Explaining the Unemployment Fluctuations in Taiwan

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Motivation

Unemployment Rate

Vacancy

- Unemployment: Different Regime before and after 1990s
- Vacancy in Taiwan
  - Series begins from 1997
  - Semi-Annual: Low frequency data cannot represent the high mobility in the labor market

Research Question

- Sources of Unemployment Fluctuations
    - Matching Frictions: Frictional Unemployment
    - Job Rationing (Michaillat 2012): Rationing Unemployment
- Is Labor Search-and-Matching Model a good Model for Taiwan?
- Analyze the Labor Market after 1997
    - Different unemployment pattern
    - Data Availability & Quality

Policy Implication

- Extended Unemployment Insurance (UI)
  - Nakajima (2012): UI → Unemployed workers' search effort ↓
  - Job Rationing as the main source
    - More Generous UI during recessions (Michaillat 2012)
  - Matching Frictions as the main source: Different Suggestion
- Search Assistance or Fiscal (or monetary) policies
  - Job Rationing: Fiscal (or monetary) policies
  - Matching Frictions: Search Assistance

Analysis Approach & Findings

- Job Rationing Model based on Michaillat (2012)
- Calibrate the Parameters based on Taiwan's Data
- I did not use estimation because I want to examine model performance

Main Findings

- Matching Frictions: Main Source for Unemployment during Normal Time (80%)
- Job Rationing: Main Source for Unemployment during Bad Time (80% during the Great Recession)

Model Equations

$$h_t = \mu u_t^{\xi} v_t^{1-\xi} \quad \Rightarrow \text{Matching Function (Hires)}$$

$$f_t = h_t / u_t \quad \Rightarrow \text{Job Finding Rate}$$

$$q_t = h_t / v_t \quad \Rightarrow \text{Vacancy Filling Rate}$$

$$u_t = 1 - (1 - s) n_{t-1} \quad \Rightarrow \text{Job Seekers (Unemployment)}$$

$$n_{t+1} = (1 - s) n_t + h_t \quad \Rightarrow \text{Employment Transition}$$

$$J_t = \alpha a_t n_t^{\alpha-1} - w_t + E_t (1 - s) J_{t+1} \quad \Rightarrow \text{Job Creation Conditions}$$

$$J_t = \frac{a_t c^v}{q_t} \quad \Rightarrow \text{Free Entry}$$

$$w_t^R = \omega a_t^{\gamma} \quad \Rightarrow \text{Rigid Wage (Source of Job Rationing)}$$

$$\ln a_t = \rho^a \ln a_{t-1} + \epsilon_t^a \quad \Rightarrow \text{Tech. Shock}$$

$$\epsilon_t^a \sim N(0, \sigma^a)$$

Model Equations

$$h_t = \mu u_t^{\xi} v_t^{1-\xi} \quad \Rightarrow \text{Matching Function (Hires)}$$

- h_t: Hires
- u_t: Unemployed Workers (Job Seekers)
- v_t: Vacancy
- ξ: Matching Elasticity

Model Equations

$$f_t = h_t / u_t \quad \Rightarrow \text{Job Finding Rate}$$

$$q_t = h_t / v_t \quad \Rightarrow \text{Vacancy Filling Rate}$$

Model Equations

$$u_t = 1 - (1 - s)n_{t-1} \quad \Rightarrow \text{Job Seekers (Unemployment)}$$

$$n_{t+1} = (1 - s)n_t + h_t \quad \Rightarrow \text{Employment Transition}$$

- Transition for Unemployment and Employment
- s: Separation Rate

Model Equations

$$y_t = a_t n_t^{\alpha} \Rightarrow \text{Production Conditions}$$

$$J_t = \alpha a_t n_t^{\alpha-1} - w_t + E_t(1-s)J_{t+1} \quad \Rightarrow \text{Job Creation Conditions}$$

$$J_t = \frac{a_t c^v}{q_t} \quad \Rightarrow \text{Free Entry}$$

- J_t: Value of hiring a worker (filling a vacancy)
- c^v: Vacancy Cost

Model Equations

$$w_t^R = \omega a_t^\gamma \quad \Rightarrow \text{Rigid Wage (Source of Job Rationing)}$$

$$\ln a_t = \rho^a \ln a_{t-1} + \epsilon_t^a \quad \Rightarrow \text{Tech. Shock}$$

$$\epsilon_t^a \sim N(0, \sigma^a)$$

- Rigid Wage: w_t^R
- γ: Tech Elasticity for Wage

Calibration

Parameter	Value	Source
β: Discount Factor	0.999	Convention
α: Labor Elasticity	0.462	Labor Share
ξ: Matching Elasticity	0.28	Observed Hires, Vacancy and Unemployment
μ: Matching Efficiency	0.69	Observed Hires, Vacancy and Unemployment
s: Separation Rate	0.023	Entry and Exit Data
c^v: Vacancy Cost	0.12	Vacancy Cost-Wage Ratio = 0.25
γ: Tech Elasticity	0.7	Pissarides (2009)
ρ^a	0.97	Output and Employment
σ^a	0.0044	Output and Employment

- Parameters are calibrated based on Monthly or Quarterly Frequency. For simulation exercise, I transform them into weekly frequency

Calibration Procedure I

$$h_t = \mu u_t^{\xi} v_t^{1-\xi} \quad \Rightarrow \text{Matching Function (Hires)}$$

$$\min \quad \ln h_t - \ln \mu - \xi \ln u_t - (1 - \xi) \ln v_t$$

- Given hiring, unemployment and vacancy data, we can estimate μ and ξ

Calibration Procedure II

$$J_t = \alpha a_t n_t^{\alpha-1} - w_t + E_t(1-s)J_{t+1} \quad \Rightarrow \text{Job Creation Conditions}$$

$$J_t = \frac{a_t c^v}{q_t} \quad \Rightarrow \text{Free Entry}$$

So, the Steady-State Equation is

$$\frac{c^v}{w}\frac{1}{q} = \alpha \frac{y}{n \cdot w} - 1 + (1-s)\frac{c^v}{w}\frac{1}{q}$$

- Given labor share and vacancy cost-to-wage ratio, we can determine α

Model Performance & Dynamics

- Compare Simulated Moments and Observed Moments
- Compare Smoothed Variables and Observed Variables (Use Tech Shock From Data)
- Impulse Response Functions

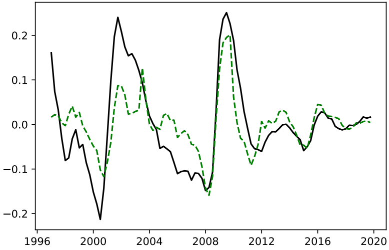
Observed Moment

	u	v	h	y	a
Standard Deviation	0.101	0.083	0.0787	0.022	0.020
Autocorrelation	0.906	0.870	0.7647	0.766	0.739
Correlation	1.000	-0.585	-0.5427	-0.692	-0.621
	-0.585	1.000	0.6347	0.788	0.786
	-0.542	0.634	1.0007	0.722	0.723
	-0.692	0.788	0.7227	1.000	0.995
	-0.621	0.786	0.7237	0.995	1.000

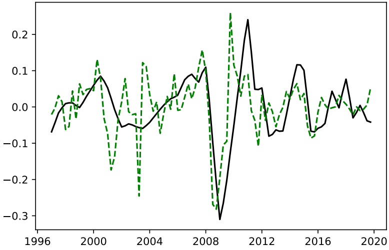
Simulated Moment

	u	v	h	y	a
Standard Deviation	0.100	0.067	0.040	0.018	0.016
	(0.015)	(0.006)	(0.003)	(0.003)	(0.002)
Autocorrelation	0.781	0.346	0.094	0.736	0.726
	(0.056)	(0.106)	(0.086)	(0.068)	(0.071)
Correlation	1.000	-0.585	-0.076	-0.958	-0.950
	(0.000)	(0.060)	(0.030)	(0.012)	(0.014)
	-0.585	1.000	0.851	0.791	0.808
	(0.060)	(0.000)	(0.028)	(0.022)	(0.019)
	-0.076	0.851	1.000	0.355	0.381
	(0.030)	(0.028)	(0.000)	(0.027)	(0.029)
	-0.958	0.791	0.355	1.000	1.000
	(0.012)	(0.022)	(0.027)	(0.000)	(0.000)
	-0.950	0.808	0.381	1.000	1.000
	(0.014)	(0.019)	(0.029)	(0.000)	(0.000)

Observed vs Smoothed Variables

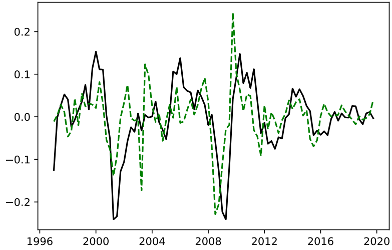


Unemployment



Vacancy

Observed vs Smoothed Variables



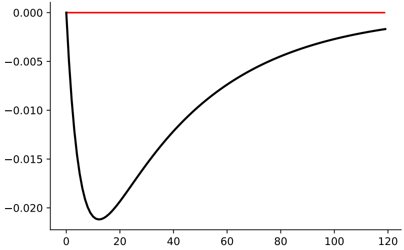
Hires

Employment

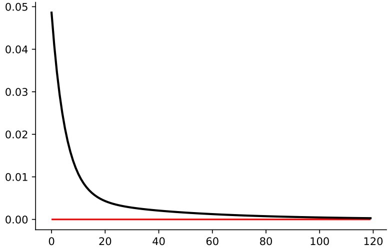
Observed vs Smoothed Variables

Output

IRFs

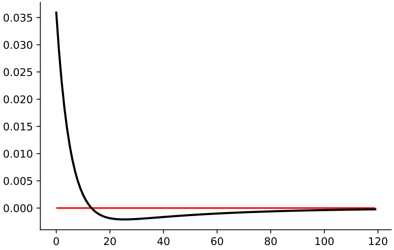


Unemployment

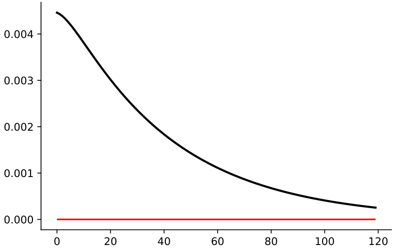


Vacancy

IRFs

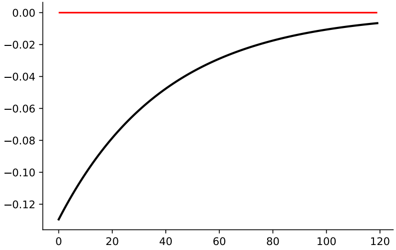


Hires

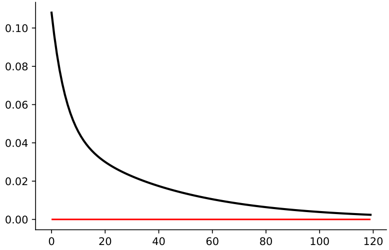


Output

IRFs



Rationing Unemployment



Frictional Unemployment

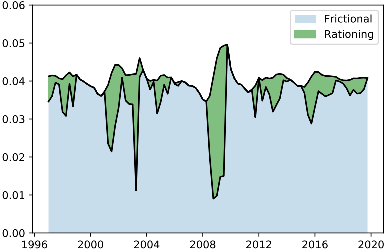
Mechanism of Job Rationing

$$J_t = \alpha a_t n_t^{\alpha-1} - w_t + E_t(1-s)J_{t+1} \quad \Rightarrow \text{Job Creation Conditions}$$

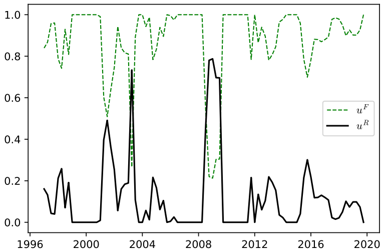
$$J_t = \frac{a_t c^v}{q_t} \quad \Rightarrow \text{Free Entry}$$

- J_t: Value of hiring a worker (filling a vacancy)
- c^v: Vacancy Cost
- As $c^v \to 0$, we have
$$\alpha a_t n_t^{\alpha-1} = w_t \to n_t^R$$
- n_t^R: Rationing Employment
- Rationing Unemployment: $u_t^R = 1 - n_t^R$
- Frictional Unemployment: $u_t^F = u_t - u_t^R$

Decomposition



Decomposition



Fraction

Model Equations for estimation

$$h_t = \mu_t u_t^{\xi} v_t^{1-\xi} \quad \Rightarrow \text{Matching Function (Hires)}$$

$$f_t = h_t / u_t \quad \Rightarrow \text{Job Finding Rate}$$

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$$w_t^R = \omega_t a_t^{\gamma} \quad \Rightarrow \text{Rigid Wage (Source of Job Rationing)}$$

$$\ln a_t = \rho^a \ln a_{t-1} + \epsilon_t^a, \ \epsilon_t^a \sim N(0, \sigma^a) \quad \Rightarrow \text{Tech. Shock}$$

$$\ln \mu_t = \rho^{\mu} \ln \mu_{t-1} + \epsilon_t^{\mu}, \ \epsilon_t^{\mu}, \sim N(0, \sigma^{\mu}) \quad \Rightarrow \text{Matching Efficiency Shock}$$

$$\ln \omega_t = \rho^{\omega} \ln \omega_{t-1} + \epsilon_t^{\omega}, \ \epsilon_t^{\omega} \sim N(0, \sigma^{\omega}) \quad \Rightarrow \text{Wage Shock}$$

Estimation

Parameter	Prior Density/(Mean Std)
ξ: Matching Elasticity	$B(0.4, 0.1)$
μ: Matching Efficiency	$G(0.7, 0.15)$
c^w: Vacancy Cost to Wage	$B(0.25, 0.1)$
γ: Tech Elasticity in Wage	$B(0.7, 0.1)$
ρ^x	$B(0.5, 0.2)$
σ^x	$IG(0.1, \infty)$

- Calibrated Model: Only Estimate Shock Process related parameter and γ
- Estimated Model: Estimate All Parameters

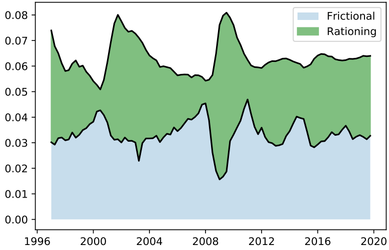
Posterior Density: Calibrated Model

Parameter	Posterior Mean	Credible Set
γ	0.8356	[0.7907, 0.8847]
ρ^a	0.6745	[0.5716, 0.7869]
ρ^μ	0.9545	[0.9342, 0.9741]
ρ^ω	0.8036	[0.7279, 0.8733]
e^a	0.0136	[0.0119, 0.0152]
e^μ	0.0491	[0.0434, 0.0549]
e^ω	0.0019	[0.0015, 0.0023]

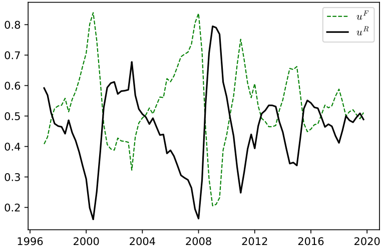
Posterior Density: Estimated Model

Parameter	Posterior Mean	Credible Set
ξ	0.5434	[0.4165, 0.6589]
μ	0.2568	[0.1001, 0.4058]
c^w	0.4024	[0.2619, 0.5324]
γ	0.6762	[0.5554, 0.7959]
ρ^a	0.7239	[0.6298, 0.8126]
ρ^μ	0.9724	[0.9492, 0.9963]
ρ^ω	0.8418	[0.7815, 0.9067]
e^a	0.0134	[0.0118, 0.0150]
e^μ	0.0471	[0.0413, 0.0528]
e^ω	0.0035	[0.0023, 0.0048]

Decomposition: Calibrated Model

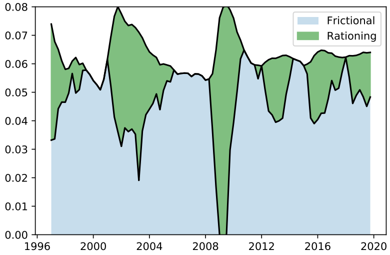


Decomposition

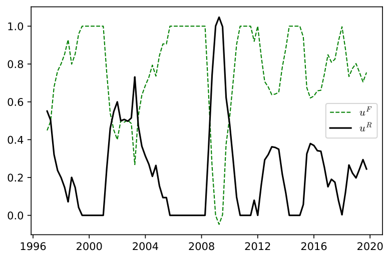


Fraction

Decomposition: Estimated Model



Decomposition



Fraction

Summary

- Job Rationing Model is not perfect for Taiwan but can well match unemployment, vacancy and hiring
- Based on the decomposition exercise, the job rationing is the main source that determine unemployment fluctuations during a recession period in Taiwan
- Fiscal or Monetary Policy are important for us to alleviate the increasing in the unemployment in Taiwan

Conclusion

- Job Rationing is an important source of unemployment fluctuations in Taiwan
- Future studies can
  - incorporate **estimation** ⇒ Data Issue
  - consider a more complete model (capital, investment, monetary policy and fiscal policy)