A Model of Aggregate Demand, Idleness, and Unemployment

Pascal Michaillat (LSE) & Emmanuel Saez (Berkeley)

June 2014
Motivation

Unemployment rate
Motivation

Unemployment rate

Technology?
Aggregate demand?
Motivation

Unemployment rate

3% 5% 7% 9% 11%

Technology?
Aggregate demand?
Mismatch?
Low job search?
Low participation?
Motivation

Unemployment rate

- Technology?
- Aggregate demand?
- Mismatch?
- Low job search?
- Low participation?
- Transfers?
- Monetary policy?
- Unemployment insurance?
- Payroll tax?
- Nothing?
The available models

1. matching model of the labor market
   ▶ tractable + microfounded + comparative statics
   ▶ but no product market + no aggregate demand

2. ?

3. New Keynesian DSGE model
   ▶ product market + many shocks + realistic quantitatively
   ▶ but greater complexity + reliance on simulations
The general disequilibrium model?

- vast literature after Barro & Grossman [1971]
- recent revival after Great Recession
  - Mankiw & Weinzierl [2011]
  - Caballero & Farhi [2014]
- captures important intuitions
- but difficult to manage rationing, to analyze, and to map with data
This model

equilibrium version of the Barro-Grossman model, built on **matching frictions** on product + labor markets:

- graphical representation of GE and welfare
- frictional + classical + Keynesian unemployment
- broad range of comparative statics
- empirical measures of slack
Overview of the model
A static model with 3 goods

- **nonproduced good** ("gold"): fixed supply, valued by workers, traded on competitive market
- **produced good** ("services"): produced by firms, valued by workers, traded on frictional market
- **labor**: fixed supply, hired by firms, traded on frictional market
Formalization of matching process

$k$ slots available

$\nu$ visits
Formalization of matching process

capacity $k$

sales

CRS matching function $h(k, v)$
purchases

visits $v$
Formalization of matching process

output: \( y = h(k, v) \)

\[
\text{sales} = k \cdot h(1, x) = k \cdot f(x)
\]

\[
\text{purchases} = v \cdot h\left(\frac{1}{x}, 1\right) = v \cdot q(x)
\]

tightness: \( x = v / k \)
Formalization of matching process

- Selling probability $f(x)$
- Buying probability $q(x)$
- Output $y$
- Capacity $k$
- Tightness $x$
- Visits $\nu$

\[ \text{Capacity } k \]

- Selling probability $f(x)$ decreases
- Output $y$ decreases
- Buying probability $q(x)$ increases
- Visits $\nu$ decreases

\[ \text{tightness } x \downarrow \]
Formalization of matching process
Formalization of matching process

capacity $k$ ↓

selling probability $f(x)$ ↑

output $y$ ↓

buying probability $q(x)$ ↓

visits $v$

tightness $x$ ↑
Formalization of matching process
Formalization of matching cost

- matching cost = $\rho$ services per visit
- output dissipated by visits = $c \cdot \tau(x)$

proof:

\[
\begin{align*}
\text{output} & = y = c + \rho \cdot v \\
\text{consumption} & = c + \rho \cdot \frac{y}{q(x)} \\
\Rightarrow & \quad y \cdot \left[1 - \frac{\rho}{q(x)}\right] = c \\
\Rightarrow & \quad y = \left[1 + \frac{\rho}{q(x) - \rho}\right] \cdot c \equiv \left[1 + \tau(x)\right] \cdot c
\end{align*}
\]
Supply side on product market

product market tightness: $x$

quantity of produced goods

price
Supply side on product market

- capacity: $k$

quantity of produced goods

product market tightness $x$
Supply side on product market

output: \[ y = f(x) \]  
capacity \( k \)

product market tightness \( x \)

quantity of produced goods

output: \[ y = f(x) \]  
capacity \( k \)
Supply side on product market

output $y$

capacity $k$

consumption:

$c = \frac{f(x) \cdot k}{1 + \tau(x)} = [f(x) - \rho \cdot x] \cdot k$

quantity of produced goods
Supply side on product market

- Aggregate supply $c$
- Output $y$
- Capacity $k$
- Consumption
- Visits
- Idle labor

Product market tightness $x$

Quantity of produced goods
Supply side on labor market

- labor supply \( n \)
- employment \( l \)
- labor force \( h \)
- producers
- recruiters
- unemployment

Number of workers vs labor market tightness \( \theta \)
Partial equilibrium on product market
Partial equilibrium on labor market

The diagram illustrates the relationship between labor market tightness ($\theta$) and the number of workers. The intersection of the labor demand and labor supply curves indicates the partial equilibrium. The vertical axis represents labor market tightness, while the horizontal axis indicates the number of workers. The employment curve shows the relationship between the number of workers and the labor force.
Keynesian, classical, and frictional unemployment

unemployment determined by three sources:

- recruiting costs (frictional)
- real wage (classical)
- probability to sell production (Keynesian)
General equilibrium

- 4 variables:
  - product market tightness + price
  - labor market tightness + wage

- 2 equations:
  - aggregate demand = aggregate supply
  - labor demand = labor supply

- 2 equations but 4 variables: indeterminacy

- need price-setting and wage-setting mechanism
Welfare

- Supply
- Number of trades
- Price too high
- Slack market
- Demand

Diagram showing the relationship between tightness, quantity, and the number of trades.
Welfare

- Price too low
- Quantity
- Demand
- Supply
- Tightness
- Number of trades
- Tight market
- Price too low

Diagram shows the relationship between supply, demand, and tight market conditions.
Welfare

- Supply
- Number of trades
- Quantity
- Tightness
- Efficient market
- Efficient price (Hosios)
- Demand
Overview of the empirical analysis
Capacity utilization in Survey of Plant Capacity
Log product market tightness
Evidence of price rigidity

Log-deviation from HP trend

stand. dev. = 14%
Evidence of wage rigidity

![Graph showing log-deviation from HP trend with standard deviation of 25%]

stand. dev. = 25%
Positive AD shock with rigid price
Positive AD shock with rigid price

![Graph showing the relationship between product market tightness, aggregate supply, output, capacity, aggregate demand, and quantity of produced goods.](image-url)
Positive AS shock with rigid price

- Aggregate supply
- Output
- Capacity
- Aggregate demand
- Quantity of produced goods
- Product market tightness
Evidence of AD shocks

![Graph showing log-deviation from HP-trend against product market tightness over time from 1974 to 2009.](image)
Product market tightness and output

Sample crosscorrelation

Lags (quarters)

0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-4
-3
-2
-1
0
1
2
3
4