Balance Sheet Recessions

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Conference on Money, Credit, and Financial Frictions

Can households' financial distress generate a recession?

In Standard Models it is Difficult

- The economy has a lot of wealth.
- Only the poor would be really affected: They want to work harder.

An expansion.

This project

1. We build a model with goods market frictions, where financial distress leads to a recession.
2. Crucially, the attempt to save reduces productivity due to real frictions.
3. We provide a theory of price dispersion during the onset of the recession.

The logic

- When hit by adverse financial shocks, agents tend to increase saving by cutting consumption expenditures.
- Goods market frictions translate lower consumption expenditures into output loss, despite the decline of prices.
- There is a realignment of consumption patterns: large drops of consumption for the poorest but modest increase of consumption for the richest.
- When we explicitly add housing that can be used as collateral, increased financial frictions greatly amplifies the magnitude of the recession.

The ingredients

- Heterogeneous agents model (How else can there be financial frictions?)
  - There are very rich, rich, poor, very poor, and borrowers; lucky and unlucky: a modern economy's earnings and wealth distribution.
  - Price dispersion: the rich are not into hassles (they pay higher prices).
- Storage economy: fixed return to savings. In addition to goods (that can be saved) there are services (that cannot be saved).
- Goods (services, really) market frictions a la Bai, Rios-Rull and Storesletten (2011) with a touch of Lagos and Wright (2005)

The contribution

We show that

1. Financial distress can lead to a recession even when agents own a lot of wealth.
2. Goods market frictions are crucial in generating the recession.
3. No nominal rigidities are required.
4. Price dispersion is counter-cyclical.
5. With housing, the effects of financial distress are more pronounced.

The Model

Environment

- Many agents that live forever and have idyosincratic shocks to endowments. Two goods per period:
- Numeraire goods
  - Used for consumption and storage.
  - As if traded in a centralized market.
- Services
  - Used only for consumption.
  - Traded in decentralized markets and subject to search frictions.

Preference

- Agents' period utility function is $u(c, s, d)$.
- Agents value numeraire goods consumption c and services s.
- To obtain services, agents have to exert search efforts d

$$s = d\Psi^b(q).$$

$\Psi^b(q)$: probability of a shopper finding services.

Competitive search in services markets

- Markets are indexed by price p and market tightness $q = \frac{T}{D}$.

- In market (p, q)
  - Active markets, sellers have guaranteed revenue

$$p\Psi^s(q) \geq \zeta$$

equilibrium determined object ζ.

  - Buyers face a trade-off between p and $\Psi^b(q)$ when choosing markets:
    - Rich agents go to high p, high q markets.
    - Poor agents go to low p, low q markets.

Endowments

- An agent receives y_s units of active locations capable of producing services.
  - When a location is found by a buyer, 1 unit of services is produced.
  - When a location is not found by a buyer, nothing is produced.
- An agent receives y_c units of numeraire goods that can be consumed, sold, or stored/loaned.
- $y = \{y_c, y_s\}$ follows a Markov process $\Pi_{y,y'}$.
- Households' asset position is a. There is an ad-hoc borrowing limit $\underline{a}$.

Agents' recursive problem

$$V(y,a) = \max_{\substack{a',c,s,\\ d,p,q}} u(c,s,d) + \beta \sum_{y'} \Pi_{y,y'} V(y',a'),$$

subject to

$$p\, s + c + a' \geq (1+r)\, a + \zeta\, y_s + y_c,$$

$$s = d\, \Psi^b(q),$$

$$\zeta \leq p\, \Psi^s(q),$$

$$a' \geq \underline{a}.$$

- Note that agents choose consumption and savings as well as which market (p,q) to go to.

Macroeconomic Aggregates (what NIPA measures)?

- Aggregate active locations: $T_s = \int y_s dx(y,a)$
- Aggregate numeraire goods endowment: $Y_c = \int y_c dx(y,a)$
- Aggregate savings: $A = \int a \; dx(y,a)$
- Aggregate output (GDP):

$$Y = rA + Y_c + \int_0^{T_s} p_i \; \Psi^f(q_i) \; di$$

$$\approx rA + Y_c + \overline{p} \, M(D, T_s)$$

Total output is increasing in aggregate search effort D.

Labor and Productivity

- We impute labor to locations and then we can separate output changes due to labor and to productivity.

- Labor
  - To maintain a location, ϵ units of labor is required.
  - When matched with a buyer , additional $1-\epsilon$ units of labor is required to produce services.
  - Aggregate labor is

$$N = \epsilon\, T_s + (1-\epsilon) \int_0^{T_s} \Psi^f(q_i)\, di$$

- Productivity

$$A = \frac{Y}{N}$$

Analysis

- We build an empirically informed quantitative economy.
- We report its properties in the steady state.
- and its properties in the aftermath of a financial shock.

Functional forms: So consumption and productivity move together

- Preferences

$$u(c,s,d) = \frac{1}{1-\sigma}\left(c_A - \xi_d \frac{d^{1+\gamma}}{1+\gamma}\right)^{1-\sigma}$$

$$c_A = \left[(1-\omega)c^{\frac{\eta-1}{\eta}} + \omega s^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}$$

- Matching

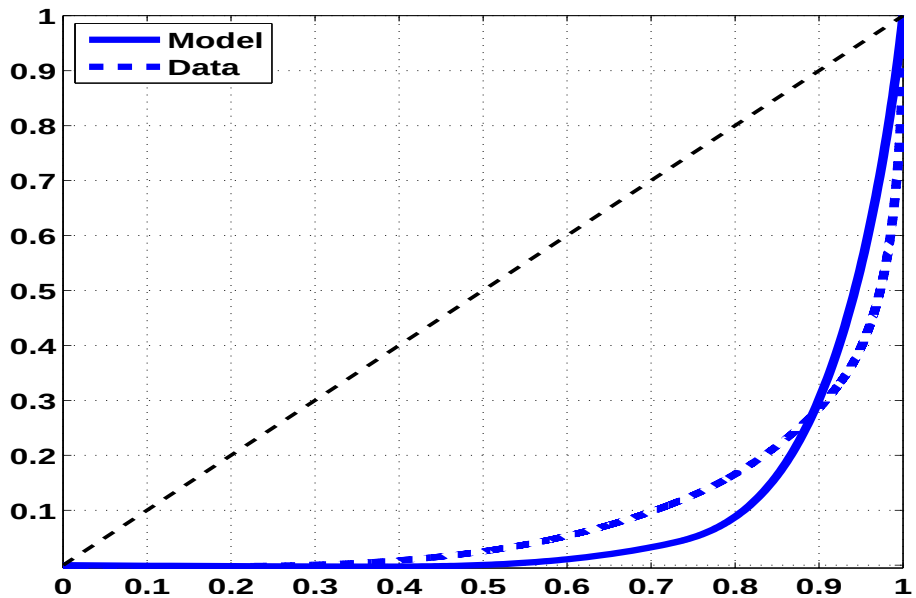
$$M(D,T) = \frac{DT}{\left(D^{\mu}+T^{\mu}\right)^{\frac{1}{\mu}}}$$

$$\Psi^{d}(q) = \left(1+q^{-\mu}\right)^{-\frac{1}{\mu}}$$

$$\Psi^{f}(q) = \left(1+q^{\mu}\right)^{-\frac{1}{\mu}}$$

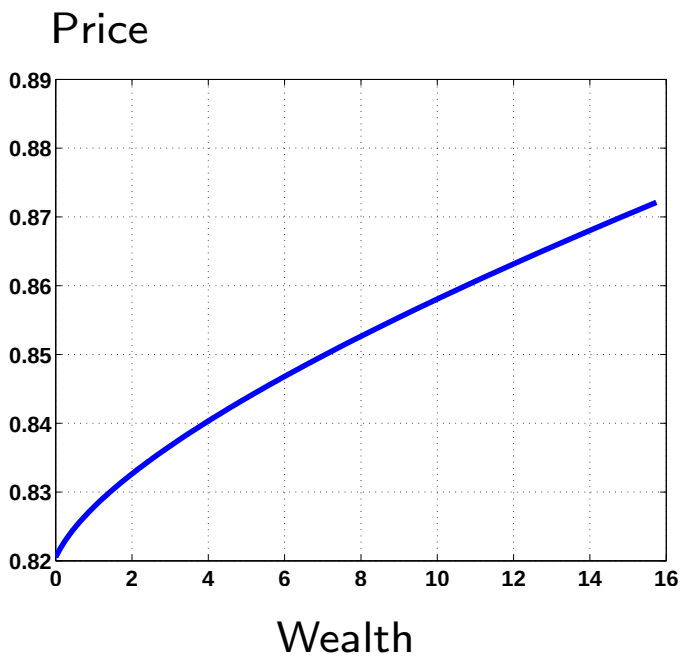
Wealth Lorenz curve Parameter

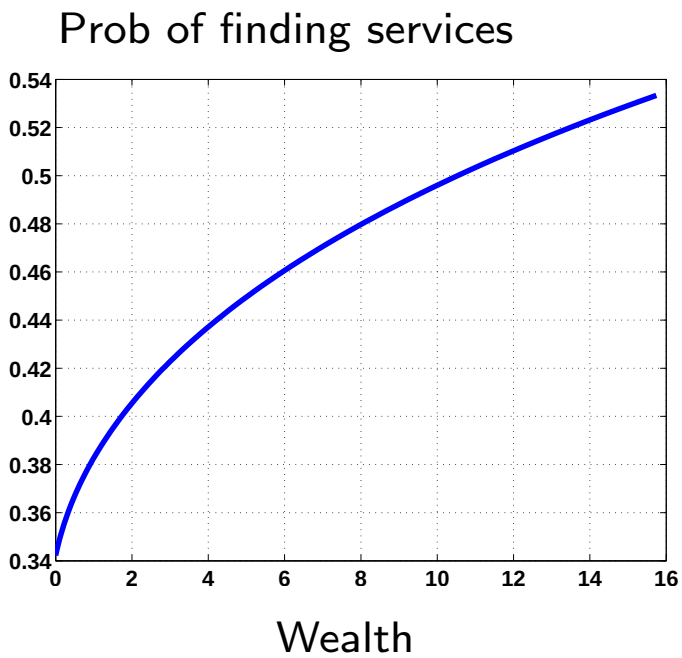
- Four types of agents: poor, normal, rich and super rich.



Steady state properties

- Rich agents go to expensive markets with short waiting lines.
- Poor agents go to cheap markets with long waiting lines.



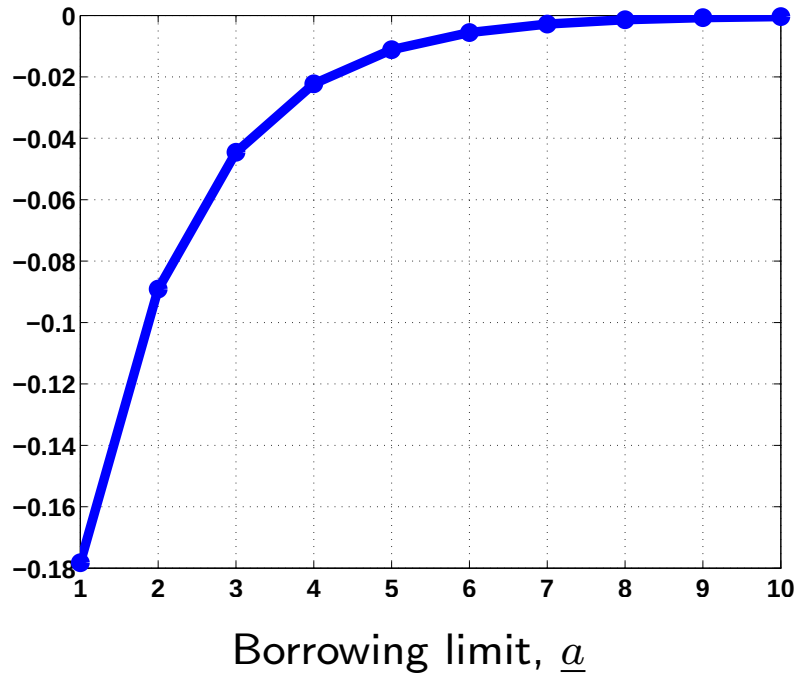


A Shock to the Borrowing Constraint

- The borrowing constraint is tightened unexpectedly but gradually.
- Agents cannot borrow any more in the new steady state.

Transition

- The borrowing constraint changes gradually.



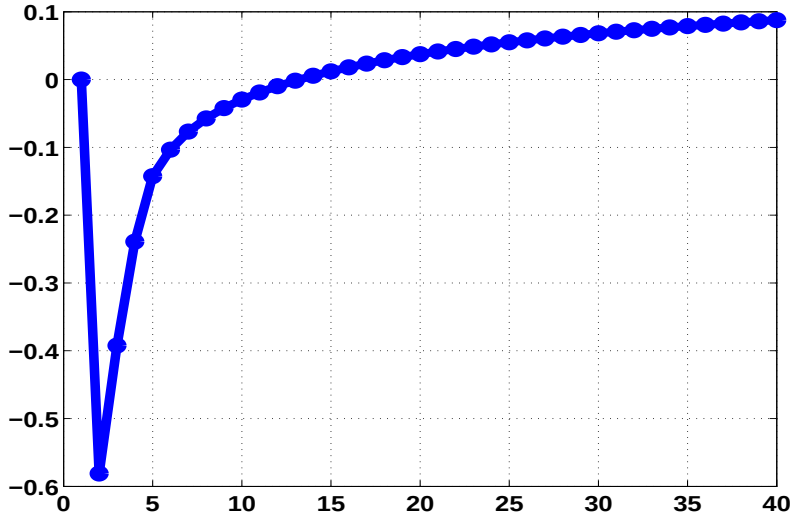
- Otherwise, some agents may have to default on their debts.

The Economy After the Shock

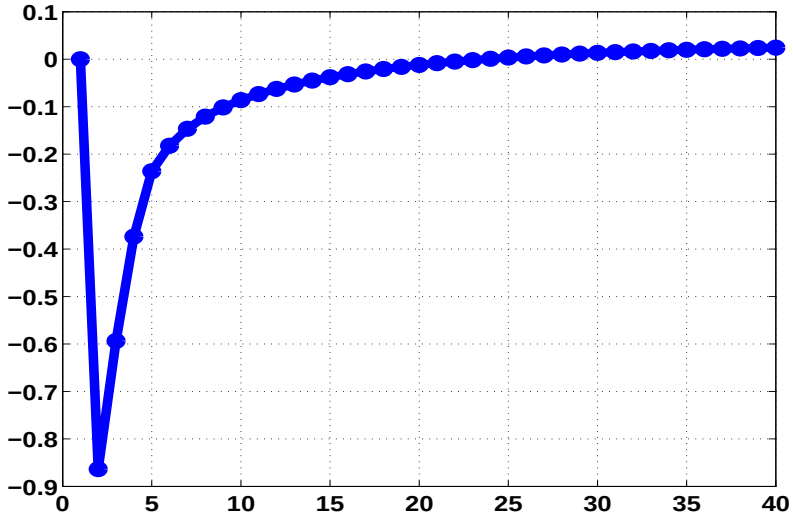
- We now look at the evolution of aggregate variables after the financial shock.

- It requires to solve for the equilibrium values of ζ_t along the transition.

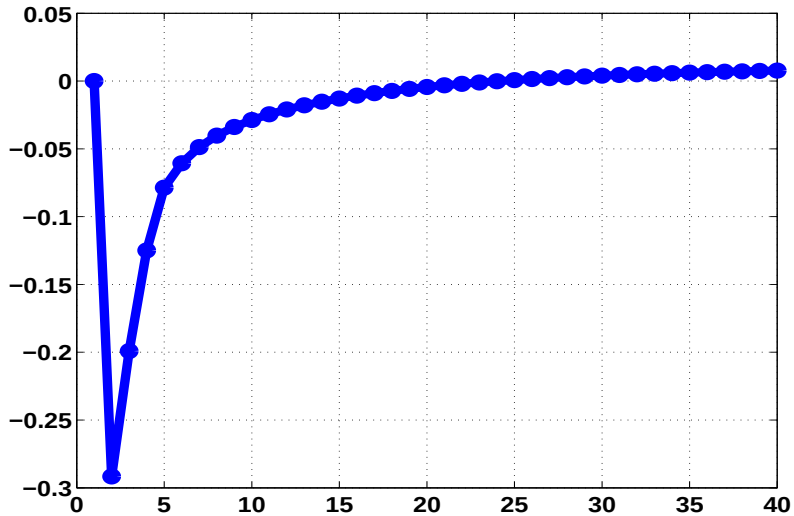
Transition: aggregate



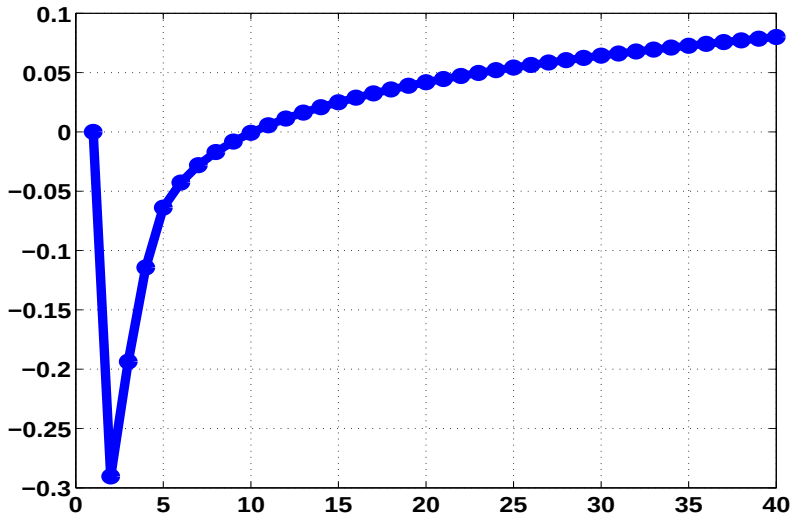
Output



Services

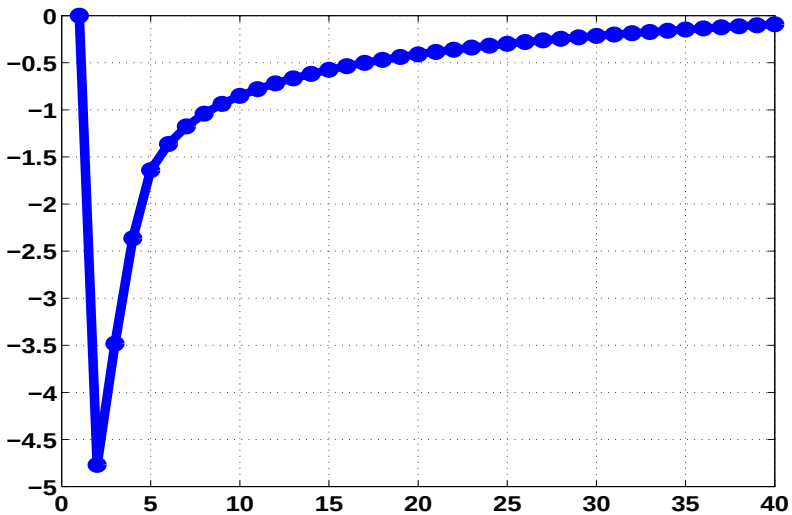


Labor

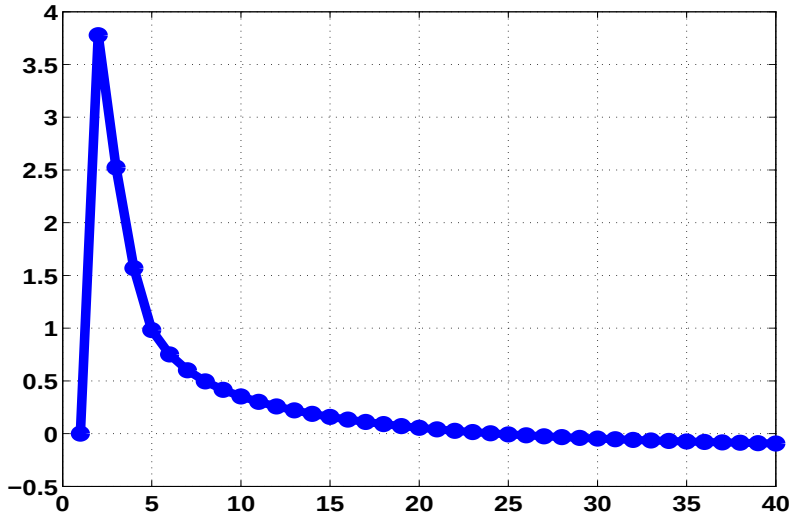


Productivity

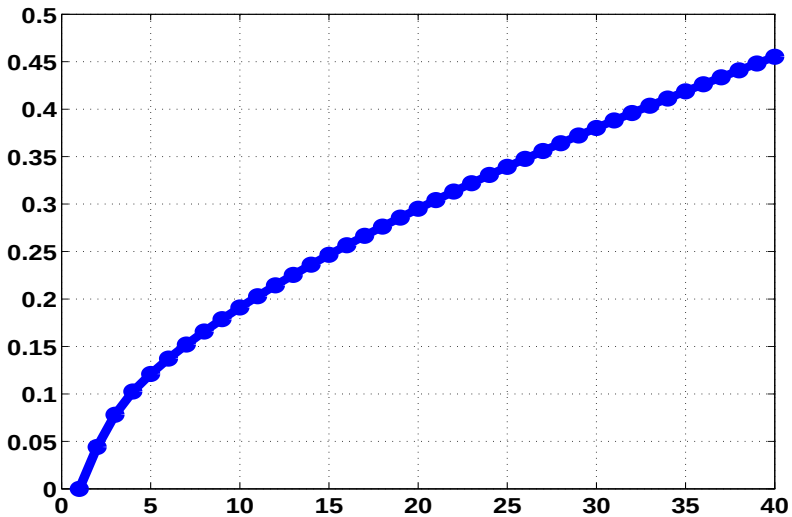
Transition: aggregate



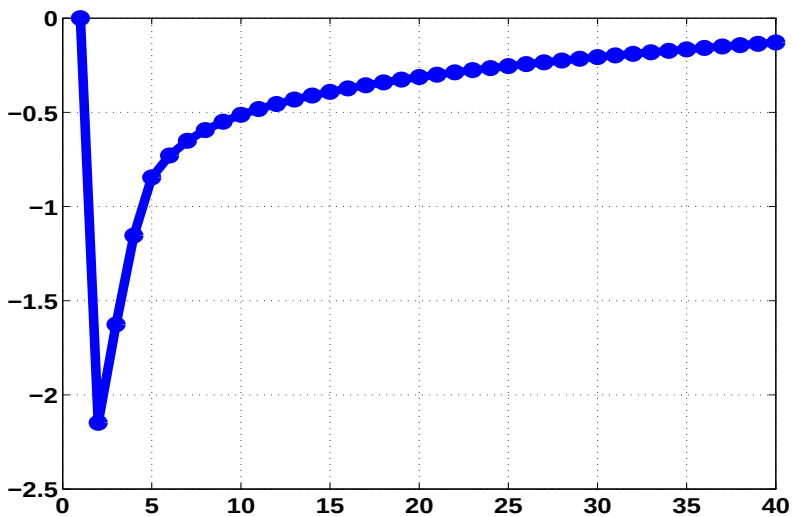
Average price



Price dispersion

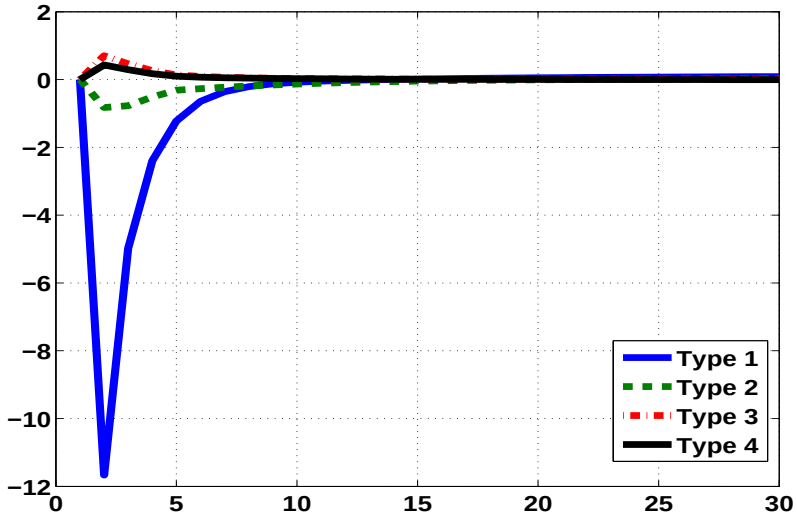


Wealth

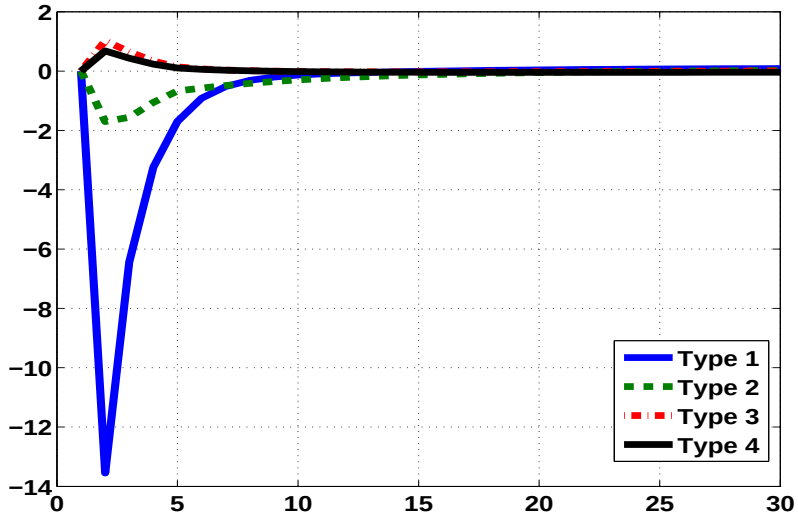


Numeraire consumption

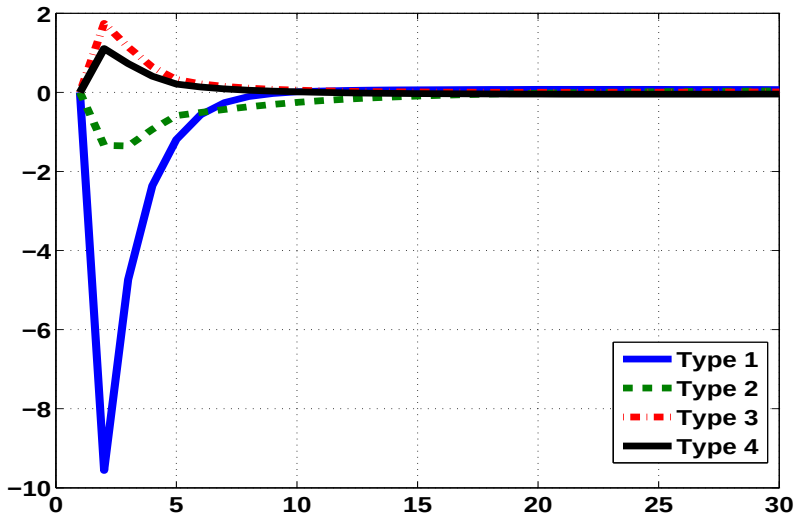
Transition: cross-section



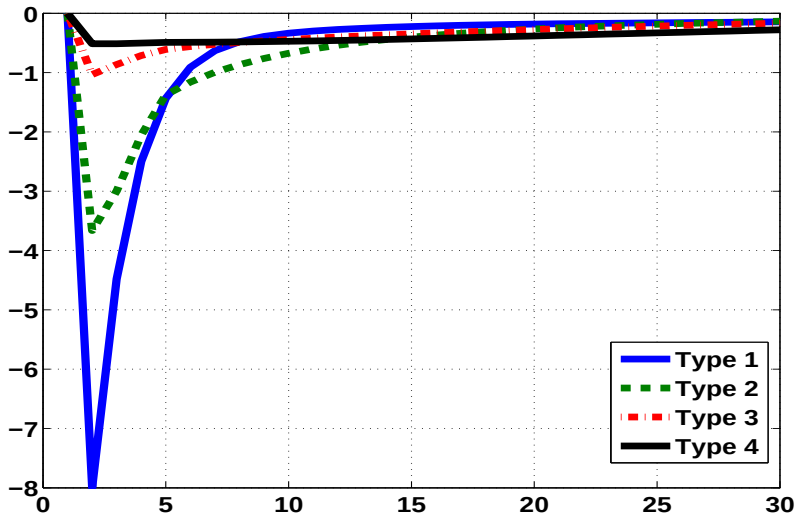
Goods finding probability



Search efforts



Services



Numeraire consumption

Properties of the Recession

- Total Services decline.
- Aggregate savings increases.
- Realignment of consumption
  - Poor agents reduce both both types of consumption and switch to worse markets (with longer lines).
  - But the richest agents increase consumption of services and switch to better markets (with shorter lines).
- Average price of services declines, but price dispersion increases.

Why the Recession is small

- Insufficient people in real trouble (borrowers).
- Those in trouble do not matter much (they are poor).
- A Larger recession requires more people in trouble and the trouble to be larger:

Housing

An Economy with housing

Housing sector

- Decreasing returns to scale in housing construction.
- A reduction in demand for housing cuts construction
- Reduces the price of existing houses: Capital loses.

Agents' problem Utility function

$$V(y,a) = \max_{\substack{a',c,s,d,\\ h,p,q,b}} u(c,s,d,h) + \beta \sum_{s'} \Pi_{s,s'} V(y',a'),$$

subject to

$$p\ s + c + p^h\ h + b \geq a + \zeta y_s + y_c + \pi,$$

$$s = d\ \Psi^b(q),$$

$$\zeta \leq p\ \Psi^s(q),$$

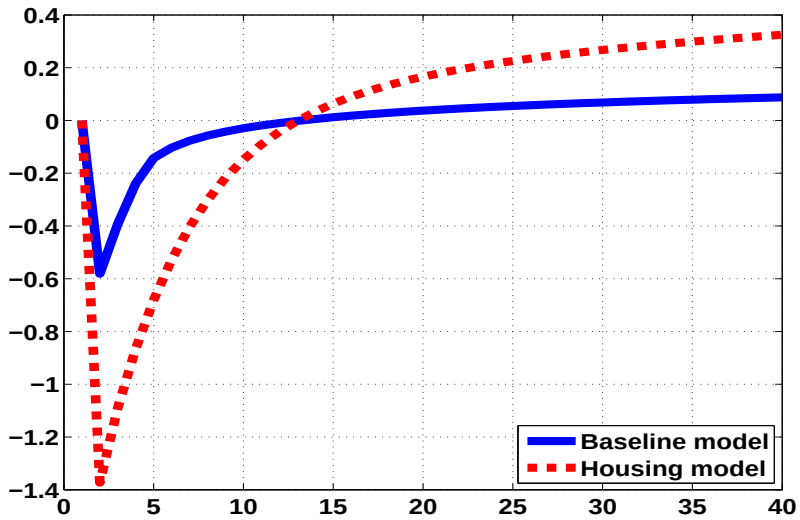
$$a' = p'_h\ h\ (1-\delta_h) + (1+r)b,$$

$$b \geq -\lambda\ p^h\ h.$$

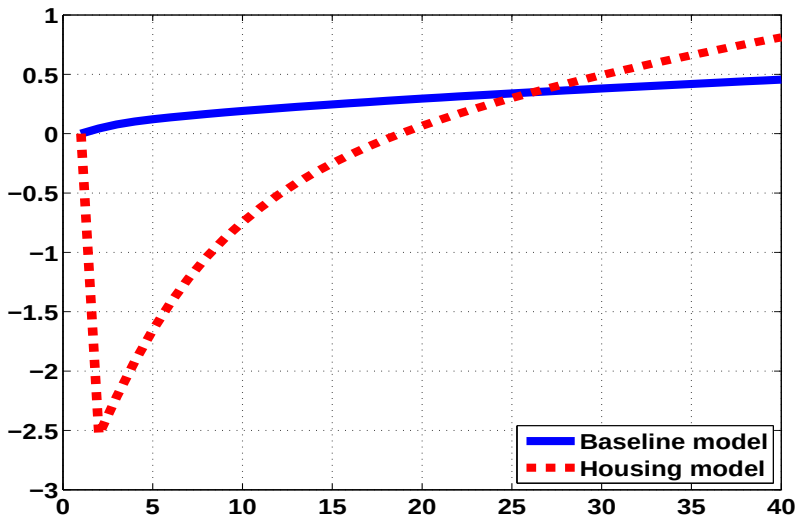
A Shock to the Collateral Constraint

- The collateral constraint is tightened unexpectedly and gradually.
- The size of the shock in the housing economy has to be comparable with the shock to the baseline economy:
  - Same consumption reduction of poorest quintile.

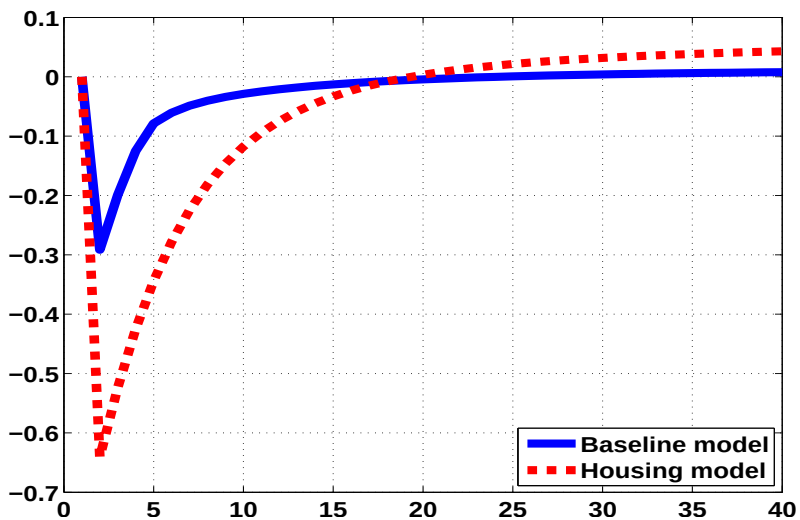
Transition: aggregate



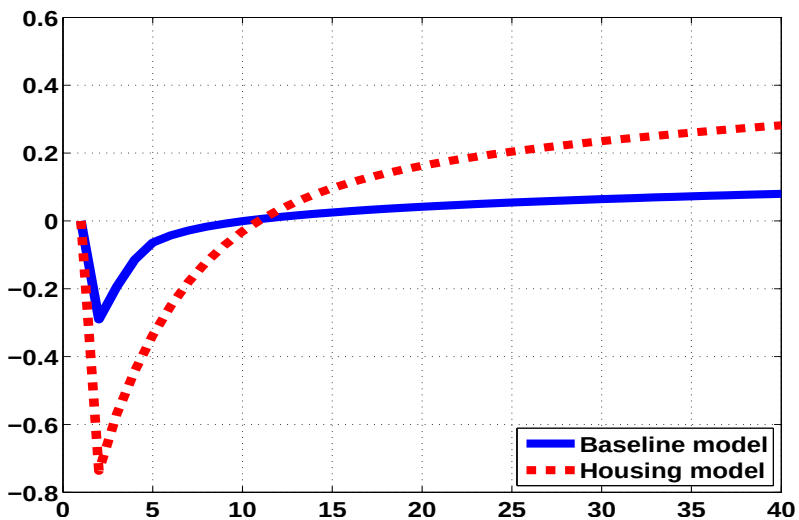
Output



Wealth

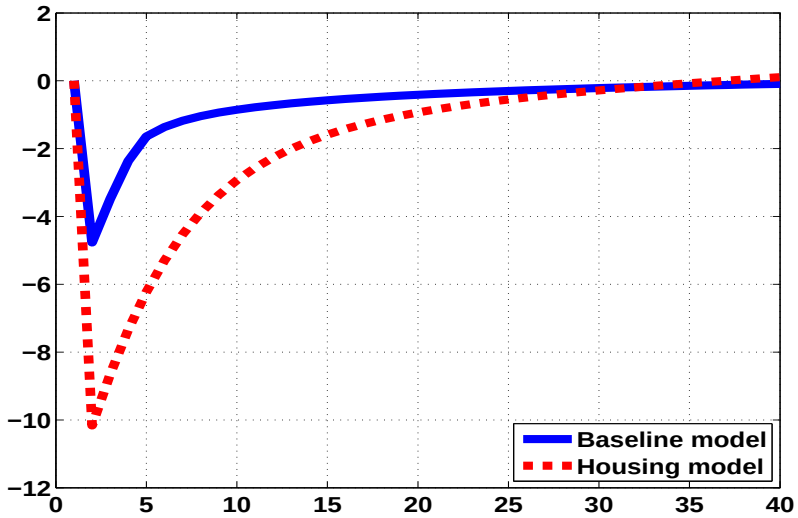


Labor

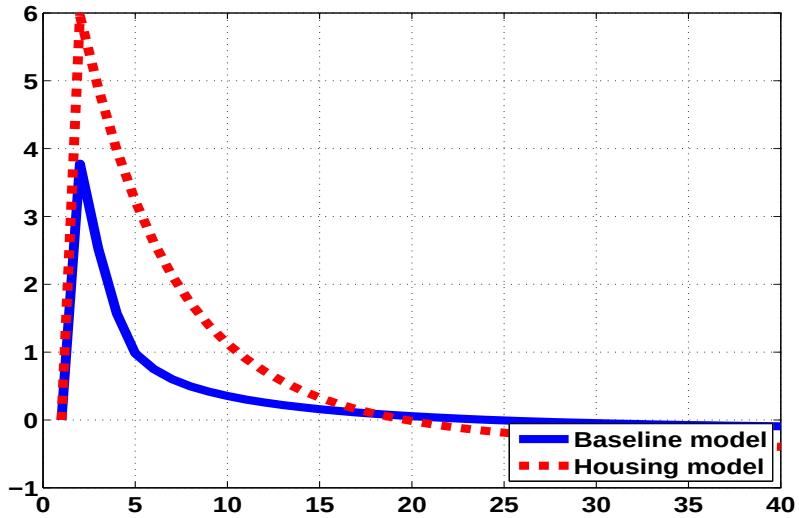


Productivity

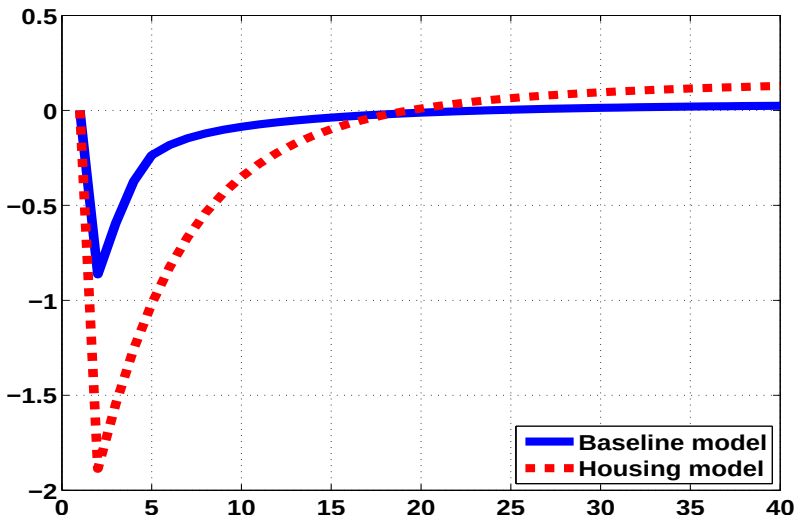
Transition: aggregate



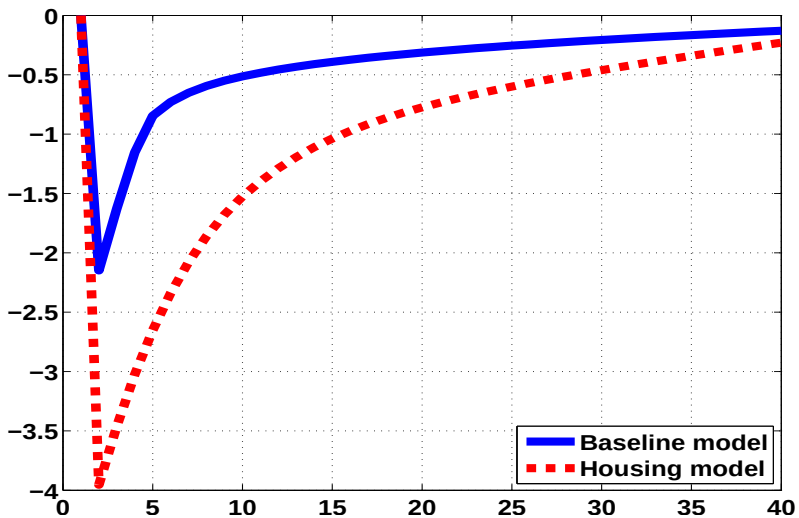
Average price



Price dispersion

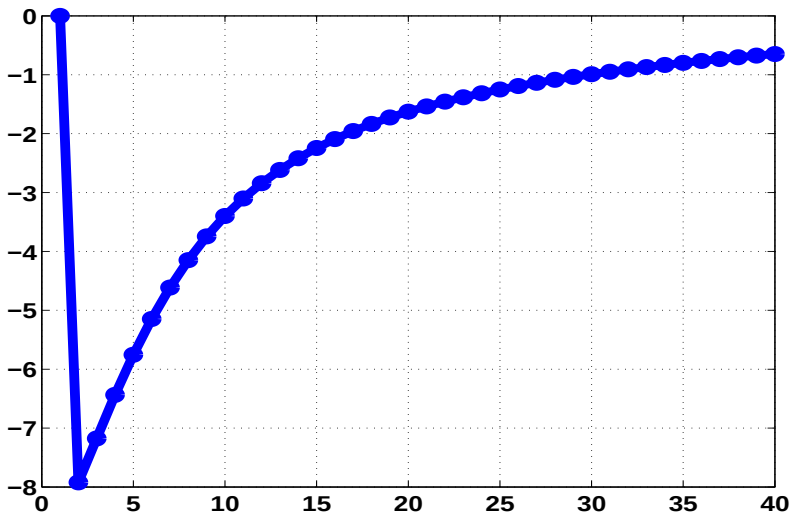


Service

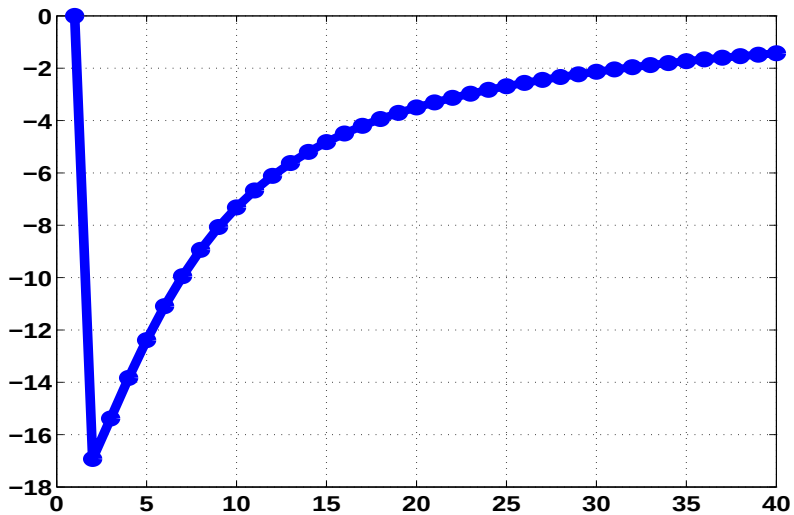


Numeraire consumption

Transition: aggregate Cross Section



Housing price



Housing investment

Properties of the Recession

- The magnitude of the recession is much larger.
- Aggregate wealth declines initially: capital loss.
- Larger fraction of agents are affected: more agents are leveraged.

Conclusion

1. In standard models, financial distress generates an expansion.
2. We build a model with goods market frictions, where financial distress can generate a recession.
3. Our model provides a framework to understand price dispersion in business cycles.
4. When housing is added, the magnitude of the recession is much larger.

Numerical example: parameter

Parameter	Value
Risk aversion, σ	2.0
Return to storage (anual), r	4%
Elasticity of substitution between tradables and nontradables, η	0.83
Frisch Elasticity of Substitution of Search Effort $1/\gamma$	0.60
Fixed labor to keep a location open, ϵ	0.59

Numerical example: parameter

Parameter	Value	Target	Value	Model
β	0.96	Wealth to output ratio	4.00	4.00
$\underline{a}$	0.12	Fraction of negative wealth	0.15	0.15
μ	2.98	Services occupation ratio	0.81	0.81
ξ_d	0.04	St.d of price dispersion	0.10	0.09
ω	0.89	Services to output ratio	0.67	0.67
α	0.20	Numeraire endowments to output	0.15	0.16
$y_{s,4}$	7.385	Wealth held by top 10%	0.70	0.70
$y_{s,1}$	0.155	Total number of locations, T_s	1.00	1.00
$\Pi_{1,4}$	0.001	Income Gini index	0.64	0.64
$\Pi_{4,1}$	0.007	Wealth Gini index	0.82	0.82
$\Pi_{1,1}$	0.965	Persistence, ρ_s	0.91	0.91
$\Pi_{2,2}$	0.976	St.d of innovation, σ_s	0.20	0.20

Numerical example: parameter

Return

Transition matrix	ϵ_1	ϵ_2	ϵ_3	ϵ_4
ϵ_1	0.965	0.033	0.000	0.001
ϵ_2	0.018	0.976	0.018	0.001
ϵ_3	0.000	0.033	0.965	0.001
ϵ_4	0.007	0.007	0.007	0.979
Skill Value	0.155	0.388	0.872	7.385

Utility function

Return

- Separable between consumption and housing.
- As households become richer, they do not want to hold many houses.

$$u(c,s,d,h)=\begin{cases}\frac{1}{1-\sigma}\left(c_A-\xi_d\frac{d^{1+\gamma}}{1+\gamma}\right)^{1-\sigma}+\frac{\xi_h}{1-\sigma_h^1}h^{1-\sigma_h^1}, & \text{if } h<\widehat{h}\\ \frac{1}{1-\sigma}\left(c_A-\xi_d\frac{d^{1+\gamma}}{1+\gamma}\right)^{1-\sigma}+\frac{\xi_h}{1-\sigma_h^2}\left(h+\underline{h}\right)^{1-\sigma_h^2}, & \text{if } h\geq\widehat{h}\end{cases}$$

Calibration

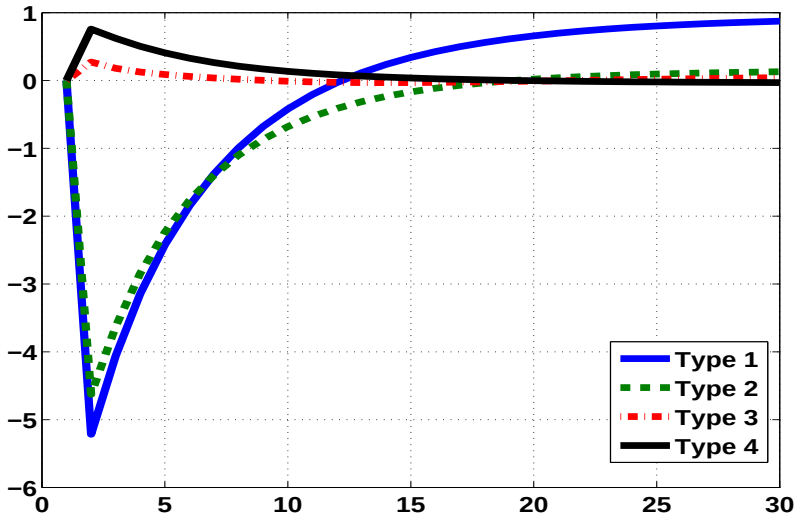
Parameter	Value
Risk aversion, σ	2.00
Curvature for Low Level of Housing, σ_h^1	2.00
Curvature for High Level of Housing, σ_h^2	10.00
Elasticity of substitution bw tradables and nontradables, η	0.83
Return to storage, r	4%
Frisch Elasticity of Substitution of Search Effort $1/\gamma$	0.60
Fixed labor to keep a location open, ϵ	0.59
Collateral requirement, λ	0.85
Elasticity of housing price w.r.t investment, φ	0.30

Housing parameters: Return

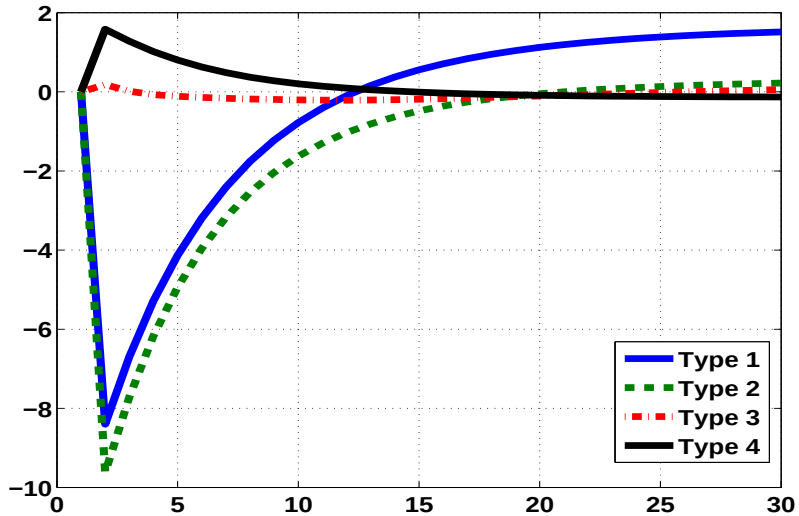
Parameter	Value	Target	Value	Model
β	0.96	Wealth to output ratio	4.00	4.20
ξ_h	0.64	Housing value to output ratio	1.50	1.50
μ	2.98	Average occupation ratio	0.81	0.81
ξ_d	0.04	St.d of price dispersion	0.10	0.09
α	0.18	Numeraire endowments to output	0.15	0.14
ω	0.89	Services to output ratio	0.67	0.70
$\widehat{h}$	1.85	Housing held by top 10%	0.25	0.24
$\underline{h}$	-0.71	u_h is continuous at $\widehat{h}$	—	—
δ_h	0.006	Investment to output ratio	0.04	0.04
z_h	0.005	Housing stock	1.00	1.00

Transition: cross-section

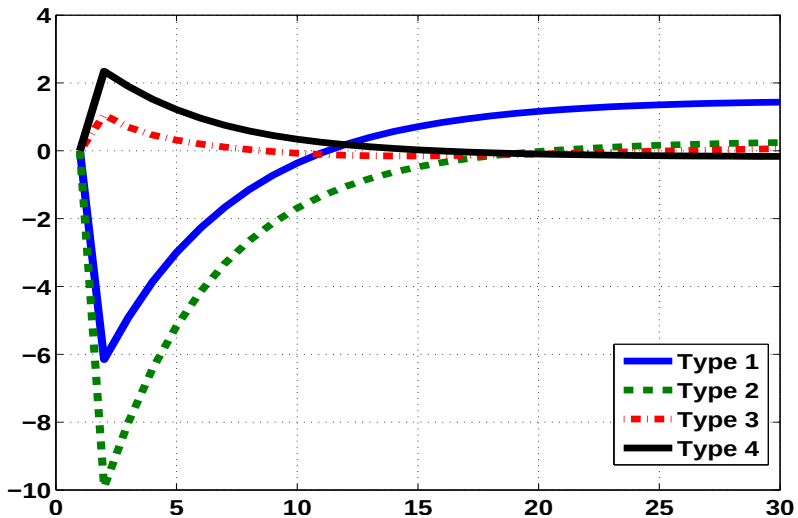
Return



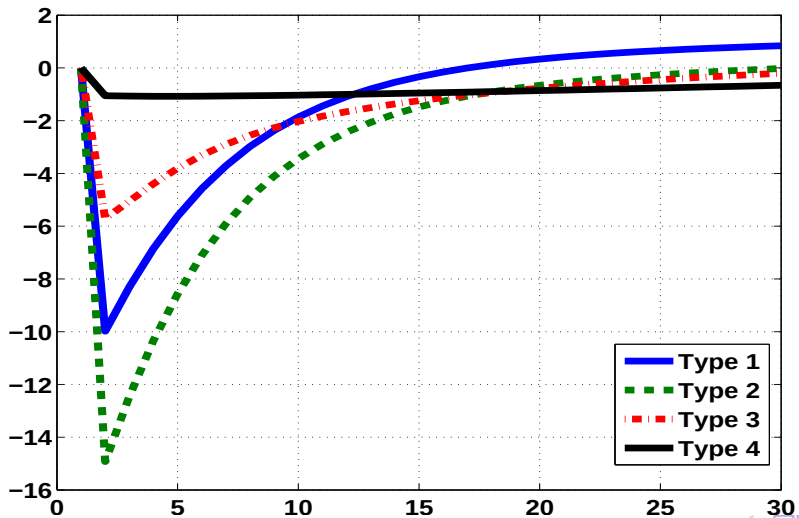
Goods finding probability



Search efforts

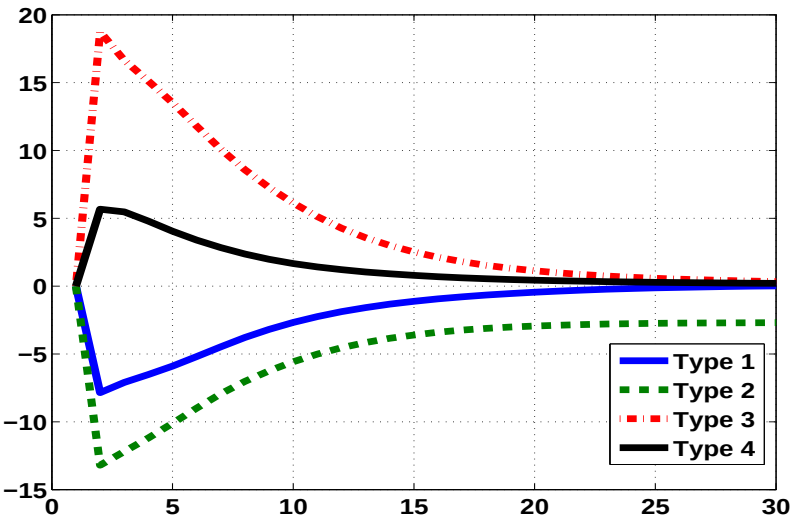


Services

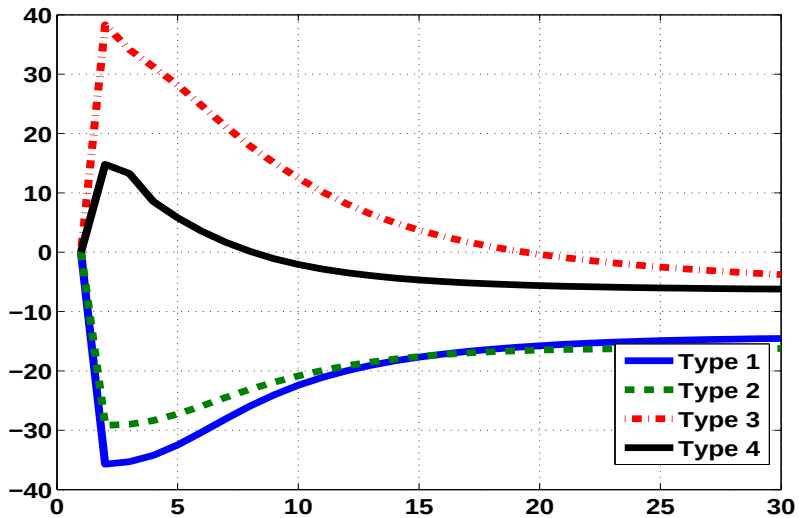


Numeraire goods

Transition: cross-section



Housing



Debt