



Unemployment and Market tightness fluctuations

MACS 30250 Project Proposal

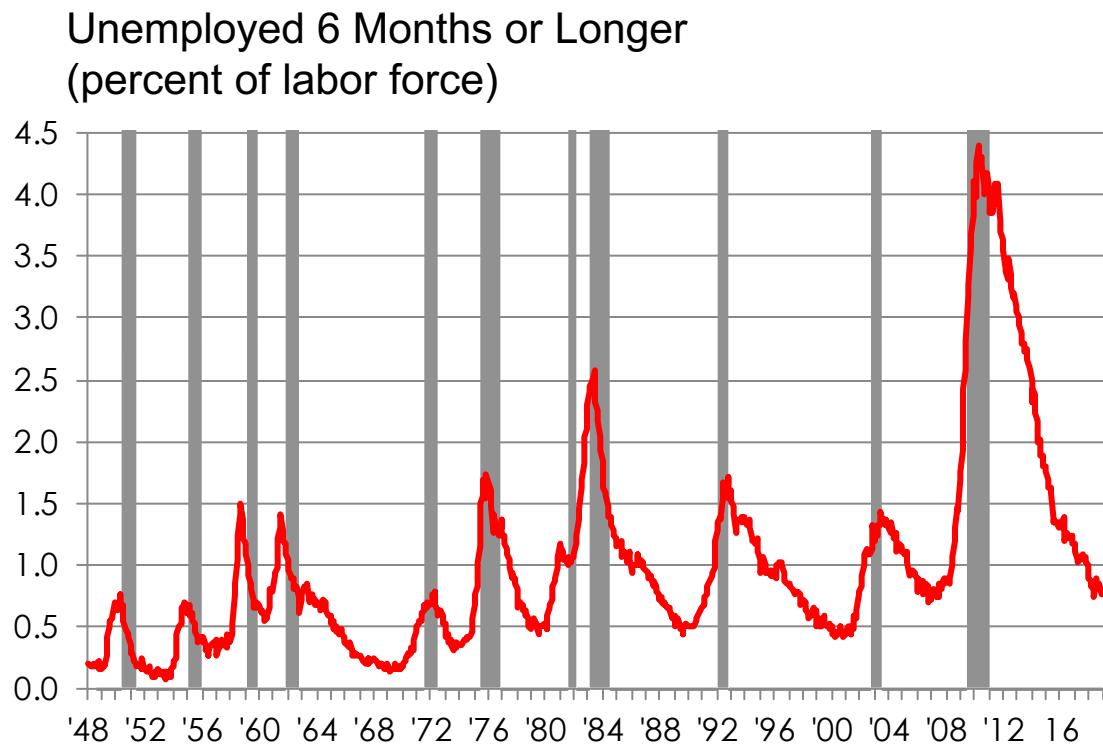
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Introduction

- Long term unemployment went way up
 - With few workers quitting jobs and hiring rates low, long-term unemployment greatly increased
- Unemployment Relative to Vacancies (JOLTS – Job Openings and Labor Turnover Survey)



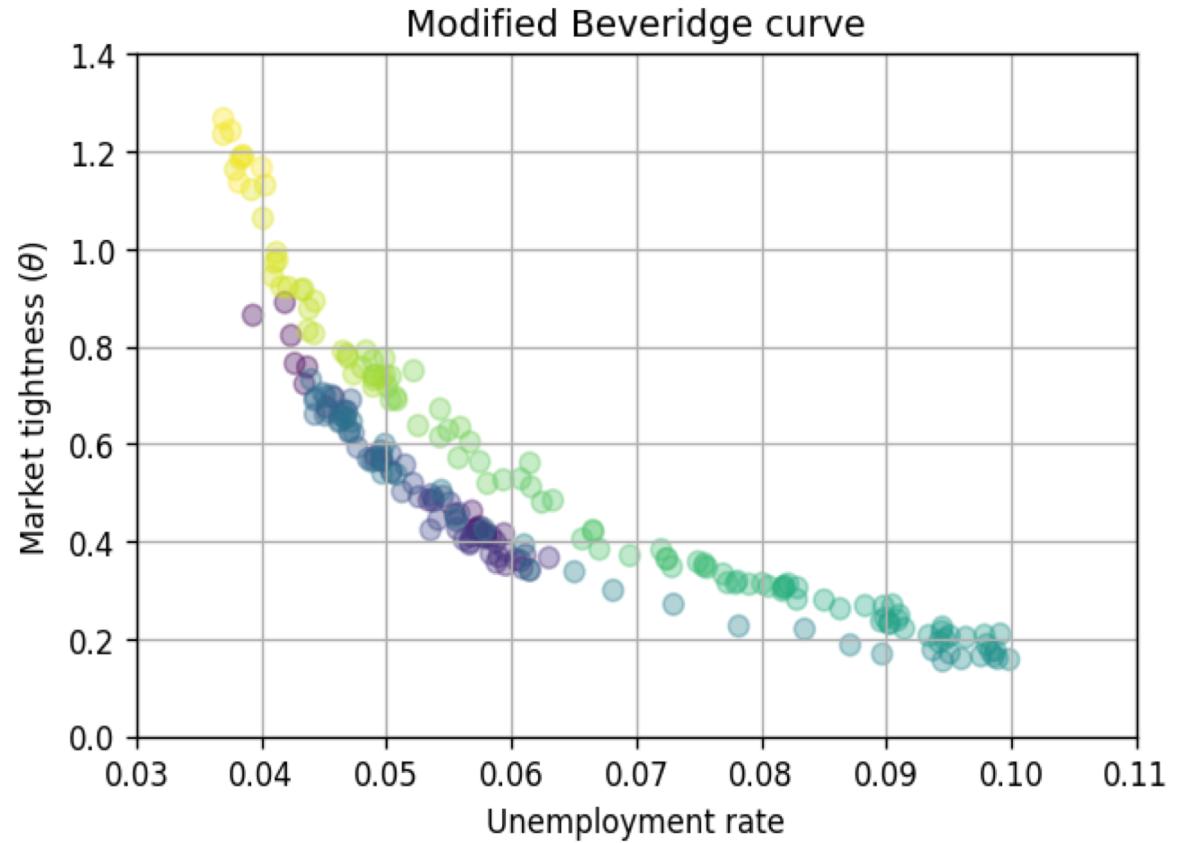
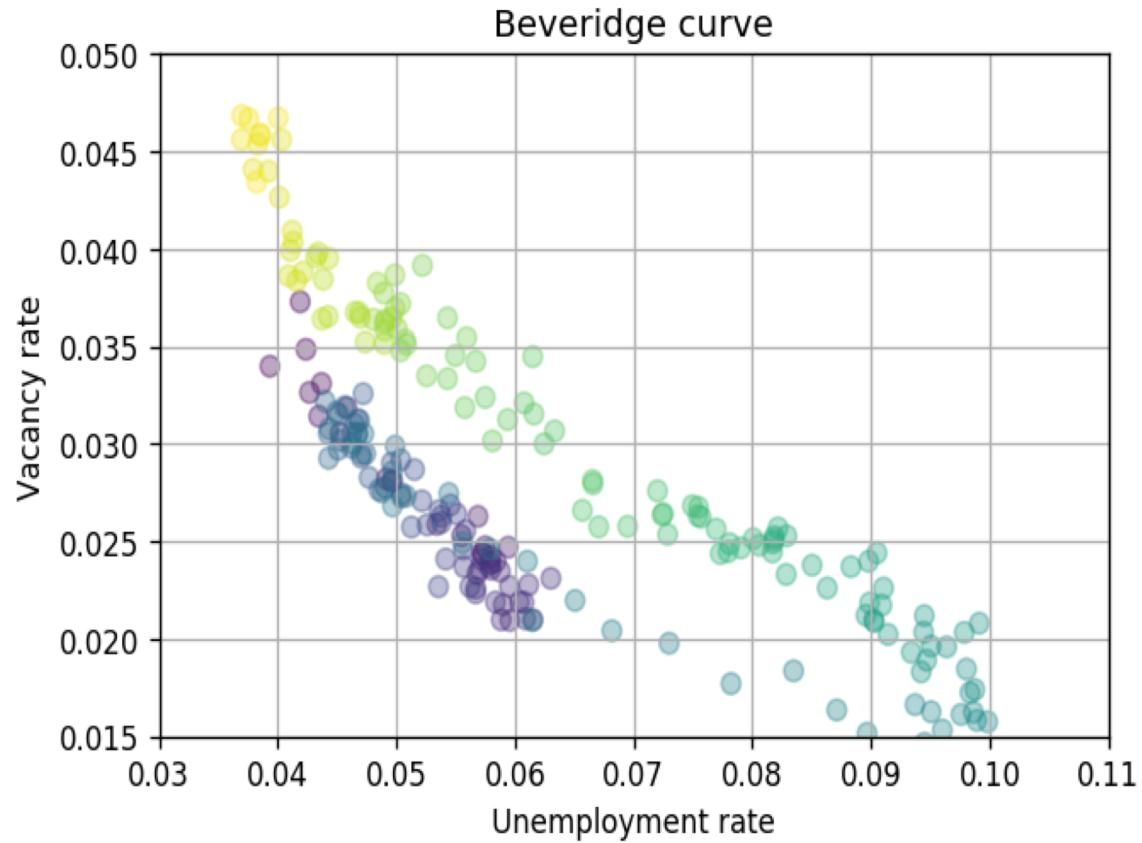
Introduction

$$\text{market tightness} = \frac{\text{job vacancies}}{\text{unemployment level}}$$



● Data visualization – Beveridge Curve & Modified Beveridge

data: FRED from 2000-12-01 to 2019-02-01





Research Question

- What's the cyclical behavior of equilibrium unemployment and vacancies?
- Business cycles are often accompanied by fluctuations in unemployment rates
- Higher unemployment rates during recessions



Theory -- Search Friction and DMP Model

Shimer, Robert. "The cyclical behavior of equilibrium unemployment and vacancies." *American economic review* 95.1 (2005): 25-49.

Assumptions:

- All worker and jobs are respectively identical and every agent has a life of indefinite length and is risk-neutral
- Every job-worker match produces market output at flow rate p and auto correlated shocks to p occur from time to time
- The time sequence $\{p_t\}$ is Markov jump process characterized by arrival rate λ and a distribution of new values F
- Matching function is non-negative, increasing, concave and homogeneous of degree one



Theory - Model Setup

- z : the opportunity cost of employment to the worker (measured in units of output)
 - c : the cost of posting a vacancy to the firm (measured in units of output)
 - $m(u, v)$: matching function where u and v represent the number of unemployed workers currently looking for a job and the number of currently open job vacancies
 - $\theta = \frac{v}{u}$: market tightness
 - job-finding rate: $f(\theta) \equiv \frac{m(u,v)}{u} = m(1, \theta)$
 - Exogenous separation rate s and all agents discount future income flows at the common rate r
- The matching function $m(\cdot)$, the productivity process(λ, F) and the set of parameters $\{z, c, s, r\}$ fully characterize the environment of interest



Theory

$$V_p \equiv J_p + W_p - U_p$$

J_p : the value of a match the employer

W_p : the value of a match to the worker

U_p : the value of unemployment

The continuous-time Bellman equations:

$$rU_p = z + f(\theta_p)(W_p - U_p) + \lambda(E_p U_{p'} - U_p)$$

$$rW_p = w_p - s(W_p - U_p) + \lambda(E_p W_{p'} - W_p)$$

$$rJ_p = p - w_p - sJ_p + \lambda(E_p J_{p'} - J_p)$$

Then we can get the following:

$$rV_p = p - z - f(\theta_p)(W_p - U_p) - sV_p + \lambda(E_p V_{p'} - V_p)$$



Theory

The general Nash solution to the bargaining problem – maximizes the Nash Product

$$(W_p - U_p)^\beta J_p^{1-\beta} \quad \beta \text{ reflects the worker's bargaining power}$$

$$\frac{W_p - U_p}{\beta} = V_p = \frac{J_p}{1 - \beta}$$

The free-entry condition given that the average time to fill a vacancy is $\frac{\theta}{f(\theta)}$: $\frac{c\theta_p}{f(\theta_p)} = J_p$

An equilibrium solution to the model is a vector of functions $(\theta_p, w_p, U_p, W_p, J_p, V_p)$

Finally based on the equilibrium wage rule and the law of motion, unemployment simply converges toward the state-contingent target:

$$u_p = \frac{s}{s + f(\theta_p)}$$



Data

- Unemployment level (Thousands of Persons, Monthly, Seasonally Adjusted) -- FRED
- Civilian labor force (Thousands of Persons, Monthly, Seasonally Adjusted) -- FRED
- Job openings and labor turnover – BLS
- Labor productivity -- FRED

Potential Computational Methods in Analysis

- Simulation
- ANN

Problems and Future Work

- Model extension and simulation (labor productivity shocks, separation shocks)
- Construct the DMP simulator
- Compare the result of ANN and model simulation



References

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