Economic Growth and Unemployment: An Analysis on Transitional Dynamics

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Background

- China experience rapid economic growth during the past ten years (9% p.a.).
- The unemployment rate in urban China increases dramatically (10%, Cai, 2004) and "laid-off" workers account for a major part of it.
- From the microeconomic perspective, this can be explained as "efficiency reform".

How can we explain the phenomenon from the macroeconomic perspective?

Introduction

- Recent studies focus on the long-term relationship between growth and unemployment (Eriksson, 1997; Hoon and Phelps, 1997; Pissarides,2000)
- The effect of growth on unemployment generally contains two types.
  - *Capitalization effect (Pissarides, 1990)*
  - *Creative destruction effect (Howitt, 1994)*

Introduction

- Little attention has been paid to the transitional dynamics of consumption, capital and unemployment.
- This paper intends to fill this gap in the literature by developing an extended Ramsey model with search unemployment.

The Model

- The economy consists of a large number of representative household with *N* members (N is large so as to smooth individual consumptions) (Pissarides, 2000; pp. 77).
- The representative individual seeks to maximize his life time utility (or consumption) subject to two conditions
  - the investment decision condition
  - the search unemployment determination condition.

The Model

- Following Pissarides (2000,Chapter 3), search unemployment can be summarized by a job-worker matching related cost (for example, recruitment cost γ

$$\dot{k}_t = f(k_t) - \frac{[f'(k_t) + \lambda]\gamma}{q(\theta_t)} + \zeta_t k_t - \delta k_t - c_t \qquad (1)$$

$$\dot{u}_t = \lambda(1 - u_t) - \theta q(\theta) u_t \qquad (2)$$

$\frac{[f'(k_t)+\lambda]\gamma}{q(\theta)}$: cost related to search unemployment

$\zeta_t k_t$: capital released from broken job pair

θ : market tightness (v/u)

The Model

- Optimisation problem of the representative individual is as below

$$\max \int_0^\infty u(c_t)e^{-\rho t}dt \qquad \text{s.t.} \qquad (3)$$

$$\dot{k}_t = f(k_t) - \frac{[f'(k_t)+\lambda]\gamma}{q(\theta_t)} + \zeta_t k_t - \delta k_t - c_t$$

$$\dot{u}_t = \lambda(1-u) - \theta_t q(\theta_t)u_t$$

$$\zeta_t = \dot{u}_t$$

The Model

- The Hamiltonian of the above dynamic optimisation can be written as

$$H = u(c_t)e^{-\rho t} + \mu_t\{f(k_t) - \frac{[f'(k_t)+\lambda]\gamma}{q(\theta_t)} + \zeta_t k_t - \delta k_t - c_t\} + \vartheta_t[\lambda(1-u_t) - \theta_t q(\theta_t)u_t]$$

$$H_{c_t} : u'(c_t) - \mu_t = 0 \qquad (5)$$

$$H_{du_t} : \mu_t k_t + \vartheta_t = 0 \qquad (6)$$

$$H_{k_t} : \rho\mu_t = \dot{\mu}_t + \mu_t[f'(k_t) - \frac{\gamma}{q(\theta_t)} f''(k_t) + \zeta_t - \delta] \qquad (7)$$

$$H_{u_t} : \rho\vartheta_t = \dot{\vartheta}_t + \mu_t[-\lambda + \theta_t q(\theta_t)]k_t + \vartheta_t[-\lambda + \theta_t q(\theta_t)] \qquad (8)$$

$$\lim_{t\to\infty} - \mu_t k_t \exp(-\rho t) = 0 \qquad \lim_{t\to\infty} - \vartheta_t u_t \exp(-\rho t) = 0$$

The Model

- **Proposition 1** *The relative shadow prices between capital per employed worker and unemployment decreases as capital per employed worker increases.*

  $\pi_t = -\frac{1}{k_t}.$ where $\pi_t = \frac{\mu_t}{\vartheta_t}$

  Proposition 1 highlights the *price effect* of capital accumulation:

  As capital per employed worker increases, the shadow price of capital falls while that of unemployment becomes more expensive.

The Model

- The Steady State

  We can solve out c_t, u_t and k_t from (5)-(8) and get

$$u^* = \frac{\lambda}{\lambda + \theta q(\theta)} \qquad (10)$$

$$[f'(k^*) - \frac{\gamma}{q(\theta)} f''(k^*)] = \rho + \delta \qquad (12)$$

$$c^* = f(k^*) - \frac{[f'(k^*) + \lambda]\gamma}{q(\theta)} - \delta k^* \qquad (14)$$

  Since $\frac{du^*}{dg} > 0$, economic growth leads to higher unemployment at steady state

The Model

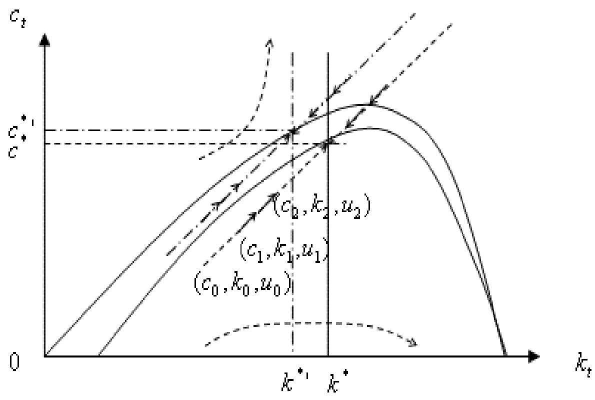
- The Transitional Dynamics

The dynamic path for c_t and k_t together with u_t can be written as:

$$\begin{pmatrix} \dot{c}_t \\ \dot{k}_t \end{pmatrix} = \begin{pmatrix} 0 & u^{-1}\{[f''(k_t) - \frac{\gamma}{q(\theta)} f'''(k_t)]\} \\ -1 & k_t[\frac{f'''(k_t)\gamma}{q(\theta)} - f''(k_t)] \end{pmatrix} \begin{pmatrix} c_t - c^* \\ k_t - k^* \end{pmatrix} \qquad (20)$$

Since $A = \begin{vmatrix} 0 & [f''(k_t) - \frac{\gamma}{q(\theta)} f'''(k_t)] \\ -1 & k_t[\frac{f'''(k_t)\gamma}{q(\theta)} - f''(k_t)] \end{vmatrix} < 0$, the system exhibits saddle-path stability.

Figure 1 The dynamics of capital accumulation and consumption



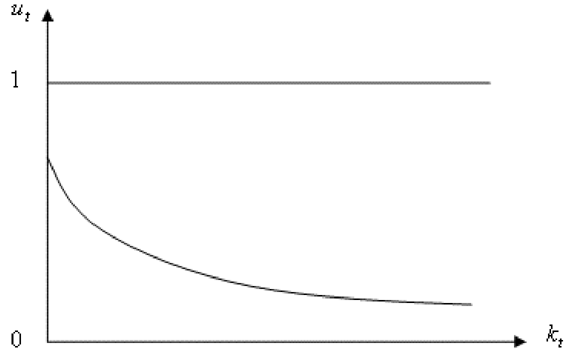
The Model

- **Proposition 2** *Along the equilibrium path, the evolution of the dynamic relationship between* u_t *and* k_t *is such that* $\frac{du_t}{dk_t} \prec 0,$ *if* $\gamma f'''(k_t) \geq 0$.

  Proposition 2 highlights the income effect of capital accumulation:

  As capital per employed worker increases, there is less loss in terms of recruitment costs so that more output is left for investment, consumption and employment.

Figure 2 The dynamic relationship between capital and employment



A policy implication: capital accumulation can be achieved by withdrawing the inefficiently used capital from destructing employment.

Conclusions

- Unemployment falls as more and more capital is accumulated along the transitional path and both the "price effect" and "income effect" can be used to explain this phenomenon.
- Looking into the dynamic behaviours of consumption, capital accumulation and unemployment along transitional path may be able to shed light on the empirical findings between growth and unemployment