Centralization, Decentralization and Incentive Problems in Eurozone Financial Governance : A Contract Theory Analysis

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Centralization, Decentralization and Incentive Problems in Eurozone Financial Governance: A Contract Theory Analysis[♦]

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Abstract

We use a Contract Theory framework to analyze the mechanisms of Eurozone financial governance through the Stability and Growth Pact (SGP), with a focus on centralization vs. decentralization and incentive problems. By constructing a Stackelberg game model with n Ministries of Finance as the first movers, and European Central Bank as the second mover, we show that each government can create growth in its own country (self-benefit) by increasing government spending, but it will increase inflation and the euro value will fall. Since these effects are shared equally by euro countries (cost sharing), there exists an incentive to free-ride on other countries. We then analyze a solution to the free-rider problem through the penalty scheme in the SGP, and derive a second best solution where a commitment not to renegotiate penalties ex-post is impossible. Lastly, we derive the parameter conditions for optimizing the EU's current allocation of authority, "divided authority structure," which consists of Monetary Centralization and Fiscal Decentralization. We find that what is effective is "contingency dependent governance" based on "relative sovereignty," where there is a division of authority as the basic structure and the main body governs with leading sovereignty depending on the contingency.

Key Words Stability and Growth Pact, Monetary Centralization, Fiscal Decentralization, Free-Rider Problem, Penalty Schemes and Renegotiation, Authority Allocation Structure, Relative Sovereignty

JEL Classification Numbers E61, F59, H11, H63, H87

1. Introduction

In this paper, we analyze the mechanisms of eurozone financial governance through the Stability and Growth Pact (SGP) in theory and in reality, with a focus on centralization and decentralization, and incentive structures.

We start by describing the institutional framework of the period 2002 to 2003 when there were 12 eurozone countries.[1]

The structure regarding the allocation of authority is both a centralization of authority on interest policy, which rests with the European Central Bank (ECB) and a decentralization of authority on fiscal policy, which rests with each country. This is to say that the eurozone has a structure of Monetary Centralization and Fiscal Decentralization under a common currency (the euro). Thus, a structure of strategic interdependence emerges between "the interest rate policy by the ECB for maintaining the value of the euro" and a "national deficit poured away by each country".

The major factor making fiscal stabilization difficult is the "**Prisoner's Dilemma**" problem in financial governance. When other countries abide by the fiscal rule, one of the countries has an incentive to become a free rider. Its neglect may cause other countries to follow, causing a loss of the binding force of the SGP. It may lead to further difficulties in maintaining the value of the euro, which theoretically corresponds to the phenomenon of a "Tragedy of Commons".

The mechanism for financial governance under fiscal decentralization lies with the SGP, which is a governance mechanism that imposes the condition of "an annual national deficit below 3% of GDP, and a government debt of lower than 60% of GDP" upon member nations, at a regional level.

As an institutional mechanism for the SGP, the European Commission (EC) is allowed to be an agent that monitors the national deficits of eurozone countries and is provided with the authority to <u>warn</u> that penalties will be applied to countries that violate the rules.

The European Commission (EC) checks for divergence from the financial stabilization plans that member nations have submitted. This serves as an early warning of any risk exceeding 3% of GDP. The European Commission (EC) employs excessive national deficit procedures against

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[1]The institutional description below is mainly based on Tsuranuki (2005), which pursues the institutional essence of eurozone financial governance from the viewpoint of political science. De Grauwe (2007) analyzes the costs and benefits associated with having one currency, as well as the practical issues involved with monetary union. However, it is not the contract/game theoretical analysis.

the continuation or deterioration in the divergence. It requires measures to be taken within four months and a resolution within one year. A penalty warning is given for breaches.

The penalty is prescribed at 0.5% of GDP as a maximum. This involves "large amounts of money". When the amount of the penalty is adopted by a vote in the Eurozone Finance Ministers Council, the penalty becomes *binding*.

However, there is a divided structure where the European Commission (EC) has the *warning* authority regarding the penalty application and the Eurozone Finance Ministers Council has the *decision-making* authority. There exists room for approaching the Ministry of Finance in each country in order for countries in violation to avoid having to pay a "huge" penalty, i.e. there is room for *renegotiation.*

Whether the penalty is indeed imposed is determined by Qualified Majority Voting (QMV) in the Finance Ministers Council. Adoption requires a two-thirds or greater number of votes, thus a blocking minority becomes applicable with one-third or more votes. The formation of the blocking minority by a major power in violation may be relatively easy.

There are two cases where institutional limitations were exposed in the period 2002 to 2003.

Case 1: Decision not to adopt an early warning against Germany, January 30, 2002

The European Commission (EC) issued an early warning. However, Germany was able to secure a blocking minority. In order to avoid a wavering in the credibility of the SGP due to a defeat in a vote, the Finance Ministers Council did not adopt the warning issued by the European Commission (EC) in exchange for a commitment by Germany to reduce its national deficit.

Case 2: Rejection of the warning against France and Germany by the Eurozone Finance Ministers Council, November, 2003

The warning to force France and Germany, to which a second warning of an excessive national deficit procedure had been issued, to reduce their national deficits was rejected by QMV. A proposal was passed on the temporarily shelved penalty given to Germany.

From these two cases, which exposed certain institutional limitations, we see that even if the penalty included in the SGP is recommended by the European Commission (EC), it is extremely difficult for it to be adopted by the Finance Ministers Council, which determines whether the penalty should actually be invoked. [2]

We can see a game structure in which the European Central Bank (ECB) raises the policy rate to maintain the value of the euro against any free-rider nation that pours away national deficits when the penalty function of the SGP to suppress a national deficit under fiscal decentralization

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[2]Though one might have a concern that these two cases are relatively old (2002 and 2003), we believe that they were the fundamental sources which undermined the credibility and effectiveness of the penalty scheme in the Stability and Growth Pact.

does not work.

From the above description, the institutional framework of the eurozone can be shown in the following figure.

Monetary Centralization, **Fiscal Decentralization** and

Eurozone financial governance through the Stability and Growth Pact (SGP)

(SGP operator)

European Commission   **European Central Bank (ECB)**

(EC)   **single (common) policy rate**

Penalty   Warning

Deviation: Free rider   Determined by a vote in the Finance Ministers Council

Ministry of Finance 1, 2 ·· Ministry of Finance n=17

MOF 1 ·············· **MOF n**

Financial spending   Financial spending

In this paper, we use a Game/Contract Theory framework to analyze the mechanisms of eurozone financial governance through the Stability and Growth Pact (SGP), with a focus on centralization vs. decentralization and incentive structures in the European Union (EU).

We first construct a Stackelberg game model played by n Ministries of Finance (MOF) in n eurozone member countries as the first movers, and the European Central Bank (ECB) as the second mover. We then show the following basic intuition. The Government in each country can create growth (economy) in its own country, which means an increase in GDP (100% self-benefit), by increasing government spending in its own country, but this increases inflation, and the value of the euro falls. Since these effects are shared equally by euro countries (the cost is shared equally), there exists an incentive to cut corners on reducing the issuance of public debt (a free ride on other countries). We see that an increase in the number n of the Ministries of Finance (MOF) or the number n of nations will lead to a more severe free-rider problem.

Following this framework, we analyze a solution to the free-rider problem through the penalty scheme in the SGP. Of course, when there exists an executor who commits himself to and enforces the penalty schemes in the SGP, the first best solution can be achieved, as the literature shows (e.g. Bolton and Dewatripont (2005) and Holmstrom (1982)). However, as we described, "re-discussion (voting)" was conducted as to whether the penalty scheme should actually be imposed on the deviating country or not. In this case, the commitment not to conduct

ex-post renegotiation on the penalty is impossible. When the major powers, Germany and France, break the fiscal rule in the SGP (by excessive government spending), ex-post renegotiation may occur. At that time, a renegotiation gain will exist. In exchange for side-payments to other countries by Germany and France, no large penalty, or a significant reduction in the amount of the penalty will ensue. We characterize the second best solution as a situation where a commitment not to renegotiate penalties ex-post is impossible. The optimal solution shows that "**limited sovereignty**" should be imposed on the high marginal cost country for the issuance of public debt.

Lastly, we derive the parameter conditions for optimizing the current EU (European Union) allocation of authority, or "divided authority structure," which consists of Monetary Centralization (ECB) and Fiscal Decentralization (the Ministries of Finance in each country). From a global equilibrium payoff comparison, we find that what is effective is governance based on "**relative sovereignty**," either where there is a centralization and decentralization structure in which several governance bodies (the ECB and the Ministries of Finance) coexist or where there is a division of authority as the basic organizational structure and the main body governs with leading sovereignty depending on the contingency.

1.1 Related Literature

Dewatripont (2001) explains an optimality of the divided authority between the MOF and the Central Bank (e.g. the Deutsche Bundesbank - The Central Bank of Germany) in one MOF and Central Bank setting. Motivated by his lecture, we have constructed an extended model consisting of n Ministries of Finance (MOF) in n eurozone member nations and the European Central Bank (ECB), and explain the free-rider problem among the n member nations as a prisoner's dilemma, which is essential not only to our analysis but also regarding urgent policy issues in the present EU. With this, we analyze a solution to the free-rider problem through the penalty scheme in the SGP, and derive a second best solution where a commitment not to renegotiate penalties ex-post is impossible; this is also today's urgent issue. In addition, we examine the parameter conditions for optimizing the current EU (European Union) allocation of authority, or "divided authority structure," which consists of Monetary Centralization (ECB) and Fiscal Decentralization (the Ministries of Finance in each country). Our finding is that what is effective is governance based on "relative sovereignty," either where there is a centralization and decentralization structure in which several governance bodies (the ECB and the Ministries of Finance) coexist or where there is a division of authority as the basic organizational structure, and the main body governs the EU with leading sovereignty depending on the contingency. This finding may be viewed as an application of Aghion and Bolton (1992)'s "Contingency

Dependent Control", or "Contingent Control Shift" idea to problems in the political economy.[3]

2. Basic Model using Contract /Game Theory

2.1 Model Setting

As member players of the European Union (EU), there exist the European Central Bank (ECB) and the Ministry of Finance (MOF) of each nation. The European Central Bank (ECB) is an integrated organization of the central banks of member nations, with a function to manage the monetary policy in an integrated manner and to determine the <u>policy rate (common interest rate)</u> i.[4] On the other hand, the Ministry of Finance (MOF) of each nation has the authority to control its own <u>financial spending</u>. So, let the financial spending level of the nation k be $d_k, k = 1, 2, ..., n$. This is a structure of monetary centralization and fiscal decentralization. The GDP (Gross Domestic Product, i.e. output) of the nation k is expressed as $x_k = d_k - i, \ k = 1, 2, ..., n$, which is financial spending (financing through the issuance of national bonds) minus the policy rate i.[5] The inflation rate (price increase rate) π_k of the nation k is expressed as $\pi_k = d_k - \beta i, \ k = 1, 2, ..., n$,[6] and we assume $\beta > 1$.[7] Note that since inflation means price increases, this is equivalent to a drop in monetary value, that is, "the value of the euro".

Next, let the objective function of the nation k 's Ministry of Finance (MOF) be $x_k - \dfrac{\alpha}{2}(d_k)^2$. This means that the nation k 's MOF puts much value on an increase in GDP, so called "economic growth" x_k, and that the issuance of public debt and the increase in outstanding

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[3] For discussion on the link between political economics and incomplete contracts, see the panel slides on Incomplete Contracts and Political Economy at Grossman and Hart at 25 (2011).

[4] The central bank of each nation can be regarded as an agent who directly implements the policy rate decided by the ECB. As a form of business organization, Suzuki (2011) referred to it as "integration", where top management gives the orders and section managers simply accept and execute their orders.

[5] This is basically an analysis of a 45-degree line, in which financial spending (government spending) increases total demand while rising interest rates reduce total demand through a decline in private investment, a reflection of the fact that they alter the equilibrium GDP.

[6] This is the view that an increase in financial spending and a decrease in the policy rate will lead to a growth in total demand and put upward pressure on commodity prices.

[7] The assumption $\beta > 1$ means that the ECB's policy rate has more effect on inflation control (price stabilization of the euro) $\pi \downarrow$ than on GDP (economy) x, which is an indicator of the real economy.

public debt will cause increasing costs $\frac{\alpha}{2}(d_k)^2$ for the MOF. The interpretation of the issuance cost of public debt $\frac{\alpha}{2}(d_k)^2$ is as follows. α is an interest rate for public debt, and also a parameter which characterizes the size of the marginal cost of the issuance of public debt. $\frac{(d_k)^2}{2}$ is the cost for obtaining the approval or acceptance of the parliament on increasing the issuance of public debt (government financial spending). This means that increasing public debt d_k is costly in two ways.

Meanwhile, let the objective function of the European Central Bank (ECB) be $-\mu\pi^2 - \frac{\alpha}{2}\sum_{k=1}^{n}(d_k)^2$. Because the ECB is a "guardian of commodity prices", whose mission is to "maintain the value of the euro", the first term quadratic loss $-\mu\pi^2$ means that inflation/deflation (price increases/decreases) and the change in the value of the euro are viewed as costs for the ECB. Here, μ is a parameter which refers to the size of the social cost of inflation. The second term means that the ECB also recognizes the amount of government debt of each nation as a cost. The most important point is that the MOF is a player with an economic-expansion bias in the sense that the MOF's objective includes x (GDP, economy/growth) but not $-\mu\pi^2$ (cost of inflation), while the European Central Bank (ECB) is a player with a price-stability (stability of the euro's value) bias in the sense that the ECB's objective includes $-\mu\pi^2$ but not x.[8] In summary, there is a conflict of interests between the MOF and the ECB.

We have specified the players of the game (Ministry of Finance $k = 1, 2, .., n$, European Central Bank), the strategies of each player (financial spending through the issuance of public debt $d_k, k = 1, 2, .., n$ and a single policy rate i), and the objectives which each player pursues. As for the time structure (timing), the MOF of each country simultaneously and independently chooses its own <u>financial spending</u> $d_1, d_2, .., d_N$, and, after observing this, the European Central Bank chooses a common policy rate i. This reflects that a policy rate can be adjusted much more quickly than financial spending (the issuance of public debt).

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[8] This is an extreme hypothesis for simplification. It is possible to generalize it to let the Ministry of Finance consider economic growth and price stability (stability of the value of the euro) as $\gamma : 1 - \gamma$, where $1/2 \leq \gamma \leq 1$ and let the European Central Bank consider them as $1 - \gamma : \gamma$ in a weighted manner.

Throughout section 2.2, the following basic mechanism will be theoretically described. The government in each country can create economic growth in their own country, which means an increase in GDP (<u>100% self benefit</u>) by increasing government spending in their own country, but inflation will increase and the value of the euro will fall. These effects are shared equally by euro countries (<u>costs are shared equally</u>). Hence, there exists an incentive for cutting corners on reducing the issuance of public debt (free ride on other countries).

2.2 Model Solution by Backward Induction

In this section, we solve the basic model by using the backward induction in one MOF case, two MOF case, and n MOF case, and point out that the "free-rider problem" occurs in equilibrium under the common currency (euro) system.

2.2.1 <u>1 MOF and ECB case[2]</u>

Timing[10]:

T=1 The Ministry of Finance (MOF) chooses financial spending d.

T=2 The European Central Bank (ECB) chooses the <u>interest rates (policy rate)</u> i.

This is the Stackelberg Game played by the Ministry of Finance (MOF) and the European Central Bank (ECB).

T=2: Given the financial spending d in T=1, the ECB chooses the <u>interest rates (policy rate)</u> i.

$$\max_{\{i\}} -\mu\pi^2 - \alpha\frac{d^2}{2}$$

Substituting $\pi = d - \beta i$ into the payoff function and optimizing with respect to i, we have the First Order Condition for the optimality: $d - \beta i = 0$

Therefore, the best response function by the ECB in T=2 is $i^*(d) = \dfrac{d}{\beta}$

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[9] This 1 MOF+ECB version borrows an idea from Dewatoripont (2001).

[10] This timing is due to the fact that interest rates can be adjusted much more quickly by the ECB than by the fiscal policy in each sovereign nation.

This shows that inflation (the fall in the value of the Euro) due to the increase in financial spending d in T=1 is suppressed by the policy rate i in T=2.

T＝1: The Ministry of Finance (MOF) expects the best response function by the European Central Bank (ECB) in T=2 and chooses the optimal financial spending.

$$\max_{\{d\}} x - \alpha \frac{d^2}{2} = \left(d - i^*(d)\right) - \alpha \frac{d^2}{2}$$

$$\text{s.t. } i^*(d) = \frac{d}{\beta}$$

That is, the Ministry of Finance (MOF) solves $\max_{\{d\}} \left(d - \frac{d}{\beta}\right) - \alpha \frac{d^2}{2}$.

The First Order Condition for the optimality is $\left(1 - \frac{1}{\beta}\right) - \alpha d = 0$

Hence, the optimal solution in T=1 is $d^* = \frac{1}{\alpha}\left(1 - \frac{1}{\beta}\right)$ and the equilibrium policy rate by ECB in T=2 is $i^* = \frac{1}{\alpha\beta}\left(1 - \frac{1}{\beta}\right)$. The solution concept is, of course, Sub-game Perfect Equilibrium, which corresponds to $d^* = \frac{1}{\alpha}\left(1 - \frac{1}{\beta}\right)$ and $i^*(d) = \frac{d}{\beta}$.

Note: The Nash Equilibrium of a Simultaneous Move Game between MOF and ECB is $d^N = \frac{1}{\alpha}$, $i^N = \frac{1}{\alpha\beta}$, which is higher than in the case of the Stackelberg Game. In the Stackelberg game, the follower (ECB), after observing the leader (MOF)'s move (the fiscal spending in T=1), cancels out some of the effect of the increase in GDP through the increase in the policy rate $i^*(d) = \frac{d}{\beta}$. Expecting this rationally, the MOF only adopts the optimal fiscal expenditure (the issuance of public debt) in order to maximize $x - \alpha \frac{d^2}{2} = \left(d - i^*(d)\right) - \alpha \frac{d^2}{2}$. In other words, the ECB has the authority to increase the policy rate, and suppress the incentive for the MOF to increase fiscal spending in T=1.[11]

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[11] Dewatripont (2001) explains an optimality of the divided authority between the MOF and the Central

Let us figure out the argument so far by using the best response functions. The best response function by the ECB $i^*(d) = \dfrac{d}{\beta}$ is depicted in Figure 1. Expecting this, the MOF chooses the optimal fiscal spending level $d^* = \dfrac{1}{\alpha}\left(1 - \dfrac{1}{\beta}\right)$ in T=1, which maximizes the difference between $d - \alpha \dfrac{d^2}{2} = d\left(1 - \alpha\dfrac{d}{2}\right)$ and $i^*(d) = \dfrac{d}{\beta}$. We can confirm that the marginal benefit $1 - \alpha d$ obtained by increasing d is balanced by the marginal increase in the optimal response $\dfrac{1}{\beta}$ at $d^* = \dfrac{1}{\alpha}\left(1 - \dfrac{1}{\beta}\right)$. The equilibrium interest rate is then $i^*(d^*) = \dfrac{1}{\alpha\beta}\left(1 - \dfrac{1}{\beta}\right)$. We depict this Stackerberg equilibrium point as S1 (for one MOF case). The Nash equilibrium point is N in the figure.
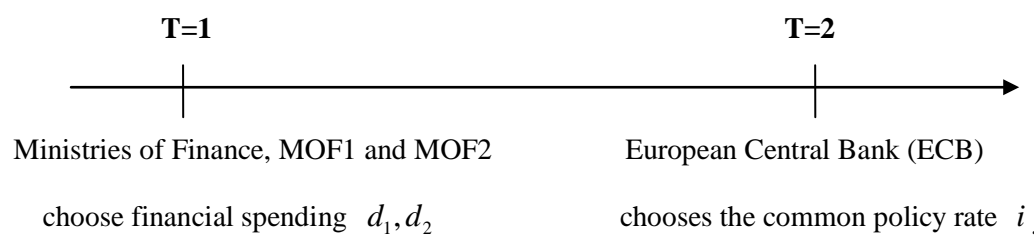
Figure1
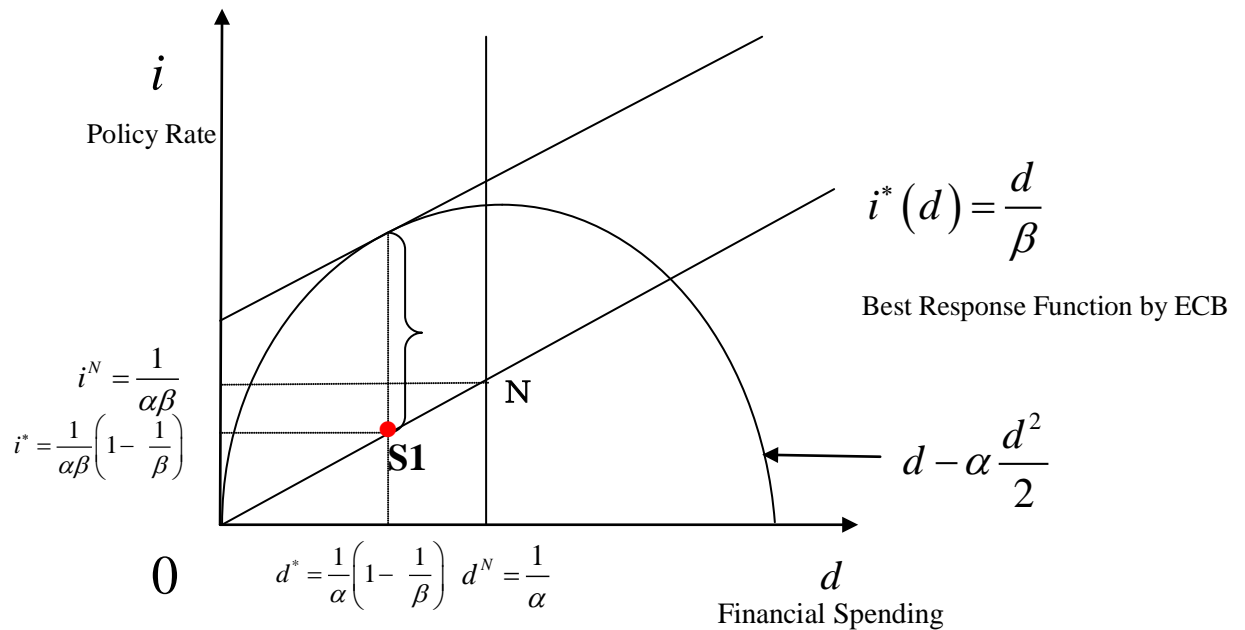
2.2.2 2 MOFs and the ECB

The time line is as follows, and we solve this game by backward induction.

Bank (e.g. the Bundesbank in West Germany) in one MOF and Central Bank.

Ministries of Finance, MOF1 and MOF2   European Central Bank (ECB)

choose financial spending d_1, d_2.   chooses the common policy rate i.

T=2: Given the financial spending d_1, d_2 of MF1 and MF2, the ECB chooses the <u>interest rate (policy rate)</u> i.

Given the first period of financial expenditure d_1, d_2, and in accordance with the common policy rate i, which the ECB chooses in T=2, the expected inflation rate in countries

$k = 1, 2$ in T=2 is $\pi_k = d_k - \beta i \ (k = 1, 2)$. Since the <u>average</u> inflation rate is

$\dfrac{\pi_1 + \pi_2}{2} = \dfrac{d_1 + d_2}{2} - \beta i$, the ECB solves the following problem.

$$\max_{\{i\}} -\mu\left(\frac{\pi_1 + \pi_2}{2}\right)^2 - \alpha\frac{d_1^2 + d_2^2}{2} \Leftrightarrow \max_{\{i\}} -\mu\left(\frac{d_1 + d_2}{2} - \beta i\right)^2 - \alpha\frac{d_1^2 + d_2^2}{2}$$

First Order Condition for the optimality is $\dfrac{d_1 + d_2}{2} - \beta i = 0$.

Hence, the best response function by the ECB in T=2 is $i^*(d_1, d_2) = \dfrac{1}{\beta}\dfrac{d_1 + d_2}{2}$.

This means that the ECB optimally raises the policy rate i against the <u>average</u> inflation increase (which means a fall in the value of the euro) due to the increase in the first period of <u>average</u> financial spending $\dfrac{d_1 + d_2}{2}$.

T=1: The Ministry of Finance in each country $k = 1, 2$ expects the best response of the European Central Bank (ECB) in T=2 and simultaneously chooses the optimal financial spending.

The problem is

$$\max_{\{d_k\}} x_k - \alpha \frac{d_k^2}{2} = \left(d_k - i^*\right) - \alpha \frac{d_k^2}{2}, k = 1, 2 \quad \text{s.t.} \ \ i^* = \frac{1}{\beta} \frac{d_1 + d_2}{2}$$

Optimizing $x_k - \alpha \dfrac{d_k^2}{2} = \left(d_k - \dfrac{1}{\beta} \dfrac{d_k + d_{-k}}{2}\right) - \alpha \dfrac{d_k^2}{2}$ with respect to $d_k, k = 1, 2$, we have the

First Order Condition: $\left(1 - \dfrac{1}{\beta} \dfrac{1}{2}\right) - \alpha d_k = 0$. The solution is $d_k^* = \dfrac{1}{\alpha}\left(1 - \dfrac{1}{2\beta}\right), k = 1, 2$ [12]

Hence, the Sub-game Perfect Equilibrium of this game is

$$d_k^* = \frac{1}{\alpha}\left(1 - \frac{1}{2\beta}\right), k = 1, 2, \ \text{and} \ i^*\left(d_1, d_2\right) = \frac{1}{\beta} \frac{d_1 + d_2}{2}$$

We see that if the number of Ministries of Finance is two, equilibrium financial spending in T=1

increases ($d_k^* = \dfrac{1}{\alpha}\left(1 - \dfrac{1}{2\beta}\right) > d^* = \dfrac{1}{\alpha}\left(1 - \dfrac{1}{\beta}\right)$), and the policy rate determined by ECB in T=2

also becomes higher ($i^*\left(d_1^*, d_2^*\right) = \dfrac{1}{\alpha\beta}\left(1 - \dfrac{1}{2\beta}\right) > i^*\left(d^*\right) = \dfrac{1}{\alpha\beta}\left(1 - \dfrac{1}{\beta}\right)$)

Intuitive Explanation

While the GDP of its own country is obtained at 100% with an increase in financial spending for the MOF of each country, the increase in interest rates (inflation offset by an increase in interest rates) in T=2 by the ECB will be half of that in a situation where the Ministry of Finance is from one country. Thus, the costs of the euro falling due to inflation are **equally shared by two countries**. Then, the 100% self-benefit vs. the 50% cost burden will lead to the "free-rider problem", that is, an excessive financial incentive to spend. There exists an incentive for cutting corners on reducing the issuance of public debt (an incentive to free ride on other countries).

Let us express this in a simple mathematical way. Each MOF $k = 1, 2$ simultaneously solves

the following problem at T=1: $\max_{\{d_k\}}\left(d_k - i^* - \alpha \dfrac{d_k^2}{2}\right)$ s.t. $i^* = \dfrac{1}{\beta} \dfrac{d_1 + d_2}{2}$

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[12] The optimal fiscal spending in T=1 $d_k^*, k = 1, 2$ is the dominant strategy for each firm, irrespective of the opponent's strategy.
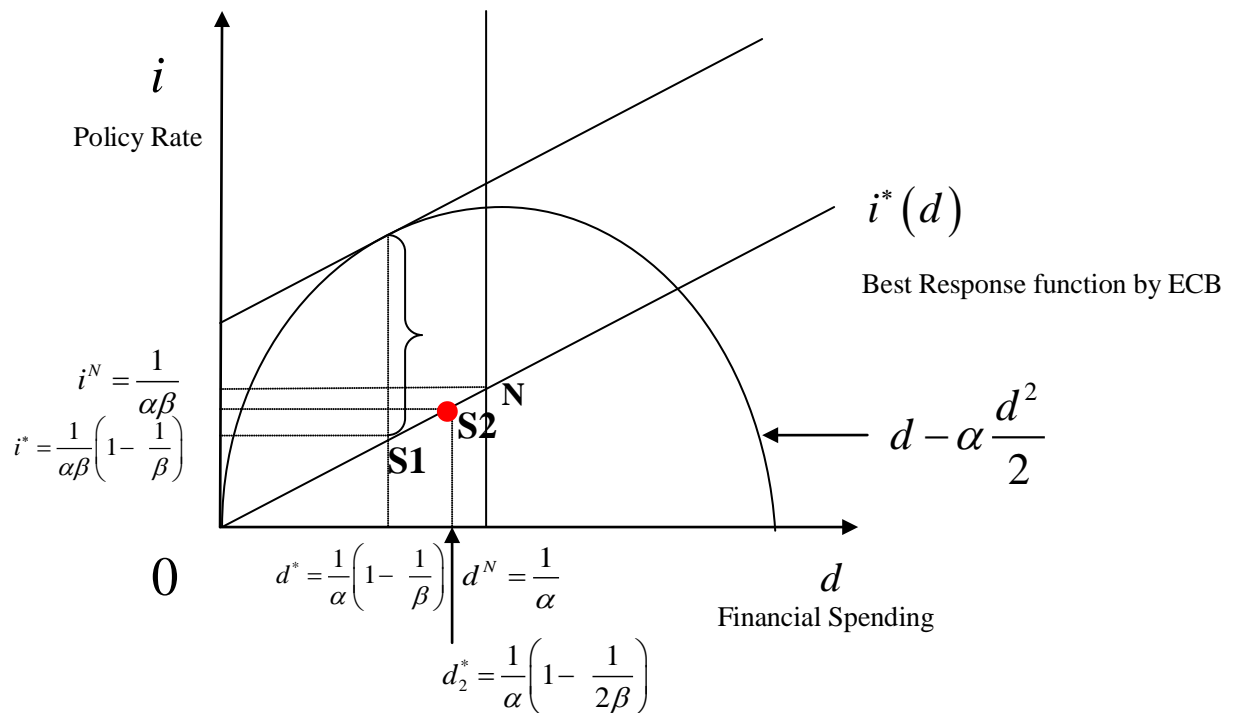
The first order condition for the optimality on d_k is $1 - \dfrac{1}{\beta}\dfrac{1}{2} - \alpha d_k = 0$

Rearranging the left hand side, we have $\underbrace{1 - \alpha d_k}_{MR} - \underbrace{\partial i^* / \partial d_k}_{MC} = \underbrace{1 - \alpha d_k}_{100\%} - \underbrace{1/2\beta}_{1/2 \text{ of SMC}}$

While the GDP of its own country is obtained at 100%, that is, $1 - \alpha d_k$, with an increase in financial spending, the increase in interest rates (inflation offset by an increase in interest rates) in T=2 by the ECB is **one half**, that is, $(1/2)(1/\beta)$ when the Ministry of Finance is from one country. <u>Since the costs of the euro falling due to inflation are equally shared by two nations</u>, the free rider problem (excessive fiscal spending) appears.

We depict the equilibrium point as **S2** (for the two MOF case) in the figure.

Figure2

$$i^N = \frac{1}{\alpha\beta}$$

$$i^* = \frac{1}{\alpha\beta}\left(1 - \frac{1}{\beta}\right)$$

$$d^* = \frac{1}{\alpha}\left(1 - \frac{1}{\beta}\right) \qquad d^N = \frac{1}{\alpha}$$

$$d_2^* = \frac{1}{\alpha}\left(1 - \frac{1}{2\beta}\right)$$

$$i^*(d)$$

Best Response function by ECB

$$d - \alpha\frac{d^2}{2}$$

2.2.3 n MOF and ECB

What happens if the number n of the Ministries of Finance (MOF) (or the number n of nations) increases? Then, each MOF simultaneously solves the following problem at T=1

$$\max_{\{d_k\}} \left(d_k - i^* - \alpha \frac{d_k^2}{2} \right) \text{ s.t. } i^* = \frac{1}{\beta} \frac{d_1 + d_2 + \cdots + d_n}{n}$$

The first order condition for the optimality on d_k is $1 - \frac{1}{\beta}\frac{1}{n} - \alpha d_k = 0$

Rearranging the left hand side, we have $\underbrace{1 - \alpha d_k}_{MR} - \underbrace{\partial i^*/\partial d_k}_{MC} = \underbrace{1 - \alpha d_k}_{100\%} - \underbrace{1/n\beta}_{1/n \text{ of SMC}}$

While the GDP of its own country is obtained at 100%, that is, $1 - \alpha d_k$, with an increase in financial spending, the increase in interest rates (inflation offset by an increase in interest rates) in the second period by the ECB is **one n$^{\text{th}}$**, that is, $(1/n)(1/\beta)$ when the Ministry of Finance is from one country. <u>The costs of the euro falling due to inflation are equally shared by n nations</u>. Hence, the free rider problem will appear in a more serious way. Indeed we have the Subgame Perfect Equilibrium Solution $d_k^* = \frac{1}{\alpha}\left(1 - \frac{1}{n\beta}\right), k = 1, 2, .., n$ and $i^* = \frac{1}{\alpha\beta}\left(1 - \frac{1}{n\beta}\right)$, which becomes higher as n becomes larger.[13]

Summarizing the argument of this section, we have the following proposition.

<u>Proposition1</u>

Under the common currency union with Monetary Centralization and Fiscal Decentralization, the free-rider problem for the issuance of public debt (excessive fiscal spending) occurs in equilibrium. As a result, the equilibrium policy interest rate also becomes higher. As the number of Euro member nations increases, the free-rider problem becomes severer.

3. Commitment and Renegotiation on the Penalty Scheme in the Stability and Growth Pact (SGP)

3.1. Commitment solution to the free rider problem (benchmark).

When only your own country deviates, you pay penalty charges *F* to the European Commission (EC). When other countries deviate, those countries pay penalty charges *F* to the European Commission (EC) and you receive the charges split by $n-1$ countries.

The penalty scheme that your country faces is

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[13]This result is consistent with the economic growth in the eurozone, the increase in member nations and the accompanying gradual increase in the policy rate until the summer of 2008, that is, before the Lehman shock. The policy rate was above 4% in the summer of 2008.

$$s_k(\mathbf{d}) = \begin{cases} -F & \text{if} & \text{Your own country deviates} \\ F/(n-1) & \text{if} & \text{One of the other countries deviates} \end{cases}$$

where $\mathbf{d} = (d_1, d_2, .., d_n)$ is the vector of fiscal spending d_k by each country $k = 1, 2, .., n$

When there exists an executor who commits himself to and enforces such schemes, where the penalty is imposed on <u>a country which deviates</u> and <u>the penalty (payment) is transferred to other countries that abide by the rule,</u> the first best solution could be achieved.[14]

3.2. What is supposed to happen <u>when a commitment not to conduct ex-post renegotiation on the penalty is impossible</u>?

As we discussed in the introduction, "re-discussion (voting)" was actually conducted as to whether the penalty should be imposed on the deviating country or not. When the major powers, Germany and France, break the fiscal rule of the SGP (by excessive government spending), **ex-post renegotiation** may occur. At that time, a renegotiation gain will exist. In exchange for side-payments to other countries by Germany and France, no large penalty (F), or a significant reduction in the amount of the penalty, will ensue. So, we set up the following hypothesis.

<u>**Hypothesis**</u>: Let the bargaining power of the European Commission (EC) be $\lambda \in [0,1]$, and the

bargaining power of all of the remaining n-1 member nations be $1 - \lambda$. When Germany (and France) "follows and accepts" the penalty, the penalty F is paid to the European Commission (EC) and shall then be allocated to the European Commission (EC) and the other n-1 countries

in the portion of $\lambda : 1 - \lambda$. When the penalty is not followed and $(1 - \lambda)F$ is paid to the

remaining n-1 member nations after direct renegotiation with them, the offer from the deviating country will be accepted by the n-1 nations and the payment by the deviating country can be

lowered by $F - (1 - \lambda)F = \lambda F \geq 0$. This is the same as the idea of "bid-rigging in tendering"

or "collusion in an auction". Then, the ex-post penalty scheme becomes weaker and it becomes difficult to suppress ex-ante fiscal incentives at the proper level.

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[14]This is a solution to the moral hazard (free-rider problem) in teams through a penalty scheme. For various forms of penalty schemes, see Bolton and Dewatripont (2005).

Now, we analyze how much fiscal discipline can be maintained through this "penalty scheme with ex-post renegotiation".

Partial analysis: We focus on a case where **equilibrium renegotiation,** led by country α_L, is induced.[15]

Let $d_k^* = \dfrac{1}{\alpha_k}\left(1-\dfrac{1}{2\beta}\right)$, $k = L, H$ be the dominant strategy (Nash) equilibrium financial spending level of types α_L, α_H [16] when the number of countries is $n = 2$ (α_L, α_H)

Letting $\bar{d}_H$ be the financial spending level of country α_H, which the SGP intends to support (i.e. fiscal budget), $\bar{d}_H \leq d_H^* = \dfrac{1}{\alpha_H}\left(1-\dfrac{1}{2\beta}\right)$ (the free-rider level), should be satisfied. Then, the amount of penalty F is set while it is taken into consideration that country α_L deviates from the SGP and renegotiation is executed between countries α_L and α_H.[17]

Now, we have the incentive constraint for country α_H to support the financial spending (fiscal budget) level $\bar{d}_H$ suggested by the SGP

$$\Delta_H \leq 0 \Leftrightarrow \frac{1}{2\alpha_H}\left(1-\frac{1}{2\beta}\right)^2 - \underbrace{(1-\lambda)F}_{\text{Substantial Penalty}} \leq \frac{\alpha_H}{2}\bar{d}_H\left[\frac{2}{\alpha_H}\left(1-\frac{1}{2\beta}\right)-\bar{d}_H\right]$$

$$\Leftrightarrow \underbrace{\frac{1}{2\alpha_H}\left(1-\frac{1}{2\beta}\right)^2 - \left[\bar{d}_H\left(1-\frac{1}{2\beta}\right)-\frac{\alpha_H}{2}\left(\bar{d}_H\right)^2\right]}_{\text{Deviation Gain from } \bar{d}_H \text{ to } d_H^*} \leq \underbrace{(1-\lambda)F}_{\text{Substantial Penalty}}$$

To support the financial spending level of at least $\bar{d}_H$, the amount of the penalty F

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[15] We assume that equilibrium renegotiation is induced. Our context is an international setting, so it is an "incomplete contract" situation. Hence, "equilibrium renegotiation" would be more natural than "renegotiation-proof".

[16] Since α is the marginal cost parameter for the issuing of public debt, α_H means a high marginal cost country, and α_L $(\leq \alpha_H)$ means a low marginal cost country for the issuance of public debt.

[17] The modeling is based on actual experience in 2002-2003when the major powers (Germany and France), which correspond to low marginal cost α_L countries, failed to abide by the SGP's fiscal rule.

$$(1-\lambda)F = \underbrace{\frac{1}{2\alpha_H}\left(1-\frac{1}{2\beta}\right)^2 - \left[\bar{d}_H\left(1-\frac{1}{2\beta}\right) - \frac{\alpha_H}{2}\left(\bar{d}_H\right)^2\right]}_{\text{Deviation Gain from } \bar{d}_H \text{ to } d_H^*}$$

is required, and is defined as $F\left(\bar{d}_H\right)$.

From comparative statics, we have $\Delta F\left(\bar{d}_H\right)\big/\Delta\bar{d}_H < 0$, which is to say, when you intend to

reduce the financial spending level $\bar{d}_H$, or intend to enhance the fiscal discipline of country α_H,

the amount of penalty F should be increased.

Now, when the incentive constraint for country α_H is binding (holding equality), country
α_L has an incentive to deviate to the equilibrium dominant strategy level

$d_L^* = \frac{1}{\alpha_L}\left(1-\frac{1}{2\beta}\right)$ against $(1-\lambda)F\left(\bar{d}_H\right)$ and $\bar{d}_L$ suggested to country $\alpha_L\left(\leq \alpha_H\right)$, which

results in the incentive constraint on country α_L not being satisfied. That is $\Delta_L \geq 0$,[18] which

is specifically as follows:

$$\underbrace{\frac{1}{2\alpha_L}\left(1-\frac{1}{2\beta}\right)^2 - \left[\bar{d}_L\left(1-\frac{1}{2\beta}\right) - \frac{\alpha_L}{2}\left(\bar{d}_L\right)^2\right]}_{\text{Deviation Gain from } \bar{d}_L \text{ to } d_L^*} \geq \underbrace{(1-\lambda)F\left(\bar{d}_H\right)}_{\text{Substantial Penalty}}$$

At this time, a side-payment of $(1-\lambda)F\left(\bar{d}_H\right)$ emerges in the ex-post renegotiation between

countries α_L and α_H. For the side-payment from the country in violation to other countries in
ex-post renegotiation, it is assumed that unnecessary spending (excess burden) $\xi \geq 0$ occurs
for each unit.[19]

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[18]As α_L is smaller than α_H, this inequality $\Delta_L > 0$ tends to hold. This implies that the major powers
with smaller marginal costs $\alpha_L < \alpha_H$, such as Germany and France, could easily block the imposition of
sanctions through collusion (the formation of a blocking coalition) among eurozone countries before the
vote at the Financial Ministers Council. In other words, an asymmetry in α_L and α_H is essential to this
argument.

[19]This idea is based on Tirole (1992) and Laffont and Tirole (1991). If $\xi = 0$, we can attain the first best
efficiency, similar to the Coase theorem (1960). In our international setting especially, a negotiation or
persuasion setting, the transaction cost $\xi > 0$ is a natural assumption. Also, this $\xi > 0$ has a similar

Total welfare in EU countries, which corresponds to financial spending levels d_L^* and $\bar{d}_H \left(\leq d_H^* \right)$, is expressed by the following formula where growth (economy, GDP), inflation, the costs of the issuance of public debt and the dead weight cost are added.

$$\left(x_L - \alpha_L \frac{d_L^2}{2} \right) + \left(x_H - \alpha_H \frac{\bar{d}_H^2}{2} \right) - \mu \left(\frac{\pi_L + \pi_H}{2} \right)^2 - \xi(1-\lambda) F\left(\bar{d}_H \right)$$

$$= \underbrace{\left(d_L^* - i - \alpha_L \frac{\left(d_L^*\right)^2}{2} \right) + \left(\bar{d}_H - i - \alpha_H \frac{\left(\bar{d}_H\right)^2}{2} \right)}_{(A)} - \underbrace{\mu \left(\frac{d_L^* + \bar{d}_H}{2} - \beta i \right)^2}_{(B)} - \underbrace{\xi(1-\lambda) F\left(\bar{d}_H \right)}_{(C)}$$

Since the policy rate is chosen by the ECB so that $i = \frac{1}{\beta} \left(\frac{d_L^* + \bar{d}_H}{2} \right)$, the second term (B) is

zero in equilibrium. The Stability and Growth Pact (SGP) sets the amount of penalty F so that the financial spending level $\bar{d}_H$ is sustained in equilibrium where the difference between the first term, total surplus (A) of the Ministries of Finance in both countries α_L, α_H and the third term (C), the dead weight cost, in the above formula will be maximized.

Now, we have the First Order Condition for the optimality:

$$-\frac{1}{2\beta} + \left(1 - \frac{1}{2\beta} \right) - \alpha_H \bar{d}_H - \xi(1-\lambda) F'\left(\bar{d}_H \right) = 0$$

$$\Leftrightarrow \quad \underbrace{-\frac{1}{2\beta}}_{\substack{\text{marginal effect on the payoff} \\ \text{of MOF of } \alpha_L \text{ country}}} + \underbrace{\left(1 - \frac{1}{2\beta} \right) - \alpha_H \bar{d}_H}_{\substack{\text{marginal effect on the payoff} \\ \text{of MOF of } \alpha_H \text{ country}}} = \underbrace{\xi(1-\lambda) F'\left(\bar{d}_H \right)}_{\text{marginal dead weight cost}}$$

As the First Order Condition for $\bar{d}_H$ shows, the fiscal discipline of $d = \bar{d}_H$ and the required amount of the penalty $F\left(\bar{d}_H \right)$ are determined so that the marginal increase in total surplus and the marginal increase in dead weight cost will be balanced.

Substituting $(1-\lambda) F'\left(\bar{d}_H \right) = -\alpha_H \left\{ \frac{1}{\alpha_H} \left(1 - \frac{1}{2\beta} \right) - \bar{d}_H \right\}$ into the above condition,

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role to the "wealth constraint" in Aghion and Bolton (1992).

we have **an explicit solution for optimal fiscal discipline (fiscal budget)** $\overline{d}_H^*$

$$\overline{d}_H^* = \frac{1}{1+\xi}\underbrace{\frac{1}{\alpha_H}\left(1-\frac{1}{\beta}\right)}_{\text{FB level for H}} + \frac{\xi}{1+\xi}\underbrace{\frac{1}{\alpha_H}\left(1-\frac{1}{2\beta}\right)}_{\substack{\text{Dominant Strategy Level} \\ \text{for H}}} \quad \cdots\cdots \; (*)$$

From $(*)$, we can read the following messages. First, the targeted fiscal discipline level

$\overline{d}_H^*$ is weighted by the first best level and the dominant strategy level (the free-rider level) in the

proportion of $1:\xi$. As ξ is larger, the divergence of $\overline{d}_H^*$ from the first best is more acceptable.

The interpretation is that as the dead weight cost ξ is larger with renegotiation, the amount of

the penalty cannot be increased.

Second, as α_H is larger, the optimal fiscal discipline $\overline{d}_H^*$ for the high marginal cost country

α_H becomes harder, i.e. the fiscal budget $\overline{d}_H^*$ assigned to country α_H becomes harder. This

implies that when the high marginal cost country α_H loses the trust of the international bond

market, and the interest rate α_H for its public debt goes up (the price goes down), the fiscal

sovereignty for the high-cost country α_H should be limited. In this sense, the solution $(*)$

optimally involves the idea of "**limited sovereignty**".

Third, as β is larger, the optimal fiscal discipline $\overline{d}_H^*$ for the high marginal cost country

α_H becomes greater, i.e. the fiscal budget $\overline{d}_H^*$ assigned to country α_H can be relaxed.

The interpretation is as follows. When β is higher, the ECB can suppress inflation sufficiently

and stabilize the value of the Euro through the policy rate i.[20] Hence it is not necessary to

impose a hard budget to suppress the fiscal spending of country α_H. Rather, the fiscal budget

should be relaxed in order to induce economic growth.

Finally, as the European Commission (EC)'s portion λ becomes larger, the effect of the

penalty scheme becomes weaker since a country in violation can easily buy countries with small

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[20] Remember that the inflation rate is formulated as $\pi = x - \beta i$

amounts of substantive reallocation. Hence, the amount of the penalty F becomes larger by the amount of the European Commission's portion λ.

Summarizing the argument of this section, we have the following proposition and corollaries.

<u>Proposition2</u>

Under the Stability and Growth Pact (SGP), a commitment not to renegotiate the penalty scheme ex post may be impossible. Then, equilibrium renegotiation occurs ex-post, which is led by the low marginal cost country α_L for the issuance of public debt. The second best solution of that regime shows an optimal fiscal discipline (fiscal budget) $\overline{d}_H^*$ for the high marginal cost country α_H, which is set at the weighted average of the first best and the dominant strategy (free-rider) levels. In this sense, the optimal solution involves the idea of "**limited sovereignty**".

<u>Corollary2.1</u> Effect of α_H on $\overline{d}_H^*$

As the cost for the issuance of public debt (the interest rate of public debt) α_H becomes higher, the optimal fiscal discipline (fiscal budget) $\overline{d}_H^*$ for the high marginal cost country α_H becomes harder, i.e. the fiscal sovereignty for the high-cost country α_H should be more limited. As the interest rate of public debt α_H becomes lower, the limitation on fiscal sovereignty should be more relaxed.

<u>Corollary2.2</u> Effect of β on $\overline{d}_H^*$

The more sufficiently the ECB can suppress inflation and stabilize the Euro value through the policy rate, the more the optimal fiscal discipline (fiscal budget) for the high marginal cost country α_H can be relaxed.

4. Authority Allocation in EU and Optimal Governance Structure

So far, we have preceded our analysis given a framework of Monetary Centralization (ECB) and Fiscal Decentralization (a Ministry of Finance in each country). In this section, we endogenously consider the structure of the allocation of authority in the EU in the framework of incomplete contracts.

First Best Regime

The Ministry of Finance (MOF) and the European Central Bank (ECB) take <u>cooperative actions</u> to maximize $x - \mu\pi^2 - \alpha\dfrac{d^2}{2}$, which is the net payoff obtained by a representative citizen, combining GDP, inflation and the cost of the issuance of public debt.

$$\max_{\{d,i\}} x - \mu\pi^2 - \alpha\frac{d^2}{2} \Leftrightarrow \max_{\{d,i\}} (d - i) - \mu(d - \beta i)^2 - \alpha\frac{d^2}{2}$$

The First Order Conditions for the optimality are

$$1 - 2\mu(d - \beta i) - \alpha d = 0 \quad \text{for} \quad d \text{,}$$

$$-1 + 2\beta\mu(d - \beta i) = 0 \Leftrightarrow 2\mu(d - \beta i) = 1/\beta \quad \text{for} \quad i \text{.}$$

The second formula is substituted into the first formula:

$$1 - 1/\beta - \alpha d = 0 \Leftrightarrow d^{FB} = \frac{1}{\alpha}\left(1 - \frac{1}{\beta}\right)$$

In the first best regime, an increase in government spending due to the issuance of public debt is suppressed by *internalizing* the negative impacts on inflation. From $2\beta\mu(d^{FB} - \beta i) = 1$, the policy interest rate is also suppressed by *internalizing* the negative impacts on economic growth (GDP).

$$i^{FB} = \frac{1}{\beta}\left(d^{FB} - \frac{1}{2\beta\mu}\right) = \frac{1}{\beta}\left(\frac{1}{\alpha}\left(1 - \frac{1}{\beta}\right) - \frac{1}{2\beta\mu}\right) = \underbrace{\frac{1}{\alpha\beta}\left(1 - \frac{1}{\beta}\right)}_{} - \underbrace{\frac{1}{2\beta^2\mu}}_{}$$

These cooperative solutions (that is, first best solutions) are implementable if the "binding contract" could be written ex ante and the parties could commit themselves to it. This is because cooperative behavior can be enforced by using sanctions that impose huge fines against players that deviate from these agreed solutions. However, relations between nations are complex, involving political negotiations and domestically sensitive issues, so there always exists a high transaction cost. In summary, this is an incomplete contract situation, where the parties cannot write and commit ex ante state contingent contracts that cover all possible contingencies. Indeed, as we analyzed in section 3, ex ante penalty (sanction) schemes for deviant behavior cannot be committed, but only renegotiated ex post. So, the first best solution cannot be implemented. The next question is: Which of the following regimes (authority allocation) is the closest to "First Best"? In other words, which is the most efficient from the viewpoint of governance costs? We analyze the question using the idea of incomplete contract theory à la Grossman and Hart (1986),

Aghion and Bolton (1992) and Aghion and Tirole (1997).

Question: Which of the following regimes (authority allocation) is the closest to "First Best"?

1. **All authority is allocated** to the ECB. The ECB determines the financial spending level (the issuance of public debt) as well as policy rates.

2. **All authority is allocated** to the Finance Ministers Council. The Finance Ministers Council determines government spending and policy rates at the same time.

3. **"Basic model"**, Monetary Centralization (ECB) and Fiscal Decentralization (a Ministry of Finance in each country)

Regime 1: ECB-Integration: The ECB has all the authority.

The European Central Bank "ECB" chooses (i, d) to maximize its own objective function,

$$-\mu\pi^2 - \alpha\frac{d^2}{2} \quad \text{in a centralized manner.}$$

The problem is $\max\limits_{\{i,d\}}\left(-\mu\pi^2 - \alpha\frac{d^2}{2}\right) \Leftrightarrow \max\limits_{\{i,d\}}\left(-\mu(d-\beta i)^2 - \alpha\frac{d^2}{2}\right)$

The First Order Conditions for the optimality are

$$-2\mu(d-\beta i) - \alpha d = 0 \quad \text{for} \quad d,$$

$$2\beta\mu(d-\beta i) = 0 \quad \text{for} \quad i.$$

Hence, the solution is $d^{ECB} = i^{ECB} = 0$.

The major goals of the European Central Bank are to suppress inflation, stabilize the value of the euro and reduce government debt (the issuance of public debt). As any increase in GDP (economic growth, economy) is not included in the goals, financial spending is set at $d = 0$ while any increase in GDP is ignored. Inflation will be zero and the value of the euro will be stable, but the economy will not grow, causing economic stagnation. Financial spending at $d = 0$ will produce the worst outcome from the viewpoint of the goals of the Ministry of Finance. The net payoff that representative citizens obtain is $\overline{x} - \mu\pi^2 - \alpha\frac{\overline{d}^2}{2} = 0$.

Regime 2: MOF-Integration: The Finance Ministers Council has all authority.

The problem when the Ministries of Finance collectively choose (i,d) is

$$\max_{\{d,i\}} \left(x - \alpha \frac{d^2}{2} \right) \Leftrightarrow \max_{\{d,i\}} \left(d - i - \alpha \frac{d^2}{2} \right)$$

The First Order Conditions for the optimality are

$1 - \alpha d = 0$ for d

$-1 < 0$ for i

Hence, $d^{\mathrm{MOF}} = \dfrac{1}{\alpha}$ and $i^{\mathrm{MOF}} = 0$ are the solutions.

The interpretation is the opposite of that in Regime 1. The major goals of the Ministry of Finance are GDP increase (economic growth) and the prioritizing of the economy ($= x$). The suppression of inflation ($-\mu\pi^2$) and the stability of the value of the euro are not included in the goals. Hence, the zero interest rate $i^{\mathrm{MOF}} = 0$ is set at the largest possible government spending $d^{\mathrm{MOF}} = \dfrac{1}{\alpha}$ without taking the suppression of inflation and the stability of the value of the euro into consideration.

The net payoff that representative citizens obtain is [21]

$$\overline{x} - \mu\pi^2 - \alpha \frac{\overline{d}^2}{2} = \frac{1}{\alpha} - \mu \left(\frac{1}{\alpha} \right)^2 - \alpha \frac{1}{2} \left(\frac{1}{\alpha} \right)^2 = \frac{1}{\alpha} \left(\frac{1}{2} - \frac{\mu}{\alpha} \right)$$

When the equilibrium level of the financial spending of the regimes is compared, we have

$$\underbrace{d^{\mathrm{MOF}} = \frac{1}{\alpha}}_{\text{MOF authority}} > \underbrace{d_k^* = \frac{1}{\alpha} \left(1 - \frac{1}{n\beta} \right)}_{\text{n MOF vs. ECB}} > \underbrace{d^* = \frac{1}{\alpha} \left(1 - \frac{1}{\beta} \right)}_{\text{1 MOF vs. ECB}} = \underbrace{d^{FB}}_{\substack{\text{First Best}\\\text{Regime}}} > \underbrace{d^{\mathrm{ECB}} = 0}_{\text{ECB authority}}$$

Regime 3: Current status = "Fiscal Decentralization + Monetary Centralization" (the two-period game in Section 2).

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[21]When the social cost of inflation μ is large enough ($\mu > \alpha/2$), the net equilibrium payoff of this regime is negative. When μ is small enough, which corresponds to the phase of recession and depression, the net equilibrium payoff of this regime is positive. This is economically relevant.

Each Ministry of Finance $k = 1, 2$ has the authority with regard to financial spending d_k and the European Central Bank (ECB) has the authority to select a common policy rate. This corresponds to a form of "division of authority". The equilibrium payoff for each country is

$$x_k - \alpha \frac{d_k^2}{2} = \frac{1}{2\alpha}\left(1 - \frac{1}{2\beta}\right)\left(1 - \frac{3}{2\beta}\right), k = 1, 2$$

$$\sum_{k=1,2}\left(x_k - \alpha \frac{d_k^2}{2}\right) = \frac{1}{\alpha}\left(1 - \frac{1}{2\beta}\right)\left(1 - \frac{3}{2\beta}\right)$$

The equilibrium payoff for the ECB is $-\mu\pi^2 - \alpha\frac{d^2}{2} = -\mu\underbrace{(d - \beta i)^2}_{0} - \alpha\frac{d^2}{2} = -\alpha\frac{d^2}{2}$

Therefore, the net payoff that representative citizens obtain is, by synthetically considering growth (GDP), inflation, and the cost of the issuance of public debt,

$$\bar{x} - \mu\pi^2 - \alpha\frac{\bar{d}^2}{2} = \frac{1}{2\alpha}\left(1 - \frac{1}{2\beta}\right)\left(1 - \frac{3}{2\beta}\right)$$

  The equilibrium points of the three regimes (1, 2, and 3) are represented as **ECB-I** (regime1), **MOF-I** (regime2) and **S2** (Monetary Centralization and Fiscal Decentralization, 2 MOF case) in Figure 3. Which equilibrium is the second best optimal depends on the parameter conditions.

Figure3
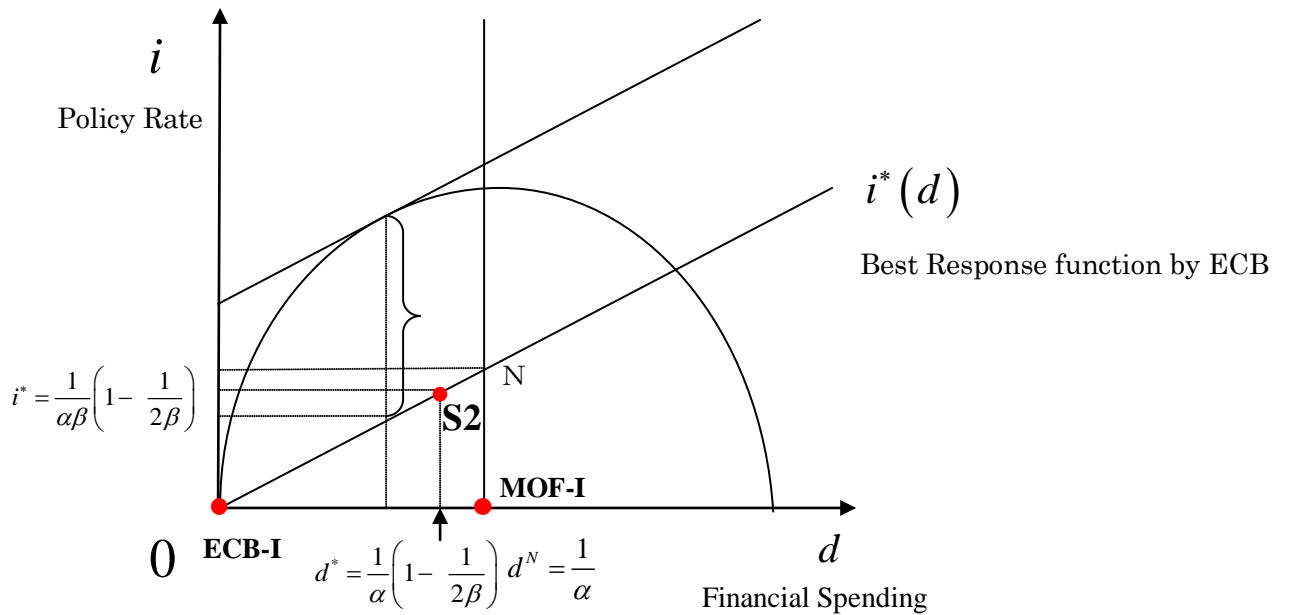
Parameter Conditions to Optimize "Current EU (European Union) Authority Allocation"

From the above description, the parameter conditions to optimize the current **EU (European Union) allocation of authority,** or "divided authority structure", which is fiscal decentralization and monetary centralization, are obtained by comparing the equilibrium payoffs among the three regimes as follows:

$$\underbrace{\frac{1}{2\alpha}\left(1-\frac{1}{2\beta}\right)\left(1-\frac{3}{2\beta}\right)}_{\text{EU divided authority}} > \underbrace{0}_{\text{ECB integration}} \quad \text{and} \quad \underbrace{\frac{1}{2\alpha}\left(1-\frac{1}{2\beta}\right)\left(1-\frac{3}{2\beta}\right)}_{\text{EU divided authority}} > \underbrace{\frac{1}{\alpha}\left(\frac{1}{2}-\frac{\mu}{\alpha}\right)}_{\text{MOF integration}}$$

Proposition3 The conditions to optimize the "Relative Sovereignty of the ECB and the Ministry of Finance" or the current "division of authority between monetary centralization and fiscal decentralization" are:

(1) $\mu \geq \alpha/2$ and $\beta \geq 3/2$ or (2) $0 \leq \mu \leq \alpha/2$ and $0 < \frac{1}{2\beta} \leq \frac{1}{3}\left(2-\sqrt{4-\frac{6\mu}{\alpha}}\right)$

Proof See **Appendix**

Intuitive Explanation

Condition (1) $\mu \geq \alpha/2$ means that the "social cost μ of inflation is higher than the issuance cost α of public debt." Then it is better to provide the European Central Bank "ECB," which has a bias towards price stability, with authority to determine the common policy rate to sufficiently cover incentives for the suppression of inflation. On the other hand, when $\beta \geq 3/2$ "policy rate i sufficiently suppresses inflation", it is *not* necessary to offset the margin for the increase in GDP and economic growth while the European Central Bank "ECB" controls authority on the fiscal spending of each country in order to suppress inflation and stabilize the value of the Euro, leading to $d^{ECB} = 0$. Thus, the "divided authority structure" which allocates the authority on financial spending to each country becomes optimal.

Condition (2) $0 \leq \mu \leq \alpha/2$ and $0 < \frac{1}{2\beta} \leq \frac{1}{3}\left(2-\sqrt{4-\frac{6\mu}{\alpha}}\right)$

When the social cost μ of inflation is relatively large, the qualitative logic is the same as condition (1). The range over which the "Relative Sovereignty of the ECB and the Ministry of

Finance" is optimal is expanded and the range where the current "authority division structure of monetary centralization and fiscal decentralization" is justified is expanded. On the other hand, when the social cost μ of inflation approaches zero (i.e. $\mu \to 0$), "MOF-Integration (MOF's Absolute Sovereignty)" is the optimal governance structure for any $\beta > 1$.

The Eurozone Finance Ministers Council has all authority and collectively chooses financial spending $d^{MOF} = 1/\alpha$ and the policy rate $i^{MOF} = 0$. The constraint $(d_k \leq \overline{d_k})$ in the SGP to suppress the financial spending of member nations to less than the target level $\overline{d_k}$ is temporarily removed.

Interpretation of EU Centralization and Decentralization and Governance Mechanism

We discuss the global solution mentioned above (parameter condition-dependent whole optimal solution) from the viewpoint of with whom and with what method EU governance is optimally performed by applying the ideas (state-dependent governance, Contingent Control Shift) in the paper on Corporate Governance by Aghion and Bolton (1992).

The insight from our analytical results is as follows. The European Central Bank "ECB" and the Ministries of Finance in member nations would be the governance bodies. "Governance based on Absolute Sovereignty which gives absolute sovereignty to a specific body regardless of contingency" is not effective in our incomplete contract world. What is effective is governance based on "**Relative Sovereignty**", either where there is a centralization and decentralization structure in which several governance bodies (the ECB and the Ministries of Finance) coexist or there is a division of authority as the basic organizational structure and the main body governs the EU with leading sovereignty depending on the contingency.

In an incomplete contract world, a certain situation will lead to inefficient EU governance when any player has the exclusive initiative. Under severe conditions (economic slowdown) (μ→0), the MOFs can conduct EU governance more efficiently. Under conditions of excessive economic overheating (μ is large enough and β is small enough), the ECB can conduct EU governance more efficiently. Hence, the idea of **"Contingency Dependent Governance"** by Aghion and Bolton (1992) can be applied, thereby we can take "**Relative Sovereignty**" where the several main bodies, which have mutually opposing interests, such as the European Central Bank, the "ECB", and the Finance Ministers Council, coexist and a main body which conducts efficient governance governs the EU with leading sovereignty depending on the contingency.

In summary, we have:

Contingency Dependent EU Governance

Normal Times: The actual structure in the European Union becomes optimal, where the unification of monetary policy is with the European Central Bank and the decentralization of fiscal policy is with the Ministry of Finance in each country. That is, it is a structure of monetary centralization and fiscal decentralization where the European Central Bank and the Finance Ministers Council coexist, and corresponds to **S2** (regime 3) in Figure 3.

Emergency (economic recession): The Initiative for EU governance moves to the Finance Ministers Council of member nations and the Finance Ministers Council handles the economic recession. The MOF-Integration regime becomes optimal, and corresponds to **MOF-I** (regime 2) in Figure 3.

Emergency (economic overheating): The initiative for EU governance moves to the European Central Bank (ECB) and the ECB handles economic overheating. The ECB-Integration regime becomes optimal, and corresponds to **ECB-I** (regime 1) in Figure 3.

Remark:

With measures where the SGP <u>temporarily</u> removed the framework ($d_k \leq \overline{d}_k$) for financial spending of the member nations for an economic recovery, GDP growth and increased employment opportunities during the severe recession after the Lehman shock of 2008, some of the governance initiative moved to the Finance Ministers Council. In accordance with this movement, the European Central Bank, the "ECB", changed its axis of cooperative monetary policy from price stability to economic stimulus. The mechanism of governance based on **Relative Sovereignty,** where the main bodies (the European Central Bank and the Finance Ministers Council), which have mutually opposing interests, have intentionally been made to coexist and the initiative is moved to either main body depending on the contingency to exercise that initiative ("Contingent control shift"), is included in the EU structure where there is a partition between centralization and decentralization (governance structure). The mechanism indeed works effectively to some extent.

5. Discussions

5.1 The Possibility of Fiscal Integration or Fiscal Union

We shall consider the possibility of Fiscal Integration or Fiscal Union, which theoretically corresponds to 1MOF + ECB model in section2, where a Stackelberg Game is played between

the Ministry of Finance (MOF) and the European Central Bank (ECB). The net payoff of this Regime is

$$x - \mu\pi^2 - \alpha\frac{d^2}{2} = d^* - i^* - \alpha\frac{d^{*2}}{2} = \underbrace{\frac{1}{\alpha}\left(1 - \frac{1}{\beta}\right)}_{d^*} - \underbrace{\frac{1}{\alpha\beta}\left(1 - \frac{1}{\beta}\right)}_{i^*} - \frac{\alpha}{2}\frac{1}{\alpha^2}\left(1 - \frac{1}{\beta}\right)^2 = \frac{1}{2\alpha}\left(1 - \frac{1}{\beta}\right)^2$$

This payoff is always larger than that of Regime 3 ("Fiscal Decentralization + Monetary Centralization" (2MOFs + ECB model), because the net payoff of Regime 3 is

$$\frac{1}{2\alpha}\left(1 - \frac{1}{2\beta}\right)\left(1 - \frac{3}{2\beta}\right) \quad \text{and it follows that} \quad \frac{1}{2\alpha}\left(1 - \frac{1}{\beta}\right)^2 > \frac{1}{2\alpha}\left(1 - \frac{1}{2\beta}\right)\left(1 - \frac{3}{2\beta}\right) \quad \text{for } \beta > 1$$

In the figure, Point **FI** represents Fiscal Integration (Fiscal Union) and the ECB equilibrium point, whose net payoff is greater than that of Regime 3 (Fiscal Decentralization and Monetary Centralization) (Point **S2**). Economically, this means that the Financial Ministers Council (or unique fiscal budgetary authority) should directly control the financial policies of all Eurozone member nations, in order to *internalize (free-riding) externalities* among them. In other words, authority regarding financial policy itself should *not* be *decentralized*, but *centralized* into unique fiscal budgetary authority.

Figure4

Fiscal Integration (Fiscal Union) +ECB regime
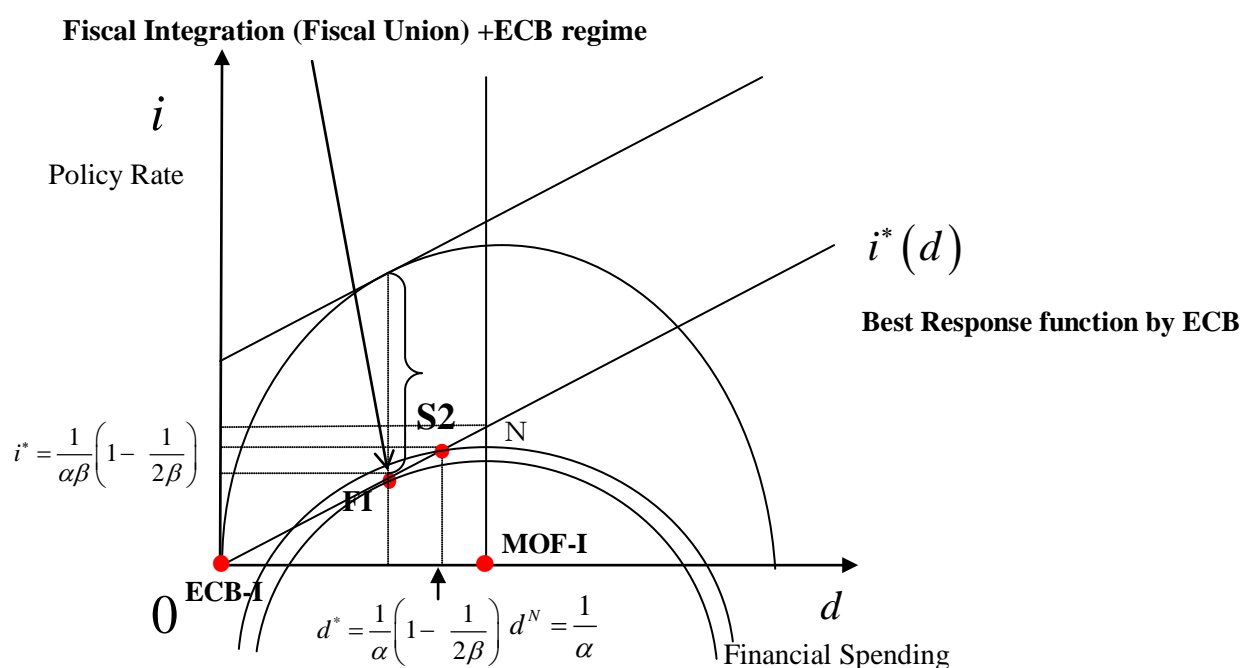
Why is this regime unattainable? In the financial governance of the Euro, each Euro member nation may derive some political benefit from its authority on fiscal policy and hesitate to

delegate this fiscal authority (i.e. sovereignty) to some central authority, so fiscal integration or fiscal union may not be realized even though it is economically more efficient. This point seems to be the same as that referred to in the literature of the Theory of the Firm for managers and workers who fear and resist losing their private benefits in a shift from non-integration to integration.[22]

Thus, we have the following corollary (of Proposition 3).

Corollary 3.1

If the Fiscal Union holds, efficiency will be enhanced under relative sovereignty (by ECB and Fiscal Union), because the free-rider problem under fiscal decentralization can be solved through the internalization of externalities. However, the Fiscal Union would not hold if the loss of political benefits to each euro member nation due to the loss of fiscal sovereignty by the fiscal integration (Fiscal Union) were large enough to induce member nations to break away.

5.2 How could an Enforcement Mechanism be devised for "Contingency Dependent Governance"?

In international contexts, there is no "world government" which designs and enforces international agreements. In other words, legal enforcement is impossible. Hence, the enforceability of "Contingency Dependent Governance" is a very important issue. We should consider some form of *self-enforcing* mechanism where players have an incentive to follow the agreement voluntarily.

A hint can be obtained from a class of repeated game where nature chooses, at the beginning of each period and according to a certain distribution, the stage game that the players will play. The game is repeated stochastically and the players do not know which stage game they will play until nature chooses one. By using this class of game, Rotemberg and Saloner (1986) analyze the behavior of oligopolies in this repeated game situation, where there are *observable* shifts in industry demand at the beginning of each period. When the stage game is chosen stochastically, as in Rotemberg and Saloner (1986), players make a decision after nature has chosen the game that will be played in this period. Thus perfection should be checked for ex-post incentive constraints by the players. In our model, there are *three possible ex-post stage games* (*Normal time, Emergency1* and *Emergency2*), as described above. Given conditional actions and payoffs for the ex-post stage games, the players play the ex-ante stochastic stage game. In the infinitely repeated game of the ex-ante stochastic stage game, it is possible to

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[22]See, e.g., Hart and Holmstrom (2010) and Suzuki (2010)

check the self-enforceability of "Contingency Dependent Governance."[23]

5.3 A Comment on the Eurozone crisis from our model analysis

Though the Eurozone crisis emerged in early 2010 from Greece, our paper shows its fundamental roots. The message which the n MOF-ECB model in section 2 gives is that a common currency with fiscal decentralization generates the economic cost of a severe free-rider problem, which concretely takes the form of higher fiscal spending than the first best level through the issuing of public debt by each member nation (MOF). Since this can result in a fall in the value of the euro (and an increase in the interest rate on public debt), the SGP has been incorporated so as to become a fiscal governance mechanism in order to prevent such a free-rider problem.

Now, on the Greek financial crisis, Greece (α_H country) should have abided by the fiscal budget rule $d_H \leq \bar{d}_H$ in the SGP, but, in fact, there had been a large deviation $d_H \gg \bar{d}_H$ which was hidden with "forged evidence". Eventually, the truth became clear to the market. This caused a sharp fall in prices and widely rising interest on Greek public debt. The difference in yield $\alpha_H - \alpha_L$ expanded greatly, where α_L is the interest rate on public debt in Germany. As a result, Greece had to be $d_H \cong 0$ and GDP fell significantly. The collapse of the Greek economy has caused a dramatic loss of trust in the euro, which could mean the end of that currency. However, ruin for the Greek economy has been prevented (i.e. Greece has been bailed out).

In August 2011, the slowdown in the world economy triggered concern about the ability of much larger economies than Greece, like Spain and Italy, to remain solvent. This extension of the crisis was reflected in rising interest rate spreads on public debt (above the interest rate on German public debt). Though there is no simple solution to the eurozone crisis, we can present the following point from our analysis.

From now on, the **ex-ante limited sovereignty** (ex-ante power restriction) derived from the analysis of section 3 on the second best optimal fiscal discipline in the SGP and the **commitment to ex-post sanctions (commitment not to renegotiate it ex-post)** will both be important. Then, of course, monitoring systems on the observance of the fiscal budget rule

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[23]Nonetheless, it is noticeable that some *formal* agreements on the fiscal budget rule and the imposition of sanctions tend to be *written* between EU governments (including eurozone member nations). This suggests the difficulty with the *self-enforcing* mechanism as described above.

should be reinforced.[24]

6. Concluding Remarks

This paper used a Game/Contract Theory framework to analyze the mechanisms of eurozone financial governance through the Stability and Growth Pact (SGP), with a focus on centralization vs. decentralization and incentive structures in the European Union (EU).

By constructing a Stackelberg game model played by n Ministries of Finance (MOF) in the n Euro zone member countries as the first movers, and the European Central Bank (ECB) as the second mover, we first expressed the basic intuition that the government in each country can create growth (economy) in its own country, that is, an increase in GDP (100% self benefit), by increasing government spending in its own country, but this will increase inflation and the value of the euro will fall. Since these effects are shared equally by euro countries (the cost is shared equally), an incentive to cut corners on reducing the issuance of public debt (a free ride on other countries) exists.

Following this framework, we analyzed a solution to the free-rider problem through the penalty scheme in the SGP, and derived the second best solution when a commitment not to renegotiate penalties ex-post is impossible. It shows that "**limited sovereignty**" should be optimally imposed on the high marginal cost country for the issuance of public debt. We also had some comparative statics results.

Lastly, we derived the parameter conditions for optimizing the current EU (European Union) allocation of authority, or "divided authority structure," which consists of Monetary Centralization (ECB) and Fiscal Decentralization (the Ministries of Finance in each country). From a global equilibrium payoff comparison, we found that what is effective is governance based on "**Relative Sovereignty**," either where there is a centralization and decentralization structure in which several governance bodies (the ECB and the Ministries of Finance) coexist or where there is a division of authority as the basic organizational structure and the main body governs the EU with leading sovereignty depending on the contingency. As a final remark, we discussed the possibility of "Fiscal Union (Fiscal Integration)" and the enforceability of "Contingency Dependent Governance" based on "Relative Sovereignty".

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[24] As an another approach, Farhi et al (2012) " Fiscal Devaluation" show that even when the exchange rate cannot be devalued like in Eurozone, a small set of conventional fiscal instruments can robustly replicate the real allocations attained under a nominal exchange rate devaluation. For example, the Ministry of Finance in the Eurozone has a value-added tax increase and a uniform payroll tax reduction available as equivalent to exchange rate devaluation. The current crisis in the Euro area has brought the option of fiscal devaluations to the forefront of policy, and indeed, Germany in 2006 and France in 2012 implemented fiscal devaluations. The option of fiscal devaluation will enhance the effectiveness of the Eurozone financial governance through the penalty scheme (as specified in the Stability and Growth Pact), by *relaxing the incentive constraints* against free-riding via excessive government spending.

Appendix: Proof of Proposition 3

We can obtain the parameter condition under which the divided authority structure is optimal, by comparing the equilibrium payoffs between three regimes (EU divided authority, MOF integration, and ECB integration).

$$\underbrace{\frac{1}{2\alpha}\left(1-\frac{1}{2\beta}\right)\left(1-\frac{3}{2\beta}\right)}_{\text{EU divided authority}} \geq \underset{\text{ECB integration}}{0} \quad \text{and} \quad \underbrace{\frac{1}{2\alpha}\left(1-\frac{1}{2\beta}\right)\left(1-\frac{3}{2\beta}\right)}_{\text{EU divided authority}} \geq \underbrace{\frac{1}{2\alpha}\left(1-\frac{2\mu}{\alpha}\right)}_{\text{MOF integration}}$$

Because $\alpha > 0$, $\underbrace{\left(1-\frac{1}{2\beta}\right)\left(1-\frac{3}{2\beta}\right)}_{\text{EU divided authority}} \geq \underset{\text{ECB integration}}{0}$ and $\underbrace{\left(1-\frac{1}{2\beta}\right)\left(1-\frac{3}{2\beta}\right)}_{\text{EU divided authority}} \geq \underbrace{\left(1-\frac{2\mu}{\alpha}\right)}_{\text{MOF integration}}$

We take the variable $X = \dfrac{1}{2\beta}$ on the horizontal axis. Then, the left hand side of the two

inequalities is $V^{DA} = \left(1-\dfrac{1}{2\beta}\right)\left(1-\dfrac{3}{2\beta}\right) = (1-X)(1-3X)$. This is part of the parabola with

the domain $X = 1/(2\beta) \in (0,1/2)$ for $\beta > 1$, and $V^{DA}\begin{cases} \geq 0 \text{ for } 0 < X \leq 1/3 \\ \geq 0 \text{ for } 1/3 < X < 1/2 \end{cases}$
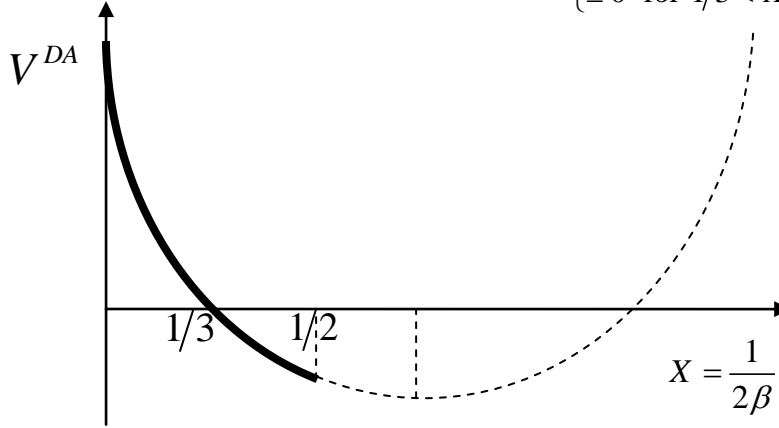
Now let us explore which regime is optimal, depending on the parameter conditions.

（Ⅰ）$1-\dfrac{2\mu}{\alpha} \leq 0 \Leftrightarrow \mu \geq \alpha/2$

When the social cost of inflation μ is greater than the cost of the issuance of public debt $\alpha/2$, the equilibrium payoff under ECB-Integration（"Absolute Sovereignty" of ECB）is greater than the one under MOF-Integration （"Absolute Sovereignty" of MOF）.
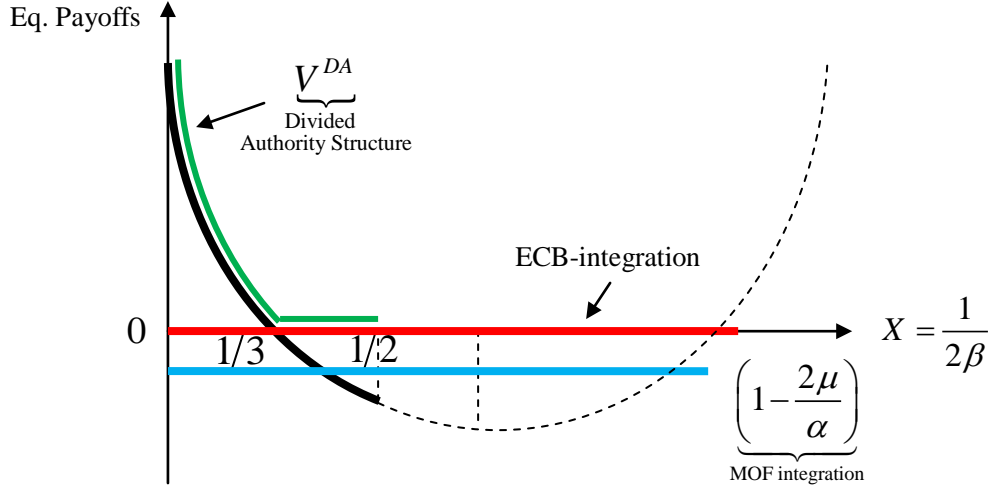
When $X = \dfrac{1}{2\beta} \leq 1/3 \Leftrightarrow \beta \geq \dfrac{3}{2}$, the current divided authority structure consisting of Monetary

Centralization and Fiscal Decentralization, i.e. the "Relative Sovereignty" of the ECB and the

Ministries of Finance, becomes the optimal governance structure.

When $X = \dfrac{1}{2\beta} > 1/3 \Leftrightarrow 1 < \beta < \dfrac{3}{2}$, ECB-Integration （"Absolute Sovereignty" of ECB）

becomes the optimal governance structure.

（Ⅱ） $1 - \dfrac{2\mu}{\alpha} \geq 0 \Leftrightarrow \mu \leq \alpha/2$

When the social cost of inflation μ is smaller than the cost of the issuance of public debt $\alpha/2$, the equilibrium payoff under MOF-Integration （"Absolute Sovereignty" of MOF） is greater than the one under ECB-Integration （"Absolute Sovereignty" of ECB）.

There then exists a cutoff value $X^*(\leq 1/3)$ which satisfies $V^{DA} = V^{MOF} \Leftrightarrow$

$(1-X)(1-3X) = 1 - \dfrac{2\mu}{\alpha} \Leftrightarrow 3X^2 - 4X + \dfrac{2\mu}{\alpha} = 0$, and we have $X^* = \dfrac{2 - \sqrt{2\left(2 - \dfrac{3\mu}{\alpha}\right)}}{3}$.

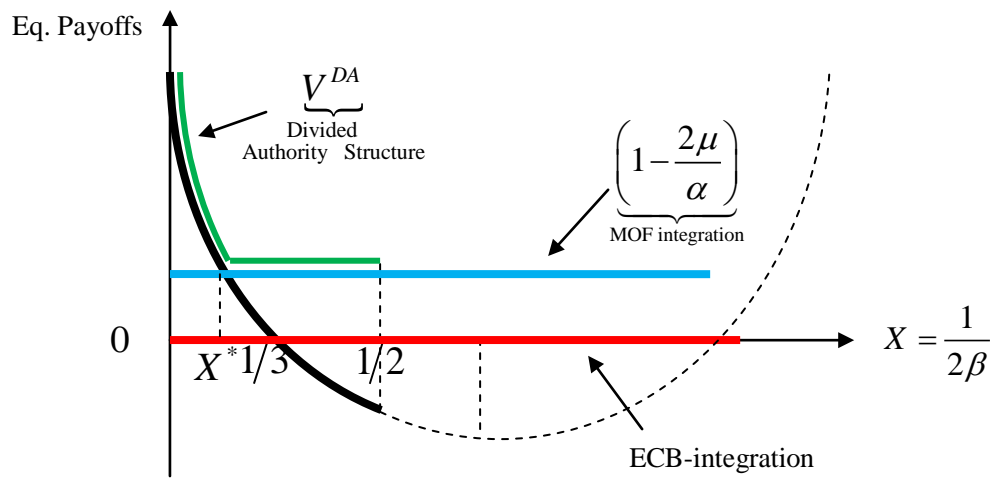From $0 \leq 1 - \dfrac{2\mu}{\alpha} \leq 1 \Leftrightarrow 0 \leq \dfrac{2\mu}{\alpha} \leq 1$, it follows that $0 \leq \dfrac{3\mu}{\alpha} \leq \dfrac{3}{2} \Leftrightarrow 1 \leq 2\left(2 - \dfrac{3\mu}{\alpha}\right) \leq 4$

Then, there exists a cut-off point $X^* \in [0, 1/3]$ which divides the optimal regimes.

When $0 < X = \dfrac{1}{2\beta} \leq X^*$, the "Relative Sovereignty" of the ECB and the Ministries of

Finance is the optimal governance structure, but when $X^* \leq X = \dfrac{1}{2\beta} \leq \dfrac{1}{2}$, MOF-Integration

（"Absolute Sovereignty" of MOF） is optimal.

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