TFP Growth Slowdown and the Japanese Labor Market in the 1990s

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The 1990s: Detrended Output

Detrended Real GNP

- **1980s:** Economy grows more than the benchmark 2%.
- **1990s:** Trend reversal. 2003 is 85% of that of 1990 had it grown at a 2% rate per year.
The 1990s: Unemployment

- **1980s**: 2.5% unemployment rate.
- **1990s**: Big increase in unemployment. 5.4% unemployment rate in 2002.
Job Finding and Sep. Rates & Worker Flows

Job finding rate: dropped from 40% to below 30%.

Job separation rate: increased from 0.8% to 1.8%.

- The number of workers losing and finding jobs increased.
- Workers losing jobs increased faster.
Several gov. measures reduced workweek from 6 to 5 days.
Motivation

Model

Parameterization

Results

Conclusions

- 1980-1990: 1.9% growth.
- 1991-2001: 0.3% growth.
- 2002-2006: 1.5% growth.
(1) Can the TFP growth slowdown generate the increase in unemployment observed in Japan over the 1990s?

(2) What other factors contributed to this increase?
What We Do

- **We build:**
  - Neo-Classical growth model with search frictions in the labor market.

- **Calibrate** it to match the Japanese economy in 1990.

- **Simulate** it using TFP, hours and gov. expenditure data and compare results with data.
What We Find

- The decreases in TFP growth and hours can account for a big part of the behavior over the 1990s of:
  - Output.
  - Unemployment.
  - Creation and destruction of jobs.
  - Wages.
The Model

- **Cass-Koopmans type model with labor market search frictions.**

- **Three types of agents:**
  - **Households:**
    - Consume.
    - Save.
    - Supply labor to firms.
  - **Firms:**
    - Hire labor and rent capital to produce output.
  - **Government:**
    - Collect taxes to finance own expenditures.

- **Labor market:**
  - Search and Matching.
  - Endogenous destruction.
Household’s Problem

- Economy composed by a big family – perfect self insurance.
- Firms are own by the Family.
- The Family chooses \( \{C_{t+i}, K_{t+i+1}\}_{i=0}^{\infty} \) to max

\[
E_t \sum_{i=0}^{\infty} \beta^i \log(C_{t+i})
\]

s.t.
\[
C_{t+i} + K_{t+i+1} = (1 - \tau_n)W_{t+i} + \Pi_{t+i} + (1 - \delta)K_{t+i} + r_{t+i}K_{t+i}
- \tau_k (r_{t+i} - \delta)K_{t+i} + (1 - n_{t+i})b_{t+i}z_{t+i} - T_{t+i}
\]

- FOC:

\[
C_t^{-1} = \beta \left\{ (1 + (1 - \tau_k)(r_{t+1} - \delta))C_{t+1}^{-1} \right\}
\]
**Labor Market**

- **Search and matching labor market.**
- **Unemployed workers and vacancies meet randomly according to CRS matching function.**
- **Production function:** $A_t k_t^\alpha h_t^{1-\alpha}$.
  - $A_t$: TFP. $\gamma = \text{Average growth rate of TFP.}$ $z_t = z_{t-1} e^\gamma$,
- **Idiosyncratic cost, }x_t\text{, - i.i.d with dist. fn: }G: [0,x_{max}] \rightarrow [0,1].$
- **Endogenous destruction:** depends on value of $x_t$.
- **Free entry** of firms.
- **Nash bargaining** for wages.
Problem for Firm and Worker

- Value of a vacancy:
  \[ V_t = -\phi z_t + \beta_t \left [ q_t (\theta_t) \max \left \{ E_t J_{t+1}, V_{t+1} \right \} + (1 - q_t (\theta_t)) V_{t+1} \right ] \]

- Value of a filled job:
  \[ J_t (x_t) = A_t f (k_t, h_t) - r_t k_t - x_t z_t - w_t (x_t) h_t + \beta_t \max \left \{ E_t J_{t+1}, V_{t+1} \right \} \]
  - Optimal capital: \( r_t = A_t f_k (k_t, h_t) \)

- Value of unemployment:
  \[ U_t = b z_t + \beta_t \left [ \theta_t q_t (\theta_t) \max \left \{ E_t N_{t+1}, U_{t+1} \right \} + (1 - \theta_t q_t (\theta_t)) U_{t+1} \right ] \]

- Value of employment:
  \[ N_t (x_t) = (1 - \tau_n) w_t (x_t) h_t + \beta_t \max \left \{ E_t N_{t+1}, U_{t+1} \right \} \]
Wage and Threshold

- Wages are determined as the Nash solution to a bargaining problem.

- **Destruction threshold:** \( S_t (\bar{x}_t) = 0 \)

  where \( S_t (x_t) = J_t (x_t) + N_t (x_t) - U_t \)
Evolution of Unemployment

Flows:

\[ u_t = \left[ 1 - p_{t-1} G(\bar{x}_t) \right] u_{t-1} + \left[ 1 - G(\bar{x}_t) \right] n_{t-1} \]

\[ I = n_t + u_t \]
Parameterization

- A subset of parameters are fixed using values in other studies or in an ad-hoc manner.

**Exogenously fixed parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elasticity of matching with respect to unemp.</td>
<td>$\zeta = 0.5$</td>
</tr>
<tr>
<td>Bargaining power of the worker</td>
<td>$\eta = 0.5$</td>
</tr>
<tr>
<td>Exponent of capital in prod. function</td>
<td>$\alpha = 0.383$</td>
</tr>
<tr>
<td>Capital depreciation</td>
<td>$\delta = 0.028$</td>
</tr>
<tr>
<td>Labor income tax rate</td>
<td>$\tau_{lt} = 0.28$</td>
</tr>
<tr>
<td>Capital income tax rate</td>
<td>$\tau_{kt} = 0.44$</td>
</tr>
</tbody>
</table>
Calibrated Parameters

- Calibration is done to match the Japanese economy in 1990.

**Calibrated parameters**

<table>
<thead>
<tr>
<th>Parameters (5)</th>
<th>Moments Matched (5)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$ : Discount Factor</td>
<td>Capital-Output ratio (1990)</td>
<td>SNA Data</td>
</tr>
<tr>
<td>0.987</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>$\phi$ : Cost of posting vacancy</td>
<td>Unemployment rate (1990)</td>
<td>Labor Force Survey</td>
</tr>
<tr>
<td></td>
<td>2.1%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.42</td>
<td></td>
</tr>
<tr>
<td>$\mu$ : Scaling param in match. fn</td>
<td>Ratio of unemp. benefit to output</td>
<td>Shimer (2005)</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>$\mu_n$ : Mean of $G(\cdot)$</td>
<td>Market tightness, $\theta$, set to 1</td>
<td>Shimer (2005)</td>
</tr>
</tbody>
</table>
Exogenous Variables

**TFP Growth**
- After 2002:
  - TFP Growth: 1.5%.
  - Hours per Week: 38.4
  - Gov. Expenditures: 14.3%
Unemployment

![Unemployment Graph]

- **Data**: 2.1% in 1990, rising to 5.3% in 2002.
- **Model**: 1.5% in 1990, rising to 5.2% in 2002.
Destruction of Jobs

Prob. of Losing Job

Prob. of Finding Job

Total Dest. of Jobs

Total Creat. of Jobs

Data

Model
Conclusions

- We build a Neo-Classical Growth Model with search frictions in the labor market.
- We show that decreases in TFP growth and hours can account for a big part of the behavior over the 1990s of:
  - Output.
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