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Poverty traps with Local Allocation Tax grants in Japan

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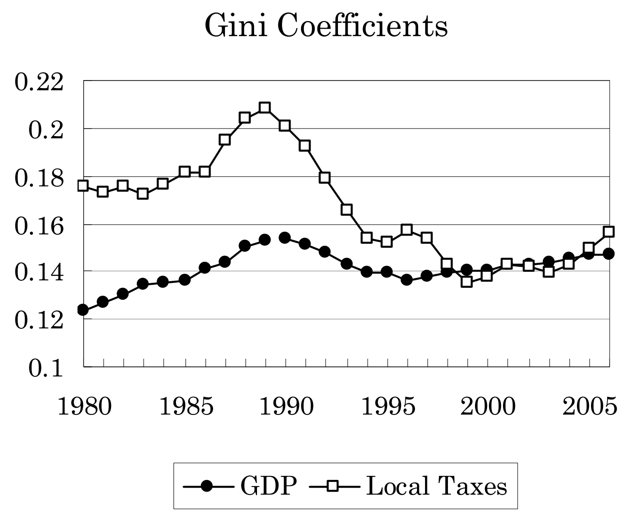
1. Introduction

- Economic and fiscal disparities among regions
- Local Allocation Tax (LAT) grants from the central government have a function of interregional income redistribution.
- Defects of the LAT grants
    - Flypaper effect: Nagamine (1995), Doi (1996, 2000)
    - Subsidy effect: Hayashi (2000), Doi and Bessho (2005)
    - Soft budget constraints: Akai, Sato, and Yamashita (2005)

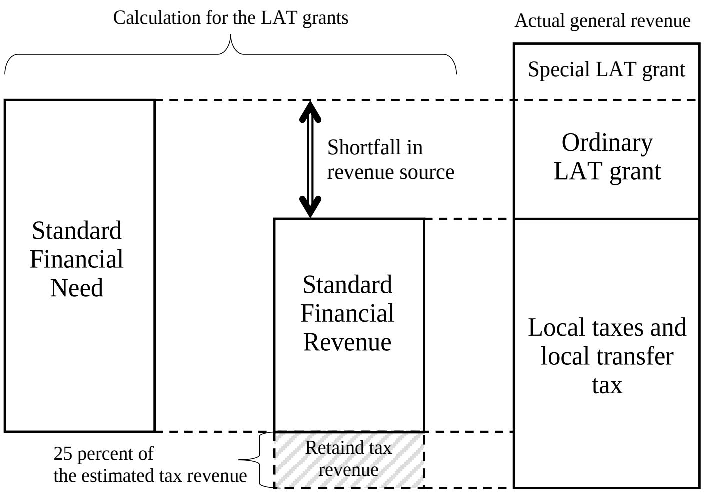
Poverty traps in the Japanese intergovernmental system
- Suggestion of the former governor of Tottori prefecture Yoshihiro Katayama
  (his presentation at the Decentralization Reform Committee on September 18, 2007)

In this paper,
- Investigate poverty traps with the LAT grants

□ Explain the system of the LAT grants
□ Effects of the LAT grants on economic growth using a simple dynamic model
□ Implement Granger (non-)causality test with panel data in Japan to confirm poverty traps with the LAT grants



Micro-Allocation Rule of LAT Grants



Source: Doi and Ihori (2009)

2. System of Local Allocation Tax grants

Table 1　Calculation of the Standard Financial Need (Outline)

Police expenses = unit cost of police officer * number of police officers * adjustment coefficient

Education expenses = unit cost of teacher * number of teachers * adjustment coefficient

Public works expenses = …
Agriculture, forestry, and fishery expenses = …
Commerce and industry expenses = …
Debt-service expenses = …
…

Sum of the above amount = the Standard Financial Need of this local government

Note: * means 'multiplied by'.　　Source: Doi and Ihori (2009)

3. A simple model of poverty traps with LAT grants

3.1 Basic framework

The local government of region i (in a small open economy)

$$\max \ U_i = \sum_{t=1}^{\infty} \frac{u_i(g_t)}{(1+\rho)^t} \qquad \rho > 0 \tag{1}$$

$$\text{s.t.} \quad b_{i,t} = g_{i,t} + x_{i,t} + (1+r)b_{i,t-1} - \tau_L y_{i,t} - h_{i,t} \tag{2}$$

where $b_{i,t}$: outstanding local government debt at the end of period t
$h_{i,t}$: fiscal transfer from the central government
τ_L: local tax rate (constant over time), $y_{i,t}$: regional income in period t
$g_{i,t}$: welfare-improving (but unproductive) government consumption
$x_{i,t}$: productive government investment
r is the interest rate, given exogenously

Employ a Solow-Swan growth model

$$k_{i,t} = (1-\delta)k_{i,t-1} + s_i(1-\tau_L-\tau_C)y_{i,t} \qquad s_i > 0,\ \delta > 0 \tag{4}$$

where τ_C: national tax rate for fiscal transfer from the central government. ($\tau \equiv \tau_L + \tau_C$)

Production function in this region

$$\sum_{i=1}^{N} \tau_C y_{i,t} = \sum_{i=1}^{N} h_{i,t}$$

$$y_{i,t} = f_i(k_{i,t-1}, x_{i,t-1}) \tag{3}$$

where $\frac{\partial y_{i,t}}{\partial k_{i,t-1}} > 0$, $\frac{\partial^2 y_{i,t}}{\partial k_{i,t-1}^2} < 0$, $\frac{\partial y_{i,t}}{\partial x_{i,t-1}} > 0$, $\frac{\partial^2 y_{i,t}}{\partial x_{i,t-1}^2} < 0$.

$k_{i,t-1}$ is capital equipped by private firms at the end of period $t-1$

The Benchmark case: $h_{i,t}$ is a lump-sum transfer

max (1) subject to (2) and (3)

FOC
$$\frac{u_i'(g_{i,t})}{u_i'(g_{i,t-1})} = \frac{1+\rho}{1+r} \tag{5}$$

$$\frac{\partial y_{i,t}}{\partial x_{i,t-1}} = \frac{1+r}{\tau_L} \tag{6}$$

3.2 Effects of the Standard Financial Revenue in the LAT grants

The amount of the (ordinary) LAT grant: the difference between the SFN and the SFR

$$h_{i,t} = \eta g_{i,t} - \theta \tau_L y_{i,t} \qquad \eta > 0,\ 1 > \theta > 0 \tag{7}$$

Substituting (7) into (2), $b_{i,t} = (1-\eta)g_{i,t} + x_{i,t} + (1+r)b_{i,t-1} - (1-\theta)\tau_L y_{i,t}$ (2')

max (1) subject to (2') and (3)

FOC
$$\frac{u_i'(g_{i,t})}{u_i'(g_{i,t-1})} = \frac{1+\rho}{1+r}$$

$$\frac{\partial y_{i,t}}{\partial x_{i,t-1}} = \frac{1+r}{(1-\theta)\tau_L} > \frac{1+r}{\tau_L} \tag{8}$$

The condition for government investment is distorted by the LAT grants (the SFR).
(8) implies the government investment $x_{i,t}$ decreases compared with the benchmark case.

Specify a function form
The production function is assumed to be the following AK function.

$$y_{i,t} = A_i(x_{i,t-1})k_{i,t-1}$$

$A_i(x_{i,t-1})$ is a function of $x_{i,t-1}$ with $A_i'(x_{i,t-1}) > 0$, and $A_i''(x_{i,t-1}) < 0$.

$$k_{i,t} = (1-\delta)k_{i,t-1} + s_i(1-\tau)A_i(x_{i,t-1})k_{i,t-1} \tag{4'}$$

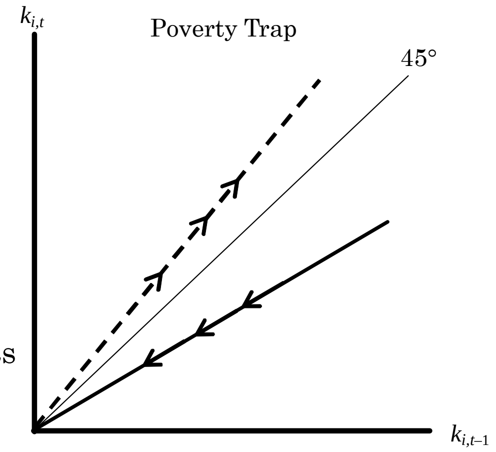
The growth rate of capital

$$\frac{k_{i,t}}{k_{i,t-1}} = 1-\delta + s_i(1-\tau)A_i(x_{i,t-1})$$

$A_i(x_{i,t-1})$ decreases due to the LAT grants. If $1-\delta + s_i(1-\tau)A_i(x_{i,t-1}) < 1$, $k_{i,t} < k_{i,t-1}$.

Ex. when $\delta = 0.05$, $s_i = 0.1$, $\tau = 0.3$, $A_i(x_{i,t-1}) = 0.6$, $1-\delta + s_i(1-\tau)A_i(x_{i,t-1}) < 1$.

(8) is replaced by $\dfrac{\partial y_{i,t}}{\partial x_{i,t-1}} = A_i'(x_{i,t-1})k_{i,t-1} = \dfrac{1+r}{(1-\theta)\tau_L}$ (8')



If $k_{i,t} < k_{i,t-1}$, $A_i'(x_{i,t}) > A_i'(x_{i,t-1})$ from (8').

Hence $x_{i,t} < x_{i,t-1}$ under this specification. It implies $y_{i,t} < y_{i,t-1}$.

In this situation, the steady state of regional income is zero.
That is a kind of **poverty traps** due to the LAT grants
like the kleptocratic poverty trap, introduced by Azariadis (2006).

3.3 Effects of the Standard Financial Need in the LAT grants

In addition to (7), including compensation for government investment

$$h_{i,t} = \eta g_{i,t} + \omega x_{i,t-1} - \theta \tau_L y_t \qquad \eta > 0,\ 1 > \theta > 0,\ \omega > 0 \quad (7')$$

Substituting (7') into (2), $b_{i,t} = (1-\eta)g_{i,t} + x_{i,t} - \omega x_{i,t-1} + (1+r)b_{i,t-1} - (1-\theta)\tau_L y_{i,t}$ (2")

max (1) subject to (2") and (3).

FOC $\dfrac{u_i'(g_{i,t})}{u_i'(g_{i,t-1})} = \dfrac{1+\rho}{1+r}$

$$\frac{\partial y_{i,t}}{\partial x_{i,t-1}} = \frac{1+r-\omega}{(1-\theta)\tau_L} \qquad (9)$$

If $\omega > (1+r)\theta$, $\dfrac{1+r-\omega}{(1-\theta)\tau_L} < \dfrac{1+r}{\tau_L}$. If $\omega \le (1+r)\theta$, $\dfrac{1+r-\omega}{(1-\theta)\tau_L} \ge \dfrac{1+r}{\tau_L}$.

4. Empirical analyses of poverty traps

Confirm whether the LAT grants enhance or deteriorate regional economic growth by using panel data on the Japanese regional economy and local public finance.

4.1 Panel Granger (non-)causality test

Hurlin and Venet (2004), and Hurlin (2005, 2008)

$$Y_{i,t} = \sum_{j=1}^{J} \gamma_i^j Y_{i,t-j} + \sum_{j=1}^{J} \beta_i^j X_{i,t-j} + \mu_i + \varepsilon_{i,t} \qquad (10)$$

Analogy from Im, Pesaran, and Shin (2003) to test the unit root hypothesis.
Set the following null hypothesis in (10) (the homogenous non-causality (HNC) hypothesis)

H0: $\boldsymbol{\beta}_i = 0 \quad \forall i = 1, 2, \ldots, N$ where $\boldsymbol{\beta}_i = \left(\beta_i^1, \beta_i^2, \cdots, \beta_i^J\right)'$

The alternative hypothesis is

H1: $\boldsymbol{\beta}_i = 0 \quad \forall i = 1, 2, \ldots, N_1 \quad (N_1 < N)$
$\boldsymbol{\beta}_i \neq 0 \quad \forall i = N_1+1, N_1+2, \ldots, N$

The average of individual Wald statistics to test the HNC hypothesis for individuals, such that

$$W_{N,T}^{Hnc} = \frac{1}{N}\sum_{i=1}^{N} W_{i,T}$$

where $W_{i,T}$ denotes the individual Wald statistics for the ith cross section unit associated to the individual test H0: $\beta_i = 0$.

For a small T sample ($T > 5 + 2J$), compute the following approximated standardized statistic

$$\tilde{Z}_{N,T}^{Hnc} = \sqrt{\frac{N}{2J} \times \frac{(T-2J-5)}{(T-J-3)}} \times \left[\frac{(T-2J-3)}{(T-2J-1)} W_{N,T}^{Hnc} - J\right]$$

$$\tilde{Z}_{N,T}^{Hnc} \xrightarrow[N\to\infty]{d} N(0,1)$$

These causality tests are applied in Peltrault and Venet (2005), Bhaduri and Durai (2006), and Suliman (2008).

4.2 Prefectural data

Sample period: from fiscal 1990 to 2006, By prefecture
GDP : real prefectural GDP per capita Cabinet Office "Annual Report on Prefectural Accounts."
LATGP: per capita real LAT grants received by prefectures (deflated by the prefectural GDP deflator)
Ministry of Internal Affairs and Communications "Annual Statistical Report on Local Government Finance."
LATGT: per capita real LAT grants received by prefectures and municipalities
Population Ministry of Internal Affairs and Communications "Basic Resident Registers."
Tokyo, Kanagawa, Aichi, and Osaka prefectures (non-receiving bodies) are excluded.

4.3 Test results

Unit Root Tests: Im, Pesaran, and Shin (2003)

	Statistic	P-value
GDP	-3.852	0.000
LATGP	-4.048	0.000
LATGT	-3.076	0.001

The panel Granger non-causality test

	Statistic	P-value
LATGP to GDP		
$\tilde{Z}^{Hnc}_{N,T}$	11.282	0.000
GDP to LATGP		
$\tilde{Z}^{Hnc}_{N,T}$	11.578	0.000
LATGT to GDP		
$\tilde{Z}^{Hnc}_{N,T}$	14.521	0.000
GDP to LATGT		
$\tilde{Z}^{Hnc}_{N,T}$	2.191	0.014

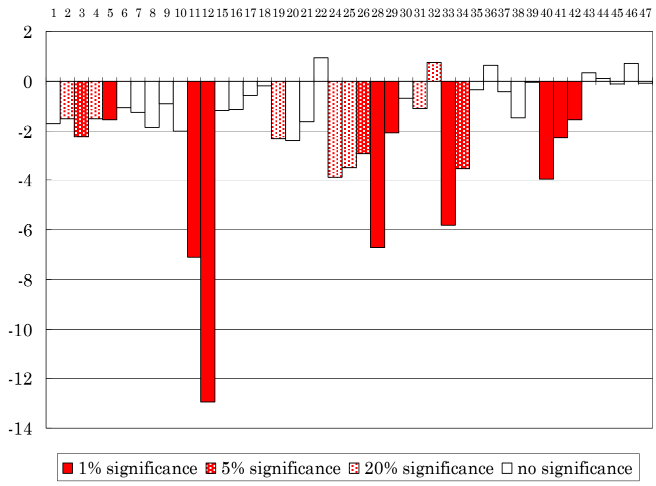
Estimate equations based on (10)

$$GDP_{i,t} = \sum_{j=1}^{J} \alpha_i^j GDP_{i,t-j} + \sum_{j=1}^{J} \beta_i^j LATGX_{i,t-j} + \mu_i^{GDP} + \varepsilon_{i,t}^{GDP}$$

$$LATGX_{i,t} = \sum_{j=1}^{J} \gamma_i^j GDP_{i,t-j} + \sum_{j=1}^{J} \zeta_i^j LATGX_{i,t-j} + \mu_{i,t}^{LATGX} + \varepsilon_{i,t}^{LATGX}$$ (where *LATGX* means *LATGP* or *LATGT*)

Identify their lag length (Schwarz Information Criterion for Identification)

Estimated coefficients in regression LATGP to GDP



5. Concluding remarks

- Examine poverty traps with the LAT grants.
- Show that the LAT grants give a disincentive to increase their estimated tax revenue and regional income by a theoretical model.
- From the panel Granger (non-)causality tests proposed, we find that there are poverty traps due to the LAT grants.
- To break out of poverty traps in the Japanese rural regions, the calculation of the LAT grants should be revised in future decentralization reform

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