Incomplete Labor Markets

July 2012

Narayana Kocherlakota

Federal Reserve Bank of Minneapolis
Disclaimer

- Usual disclaimer: I am not speaking for others in the Federal Reserve or on the Federal Open Market Committee.

- But I’ll make an even stronger disclaimer: I’m exploring a new theoretical model ...

- And so the results do not necessarily reflect my thinking about policy.
Three (Common) Assumptions in Macro

- Households are homogeneous.
- Households supply labor in competitive markets.
- Aggregate labor market clears instantaneously.
US Labor Data Since 2007:IV

• Per capita consumption has fallen.

• Real compensation per hour is roughly flat.

• The three assumptions imply that per capita hours should be about the same or maybe even slightly higher.

• BUT : per capita hours have fallen greatly.
Incomplete Labor Markets Models

- Motivated by data, I drop assumption 3 - labor market clearing.

- Formally: remove household optimization decision over labor.

- Replace with: exogenously specified real interest rate.
• In these models, agents cannot offer to work more at a lower wage.

• That is, the models ban certain kinds of mutually beneficial trades ...

• Just like in models of incomplete financial markets.
  – See Chien, Cole, Lustig (2011, RES) for recent example.
Exogenous Real Interest Rate in a Closed Economy?

- Interpretation: given nominal rate, is expected inflation rate exogenous?
- In standard model: expected inflation rate is an equilibrium object.
  - Adjusts so as to clear labor market.
- In incomplete labor markets model: expected inflation rate is exogenous.
Benchmark Model

- What is the impact of a fall in land prices in OG economy with inelastic labor?
  - Source of land price fall is not modeled in an interesting way.
  - People just don’t like land as much as they used to.
• Complete labor markets: there is no change in employment.
  – *Endogenous* real interest rate falls.

• Incomplete labor markets: employment falls
  – unless the *exogenous* real interest rate is lowered enough.

• The paper provides a linkage between asset price falls and employment declines.
Three Generalizations

• Add capital.

• Land price is a bubble.

• Translation into Bewley economy.
Policy Implications in Incomplete Labor Markets Model

- With incomplete labor markets + land price fall:
  - Debt-financed government spending is Pareto improving
  - Lowering real interest rate is Pareto improving.
  - Increasing transfers to the old is Pareto improving.
The Paper’s Approach Is ...

• Distinct from New Keynesian Models.
  – In this paper: product prices are flexible.
  – In this paper: a liquidity trap can last forever.

• Distinct from rigid real-wage models (Shimer (2012)).
  – Those models hinge on shocks to labor demand, not product demand.

• Similar to Hall (2011).
BENCHMARK MODEL
Structure

- OG model
  - agents live for two periods
  - constant population
Endowments

- Initial old endowed with one unit of land.

- Land generates one unit of services in every period.

- Young have one unit of time - can produce $An$ by working $n$. 
Preferences

\[ u(c_y) + \beta u(c_o + \theta d_o), \theta > 0 \]

- \( c_y, c_o \) is consumption of young, old.

- \( d_o \) is land services received by old.


**Government**

- Initial old each own $B$ units of one-period real government debt.

- One unit of debt pays off one unit of consumption.

- Government pays off obligations:
  - new debt sales
  - lump-sum taxes on young
Complete Labor Markets Equilibrium (def’n)

- Households solve:

\[
\max_{c_y, c_o, L, n, b} \ u(c_y) + \beta u(c_o + \theta L) \\
\text{s.t.} \ c_y + p_L L + qb = wn - \tau^* \\
c_o = p_L L + b
\]

- Firms solve:

\[
\max_{n \geq 0} An - wn
\]
• Markets clear:

\[ c_y^* + c_o^* = An^* \]

\[ L^* = 1 \]

\[ b^* = B \]

\[ \tau^* = B - qB \]
Complete Labor Markets Equilibrium (Conditions)

\[\begin{align*}
w & = A \\
n^* & = 1 \\
\tau^* & = B(1 - q) \\
c^*_y & = wn^* - p_L - B \\
c^*_o & = p_L + B \\
p_L & = q\theta/(1 - q) \\
q u'(c^*_y) & = \beta u'(c^*_o + \theta)
\end{align*}\]
Complete Labor Markets Equilibrium (Comparative Statics)

Suppose $\theta$ falls.

- $n^*$ doesn’t change.
- $q$ rises (lower real rate).
Suppose $B$ rises.

- $n^*$ doesn’t change.

- $q$ falls.

- Dynamically efficient eq’m: All agents are worse off (except initial old).
Households don’t maximize over $n$:

$$\max_{c_y, c_o, b, L} u(c_y) + \beta u(c_o + \theta L)$$

subject to:

$$c_y + p_L L + qb = wn^* - \tau^*$$

$$c_o = p_L L + b$$

Firms solve:

$$\max_{n \geq 0} An - wn$$
• Markets clear:

\[ c_y^* + c_o^* = An^* \]

\[ L^* = 1 \]

\[ b^* = B \]

\[ \tau^* = B - qB \]
Intuition?

• Firms take total product demand as given, and compete for *market share*.
  – Competition drives down output price to equal $w/A$.

• But firms don’t compete in labor market.
  – That is, they won’t hire workers who offer to work for less than $w$. 
Incomplete Labor Markets Equilibrium (Conditions)

\[ q \text{ given} \]
\[ w = A \]
\[ \tau^* = B(1 - q) \]
\[ c_y^* = wn^* - p_L - B \]
\[ c_o^* = p_L + B \]
\[ p_L = q\theta/(1 - q) \]

\[ qu'(c_y^*) = \beta u'(c_o^* + \theta) \]
Incomplete Labor Markets Equilibrium (Comparative Statics)

Everything hinges on the Euler equation:

\[ q\theta'(wn^* - q\theta/(1 - q) - B) = u'(\theta + B + q\theta/(1 - q)) \]

- Suppose \( \theta \) falls and \( q \) doesn’t change.

- Then \( n^* \) falls.
Suppose $n^* < 1$ and $B$ rises.

- $n^*$ rises

- All agents are better off (both $c_y^*$ and $c_o^*$ rise) ...

- ... even though eq’m is dynamically efficient ($q < 1$).
GENERALIZATIONS
1. Capital

\[ w = F_n(k^*, n^*) \]
\[ r = F_k(k^*, n^*) \]
\[ qu'(c_y^*) = \beta u'(c_o^* + \theta) \]
\[ q(1 - \delta + r) = 1 \]
\[ \tau^* = B(1 - q) \]
\[ c_y^* = wn^* - p_L - B - k^* \]
\[ c_o^* = p_L + B + k^*(1 - \delta + r) \]
\[ p_L = q\theta/(1 - q) \]
Comparative statics work as before if:

\[ u \text{ is NIARA} \]

\[ wn^* - k^* > k^*(1 - \delta + r) \]

\[ q \leq \beta \]

\[ F_{kk}k > -1 \]
2. Bubbles

- Preferences:
  \[ u(c_y) + \beta u(c_o) \]

- If \( q = 1 \), then there is a continuum of SS equilibria indexed by \( p_L \):
  \[
  u'(c^*_y) = \beta u'(c^*_o) \\
  c^*_y = An^* - p_L - B \\
  c^*_o = p_L + B
  \]
• If $q < 1$, $p_L = 0$.

• If $q > 1$, continuum of SS equilibria that converge to zero.
3. Bewley Economy

• Two groups of agents with offsetting productivity fluctuations.

• Agents are borrowing constrained.
  – High-income types are like the young.
  – Low-income types are like the old.

• Need additional condition $q \geq \beta$. 
DATA AND POLICY PERSPECTIVES
Positive Analysis

• U.S. residential land price fell by over 50% since 2006.

• I will treat that as largely unanticipated.

• Question: how does an unanticipated fall in $\theta$ in period $T$ affect current and future $n$?
• Assume \( q \) and \( B \) don’t change.

• Employment falls immediately and permanently to \( n' \) that solves:

\[
\begin{align*}
c'_o & = B + \theta'/ (1 - q) \\
c'_y & = u'^{-1}(\beta q^{-1} u'(c'_o)) \\
n' & = \frac{c'_y + c'_o}{A}
\end{align*}
\]
Normative Analysis: Interest Rates

- Suppose that $q$ rises permanently to $q'$ in period $T$, when $\theta$ falls.

- Then, $n$ falls by less: that is, to $n'_q > n'$ where:

\[
\begin{align*}
    c_o(q') &= B + \frac{\theta'}{1 - q'} \\
    c_y(q') &= u^{n'-1} \left( \frac{\beta u'(c_o(q'))}{q'} \right) \\
    n'_q &= \frac{c_y(q') + c_o(q')}{A}
\end{align*}
\]
• The rise in $q$ (fall in interest rate) impacts $n'_q$ in two ways.

• First, land prices rise - that generates more demand among the old and the young.

• Second, the lower real interest rate leads the young to demand more.
  – This effect is muted if the EIS is small.
Normative Analysis: Debt Policy

- Suppose that $B$ permanently rises to $B'$ in period $T$, when $\theta$ falls.

- Government spends extra resources in period $T$ on:
  - public goods OR
  - transfers to the old

- Rolls over debt in future periods and sets $\tau' = (1 - q)B'$.
• Then, \( n \) falls by less: that is, to \( n'_B > n' \) where:

\[
c_o(B') = B' + \theta'/(1 - q)
\]

\[
c_y(B') = u'^{-1} \left( \frac{\beta u'(c_o(q'))}{q} \right)
\]

\[
n'_B = \frac{c_y(B') + c_o(B')}{A}
\]

• Higher \( B' \) allows old to consume more - and generates more demand for young.

• NOTE: Policy change makes everyone better off.
Normative Analysis: Transfers to the Old

• In period $t \geq T$: increase $\tau^*$ to $\tau'$ and transfer $\tau' - \tau^*$ to the old.

• Then: $n$ falls by less: that is, to $n'_\tau > n'$ where:

  $$c_o(\tau') = B + \theta'/(1 - q) + \tau' - \tau^*$$

  $$c_y(\tau') = u' - 1 \left( \frac{\beta u'(c_o(\tau'))}{q} \right)$$

  $$n'_\tau = \frac{c_y(\tau') + c_o(\tau')}{A}$$

• Again, both $c_y$ and $c_o$ rise - everyone’s better off.
SOME CONCLUSIONS
• Inside of incomplete labor market OG models:

• Unanticipated land price fall generates a persistent and inefficient fall in employment.

• Many government interventions are beneficial:
  – Lower real interest rate
  – Temporary debt-financed government spending has permanent effects
  – Transfers from young to old
• Note that in incomplete labor market models:
  – prices are flexible
  – real wages are flexible
  – expectations are rational
  – equilibrium is dynamically efficient
  – limited financial market frictions and heterogeneity

• Nonetheless, “Keynesian” interventions are beneficial.
• Tentative conclusion: the structure of the labor market is critical to policy debate.

• Not surprising: cyclical properties of labor market are still not well understood.

• Academics and policymakers both need better models of aggregate labor markets.