Interaction between demand for labor and consumption over the business cycle

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Importance of "demand"

*We bought a new refrigerator, new phones, new car.*

*I hope it is enough of a demand push to bring the Spanish economy up to speed.*

Spanish economist in an email to me.
Importance of "demand"

In coming months there will be less Fiats, Peugeots, and Opels coming from the assembly line in France, Italy, and Germany.

Car manufacturers lower production because they are scared to be stuck with unsellable inventories. And that chance is real, because car sales have dropped sharply during the last few months.

Every new car coming from the assembly line then costs money.

NOS - October 19 2011
Role of demand in popular press

- Lack of demand $\rightarrow$ firms do not hire workers
- Uncertain job prospects $\rightarrow$ consumers do not spend
- Demand seems key in understanding business cycles

No mention of sticky prices!
National Federation of Independent Business Survey

Question:
What is single most important problem facing your business today

1. sales (demand)  
2. taxes  
3. interest rates & finance  
4. labor quality  
5. big business  
6. inflation  
7. insurance  
8. regulation
SELECTED SINGLE MOST IMPORTANT PROBLEM

Taxes, Interest Rates, Sales and Labor Quality

January 1986 to August 2011

Source: National Federation of Independent Business
SELECTED SINGLE MOST IMPORTANT PROBLEM

Inflation, Big Business, Insurance and Regulation

January 1986 to August 2011

Source: National Federation of Independent Business
Lack of demand and unemployment

Source: Arnold Kling on modeledbehavior.com
History of economic thought

- Can there be a general glut in demand?
- Nice blog by Brad Delong summarizing view of famous economists through time
  - next 3 slides are based on his blog
Can a general glut exist?

John Stuart Mill (1806–’73) describing Say’s views:

*There can never, it is said, be a want of buyers for all commodities; because whoever offers a commodity for sale, desires to obtain a commodity in exchange for it, and is therefore a buyer by the mere fact of his being a seller*

*... if there be more sellers than buyers of one thing, there must be more buyers than sellers for another*
Say on Say’s Law

Say changed his mind after financial panic and recession of 1825-6:

_As the bills that businessmen had discounted came to maturity, they were obliged to meet them, and finding no more advances from the bankers, each was forced to use all the resources at his disposal._
JS Mill again

Although he who sells, really sells only to buy, he needs not buy at the same moment when he sells ...

there may be, at some given time, a very general inclination to sell with as little delay as possible, accompanied with an equally general inclination to defer all purchases as long as possible.... In order to render the argument for the impossibility of an excess of all commodities applicable...

money must itself be considered as a commodity
Demand & academic literature

- RBC
  - production = income = demand

- Mortensen-Pissarides matching models
  - production = income = demand
  - even though capacity decision is forward looking
Demand & academic literature

- NK framework with sticky prices
  - adjustment through hiring/firing workers instead of $\Delta P$

- Coordination failure & multiple equilibria
  - Coconut model of Diamond (1982)
  - Strategic complementarities of Cooper and John (1988)
General demand glut

Where can general demand glut find its counterpart?

1. demand for "money" ↑
   - why doesn’t general price level adjust?

2. supply of bonds, etc. ↑
   - why doesn’t interest rate adjust?
Borrowing/lending & demand glut

• Suppose there is a demand glut
  \[\Rightarrow\] more agents willing to lend out funds

Possibilities:

1 Demand for funds fixed
  \[\Rightarrow\] lower interest rate gets rid of demand glut

2 Amount saved and borrowed ↑
  \[\Rightarrow\] those that borrow can spend more
doesn’t this get rid of demand glut?
My view on general demand glut #1

- group of consumers wants to consume less

- \[ \implies \]

- Somebody wants/needs to borrow
  his "demand" for products isn’t helpful

- Most of talk is on this type of glut
My view on "general" demand glut #2

- glut could be glut in demand for durables
- worker reallocation friction prevents supply of relatively more attractive commodity to ↑

- bit on this at end of talk
Approach #1

- one commodity
- flexible prices
- "sell" friction and inventories
- borrowing and lending
Approach #2

- two commodities and *durable* demand glut
- flexible prices
- friction to reallocate labor
What is next

1. Approach #1
   1. Simple version to explain key ideas and model properties
   2. Model and some more results

2. Approach #2
Environment in simple version

- financial market:
  - one-period risk-free bonds
- continuum of ex ante identical workers:
  - ex post employed or unemployed
  - trade in financial market
- representative firm
  - hires workers
  - faces "sell" friction $\rightarrow$ inventories
  - trades in financial market
general glut in simple version

workers

price = 1
consumption

labor
wages = w

firms

price = 1
consumption

inventories

demand for bonds
q

firm owners

supply of bonds
intro  general glut in simple version  general glut plus labor market matching  durables

workers

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<th>firms</th>
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firm owners

demand for bonds ↑

\( q \) ↑
supply of bonds

supply of bonds

1

w

price = 1

consumption

1
Intro

General glut in simple version

General glut plus labor market matching

Durables

- Workers
  - Consumption: \[ \text{price} = 1 \]
  - Labor: \[ \text{wages} = w \]
- Firms
  - Inventories
  - Demand for bonds: \( q \)
  - Supply of bonds
  - Consumption: \[ \text{price} = 1 \]
- Firm owners
workers

price = 1

consumption

labor

wages = w

firms

price = 1

consumption

inventories

firm owners

demand for bonds

q

supply of bonds

q

inventorys
introduction general glut in simple version general glut plus labor market matching durables

workers

firms

firm owners

price = 1

consumption

labor

price = 1

consumption

wages = w

demand for bonds

supply of bonds

inventories

q
Workers

\[ c_{i,t} + q_{i,t} b_{i,t}^d = e_{i,t} w_t + (1 - e_{i,t}) \mu + b_{i,t-1}^d \]

\[ e_{i,t} \in \{0, 1\} \]

\[ q_{i,t} = \begin{cases} 
q_t \left(1 - \zeta \left(b_{i,t}^d \right)^2 \right) & <q_t \quad \text{if } b_{i,t}^d < 0 \\
q_t & \text{if } b_{i,t}^d \geq 0
\end{cases} \]
Employed workers

\[ v_e(b_{i,t-1}, s_t) = \max_{c_{i,t}, b_{i,t}} \frac{c_{i,t}^{1-\gamma} - 1}{1 - \gamma} + \left( 1 - \rho_{x,t+1} \right) + \rho_{x,t+1} \]

\[ \mathbb{E}_t [v_e(b_{i,t}, s_{t+1})] + \mathbb{E}_t [v_u(b_{i,t}, s_{t+1})] \]

s.t.

\[ c_{i,t} + q_{i,t} b_{i,t}^d = \omega_t + b_{i,t-1}^d \]
Unemployed workers

\[ v_u(b_{i,t-1}, s_t) = \max_{c_{i,t}, b_{i,t}} \frac{c_{i,t}^{1-\gamma} - 1}{1 - \gamma} + \frac{\lambda_{w,t+1}}{E_t [v_e(b_{i,t}, s_{t+1})]} + (1 - \lambda_{w,t+1}) \frac{\lambda_{w,t+1}}{E_t [v_u(b_{i,t}, s_{t+1})]} \]

s.t.

\[ c_{i,t} + q_{i,t} b^d_{i,t} = \mu + b^d_{i,t-1} \]
Representative firm

- linear production function
  
  \[ y_t = n_t \]

- fixed supply of commodities: \( \tilde{y} \)
  
  - supply is kept fixed to highlight role of inventories

- demand for labor
  
  \[ n_t = \tilde{y} - (1 - \delta) i_{t-1} \]
Inventories

- friction in commodity market $\rightarrow$ inventories

- what kind of friction?
Friction in the goods market

- what do I want?

Friction in the goods market

- what do I want?
- demand $\downarrow \iff$ inventories $\uparrow$ \textit{and} market clearing
Friction in the goods market

- what do I want?
- demand $\downarrow \iff$ inventories $\uparrow$ and market clearing
- standard matching friction would give you this
  search effort $\downarrow \iff$ inventories $\uparrow$

Friction in the goods market

- Are search frictions in the goods market important?

- For me personally? Yes absolutely

- But not everybody is that convinced
  (except in some specific cases like housing)
Friction in the goods market

friction in the goods market adopted

- "sell" friction
- consumers costlessly observe what is out there
- consumers either do not buy or buy with unit probability
Mismatch in goods markets

product space

supplied

potential interest consumer

also supplied

also sellable
Friction in the goods market

what do I need?

- "sell friction" ↑ when
  1. demand by workers ↓
     even if drop is offset by demand ↑ of firm owners
  2. aggregate demand ↓ and \( \frac{\text{demand}}{\text{supply}} \) remains constant
Increased mismatch in goods markets

Product space

Supplied

- Potential interest consumer

Also supplied

- Also sellable

Proportional scaling of supply and interest $\Rightarrow$ bigger chance of mismatch

(Product space doesn't shrink)

Suppliers don't get the chance to learn quickly who dropped out of market
Increased mismatch in goods markets

product space

supplied

also supplied

potential interest consumer

also sellable

replacing customers by new ones ⇒ mismatch
Formulation of friction

- producers find a buyer with probability $< 1$

$$\pi_t = \bar{\pi} + \pi \left( \frac{c_t}{\bar{c}}, \frac{c_{e,t}}{\bar{c}_e} \right)$$

- recall that supply is fixed
Key assumption

- friction increases when
  - overall activity decreases
  - shifts in types of customer

- Thus

\[
(c_t + c_{e,t}) \downarrow \quad \Rightarrow \quad \pi_t \downarrow
\]

\[
c_t \downarrow \quad \& \quad \Delta (c_t + c_{e,t}) = 0 \quad \Rightarrow \quad \pi_t \downarrow
\]
Simple example

- Let $\bar{c}_0$ be steady state without friction

$$\pi_t = \bar{\pi} + \phi \frac{c_t}{\bar{c}_0} \text{ with } 0 < \phi < 1$$

- consistent with graphs above for $c_t \downarrow$
- numerical results: $\phi = 0.5$
Friction bottom line

- consumption workers ↓ with 1% ➞
  1. half ends up in inventories
  2. half is bought by other consumers (firm owners)
Stickiness

- Aggregate prices can be fully flexible

- But unlucky producers don’t adjust relative prices. Why not?
  - they might sell next period at higher price
  - signals bad quality
  - costs would no longer be covered
  - too late to tell non-buying consumers that posted price was too high
Supply of bonds

\[ b_t^s = \eta_0 + \eta_q q_t + \eta_i (1 - \delta_i) i \]

\[ \eta_q \geq 0, \eta_i \geq 0 \]

- firm owner's not affected by "demand" channels
  - by assumption not affected by \( \tilde{\beta}_t \)
  - representative firm owner \( \Longrightarrow \) no idiosyncratic risk
Bond market

\[ b^s_t = b^d_t \]
Labor market

\[ n_{t+1} - n_t = \lambda_{w,t+1} (1 - n_t) - \rho_{x,t+1} n_t \]

- \( n_{t+1} \) is determined by \( i_t \) and \( \bar{y} \)
  - half of \( \Delta n_{t+1} \) due to \( \rho_{x,t+1} \)
  - half of \( \Delta n_{t+1} \) due to \( \lambda_{w,t+1} \)
Couple things to remember

- no multiplicity, no self-fulfilling beliefs
- two demand channels
  1. exogenous $\Delta \tilde{\beta}_t$
  2. endogenous: $E_t [n_{t+j}] \uparrow \implies$ precautionary savings $\uparrow$
change in savings when economy gets into recession

but more becoming unemployed

change in behavior employed
Object of interest: savings $\uparrow$ due to "fear"

- initial shock here $\tilde{\beta}_t \uparrow$ from 0.97 to 0.99

$\tilde{\beta}_t$ follows a two-state Markov process

- initial shock can be something else that decreases $E_t \left[ n_{t+j} \right]$
Two mechanisms

1 demand channel:
   \[ \tilde{\beta}_t \uparrow \implies c_t \downarrow \implies \pi_t \downarrow \implies i_t \uparrow \implies n_{t+j} \downarrow \implies c_t \downarrow \implies \pi_t \text{ etc.} \]

2 \[ n_t \downarrow \implies \text{buffer stock savings} \downarrow \implies c_t \downarrow \text{ etc.} \]

2 borrowing behavior of entrepreneur
persistent shock, $\eta_q = 5$, $\delta = 0.05$, $\phi = 0.5$, $\eta_i = 0$
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consumption entrepreneur when $\eta_q = 5$ and $\beta$ increases
persistent shock, $\eta_q = 5$, $\delta = 0.05$, $\phi = 0.5$, $\eta_i = 0$
Access to financing worsens downturn !!

- **Q:** What if entrepreneurs would not change supply of bonds, i.e., $\eta_q = 0$?

- **A:** Downturn is less severe
No financing, $\eta_i = 0, \eta_q = 0, \delta = 0.05, \phi = 0.5$
Access to inventory financing worsens downturn !!

- **Q:** What if entrepreneurs would not finance inventories: $\eta_i = 0$?

- **A:** Downturn is less severe
Plus inventory financing, $\eta_i > 0, \eta_q = 5, \delta = 0.05, \phi = 0.5$
Durable inventories worsen downturn

- **Q:** What if inventories depreciate less?
- **A:** Downturn is more severe
Less durable inventories, $\eta_i = 0$, $\eta_q = 0$, $\delta = 0.95$, $\phi = 0.5$
Flexible wages !!

- Q: what if wages are flexible?
- A: downturn is more severe
Flexible wages, $\eta_i = 0, \eta_q > 0, \delta = 0, \phi = 1$
What is still missing?

- optimal savings decision entrepreneur
  - easy and doesn’t seem to change much

- labor demand that depends on profitability (and thus on $\pi_t$)
  - introduce labor market matching model
Model with friction in 2 markets

- two agents:
  - workers (as above)
  - representative entrepreneur who owns the firm
- commodity market friction (as above)
- labor market friction
  - standard Mortensen-Pissarides
Representative entrepreneur/firm

\[
\max \mathbb{E} \sum_{t=0}^{\infty} \beta^{t-1} \frac{c_{e,t}^{1-\gamma_e} - 1}{1 - \gamma_e}
\]

s.t.

\[
s_t = A n_{t-1}^{\alpha} + i_{t-1}
\]

\[
c_{e,t} - b_t^s - \psi v_t = \pi_t s_t + q_t b_t^s
\]

\[
n_t = (1 - \delta_n) n_{t-1} + \pi_f t v_t
\]

\[
i_t = (1 - \delta_i) i_{t-1} + (1 - \pi_t) s_t
\]
Representative entrepreneur/firm - FOC

\[ q_t c_{e,t}^{-\gamma_e} = E_t \left[ \beta \tilde{\beta}_t c_{t+1}^{-\gamma} \right] \]

\[ c_{e,t} - b_{t-1}^s - \psi \nu_t = \pi_t s_t + q_t b_t^s \]

\[ n_t = (1 - \delta_n) n_{t-1} + \pi_{f,t} \nu_t \]

\[ i_t = (1 - \delta_i) i_{t-1} + (1 - \pi_t) s_t \]
Representative entrepreneur/firm - FOC

\[ v_{n,t} = \beta E_t \left[ \left( \frac{c_{e,t+1}}{c_{e,t}} \right)^{-\gamma_e} \left( -w_{t+1} + A \alpha n_t^{\alpha-1} \left( \frac{\pi_{t+1} \times 1}{1 - \pi_{t+1}} \right) + (1 - \rho_x) v_{n,t+1} \right) \right] \]

\[ v_{i,t} = E_t \left[ \beta \left( \frac{c_{e,t+1}}{c_{e,t}} \right)^{-\gamma_e} \left( \pi_{t+1} \times 1 + (1 - \pi_{t+1}) (1 - \delta_i) v_{i,t+1} \right) \right] \]
Equilibrium

\[ b_d^t = b_s^t \]
\[ \pi_t = \bar{\pi} + \phi \frac{c_t}{\bar{c}_0} \]
\[ \pi_{f,t} = \phi_0 v_t^{\phi_1} (1 - n_{t-1})^{1-\phi_1} \]

wage setting rule
Basic story

- $\bar{\beta}_t \uparrow \implies$
- consumers want to save more $\implies$
- $q_t \uparrow \implies$ which induces firms to borrow more $\implies$
  - (unless firms are insensitive to $q_t \uparrow$)
- consumers indeed save more and spend less $\implies$
  - $\pi_t \downarrow \implies$ inventories $\uparrow$
- with persistence $E_t \left[ \pi_{t+j} \right] \downarrow \implies n_t \downarrow$
With and without persistence

- after $\tilde{\beta} \uparrow \implies$ consumers are rich $\implies \pi \uparrow \implies n \uparrow$ now
- with persistence: this effect takes a while to kick in
one-time shock, sticky wages, $\delta_i = 1$, $\gamma = 3$
persistent shock, sticky wages, $\delta_i = 1$, $\gamma = 3$
Allow for partial depreciation inventories

- $\pi_t \uparrow$ not so bad if unsold commodities can be sold next period
- $\uparrow$ in inventory has no impact on demand for labor by firm in standard matching model
- $\implies \delta \downarrow \implies$ smaller downturn
persistent shock, sticky wages, $\delta_i = 0.2, \gamma = 3$
Allow for flexible wages

downward wages:

- could reinforce reduction in spending desire
- dampening effect on profit decrease more important here
persistent shock, flexible wages, $\delta_i = 1, \gamma = 3$
Make consumption smoothing less important

- Savings make downturn worse
- $\gamma \downarrow \implies \left( \frac{\Delta \text{savings}}{\Delta \beta} \right) \uparrow \implies$ more unsold commodities $\implies$ bigger downturn
persistent shock, sticky wages, $\delta_i = 1$, $\gamma = 1$
What is still missing?

- inventory $\uparrow \not\Rightarrow$ demand for labor $\downarrow$
Why this is different from Diamond

Diamond

Mortensen-Pissarides

Labor flow equation

Labor flow equation

return on vacancy

return on vacancy
Could be similar to Diamond

Diamond

Mortensen-Pissarides
Spirit similar to Diamond

Diamond

Mortensen-Pissarides
Key friction

• demand $\downarrow$
• $\implies \pi \downarrow$
• $\implies$ expected value producing, $v_n$, $\downarrow$
• $\implies n \downarrow$, etc
Durables and demand glut

- durables are an obvious victim of "desire to spend less"
- nondurables may not even be affected that much
- what if demand glut means demand for durables↓
**Approach 2**

approach 1  approach 2

demand ↓ demand ↓

$$\implies \pi \downarrow$$  $$\implies \text{price of durables} \downarrow$$

$$\implies v_n \downarrow$$  $$\implies v_n \downarrow$$

$$\implies n \downarrow$$  $$\implies n \downarrow$$
Durables and demand glut

the role of $\pi_t$ can be replaced by relative price of durables $p$

- demand for durables ↓ $\iff$ $p$ ↓
- $\implies$ less demand for workers in durable sector
  - need friction to hamper transition to other sectors
- $\implies$ now inventory ↑ should reduce $p$
Demand for durables and unemployment uncertainty

• suppose a period with higher unemployment uncertainty starts
Demand for durables and unemployment uncertainty

- suppose a period with higher unemployment uncertainty starts
- what happens with demand for durables?
Demand for durables and unemployment uncertainty

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- What happens with demand for durables?
- In many models it *increases*
Demand for durables and unemployment uncertainty

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  • form of savings *even* in the aggregate
Demand for durables and unemployment uncertainty

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- small changes not enough
Demand for durables and unemployment uncertainty

- suppose a period with higher unemployment uncertainty starts
- what happens with demand for durables?
- in many models it increases
  - form of savings even in the aggregate
- small changes not enough
  - e.g. imposing $d_t \geq (1 - \delta_d) d_{t-1}$ lowers supply so firms are more protected from demand drops
Very simple model with durables

- One-period model
- Two types of workers
  - work in durable sector
  - work in non-durable sector
  - cannot switch sector
Individual household

- Two cases:
  1. full unemployment insurance
  2. no insurance
Durable producers

Free entry determines vacancies and employment:

\[
v_{n,t} = \beta E_t \left[ \left( \frac{c_{e,t+1}}{c_{e,t}} \right)^{-\gamma_e} \left( -\omega_{t+1} + A\alpha n_t^{\alpha - 1} \left( \frac{p_{t+1}}{\pi_{t+1}} \times 1 \right) \right) + (1 - \rho_x) v_{n,t+1} \right]
\]

instead of

\[
v_{n,t} = \beta E_t \left[ \left( \frac{c_{e,t+1}}{c_{e,t}} \right)^{-\gamma_e} \left( -\omega_{t+1} A\alpha n_t^{\alpha - 1} \left( \frac{\pi_{t+1} \times 1}{\pi_{t+1}} \right) + (1 - \rho_x) v_{n,t+1} \right) \right]
\]
General versus durable glut

- general glut: $\pi_t \downarrow$
- durable glut: $p_t \downarrow$
Non-durable producers

- stable sector
- employment is fixed
aggregate durable demand, \( D = d_o + d \)

price of the durable, \( Q \)

GE demand

shift in PE due to shift in supply curve
shift in PE demand due to supply decrease

aggregate durable demand, $D = d_o + d$

price of the durable, $Q$

GE demand
aggregate durable demand, $D = d_o + d$

partial equilibrium demand curve

general equilibrium demand curve
aggregate durable demand, $D = d_o + d$
Concluding comment
Concluding comment

- still a lot to do
Importance of "demand"

In Frankrijk, Italië en Duitsland zullen de komende maanden minder Fiats, Peugeots, Renaulds en Opels van de lopende band rollen. De autofabrieken schroeven hun productie terug, omdat ze doodsbang zijn om met onverkoopbare voorraden opgescheept te zitten. En die kans is reëel, want de verkoop van auto's zakt de laatste maanden fors in. Elke nieuwe auto die dan van de band rolt, kost geld. NOS website Oct 19 2011
http://nos.nl/artikel/305152-rem-op-productie-autos.html