Difficulties of One-Dimensional Fiscal Policy in the EMU
— Applying Optimal Fiscal Policy to Multiple Countries —

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I. Introduction

Since 1993, member countries of the European Economic and Monetary Union (EMU) receive instructions for their fiscal policy from the European Commission. In 1993, the Maastricht treaty sets four convergence criteria that must be met by each member country before it can take part in the third stage of the EMU: that is, before it can adopt the common currency, the "EURO." The convergence criteria are meant to ensure that economic development within the EMU is balanced and does not give rise to any tensions among member countries. One of the convergence criteria involved the following restrictions on fiscal policy: the ratio of the government deficit to GDP must not exceed 3% and the ratio of government debt to GDP must not exceed 60%.

These criteria must continue to be met after the introduction of the EURO in 1999. In 1997, the Stability and Growth Pact (SGP) enabled to coordinate national government budget policies and avoid excessive government budget deficits to facilitate meeting the convergence criteria. We regard these fiscal policy instructions as one-dimensional fiscal policy restrictions in the EMU. “One-dimensional” means that all member countries accept identical instructions, even though they have different economic conditions and fiscal policy backgrounds.

Buti et al. (1998) and many other previous studies consider the optimal
way to implement fiscal policy and the effects of its coordination within a monetary union. Those studies focus on scenarios where a new EMU member would lose the possibility of using monetary policy for the stabilization of country-specific shocks, thus being in a situation where fiscal policy is the only remaining instrument. Beetsma and Uhlig (1999) try to capture some hypothetical interactions between several governments and a common central bank, in which the governments have the possibility to raise debt and the common central bank sets unified monetary policy for all member countries. Beetsma et al. (2001) discuss the role of national fiscal policies in stabilizing country-specific economic disturbances in the EMU and international spillover effects from such stabilization policies. Giuliodori and Beetsma (2008) investigate the interdependence of fiscal policies empirically, concluding that the fiscal policy plans of large countries affect those of small countries, but the influence does not move in the other direction. Ferre (2008) points out that a broader coordination of fiscal policies among the EMU member countries should be sought because countries will benefit individually and collectively. However, there could be occasions where one of the countries would choose not to follow a broad coordination, even though collectively they would prefer the broad coordination’s outcome. If a country loses more benefit individually than it can win collectively through fiscal policy coordination, the country should not follow the monetary union’s instructions to coordinate fiscal policy among members.

In our study we focus on the individual national outcome resulting from fiscal policy instructions given to all member countries by the monetary union. We point out how fiscal policy restrictions can affect developing and developed countries differently, because their fiscal policy, especially government expenditure, can play a different role. The main purpose of our paper is to examine the implications of one-dimensional fiscal policy instructions for the growth of EMU member countries. In the following section, we employ a growth model with optimal fiscal policy to define...
reasons for the balance between public and private capital in a developed
country, and different effects that one-dimensional fiscal policy restrictions
have on developing and developed countries. In section III, we empirically
analyze conditions of public and private capital and their effects on GDP
in EMU member countries. We focus on the bottom four countries in
terms of GDP per capita. We regard these bottom four countries as
developing countries, relative to other eight member countries, and exam-
ine whether one-dimensional fiscal policy coordination prevents smooth
development of economic growth in these four countries. In section IV,
we conclude our research and outline a number of issues that need
further research.

II. Theoretical Approach

In this section, we introduce a growth model that portrays optimal
fiscal policy through a relationship between public and private capital on
optimal economic growth. With this model, we try to determine a
country-specific outcome from the fiscal policy instructions given to all
monetary union members. We also try to connect this growth model to
Convergence Hypothesis, to understand the difficulties of one-dimensional
fiscal policy coordination for multiple countries.

The theory of economic growth explained by Barro (1990), Glomm and
Ravikumar (1994, 1999), Futagami et al. (1993) and others analyzed
relationships between national fiscal policy and optimal economic growth.
The theory of optimal growth by Arrow and Kurz (1970) specifies a
condition of public and private capital goods for the existence of a
stationary solution in the dynamics of an optimal growth path. With
regard to these studies, we point out the ratio between public and private
capital as a key indicator for optimal fiscal policy.

In our study, we adopt fundamentally the simple growth model of
Glomm and Ravikumar (1994) to analyze the effects of public investment
on infrastructure and to explore the political implications of capital accumulation in the public and private sectors. In respect to their specification, we assume that investments in infrastructure may be viewed as expenditures on publicly provided inputs such as roads and highways, water supply, airports, law enforcement, education, etc. To simplify our model, we assume no spillover effect among monetary union members. The model framework is hereby described.

Assume that the economy is populated by a large number of identical infinitely-lived households and a government. The population growth rate is assumed to be zero and the size of the population is denoted by \( N_t \). Each household supplies one unit of labor inelastically and is valued as a single non-storable good by the utility function,

\[
\max \sum_{t=0}^{\infty} \beta^t \ln(c_t),
\]

where \( \beta \in (0, 1) \) is the discount factor and \( c_t \) is the consumption of the representative household at time \( t \).

Each household faces the following budget constraint and initial condition,

\[
\sum_{t=0}^{\infty} p_t (c_t + k_{t+1}) = \sum_{t=0}^{\infty} \{ p_t (1 - \tau_t) (w_t + r_t k_t) + z_t \},
\]

\[
c_t, k_{t+1} \geq 0, t = 0, 1, \ldots,
\]

\[
given \ k_0, \{ p_t, w_t, r_t, z_t, \tau_t \}_{t=0}^{\infty},
\]

where \( p_t \) is the price of consumption/investment goods, \( w_t \) is the wage rate, \( r_t \) is the rental rate on capital, \( \tau_t \) is the tax rate, and \( z_t \) is the household's share of profits. In this model, each household owns an initial stock of private capital \( k_0 \) but the private capital depreciates at 100 percent and evolves according to

\[
k_{t+1} = i_t, \ t = 0, 1, \ldots,
\]
where \( i_t \) is the representative household’s investment. Each household maximizes eq. (1) subject to eqs. (2)-(5).

The representative firm’s problem is choosing capital and labor with the production function to maximize its profit.

\[
\max A \hat{G}_t k_t^\alpha l_t^{1-\alpha} - w_t l_t - r_t k_t, \tag{6}
\]

s.t. \( \hat{G}_t = \frac{G_t}{K_t^\alpha L_t^\alpha} \)
\[
k_t, l_t \geq 0,
\]
given \( \hat{G}_t, w_t, r_t \),

where \( k_t \) is the private capital, \( l_t \) is the number of hired labors. \( G_t \) and \( K_t \) are the aggregate stocks of infrastructure (Government Expenditure) and private capital and \( L_t \) is the aggregate labor input. \( \hat{G}_t \) is the aggregate stock of infrastructure available to all firms and is subject to congestion.

A competitive equilibrium, named the \( \pi \)-competitive equilibrium \((\pi\text{-CE})\), for this economy is defined as follows. Let \( \pi = \{\tau_t, \hat{G}_{t+1}\}_{t=0}^{\infty} \) be an arbitrary fiscal policy with \( \tau_t \in [0,1] \) and \( \hat{G}_{t+1} \in \mathbb{R}^+ \) for all \( t \). \( \pi\text{-CE} \) is a set of allocations \( \{c_t, l_t, k_{t+1}\}_{t=0}^{\infty} \) together with \( \{p_t, w_t, r_t\}_{t=0}^{\infty} \) such that (i) \( \{c_t, k_{t+1}\}_{t=0}^{\infty} \) solves the representative household’s problem; (ii) \( \{l_t, k_t\}_{t=0}^{\infty} \) solves the firm’s problem; and (iii) the labor and goods markets clear the condition \( c_t + k_{t+1} = (1-\tau_t) \hat{G}_t k_t^\alpha, \ l_t = 1, \ t = 0, 1, \cdots \).

In the public sector investment in infrastructure \( I_t^G \) plays a significant role. We assume that the budget constraint of a government is balanced each period,

\[
G_{t+1} = I_t^G = \tau_t (w_t L_t + r_t K_t), \tag{7}
\]

and the initial stock of infrastructure \( G_0 \) is exogenous. There are tradeoffs for fiscal policy as follows. A higher tax at time \( t \) implies lower current consumption and saving. A higher income tax implies more investment in public capital, which leads to a higher future output. The higher tax also
yields the benefit of reducing congestion by providing a disincentive for private capital accumulation.

Using the unique solutions of this optimization exercise, the optimal public policy under the conditions of $\pi$-$CE$ is determined by choosing $\{\tau_t\}_t^{\infty}$ to

$$\max \sum_{t=0}^{\infty} \beta^t \ln \{ (1-\alpha\beta)(1-\tau_t)A\hat{G}_t^\varnothing k_t^\varnothing \},$$

s.t. $\tau_t \in [0,1],

\begin{align*}
G_{t+1} &= \tau_t NAG_{t+k_t^\varnothing}, \\
\hat{G}_t &= \frac{G_t}{K^\varnothing N^\varnothing}, \\
K_{t+1} &= Nk_{t+1}, \\
k_{t+1} &= \alpha\beta(1-\tau_t)A\hat{G}_t^\varnothing k_t^\varnothing, t=0,1,... \quad (9-2)
\end{align*}

$k_0, G_0$ given.

To derive the optimal tax rate in this model, we reform the aforementioned objective function to the value function below to employ dynamic programming.

$$\nu(k_t, G_t) = \max \ln \{ (1-\alpha\beta)(1-\tau_t)A\hat{G}_t^\varnothing k_t^\varnothing \} + \beta \nu(k_{t+1}, G_{t+1})$$

s.t. $G_{t+1} = \tau_t NAG_{t+k_t^\varnothing},

\hat{G}_t = \frac{G_t}{K^\varnothing N^\varnothing},

K_{t+1} = Nk_{t+1},

k_{t+1} = \alpha\beta(1-\tau_t)A\hat{G}_t^\varnothing k_t^\varnothing.$

To solve this objective function (Bellman’s Equation) we use a recursive approach as follows:

$$\nu(k, G) = \frac{\alpha - \rho \theta}{1 - (\alpha - \rho \theta) \beta - \theta \beta} \ln(k) + \frac{\theta}{1 - (\alpha - \rho \theta) \beta - \theta \beta} \ln(G) + D, \quad (11)$$
where $D$ is constant. To solve this function, we can find the optimal policy function for the tax rate as

$$\tau_t = \theta \beta. t = 0, 1, \ldots.$$  \hspace{1cm} (12)

where public capital depreciates at 100 percent in each period. In other words, in this model, we are focusing on the flows of private and public capital. We put this solution into eqs. (9-1) and (9-2), and thus derive the optimal ratio of public to private capital as follows:

$$\frac{G_{t+1}}{k_{t+1}} = \theta \frac{N}{\alpha(1-\theta \beta)}. \hspace{1cm} (13)$$

Equation (13) implies that the optimal ratio of public to private capital should be constant at a certain level with given parameters, when the government chooses the optimal policy for the tax rate.

We can derive the evolution of private capital from eq. (13) as

$$k_{t+1} = \alpha(1-\theta \beta)^{1-\theta} \theta^\alpha A \beta N^{\theta(1-\rho-\phi)} k_t^{\alpha+(1-\rho)\theta}. \hspace{1cm} (14)$$

For $\alpha + (1-\rho)\theta \in (0,1)$, we understand from eq. (14) that the dynamic map ($k_{t+1}$ vs. $k_t$) is increasing, strictly concave, and has a slope that eventually declines to zero. As a result, the sequence $\{k_t\}$ monotonically converges to a steady state level $k^*$ independent of initial stocks $k_0$ and $G_0$.

In addition to this growth model, we assume decreasing returns to reproducible factors for the production function. The evolution of private capital in this case is not as straightforward. If we assume that the growth rates of public and private capital should be equal through eq. (13) and the production function has a decreasing return in eq. (14), then the growth rates of both types of capital converge to the level of those countries with the most developed economy. Even in reality, it is natural to assume a production function with a decreasing return; therefore we will accept $\alpha + (1-\rho)\theta < 1$ in eq. (14). Consequently, this assumption of
decreasing return could be related to the Convergence Hypothesis.

The Convergence Hypothesis elucidated by Baumol (1986) suggests that levels of per capita output will converge in the long term. We assume that the mechanism of the Convergence Hypothesis will be accelerated through the monetary union because of free mobility of production factors among member countries. Therefore the hypothesis works even in the short term within a monetary union. The mechanism is as follows. If a less developed country has the potential to catch up to the economic level of a country with the most advanced technology, the less developed country (developing) will grow faster than a more developed country through technological transfer. In other words, developing countries could imitate the technologies of developed countries, which is much easier and faster than developing new frontier technologies in the most advanced countries. We mention the “potential” to catch-up, which mainly refers to the degree of enhancement of infrastructure. If a developing country has not invested sufficiently in infrastructure, it obligatorily spends extra capital, especially public capital, on the infrastructure in order to attain the catching-up potential of the economy. Developed countries have already invested in their infrastructure, and therefore their public investment has only a small impact on their growth. Hence, their growth rate will be stabilized. Marrero (2008) concurs that a developed country tends to stabilize its growth rate. His findings suggest that this trend should be accompanied by an optimal strategy that reduces the share of output devoted to public investment.

These conditions lead per capita output to drop anchor at a particular level as a steady state. If we set the same parameters for all countries in our model, because of a common market for all member countries in a monetary union, all countries should reach an identical level of per capita output. In brief, the levels of per capita output converge to the level of the most developed country. If the levels of economies thus converge, an optimal fiscal policy will become common to all member countries. How-
ever, if one member is a developing country, whose economy is far below the level of developed countries in the monetary union, we need to set different parameters in our model, and therefore, the optimal fiscal policy for the developing country must be different from those in developed countries. Because of the Convergence Hypothesis, a fiscal policy for the purpose of catching-up is effective in developing countries. According to this idea, public capital has much more significant meaning in developing countries than in developed countries. Therefore, it is imaginable that developing countries should give more density to public capital than developed countries. In consequence, through eq. 13, we assume that optimal capital conditions are different between developed and developing countries, leading to their respective optimal fiscal policies as follows:

\[ \text{Opt.}\frac{G_{t+1}}{k_{t+1}}(\text{DevelopedCountries}) \neq \text{Opt.}\frac{G_{t+1}}{k_{t+1}}(\text{DevelopingCountries}). \]  
(15)

With regard to one-dimensional fiscal policy instructions in a monetary union, we can define the following case. If the instructions are composed of optimal fiscal policy for developed countries in the monetary union, capital conditions will become as follows:

\[ \frac{G_{t+1}}{k_{t+1}}(\text{DevelopedCountries}) = \text{Effective} = \text{Const.} \] 
(16)
\[ \frac{G_{t+1}}{k_{t+1}}(\text{DevelopingCountries}) = \text{Ineffective} = \text{NotConst.} \] 
(17)

As a result of our theoretical approach, it is clear that an optimal strategy of the fiscal policy commonly exists only for developed countries, because the same fiscal policy does not fit the conditions for developing countries, even when there are identical market conditions within a monetary union.
Table 1. Ratio of Collective Consumption Expenditure of General Government to Gross Fixed Capital Formation for the bottom four countries

<table>
<thead>
<tr>
<th></th>
<th>Ireland</th>
<th>Greece</th>
<th>Spain</th>
<th>Portugal</th>
<th>All 12 Ave</th>
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<tbody>
<tr>
<td>1995</td>
<td>0.38</td>
<td></td>
<td>0.37</td>
<td>0.32</td>
<td>0.42</td>
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<tr>
<td>1996</td>
<td>0.34</td>
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<td>0.36</td>
<td>0.30</td>
<td>0.41</td>
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<tr>
<td>1997</td>
<td>0.30</td>
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<td>0.35</td>
<td>0.29</td>
<td>0.40</td>
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<tr>
<td>1998</td>
<td>0.27</td>
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<td>0.32</td>
<td>0.28</td>
<td>0.37</td>
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<tr>
<td>1999</td>
<td>0.23</td>
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<td>0.30</td>
<td>0.27</td>
<td>0.36</td>
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<tr>
<td>2000</td>
<td>0.22</td>
<td>0.55</td>
<td>0.28</td>
<td>0.29</td>
<td>0.36</td>
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<tr>
<td>2001</td>
<td>0.23</td>
<td>0.54</td>
<td>0.28</td>
<td>0.29</td>
<td>0.36</td>
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<td>2002</td>
<td>0.24</td>
<td>0.55</td>
<td>0.28</td>
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<td>2003</td>
<td>0.23</td>
<td>0.46</td>
<td>0.27</td>
<td>0.35</td>
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<td>2004</td>
<td>0.21</td>
<td>0.47</td>
<td>0.27</td>
<td>0.36</td>
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<tr>
<td>2005</td>
<td>0.19</td>
<td>0.46</td>
<td>0.25</td>
<td>0.39</td>
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<td>2006</td>
<td>0.19</td>
<td>0.41</td>
<td>0.25</td>
<td>0.38</td>
<td>0.37</td>
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<tr>
<td>2007</td>
<td>0.20</td>
<td>0.44</td>
<td>0.25</td>
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| STDV  | 0.057   | 0.053  | 0.041 | 0.040    | 0.036      |

Source: Eurostat (GDP and main components, Current prices, 1995-2007)

III. Empirical Analysis

In this section, we analyze empirically the conditions between public and private capital and their effects on GDP of EMU members, using data from 1995 to 2007. According to our theoretical approach, we assume that conditions between public and private capital should not be stable in developing countries. In this aspect, we calculate the ratio of government expenditure (public capital) to private sector investment (private capital) for the bottom four countries. We regard data related to collective consumption expenditure of all levels of government as government expenditure, and gross fixed capital formation as private sector. In partic-
Figure 1: Collective Consumption Expenditure of General Government/GDP (Top eight countries)

![Figure 1: Collective Consumption Expenditure of General Government/GDP (Top eight countries)](image)

Figure 2: Collective Consumption Expenditure of General Government/GDP (Bottom four countries)

![Figure 2: Collective Consumption Expenditure of General Government/GDP (Bottom four countries)](image)

Source: Eurostat (GDP and main components, Current prices, 1995-2007)


In particular, we view Ireland, Greece, Spain and Portugal as developing countries (Bottom four countries), because GDP per capita in these countries was lowest among the 12 EMU member countries in 1995. In this section, our main framework is to compare the results of the bottom four countries with that of the top eight countries.

Based on eqs. 16 and 17, Table 1 shows time series data for the ratio in each of the bottom four countries as well as the average for all 12 EMU member countries. We found that standard deviations in the bottom four
countries are larger than that average of the 12-member average. From these results of GDP per capita and their larger volatilities in capital conditions, we assume that the bottom four countries were not in an economic steady state; in other words, they had not yet reached the constant economic growth conditions seen in the eight developed countries. It is possible that the restrictions on fiscal policy, Convergence Criteria and SGP, limit their economic growth, as we mentioned in section II. Using a graphic representation of time series data about public and private capital ratio to GDP, we can intuitively discern converging and not-converging trends.

Figures 1 and 2 show the ratio of the collective consumption expenditure of general government to GDP in the top eight and bottom four countries. From the both figures, it appears that most member countries’ ratios approach 8%, except Netherlands (averaged over 10%) and Ireland (averaged under 6%). The time series trend for Greece is an example of the convergence, with the ratio decreasing from 12% to 8% as shown in Figure 2. From these figures, we can intuitively define time-trends for the ratio of the collective consumption expenditure of general government to GDP in most member countries as converging to 8%. From this result, we can assume that the convergence criteria controlled the levels of this ratio for all member countries.

Figures 3 and 4 show the ratio of fixed capital formation to GDP in the top eight and bottom four countries. In Figure 3, we see a converging trend to 20% for the ratio among the top eight countries. To clarify the converging trend, we employ coefficient of variation (CV) for the top eight and all 12 countries in Table 2. The CV is a normalized measure of dispersion in a probability distribution. For the top eight countries, the CV decreased from 12.5% in 1995 to 8.0% in 2007; in brief, the disparities among these countries are declining. On the other hand, the CV for all the 12 EMU countries increased from 11.0% in 2000 to 16.4% in 2006. This statistic implies that the top eight countries are in a steady
state under constant conditions of economic growth, and hence, their ratio of private capital to GDP is converging to a certain level. Because of the influence of the bottom four countries, the CV for all the 12 countries is increasing. In Figure 4, we can not find such a converging trend. Here we define the not-converging trend of this ratio for the bottom four countries.

To examine the correlation between capital flows (gross fixed capital formation as investment, and collective consumption expenditure of gen-
Table 2: Coefficient of Variation for Gross Fixed Capital Formation/GDP at All 12 and Top eight countries

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<td>2005</td>
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<td>2007</td>
<td>5.7%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Eurostat (GDP and main components, Current prices, 1995–2007)
* For All 12 countries the CV is valid only from 2000 to 2006, because data exist for Greece only from 2000 to 2007 and for Portugal only from 1995 to 2006.

eral government as government expenditure) and GDP, we set up a model for a goods market with a panel data analysis using ordinary least squared (OLS) as follows.

\[ Y_{it} = \alpha C_{it} + \beta I_{it} + \delta G_{it} + \varphi EX_{it} + u_{it} \]  

(18)

Here \( Y_{it} \) stands for the nominal output of country \( i \) at time \( t \). \( C_{it} \) is the final consumption expenditure of households. \( I_{it} \) is the gross capital formation as private capital flow. \( G_{it} \) is the collective consumption expenditure of general government as government expenditure. \( EX_{it} \) stands for the external balance of goods and services. Because of the EMU, all member countries are involved in one market; therefore, we assume that the price level and the inflation quote, each have a single value for all member countries. \( u_{it} \) stands for the residual in this estimation. To prevent the correlation between residuals and their own lagged values in time series regression, we set up a first order autoregressive method as follows:
Difficulties of One-Dimensional Fiscal Policy in the EMU (DOI: OOHAMA)

Table 3:
Panel data OLS analysis with first order autoregressive model for Goods Market

\[ Y_{it} = \alpha C_{it} + \beta I_{it} + \delta G_{it} + \varphi EX_{it} + \mu_{it} \]

\[ \mu_{it} = \rho \mu_{it-1} + \epsilon_{it} \]  

<table>
<thead>
<tr>
<th></th>
<th>All 12</th>
<th>Top eight</th>
<th>Bottom four</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\alpha) (P-Value)</td>
<td>1.02(0.00)</td>
<td>1.00(0.00)</td>
<td>1.18(0.00)</td>
</tr>
<tr>
<td>(\beta) (P-Value)</td>
<td>1.17(0.00)</td>
<td>1.18(0.00)</td>
<td>1.03(0.00)</td>
</tr>
<tr>
<td>(\delta) (P-Value)</td>
<td>1.27(0.00)</td>
<td>1.32(0.00)</td>
<td>0.92(0.00)</td>
</tr>
<tr>
<td>(\varphi) (P-Value)</td>
<td>0.84(0.00)</td>
<td>0.83(0.00)</td>
<td>0.89(0.00)</td>
</tr>
<tr>
<td>AR (1)</td>
<td>1.04(0.00)</td>
<td>1.04(0.00)</td>
<td>1.07(0.00)</td>
</tr>
<tr>
<td>Adj. R-Squared</td>
<td>0.99</td>
<td>0.99</td>
<td>0.99</td>
</tr>
<tr>
<td>D-W Stat</td>
<td>2.23</td>
<td>2.23</td>
<td>2.54</td>
</tr>
<tr>
<td>Observation</td>
<td>138 (Unbalanced Pool)</td>
<td>96 (Balanced Pool)</td>
<td>42 (Unbalanced Pool)</td>
</tr>
</tbody>
</table>

Source: Eurostat (GDP and main components, Current prices, 1995–2007)
(Millions of euro (from 1.1.1999)/Millions of ECU (up to 31.12.1998))

\[ u_{it} = \rho u_{it-1} + \epsilon_{it} \]  

(19)

where \(\rho\) is an unknown parameter between \(u_{it}\) and \(u_{it-1}\), which we call the first order serial correlation coefficient. In effect, the first order regressive model incorporates the residual from the past observation into the regression model for the current observation.

For this model, we employ the national accounts data of EUROSTAT from 1995 to 2007 (but for Greece, the period is from 2000 to 2007, and for Portugal, it is from 1995 to 2006) as panel data. We calculate this model for three patterns:

1) all 12 EMU countries with 138 observations,
2) top eight countries with 96 observations, and
3) bottom four countries with 42 observations.

Table 3 shows the results of our regression analysis. At first glance, we can recognize that all variables for the set of the 12 EMU member
countries (All 12) have constant ties to GDP, because all results are statistically significant. Our main interest in this analysis is comparing the two sub-groups: top eight and bottom four countries. In both data sets, every coefficient is statistically significant. The coefficient $\beta$ of private capital in the bottom four countries is smaller than in the top eight countries. It is possible that private capital flow in the bottom four countries influences their growth less effectively, because their infrastructures are consolidated insufficiently and they have not reached the level of efficient economy seen in the top eight countries. The most interesting result in this regression analysis is for the public sector. The coefficient $\delta$ of public capital in the bottom four countries is much low (0.92) than in the top eight countries (1.32). From this result, we understand that public capital flow in the bottom four countries has much weaker effects on their economic growth than in the top eight countries.

IV. Concluding Remarks

The main purpose of our study was to examine the individual national outcomes of one-dimensional fiscal policy instructions given to all EMU member countries. In our theoretical approach, we could define different effects of one-dimensional fiscal policy on developing and developed countries, because government expenditure can play a more important role for infrastructure improvement in developing than in developed countries. On one hand, developed countries have stable economic growth condition. On the other hand, developing countries can grow faster and stronger to catch up their economic levels through technological transfer, even though they do not have stable economic growth conditions. If economic levels are truly converging within all member countries of the EMU, one-dimensional fiscal policy instructions and policy coordination could affect all member countries equally and thus effectively. However, if one country's economy is far below the level of the other (developed) countries,
with its infrastructure consolidated less sufficiently than theirs, it is possible that fiscal policy restrictions will prevent its smooth economic growth.

According to our empirical approach, we found that four member countries (Ireland, Greece, Spain and Portugal) have trends toward convergence of their ratio of government expenditure to GDP, but no such converging trends for their ratio of private capital to GDP. In addition, the results of our regression analysis show that these bottom four countries show weaker effects of private and public capital on GDP than seen in the other eight countries. As a result, we conclude that the bottom four countries have not reached the economic level of the top eight countries; therefore, identical fiscal policy instructions for the entire EMU will lead to disturbances of the capital conditions and economic growth in the bottom four countries.

Finally, we wish to address issues for our future research. In this study, we employed a simple theoretical model without considering the collective benefit and spillover effects from fiscal policies of other monetary union members. For example, we need to involve the effects of the Structural Fund for economic and social cohesion in EU, in which developing countries will be supported for their regional development by the fund of EU. It is possible that a country will lose individual benefits from fiscal policy coordination but win overall by gaining more benefits from collective aspects. We should incorporate collective benefits in our theoretical model and set up spillover effects in a concrete form to extend our empirical analysis. In our empirical analysis the expression on the demand side was used, because the analysis on the supply side was difficult without forcible settings on the key parameters. However, the model setting in our empirical analysis is one of the most relevant assignments to develop our future research. Moreover, we need to grasp the time lag in developing countries between government expenditure for infrastructure and its effects on growth.
References