

# Incomplete Labor Markets

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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:

$$\begin{aligned} \max_{c_y, c_o, L, n, b} & \quad u(c_y) + \beta u(c_o + \theta L) \\ \text{s.t.} & \quad c_y + p_L L + qb = wn - \tau^* \\ & \quad c_o = p_L L + b \end{aligned}$$

- 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)

$$w = A$$

$$n^* = 1$$

$$\tau^* = B(1 - q)$$

$$c_y^* = wn^* - p_L - B$$

$$c_o^* = p_L + B$$

$$p_L = q\theta/(1 - q)$$

$$qu'(c_y^*) = \beta u'(c_o^* + \theta)$$

## 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).

## Incomplete Labor Markets Equilibrium (def'n)

- Households don't maximize over  $n$ :

$$\begin{aligned} \max_{c_y, c_o, b, L} & u(c_y) + \beta u(c_o + \theta L) \\ \text{s.t.} & c_y + p_L L + qb = wn^* - \tau^* \\ & c_o = p_L L + b \end{aligned}$$

- 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)

$q$  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:

$$\begin{aligned} & qu'(wn^* - q\theta/(1 - q) - B) \\ &= u'(\theta + B + q\theta/(1 - q)) \end{aligned}$$

- 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:

$u$  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.

- Woodford (1986) isomorphism: OG model = Bewley economy.
  - 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:

$$c'_o = B + \theta' / (1 - q)$$

$$c'_y = u'^{-1}(\beta q^{-1} u'(c'_o))$$

$$n' = \frac{c'_y + c'_o}{A}$$

## 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:

$$\begin{aligned}c_o(q') &= B + \theta' / (1 - q') \\c_y(q') &= u'^{-1} \left( \frac{\beta u'(c_o(q'))}{q'} \right) \\n'_q &= \frac{c_y(q') + c_o(q')}{A}\end{aligned}$$

- 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:

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

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

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

- 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:

$$\begin{aligned}c_o(\tau') &= B + \theta' / (1 - q) + \tau' - \tau^* \\c_y(\tau') &= u'^{-1} \left( \frac{\beta u'(c_o(\tau'))}{q} \right) \\n'_\tau &= \frac{c_y(\tau') + c_o(\tau')}{A}\end{aligned}$$

- 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.