Unemployment Flows and the Natural Rate in Turkey

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Disclaimer

The views expressed herein are those of the authors and not necessarily those of the Central Bank of the Republic of Turkey, or the Federal Reserve Bank of Cleveland or the Federal Reserve System.

Motivation

- Unemployment is arguably the single most important variable describing the state of the labor market
- Central Banks are interested in unemployment
  - It is part of central bank mandates (FED, CBRT)
  - Financial crisis resurfaced the debate on the natural rate of unemployment

This Paper

- Provides an estimate of the long-run trend in the unemployment rate for Turkey - using unemployment flows.
- Analyzes the time series behavior
  - decompose the unemployment fluctuations both at high and low frequencies - Inflows versus Outflows.

What is Natural Rate?

- A vaguely defined concept, starting with Friedman's 1968 AEA Presidential Address

> The natural rate of unemployment... is the level that would be ground out by the Walrasian system of general equilibrium equations, provided there is imbedded in them the actual structural characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availabilities, the cost of mobility, and so on.

- We mean trend component of the unemployment (Rogerson, 1997)
  - Use flow rates into and out of unemployment to to get the natural rate
  - Can be more informative than detrending the series itself

Framework

- Guidance from search theory of unemployment - introduce flows into and out of unemployment as the main determinants of long-run unemployment.

$$u_{t+1} = (1 - u_t)S_t - u_t F_t \quad \Rightarrow \quad \bar{u} = \frac{\bar{S}}{\bar{F} + \bar{S}}$$

F_t and S_t are job arrival and destruction probabilities

- Present a simple, reduced form model of comovement between unemployment flows and GDP.
- Construct a time-varying trend estimate for the unemployment rate in this framework.

Data

- Quarterly data from 2000Q1 to 2012Q4
- Labor Market Data
  - Number of labor force and unemployed by duration in 1, 3, 6, 9, 12 months
  - Comes from TurkStat
- GDP Data
  - With 1998 prices
  - Comes from CBRT

Methodology

- Use unobserved components method
  - Assume that Y_t (output), F_t and S_t have stochastic trend and stationary cyclical components

$$Y_t = \bar{y}_t + y_t$$
$$F_t = \bar{f}_t + f_t$$
$$S_t = \bar{s}_t + s_t$$

  where $\bar{y}_t$, $\bar{f}_t$ and $\bar{s}_t$ are trends; y_t, f_t and s_t are cycles
  - Only Y_t, F_t and S_t are observable
  - Define a process for trend and cycle equations
  - Use MLE to estimate parameters
  - Use Kalman Filter to back out trend and cycle

- Modeling Output

$$
\begin{aligned}
Y_t &= \bar{y}_t + y_t \\
y_t &= \phi_1 y_{t-1} + \phi_2 y_{t-2} + \varepsilon_t^{yc} \\
\bar{y}_t &= g_{t-1} + \bar{y}_{t-1} + \varepsilon_t^{yn} \\
g_t &= g_{t-1} + \varepsilon_t^{g}
\end{aligned} \tag{1}
$$

- Output trend is a random walk with a drift, cycle is AR(2) (Clark (1987), Ozbek and Ozlale (2005))

Getting Trends and Cycles

- Modeling flow rates

$$
\begin{aligned}
F_t &= \bar{f}_t + f_t \\
f_t &= \rho_1 y_t + \rho_2 y_{t-1} + \rho_3 y_{t-2} + \varepsilon_t^{fc} \\
\bar{f}_t &= \bar{f}_{t-1} + \varepsilon_t^{fn}
\end{aligned} \tag{2}
$$

$$
\begin{aligned}
S_t &= \bar{s}_t + s_t \\
s_t &= \theta_1 y_t + \theta_2 y_{t-1} + \theta_3 y_{t-2} + \varepsilon_t^{sc} \\
\bar{s}_t &= \bar{s}_{t-1} + \varepsilon_t^{sn}
\end{aligned} \tag{3}
$$

- Trend of F_t and S_t relates to institutions, demographics, labor market rigidities.
- Cyclical components of F_t and S_t move only in response to cyclical changes in output.
- consistent with standard search and matching models (Mortensen and Pissarides (1994))

Getting Trends and Cycles

- Assume all error terms are independent white noise processes

$$\varepsilon_t^i \sim N(0, \sigma_i) \quad i \in \{g, yn, yc, fn, fc, sn, sc\}$$

- Some restrictions over estimation
  - Use relative ratios of standard deviations of trend and cycle shocks for flow rates

$$\gamma_f = \frac{\sigma_{fn}}{\sigma_{fc}}, \quad \gamma_s = \frac{\sigma_{sn}}{\sigma_{sc}}$$

  - Search over grids for γ_f and γ_s that will maximize the likelihood.
- Natural rate of unemployment

$$\bar{u}_t = \frac{\bar{s}_t}{\bar{f}_t + \bar{s}_t}$$

- Some notation:
  - Time (τ) is continuous, data is available at discrete dates t
  - $L_{t+\tau}$ ($U_{t+\tau}$): number of labor force (unemployed) at time $t+\tau$.
  - Assume labor force does not change between $t$and $t+1$ ($\rightarrow$ relaxing this assumption is work in progress)
  - $U_t^{<d}$: number of unemployment duration $< d$ months in month t.
  - f_t (s_t): job arrival (destruction) rate during period t
- law of motions:

$$\dot{U}_{t+\tau} = (L_{t+\tau} - U_{t+\tau})s_t - U_{t+\tau}f_t, \tag{4}$$

$$\dot{U}_t^{<1}(\tau) = (L_{t+\tau} - U_{t+\tau})s_t - U_t^{<1}(\tau)f_t, \tag{5}$$

- Equations 4 and 5 imply

$$\dot{U}_{t+\tau} = \dot{U}_t^{<1}(\tau) - (U_{t+\tau} - U_t^{<1}(\tau))f_t. \tag{6}$$

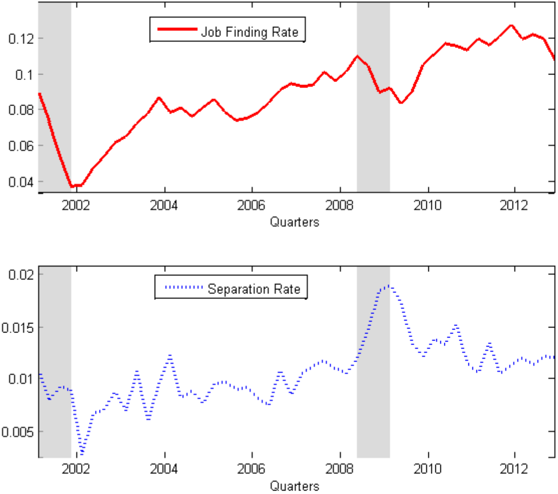
- Solve difference equation 6:

$$u_t = e^{-f_t}u_{t-1} + u_t^{<1}. \tag{7}$$

- Can compute f_t using equation above (more on estimation)
- Then, can compute separation rate using equation 4:

$$u_t = \frac{s_t}{f_t + s_t} + e^{-3(f_t+s_t)}(u_{t-3} - \frac{s_t}{f_t + s_t}). \tag{8}$$

Results: Flows Rates



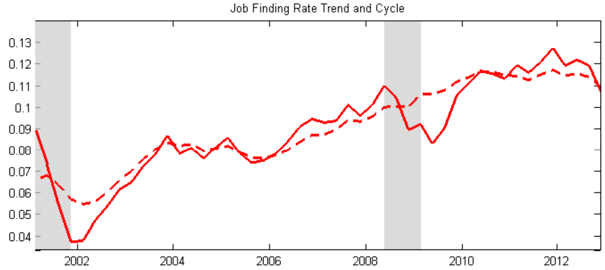
Estimation

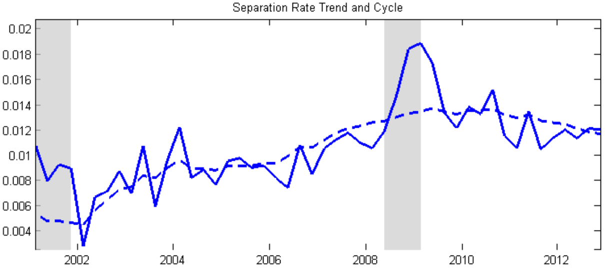
Table 1: Estimation Results: 2001:Q1-2012:Q4

	Estimate			Estimate	
ϕ_1	1.2906	(0.1993)	σ_{yn}	0.0167	(0.0026)
ϕ_1	-0.5215	(0.1844)	σ_{yc}	0.0149	(0.0034)
ρ_1	0.1060	(0.0700)	σ_g	$2.89 * 10^{-7}$	(0.0092)
ρ_2	0.1614	(0.0683)	σ_{fn}	0.0037	(0.0005)
ρ_3	$2.04 * 10^{-5}$	(0.0027)	σ_{sn}	0.0006	(0.0002)
θ_1	-0.0959	(0.0211)			
θ_2	0.0488	(0.0182)			
θ_3	$2.69 * 10^{-6}$	(0.0006)			
L	361.3635				

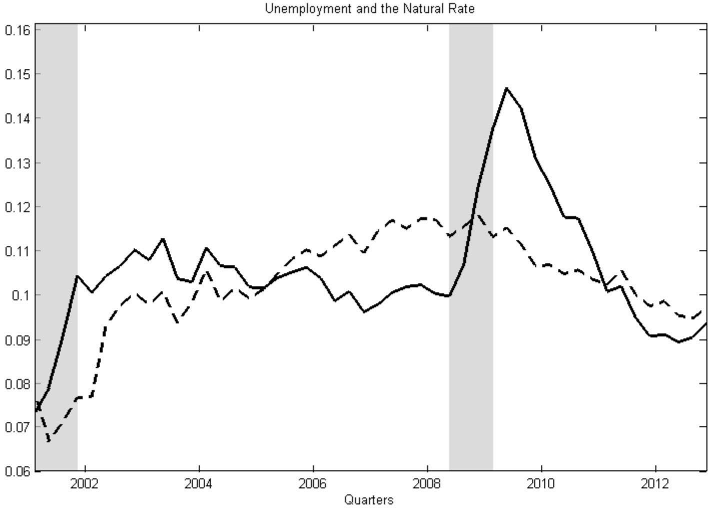
Standard deviations are in (). $\gamma_f = 0.75$, $\gamma_s = 0.75$

Results: Flow Rates

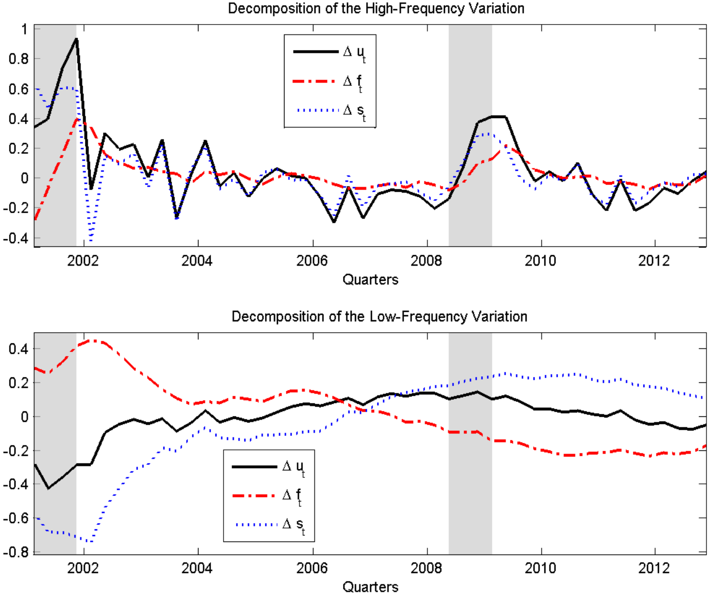




Results: Natural Rate



Decomposing Ins and Outs



Conclusion

- We used a theoretically meaningful concept to measure the Turkish equilibrium unemployment in the long-run.
  - Helps to distinguish between duration and incidence of unemployment as a driving force.
- Effect of constant labor force assumption (work in progress)
- Can improve forecast performances?

Computing Flows Rates ▸ back

- F_t is noisy estimate if duration is long
  - Short term unemployed is %17 of all unemployed, may not sample well
- Use additional duration data
  - $F_t^{<d} = 1 - \frac{u_t - u_t^{<d}}{u_{t-d}}$, for $d \in \{1, 3, 6, 9, 12\}$
  - Reject the hypothesis that $f_t^{<d}$ is same $\forall d$ at 5% confidence level ($\rightarrow$ duration dependence).
  - Use asymptotic distribution to compute an optimally weighted estimate of outflow rate that minimizes the MSE of the estimate (F).
- Use equation 8 to solve for job separation rate:

$$u_t = \frac{s_t}{f_t + s_t} + e^{-3(f_t + s_t)}\left(u_{t-3} - \frac{s_t}{f_t + s_t}\right).$$