t and J_t
- Solving for P_t and J_t by imposing equilibrium exactly (both on the grid and when simulating)
- This latter part is very important: Without it the model may be "leaking".

Algorithm to solve the model

Without aggregate risk

1. Guess for J and P. Notice that J and P imply a steady state employment rate n_{ss}.
2. Solve the household's problem and find demand functions $q(e_i, q_i, M_i; J, P)$, $M(e_i, q_i, M_i; J, P)$
3. Aggregate (i.e. integrate). If $\int q(e_i, q_i, M_i; J, P) > n_{ss}$, increase J. If $\int M(e_i, q_i, M_i; J, P) > M$, lower P.
4. Rinse and repeat.

Algorithm to solve the model

- With aggregate risk the problem is hairier.
- In the Krusell and Smith world, an error in perception of return means that agents will receive less resource in the future than they anticipated.
  - Not a big deal
- In our model a misperception of J and P means that agents may think they have more resources in the present than they actually have.
  - $\Rightarrow$ Over/underspending, no market clearing (!)

Algorithm to solve the model

Given a law of motion for (perceived) prices, $J(s_t)$, $P(s_t)$, and $s_{t+1} = f(s_t)$

- Find policy function for *real money holding* $m(e_i, q_i, M_i) = M_i(e_i, q_i, M_i)/P_t$.
- Then update P as $P = M/(\int m(e_i, q_i, M_i))$.
- Given this updated price, find nominal investments $a_{i,t}$ as

$$a_{i,t} = q_{i,t}D_t + (1 - \tau_t)W_t e_{i,t} + \mu W_t(1 - e_{i,t}) - Pc(e_i, q_i, M_i)$$

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- Then find the equilibrium J as the solution to

$$\kappa = h_t \frac{J_t}{P}, \quad \int a_{i,t} = h_t J_t$$

Typical approach in literature

- Increased idiosyncratic risk $\Rightarrow E_t[u'(c_{i,t+1})/u'(c_{i,t})] \uparrow$ and this is allowed to operate in the Euler equation for the *non-productive* investment (money)
- **However**, in the Euler equation for the *productive* investment, $c_{i,t}$ is replaced by *aggregate* consumption (or by 1), e.g.,

$$\frac{J_t}{P_t} = \beta E_t \left[\frac{u'(c_{t+1})}{u'(c_t)} \left(\frac{D_{t+1}}{P_{t+1}} + (1-\delta) \frac{J_{t+1}}{P_{t+1}} \right) \right]$$

Typical approach in the literature

Why does this matter?

$$\frac{J_t}{P_t} = \beta E_t \left[\frac{u'(c_{t+1})}{u'(c_t)} \left(\frac{D_{t+1}}{P_{t+1}} + (1-\delta) \frac{J_{t+1}}{P_{t+1}} \right) \right]$$

- recession: $E_t \left[D_{t+1}/P_{t+1} \right] \downarrow \Rightarrow$ (of course) $J_t/P_t \downarrow$
- **But** investors' desire to reduce consumption due to an increase in precautionary savings, i.e., $E_t[u'(c_{i,t+1})/u'(c_{i,t})] \uparrow$, should be allowed to dampen this

A couple of comments about our calibration

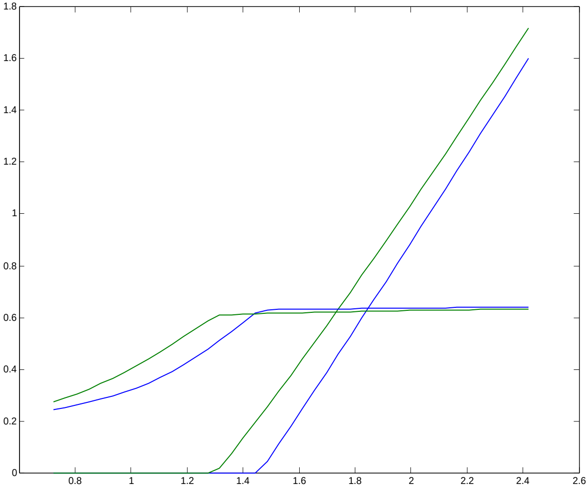
- 50% of agents are at the short-sale equity constraint
- median newly unemployed worker has assets equal to 50% (100%) of the expected (net) income loss during unemployment spell

Example to show that it matters

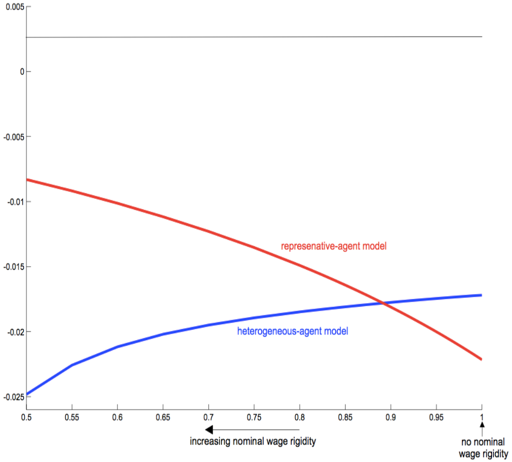
Impact of negative shock in model with **no** nominal wage rigidity

- Employment decreases with 2.2 ppt with incorrect discounting
  ($\approx$ response of representative-agent version of model)
- Employment decreases with 1.7 ppt with correct discounting

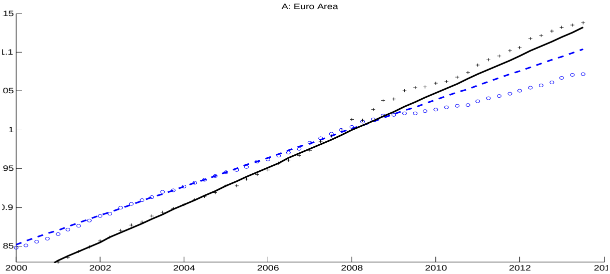
Results: Policy function

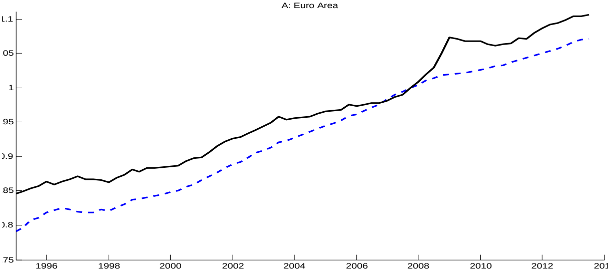


Employment drop and nominal wage stickiness

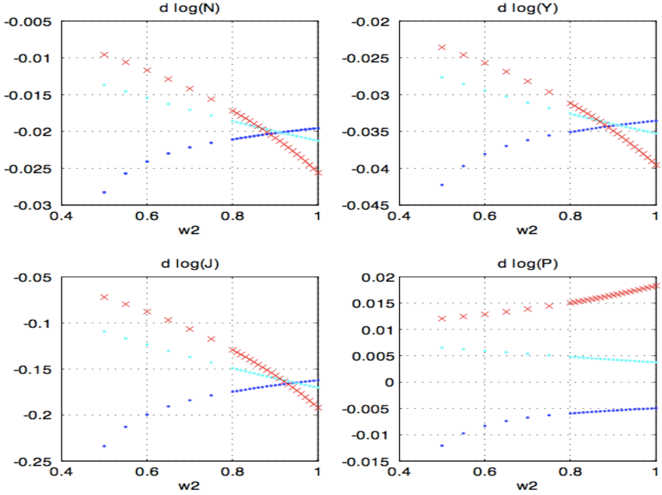


Empirics: Euro Zone

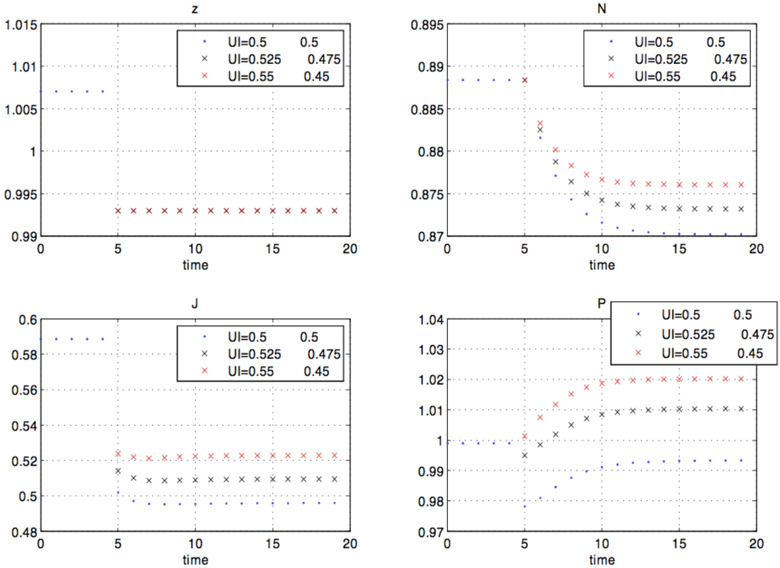




Unemployment Insurance Extension 1



Unemployment Insurance Extension 2



Conclusions

- There is a widespread belief that uncertainty and fear can be at the core of an important propagation mechanism in recession
- However, it is generally difficult to tell this story in an internally consistent framework
- Either precautionary savings are engineered to end up in *unproductive* activities as money holdings (by inappropriate discounting), or one discounts correctly and precautionary savings may end up in *productive* activities and therefore create a boom.

Conclusions

This paper resolves some of the questions

- We show how profits should be discounted correctly in an incomplete markets framework
- With sufficient nominal wage rigidity the fraction of savings that goes to money holding may counter the productive investments
- We document that this mechanism could have been present in the financial crisis.
- UI extension could be an important countercyclical policy tool.