Labor Market Dynamics and the Business Cycle

Toshihiko Mukoyama

Georgetown University

JEA Nakahara Lecture, June 2018

Two topics today

I will divide today's lecture into two parts:

- First, I will talk about the line of research associated with this prize. (* for the ones cited by the committee.)
  - Costs of business cycles
  - Labor market frictions and heterogeneity
  - Labor supply, labor demand, and the business cycle.
- Second, I will talk about the new paper written for the *Japanese Economic Review*.
  "Heterogeneous Jobs and the Aggregate Labor Market"

Costs of business cycles

How does the heterogeneity of consumers affect the business cycle analysis?

- For positive questions: Not much. (Krusell and Smith, 1998 *JPE*; KS)
  - Formulation of preferences: "homotheticity across time" (balanced growth) implies "homotheticity in cross section" (Gorman aggregation). This is true when people are well-insured.
  - The asset market is not "one person one vote": People with more votes (the rich) tend to be well-insured.
- How about normative questions?

Costs of business cycles

Some people may be affected by business cycles more than others.

- Background: Lucas (1987 *Models of Business Cycles*) calculated that the cost of business cycles for a representative consumer is 0.008% of consumption equivalent.
- When asset markets are incomplete (which means that idiosyncratic shocks such as unemployment shocks matter) and idiosyncratic shocks are correlated with aggregate shocks, business cycles may affect some more than others.

Costs of business cycles

- Mukoyama and Şahin (2006, *JME*) "Costs of Business Cycles for Unskilled Workers": for a borrowing-constrained, unskilled, and unemployed worker, the cost of business cycles can be as high as 0.6% of consumption equivalent.
- *Krusell, Mukoyama, Şahin, and Smith (2009, *RED*) "Revisiting the Welfare Effects of Eliminating Business Cycles": for a borrowing-constrained, impatient, and long-term unemployed worker, the cost can be as high as 8.8% of consumption equivalent.

Labor market frictions and heterogeneity

- These cost calculations have to make some arbitrary assumptions on what will happen to the nature of idiosyncratic shocks when business cycles are eliminated.
- These models are limited for policy analyses too, as the idiosyncratic shocks are assumed to be exogenous.
- Given that the idiosyncratic shocks we consider are often unemployment shocks, it is a reasonable first step to endogenize unemployment to business cycle shocks.
- The workhorce model of endogenous unemployment in business cycles: Diamond-Mortensen-Pissarides (DMP) model.

Labor market frictions and heterogeneity

- *Krusell, Mukoyama, and Şahin (2010, *REStud*) "Labour-Market Matching with Precautionary Savings and Aggregate Fluctuations": merges the DMP model and the KS model, and then analyzes (i) unemployment insurance (UI) policy and (ii) business cycles. Methodological obstacles:
  - Nash bargaining implies that wages depend on individual wealth $\rightarrow$ treat wages as functions of wealth.
  - in a DMP model, a firm earns profits and we have to appropriately price future profits $\rightarrow$ this can be achieved by introducing sufficient number of assets to span all *aggregate* states.

Labor market frictions and heterogeneity

- The second point is extended in Krusell, Mukoyama, and Smith (2010, *JET*) "Asset Prices in a Huggett Economy." The model is widely used in recent New Keynesian papers (Werning; McKay, Nakamura, and Steinsson; Ravn and Sterk; Bilbiie, etc.).
- UI policy is more extensively analyzed in Mukoyama (2013, *JMacro*) "Understanding the Welfare Effects of Unemployment Insurance Policy in General Equilibrium"

Labor supply, labor demand, and the business cycle

- A typical DMP model do not consider the labor supply margin. This is in stark contrast to the traditional RBC analysis.
- This seems reasonable in analyzing unemployment U; typically unemployed workers search for jobs harder in recessions—see Mukoyama, Patterson, and Şahin (2018, *AEJ Macro*) "Job Search Behavior over the Business Cycle."
- However, there are many people moving directly from N (nonparticipation) to E (employment), that is, making labor force participation decision. The population of the flow from N to E is typically larger than U to E flow. And labor force participation rate is weakly procyclical.
- Analyzing the labor supply decisions together with frictional unemployment requires a new framework.

Labor supply, labor demand, and the business cycle

- In a series of papers, we have gradually built a model of labor supply and labor market frictions.
  - Krusell, Mukoyama, Rogerson, and Şahin (2008, *JME*) "Aggregate Implications of Indivisible Labor, Incomplete Markets, and Labor Market Frictions"
  - Krusell, Mukoyama, Rogerson, and Şahin (2011, *JET*) "A Three State Model of Worker Flows in General Equilibrium"
  - Krusell, Mukoyama, Rogerson, and Şahin (2010, *QE*) "Aggregate Labor Market Outcomes: The Roles of Choice and Chance"
  - *Krusell, Mukoyama, Rogerson, and Şahin (2017, *AER*) "Gross Worker Flows over the Business Cycle"
- In the last paper, we analyze the business cycle dynamics. The model can successfully account for the dynamics of flows across E, U, and N on average and also in business cycles. Heterogeneity plays an essential role.

Future of this line of research (heterogeneous agents and labor market)

- Projects on the dynamics of firms to better understand the labor demand.
- Issues of mismatch, sorting, misallocation (e.g. a working paper with Ismail Baydur)
- Life cycle and gross worker flows. (e.g. a project with Tomaz Cajner and Ilhan Guner)
- Application to various policy analyses. (Recently we see more examples in the monetary policy analysis.)

Ok, let's talk about something new.

Heterogeneous Jobs and the Aggregate Labor Market

Motivation

- In the standard DMP model, (ex ante) heterogeneity of jobs and workers are not explicit.
- Here I analyze the ex ante job heterogeneity explicitly.
- Two results:
  - Efficiency of an equilibrium
  - Effects of (aggregate) productivity shocks
- Related papers:
  - Bertola and Caballero (1994, *REStud*), Davis (2001, *NBER WP*), Acemoglu (2001, *JoLE*), Ljungqvist and Sargent (2012, Section 28.4): heterogeneous jobs, focus on efficiency.
  - Elsby and Michaels (2013, *AEJ Macro*), Kaas and Kircher (2015 *AER*), Lise and Robin (2017 *AER*): heterogeneous firms, but different settings. Less tractable.
  - Bils, Chang, and Kim (2012, *JME*), Mueller (2017, *AER*): heterogeneous workers.

The continuous-time model

- Consumers (workers) are identical and maximize the utility

$$\boldsymbol{U} = \int_0^\infty e^{-rt} c(t) dt.$$

- The total population is 1, and a worker is either employed at a type-i job or unemployed:

$$\sum_i n^i(t) + u(t) = 1.$$

- Jobs can be different in terms of productivity, stability, worker's bargaining power, and the vacancy posting cost (cost of job creation).

The continuous-time model

The frictional labor market:

- Labor market tightness of market for type i:

$$\theta^i(t) \equiv \frac{v^i(t)}{u(t)}.$$

- The Poisson rate that a type-i vacancy finds a worker is $q^i(\boldsymbol{\theta}(t))$, where $\boldsymbol{\theta}(t) \equiv \left\{\theta^1(t), \theta^2(t), \cdots, \theta^N(t)\right\}$.
- This means that the total type-i match is $v^i q^i(\boldsymbol{\theta}(t))$ and an unemployed worker's job-finding rate is

$$\frac{v^i q^i(\boldsymbol{\theta}(t))}{u(t)} = \theta^i(t) q^i(\boldsymbol{\theta}(t)).$$

- Separation rate: σ^i.
- Flow cost of vacancy posting: κ^i. Firms post vacancies until the net value of vacancy is driven down to zero. (Free entry.)
- Wages are determined by the Generalized Nash Bargaining, with worker's bargaining power parameter $\gamma^i \in (0, 1)$.

The continuous-time model

Two examples:

- Perfectly segmented markets (no externality across types): the matching function $M^i(u, v^i)$ implies

$$q^i(\boldsymbol{\theta}) = M^i\left(\frac{1}{\theta^i}, 1\right).$$

- Perfect pooling: the matching function $M\left(u, \sum_k v^k\right)$ implies

$$q^i(\boldsymbol{\theta}) = M\left(\frac{1}{\sum_k \theta^k}, 1\right).$$

Efficiency

Proposition:
In the steady state, the market equilibrium is socially efficient if

$$\gamma^i = \sum_j \varepsilon_i^j \frac{\kappa^j/(1-\gamma^j)}{\kappa^i/(1-\gamma^i)}$$

for all i, where

$$\varepsilon_i^j \equiv -\frac{\theta^j(\partial q^j(\boldsymbol{\theta})/\partial \theta^i)}{q^j(\boldsymbol{\theta})}.$$

- The original Hosios (1990) condition corresponds to $\gamma^i = \varepsilon_i^i$.
- Here, we have to consider all externalities imposed by the vacancy posting.

Business Cycles

Proposition:
Suppose that there are no externalities across the markets, that is, $q^i(\boldsymbol{\theta})$ depends only on θ^i. Let $\hat{p}^i$ and $\hat{\theta}^i$ be the log deviation of the variables p^i and θ^i. Suppose that $\hat{p}^i > 0$ and $\hat{p}^j = 0$ for all $j \neq i$. Then $\hat{\theta}^i > 0$ and $\hat{\theta}^j < 0$.

- The effect across types comes from the wage change.
- With externality, there will be another channel.
- This is the steady-state comparison.
- Next I analyze the dynamic reaction to the shocks by building a discrete-time model.

Business Cycles

For quantitative experiments, I construct the discrete-time version of the model. The log-deviations of θ^i and (p_t^i, p_t^j) have the following relationship:

$$\hat{\theta}_t^i = \psi^i \hat{p}_t^i + \phi^i \hat{p}_t^j.$$

	ψ^1	ϕ^1	total 1	ψ^2	ϕ^2	total 2
(i) Baseline	11.8	−8.6	3.2	11.8	−8.6	3.2
(ii) $\bar{p}^1 = 1.01$, $\bar{p}^2 = 0.99$	8.8	−6.3	2.5	18.1	−13.4	4.6
(iii) $\sigma^1 = 0.02$, $\sigma^2 = 0.10$	6.6	−4.0	2.6	23.0	−17.4	5.6
(iv) Both $\bar{p}$ and σ	5.8	−3.5	2.4	49.7	−38.5	11.2

- Heterogeneity in $\bar{p}^i$ and σ^i affects the propagation of shocks.
- A strong total propagation comes with even stronger propagations to type-specific shocks.

Business Cycles

US Data:

		u	v	v/u	p
Standard Deviation		0.125	0.139	0.259	0.013
Quarterly Autocorrelation		0.870	0.904	0.896	0.765
Correlation Matrix	u	1	−0.919	−0.977	−0.302
	v	—	1	0.982	0.460
	v/u	—	—	1	0.393
	p	—	—	—	1

Baseline model:

		u	v	v/u	p
Standard Deviation		0.011	0.032	0.041	0.0130
Quarterly Autocorrelation		0.818	0.703	0.763	0.765
Correlation Matrix	u	1	−0.851	−0.913	−0.814
	v	—	1	0.991	0.973
	v/u	—	—	1	0.961
	p	—	—	—	1

- Successful in generating the Beveridge curve, but the model fluctuations are small ("labor market volatility puzzle").

Business Cycles

Baseline model:

		u	v	v/u	p
Standard Deviation		0.011	0.032	0.041	0.0130
Quarterly Autocorrelation		0.818	0.703	0.763	0.765
Correlation Matrix	u	1	−0.851	−0.913	−0.814
	v	—	1	0.991	0.973
	v/u	—	—	1	0.961
	p	—	—	—	1

Model with $\bar{p}$ and σ heterogeneity:

		u	v	v/u	p
Standard Deviation		0.020	0.071	0.089	0.0129
Quarterly Autocorrelation		0.789	0.719	0.763	0.764
Correlation Matrix	u	1	−0.892	−0.922	−0.846
	v	—	1	0.995	0.969
	v/u	—	—	1	0.959
	p	—	—	—	1

- Stronger labor market response with heterogeneous jobs.

Summary

- In the first half, I outlined the line of research that I conducted in the recent past, mostly on business cycles, labor market, and heterogeneity.
- In the second half, I presented a new paper prepared for the *JER*.
  - When jobs are heterogeneous, the efficiency condition has to incorporate externalities across different labor markets.
  - Type-specific shocks can affect different types through wages (and matching externalities).
  - An aggregate productivity shock can have a larger impact on the labor market when jobs are different in terms of average productivity and job stability.