Social Rationality in International Policy Coordination Game

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1. INTRODUCTION

With the advent of the Asian liquidity crisis in late 1990's, an Asia-wide consensus on the necessity of the international policy coordination mechanism to reduce the financial volatility has been reached. Based on a common understanding that the recent liquidity crisis is a self-fulfilling crisis, it is widely recognized that a policy measure to increase the transaction cost in the foreign exchange market, such as a Tobin tax, can be a solution to reduce financial volatility. The economic rationale behind the above argument goes as follows. When a transaction cost of a certain market, such as a foreign exchange market, is reduced to a very low level close to zero, the individually rational strategy in the market is to follow the herd behavior strategy, regardless of whether the herd behavior is based on true information or not. That is, when all the other economic agents behave based on wrong information, the rational strategy is to follow the same strategy when the transaction cost is close to zero. Therefore, when governments impose a Tobin tax, increasing transaction costs, then a herd behavior cannot be a rational strategy, reducing the financial volatility. Therefore, the Tobin tax system might be construed as a policy tool coordinating individual rationality and social rationality.[1]

However, unless all major countries abide by the cooperative Tobin tax policy, the policy coordination mechanism will collapse because every country has an incentive to deviate from the policy coordination from an individual perspective. That is, each country has an incentive to lower the Tobin tax rate to induce more capital inflows into its own market when other countries abide by the coordination system. In reality, although the Tobin tax system was proposed through many international occasions, the actual adoption of the system looks far beyond the reach of the interested countries in near future. The major reason for this problem is that major players, such as the United States and United Kingdom have little incentive to abide by the policy coordination.

The rational strategy of each individual country induces the non-cooperative Nash equilibrium, of which welfare level is much lower than the cooperative equilibrium case in one period policy coordination game. That is, individual rational

[1] Many valuable comments and suggestions by three anonymous referees, the editor, and the Philosophy of Economics Workshop participants are deeply appreciated.

strategy turns out to be socially irrational strategy in a one-shot policy game.[2] Such prisoner's dilemma of policy coordination in one-shot game can be resolved by the introduction of repeated game even if each country takes the non-cooperative strategy in the majority of policy coordination games as long as each country takes the tit-for-tat strategy. Moreover, when a credible enforcement mechanism for a cooperative strategy can be enforced, the cooperative equilibrium is guaranteed. In case of international trade policy coordination game, the introduction of a repeated trade negotiation forum, under the form of GATT and WTO, has enabled to reach a presumably cooperative equilibrium, reducing the average tariff rate of OECD countries from 40 percent to 4 percent. In addition to the accomplishment of the cooperative equilibrium in terms of tariff reduction, WTO tried to establish a credible enforcement mechanism for cooperative trade policies through strengthened dispute settlement system.

However, in case of international trade policy coordination to reduce the financial volatility, the cooperative equilibrium does not seem to be achievable in near future even though the policy coordination game is a repeated game. Moreover, the repeated trials and discussions on the establishment of institutional arrangement for the adoption of Tobin tax system, as a credible enforcement mechanism, have made little progress. This paper aims to examine the backgrounds why the cooperative equilibrium has not been achievable in the policy coordination for financial market stability. Based

[2] Definitions of 'rationality' vary widely depending on different disciplines, and different contexts. An epistemological rationality is defined as a methodology of each discipline for 'the exact and correct description of the fact based on empirical intuition.' The second definition of rationality, so called behavioral definition of rationality, is made as a description of human behavior pattern both in individual and social context. Majority of previous definitions of rationality such as follows can be categorized into the behavioral definition of rationality: i) 'the practical rationality' defines rationality in terms of feasibility of accomplishment. That is, rational behavior targets to something accomplishable. ii) Rationality is differentiated the individual rationality and social rationality in terms of social values or norms. iii) Instrumental rationality is defined as a means to accomplish a defined target, with no connection to social and contextual rationality, which is defined through social norms or values.

The definition of the rationality in this paper is more or less close to behavioral definition, especially to instrumental rationality, i.e., to maximize each economic agent's utility. However, the concept of rationality as an instrumental rationality used in this paper is different from the traditional instrumental rationality, which is defined to seek the maximum possibility of physical consumptions. This traditional understanding of the instrumental rationality comes from too restrictive definition of utility. The concept of 'utility' represents the level of satisfactions or happiness of each economic agent, not confined to represent the level of satisfaction from physical consumptions. If we define utility as a level of satisfaction or happiness, not as a level of physical consumptions, majority of the previous differentiation between instrumental rationality and other behavioral definition of rationality becomes trivial.

on the analysis, this paper aims to determine the optimal policy path to achieve the cooperative equilibrium focusing on the incentive compatibility condition of the policy coordination for financial market stability.

2. SOCIAL IRRATIONALITY V.S. INDIVIDUAL RATIONALITY: THE CASE OF INTERNATIONAL FINANCIAL MARKETS

A typical example of a non-cooperative equilibrium as social irrationality based on individual rationality is the case of international financial market, especially foreign exchange market. The Asian financial crisis in 1997, which was transmitted to Brazilian financial crisis after Russian liquidity crisis, has significantly changed the perspective of most economists in their understanding of the major factors behind the financial crisis. According to so called 'first generation model of speculative attacks', apparently random speculative attacks on policy regimes can be fully consistent with rational and well-informed speculative behavior. In other words, according to the first generation model such as Krugman (1979), Flood and Garber (1984), most of the financial crises occurred mainly because of the structural problems in their economic fundamentals and macroeconomic policy inconsistencies, such as the continuous government budget deficit and the simultaneous over-valuation of its currency in spite of continuous deteriorating current account balance.

However, after the Asian financial crisis, which has engulfed Thailand, Indonesia, Malaysia, and Korea within four months starting in July 1997, economists came to believe that the crisis can occur even when there is no policy inconsistency and that the speculators' expectation or belief about the imminent financial crisis itself has a tendency to realize the crisis itself. That is, what we can observe from the Asian financial crisis is that speculation emerged so suddenly and unexpectedly even though the economic conditions had been deteriorating progressively and predictably for some time. While the apparent shortsightedness of speculators may be attributed to irrationality, it has been shown that the speculation and the resulted financial crisis can

be explained by rational self-fulfilling animal spirits, not by market spirits. (Eichengreen and Wyplosz, 1993; Obsfeld and Rogoff, 1995). When the financial crisis is caused by the self-fulfilling tendency of speculators' beliefs about the crisis, it is necessary to arrange some type of government intervention and regulation to control the side effects caused by the speculators' herd behavior and self-fulfilling beliefs.

The main purpose of this paper is to examine the optimal government policy to reduce the financial volatility as a way to achieve social rationality in the policy coordination game. Especially, this paper is concerned about the feasibility issue of introducing a financial transaction tax system, which can work as 'a sand in an over-efficient wheel' to reduce the short-term speculative financial transaction.[3] We discuss the characteristics of recent trends in the international financial market, and some recent policy suggestions to deal with this volatility issue. Then, based on a model analysis on the international policy coordination with respect to the introduction of the Tobin tax system, we suggest several policy implications for the actual implementation of the Tobin tax system.

Reflecting the recent change in the interpretation of the major reasons for the financial crisis, G-7 summit meeting in June 1999 reached an agreement on the six priority areas to strengthen the international financial architecture and to reduce financial volatility.[4] The noteworthy aspect is the agreement to enhance transparency in

[3] A question might be raised regarding the relationship between the Tobin tax system and the reduction of financial volatility in the sense that the control of the transaction amount cannot be interpreted as the reduction of financial volatility. It is true that the reduction of the transaction amount itself cannot be interpreted as identical with the reduction of the financial volatility. The main contribution of the Tobin tax system is to impose a heavier tax burden on a short-term transaction compared to a long term transaction as discussed in detail in next section, and it is well known that the volume of short-term speculative transactions is highly correlated with the volatility in foreign exchange markets as argued by Tobin (1979) and Frankel (1996). In this sense, this paper assumes that by reducing the amount of short-term transactions, the volatility in foreign exchange markets, which is instigated by the herd behavior in financial markets, can be reduced.

[4] The six priority areas are as follows: 1. Strengthening and reforming the international financial institutions and arrangements; 2. Enhancing transparency and promoting best practices; 3. Strengthening financial regulation in industrialized countries; 4. Strengthening macroeconomic policies and financial systems in emerging markets; 5. Improving crisis prevention and management, and involving the private sector; 6. Promoting social policies to protect the poor and most vulnerable. Among these 6 areas, the

the financial market, and to make an efficient system to share the information about the financial market of each country. Considering the fact that incomplete information about the financial markets and the economic fundamentals of each country is one important reason of herd behaviors in financial markets and the resulted unexpected financial crisis, G7 agreement to enhance the information distribution system is a significant progress in reducing the source of financial volatility. However, as shown by Calvo and Mendoza (1998), when a speculator is more diversified in its investment, it has a less incentive to obtain the exact information for each country, and as a result, it comes to take the herd behavior strategy.[5] Therefore, the efforts to enhance the information distribution system itself cannot be a sufficient measure to solve the international financial volatility problem caused by the herd behavior.

The recent statistics of the foreign exchange market turnover show that the current amount of transactions in foreign exchange markets far exceeds the amount of trade in goods and services, and the growth rate of foreign exchange transaction volume is also much higher than that of international trade. That is, in terms of notional principal amounts, global turnover in traditional foreign exchange market segments (i.e., spot transactions, outright forwards and foreign exchange swaps) increased 45% during 1992-95 and expanded additionally by 29% during 1995-1998. However, adjusted for differences in the dollar value of non-dollar transactions, growth rate in the amount of foreign exchange transaction accelerated from 29% to 46% between two periods. This growth rate far exceeds the growth rate of international trade in real sector (8%), and reflects the rapid growth of speculative transactions in the foreign exchange market.[6]

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only area where the concrete means were provided was the area of enhancing transparency through enhancing the availability of accurate and timely information about the financial market of each country. However, in other areas, mainly the basic principles were emphasized without the concrete policy measures.

[5] Refer Guillermo Calvo and Enrique Mendoza, "Contagion, Globalization, and the Volatility of Capital Flows," mimeograph January 1998.

[6] The statistics in table 1 show that the volume of foreign exchange transactions under the purpose of the settlement in international trade in goods and service is less than 1.3% of the total transaction in foreign exchange in annual terms. This means that 98.7% of total foreign exchange transactions is targeted to arbitrage profits, which can be called as speculative transactions. Even though the speculative transactions take the majority of the total foreign exchange transactions, the sharply increasing turnover in foreign

In addition, the data of international capital flows show that an extended period of easy access by emerging market economies to international financing came to an abrupt end in the second half of 1997. The private capital sector, which flowed into emerging market economies at the level of $140 billion in 1996, shrank to $40 billion as the first waves of financial turmoil hit the developing world in 1997, and dried up completely in 1998. However, some of the financing gap left by reduced private capital flows was filled by rising inflows of official funds. In addition, foreign direct investment flows have remained buoyant over 97-98, suggesting that confidence in the longer-term prospects of most emerging market economies has remained intact.

However, when we focus on the data of Asian region, the private sector capital outflows were dominant to the official capital inflow exceeding by 40 billion US dollars in 1998. The huge outflows of the private capital (69 millions in US dollars in 1998) were preceded by a huge inflows of private capital (81 millions in US dollars in 1996), and these statistics show the volatile movement of private capitals is a major factor behind the Asian financial crisis, which should be addressed in reducing the volatility.

There have been various policy measures already taken by several countries to reduce the financial volatility such as the Chilean system of deposit requirement on foreign capital inflows, and a currency board system as in Hong Kong. Recently, there are increased discussions on the Tobin tax system, a transaction tax in foreign exchange markets as suggested by James Tobin (1979). Among the various types of government interventions, a transaction tax system turns out to have the least distortion in the economy compared to direct quantity restrictions in international financial markets. However, several serious limits of Tobin tax system have been pointed out, and the

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exchange markets itself cannot be interpreted as a major reason for financial volatility as pointed out by an anonymous referee. The volatility in financial markets has high correlation only with short-term speculative transactions, which is targeted to be reduced by the Tobin tax system. Figures in table 1 and 2 are supposed to show the increasing role and portion of speculative transactions in foreign exchange markets instead of showing any policy implication to reduce the financial volatility.

possibility of actual application of Tobin tax is seriously doubted.[7] Two serious shortcomings of the Tobin tax system are i) economic distortions and inefficiencies caused by the Tobin tax, and ii) enforceability of Tobin tax system because all the related parties have an incentive to deviate from the coordinated Tobin tax rate to lower the tax rate or exempt the tax at all to induce more capital inflows and induce the foreign exchange business into their territory.

Regarding the economic distortions caused by the Tobin tax, it is true that when the price elasticity of demand in a foreign exchange market is high, the possible distortion caused by the transaction tax is also high. However, when we consider the devastating results of financial crisis, which is resulted from the short-term speculative transactions, the welfare enhancing effect of the Tobin tax system is dominant to the welfare loss as a result of economic distortion caused by the tax. In other words, the Tobin tax system can internalize the economic externality caused by the herd behavior in financial markets. In addition, regarding the discussion whether Tobin tax is really effective in reducing financial volatility, Jeffrey Frankel (1996) has already shown in a quite simple way that the transaction tax can reduce financial volatility because the tax burden turns out to be very high only to a short term speculative investor, and as a result, discourages those speculative transactions.[8]

This paper focuses on the enforceability issue of Tobin tax from the perspective of the international tax policy coordination. The cooperative tax policy regime can be sustained only when the enforcement mechanism is available. This paper determines under what conditions, Tobin tax system is enforceable, and how the enforceability of

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[7] The main characteristics of Chilean deposit requirement system and the transaction tax can be summarized as follows. For a detailed comparison about the two systems, refer Jeffrey Frankel, 1996, "How Well Do Foreign Exchange Markets Function?" NBER Working Paper No. 5422.

[8] Frankel shows that when a government imposes a transaction tax t, the market equilibrium condition for the speculator turns out to be :$(1+i^*y)(1-t)-t=1+iy$ where i^* is the foreign interest rate, and y is the duration of investment, and t is the transaction tax rate, and i is the domestic interest rate. By a simple manipulation of the equilibrium condition, we obtain the following condition: $i^* = \frac{i + 2t/y}{1-t}$. From this condition, we can see easily that when y is small, i.e., with short-term transaction, foreign interest rate should be significantly high for the transaction to occur. For a detailed discussion, refer Frankel, J., 1996, How Well Do Foreign Exchange Market Function: Might a Tobin tax help?, NBER Working paper 5422

the Tobin tax system can be improved considering the different economic characteristics of each country, such as current account balance, the composition of national output, and other economic fundamentals.

Although there are several discussions about the Tobin tax system, most of the prior studies were descriptive, and Frankel (1996) shows the effectiveness of Tobin tax system using a quite simple model as described in footnote 6. However, his simple model does not consider any economic variables, which reflect the economic fundamentals, and does not consider the enforceability issue either. Jeanne (1996) discussed about the effectiveness of Tobin tax in reducing the financial volatility in EMS system incorporating the impacts of economic variables of a country adopting the tax system. However, he neither considered the feasibility of policy coordination issue nor considered the strategic relationship between the participating countries in tax policy coordination. To complement the shortcomings of the earlier studies, this paper introduces the policy coordination issue by assuming two governments decide its optimal tax policy simultaneously, which was not considered in earlier studies. In addition, this paper examines how the economic fundamentals such as current account balances and industrial structures influence the government decision on the policy coordination.

3. THE MODEL

Assume that there are three players in the international financial market, a speculator from a third country, a domestic government, and a foreign government. The speculator tries to maximize its profit from its financial investment in two countries, and each government tries to maximize its social welfare by reducing exchange rate volatility and inducing the long-term foreign investment through the policy measure of Tobin tax, which is a transaction tax in the foreign exchange market. The speculator decides its duration of investment, i.e. the frequency of the short-term transaction in home country and foreign country to maximize its profit from portfolio investment. The government of each country tries to stabilize its foreign exchange rate, and at the same time induce long-term investment by imposing a transaction tax for all foreign currency exchanges in each country.

Based on the empirical result that the frequency of the short-term transaction is positively related to the volatility of financial market, we represent the stability of the financial market by the long duration of foreign investment. The objective function of the speculator can be set up as follows based on Frankel's formulation on the transaction tax.[9]

The Speculator maximizes the following profit function with respect to y and y^*:

$$\underset{y}{Max} \prod(t) = ((1+ry)(1-t)-t)(1-by) + ((1+r*y)(1-t^*)-t^*)(1-b*y) \qquad (1)$$

where r and r^* are the rate of capital return, and y is duration of the investment measured as the number of years, and t is the transaction tax rate, and b is the

[9] Frankel used the following formula, $(1+i*y)(1-t)-t=1+iy$, just to show that a small transaction tax rate can be a heavy tax burden to a short-term speculator in annual terms. However, to develop a model where two governments decide their strategies with policy coordination with respect to tax rate, considering a rational speculator who tries to maximize its profit, we extends Frankel's formula to a quadratic profit function with respect to the investment duration, y, with a coefficient b, which reflects the country risks. In addition, we examine the policy coordination problems with the assumption that both governments try to induce a longer investment duration and simultaneously to maximize the capital inflows to their countries by setting up objective functions of two governments, which was not addressed by any prior studies including Frankel (1996).

coefficient which represents the investment risks including the economic fundamentals. For the simplicity of discussion without influencing the results we normalize b^* to 1.

The objective function of each government can be represented as to minimize exchange rate volatility and to maximize the inflow of the foreign capitals into the country. To simplify the discussion without distorting the implication, we assume that the reduction of volatility can be represented by the increase of the duration of the foreign investment. Therefore, the government objective function is to maximize the duration of the investment, that is, to induce the long-term investment instead of short-term investment, and at the same time to induce the maximum foreign capital inflow. So, in non-cooperative policy regime, the objective function of the Home and Foreign government can be represented as follows:

Home Government: $\underset{t}{Max}\, W(t) = hy + jk$ (2)

Foreign Government: $\underset{t^*}{Max}\, W^*(t^*) = h^* y + j^* k^*$ (3)

where h is the parameter which represents how much the economy benefits from reducing the financial volatility, i.e., from the transformation of the short term foreign capital investment into a long term foreign capital investment, and k and k^* are the capital inflow to the home and foreign country respectively, and j and j^* are the coefficient which represent how much the home and foreign country's welfare is influenced by the foreign capital inflow respectively. We assume that the foreign capital inflow is positively influenced by the foreign country's transaction tax rate, and negatively influenced by the home country's transaction tax rate: $k = d(t^* - t), k^* = d(t - t^*)$. For now, we assume that the interest rate, or rate of return to capital is exogenous in the model. In addition, if $h>h^*$, home country is more heavily influenced by financial stability induced by the long-term capital inflows. Stability in foreign exchange rate is more important issue to country with a higher dependency in international trade in goods and services. Therefore, we can interpret that if $h>h^*$, home country is a country with a higher dependency in international trade in

goods and services. If $j>j^*$, the home country puts a larger weight on the capital inflows in her social welfare compared to foreign country because of the poor performances in current account balances. Therefore, a higher j means a smaller foreign reserves and poor performance in the current account balances. For the sake of simplicity in the discussion, we assume $j^* = h^* = 1$. Then, if $h>1$ and $j>1$, the home country is a smaller country than the foreign country, and the home country is more badly needed the foreign capital inflow, in other words, the home country's foreign reserve and current account balance is shakier than that of the foreign country.

In the cooperative policy game, both governments maximize the joint welfare function as follows:

$$\underset{t}{Max}\, WW(t) = Max(t) + MaxL^*(t) = (h + h^*)y \tag{4}$$

H and F will choose the cooperative tax policy only when there is no incentive to deviate from the cooperative strategy. First, we discuss the case of non-cooperative policy game. As described above, in non-cooperative game, each government tries to maximize its own social welfare, i.e., maximize its social welfare function assuming the strategy of the other country is given. The sequence of the game is as follows. First, the government decides the tax level. Then, the speculator decides the duration of investment. We determine the optimal decision on the transaction tax rate and the investment duration by backward induction reflecting the game structure.

By solving the profit maximization problem of speculator with respect to the investment duration, y, we obtain the optimal value of y as follows:

$$\hat{y} = \frac{r(1-t) + r^*(1-t^*) - 2b(1-t-t^*)}{2b((r(1-t) + r^*(1-t^*))} \tag{5}$$

Secondly, we determine the government's optimal Tobin tax rate under a non-cooperative policy game. By solving the social welfare maximization problem of domestic government with respect to Tobin tax rate after we substitute the optimal value of y, we obtain the following best response function of domestic government.

$$\frac{\partial W}{\partial t} = 0$$
$$t = \frac{r + r^*(1 - t^*)}{r} + \frac{\sqrt{hj(r^* - t^*(r^* - r))}}{jr} \tag{6}$$

Now we determine the optimal Tobin tax policy of the foreign government by solving the foreign government's welfare maximization problem with respect to t*. The best response function of the foreign government is given as:

$$\frac{\partial W^*}{\partial t^*} = 0$$
$$t^* = \frac{r^* + r(1 - t) + \sqrt{r - t(r - r^*)}}{r^*} \tag{7}$$

Under a non-cooperative game, both governments of H and F decide the optimal Tobin tax non-cooperatively. The equilibrium Tobin tax rate of each country can be obtained by solving two best response functions simultaneously to each other as follows:

$$\hat{t} = \frac{r}{r - r^*} - \frac{h^2(r - r^*)}{(hr - r^* j)^2}$$
$$\hat{t}^* = \frac{r^*}{r^* - r} - \frac{rj(r^* - r)}{(hr - r^* j)^2} \tag{8}$$

Now, we consider the case when both the home and the foreign countries take cooperative strategies to reduce the financial volatility. In this cooperative policy regime, both the home and the foreign governments take coordinated tax strategies to reduce the financial volatility, i.e., take the same transaction tax rate as follows:

$$WW(t) = W(t) + W^*(t) = (h + h^*)y \tag{4'}$$

When we solve the world welfare maximization problem with respect to the coordinated tax rate, we obtain the following result.

$$\frac{\partial WW(t)}{\partial t} = \frac{\partial (h + h^*)y}{\partial t} = \frac{\partial (h + h^*)\left(\frac{r(1-t) + r^*(1-t^*) - 2b(1-t-t^*)}{2b((r(1-t) + r^*(1-t^*))}\right)}{\partial t} = \frac{(h + h^*)}{(r + r^*)(1-t)^2} > 0 \tag{9}$$

Therefore, we obtain a corner solution, that is, the optimum transaction tax rate

turns out to be the maximum tax rate within the interval supported by the assumption. We can obtain the maximum bound of the tax rate from the individual participation condition as follows:

$$(1+ry)(1-t)-t \geq 0 \quad \Rightarrow t \leq 1-\frac{1}{2+ry} \leq 1.$$

This result shows that the cooperative tax rate is the highest possible tax rate, t_c. As a result, the optimal tax rate in a non-cooperative game is always lower than the cooperative game. In other words, in a non-cooperative game, each government has always an incentive to deviate from the cooperative tax rate to lower its tax rate to induce more capital inflows. Therefore, in the non-cooperative tax regime, the duration for the foreign capital investment will be much shorter than the cooperative tax regime, and as a result, the financial volatility will be higher than that in the cooperative regime.

Now, we check the condition for the cooperative tax policy regime to be sustained. There are two cases where the cooperative tax regime can be sustained. The first case is where the social welfare from the cooperative tax regime is higher than the non-cooperative regime. The second case is where the enforcement mechanism can be designed and abided by the all countries. First, we check the condition where the cooperative payoff is higher than the maximum deviation payoff. The maximum deviation payoff would be the case when the home country levies a non-cooperative tax rate at the initial stage, and the foreign government imposes a cooperative tax rate. However, from the second stage, the foreign government realizes the home government's deviation, and retaliates with a trigger strategy. In that case, the maximum deviation payoff to the home government is as follows:

$$\sum_{i=1}^{\infty} W_i(\hat{t}_N^H, \hat{t}_C^F) = W_{i=1}(\hat{t}_N^H, \hat{t}_C^F) + \sum_{i=2}^{\infty} W_i(\hat{t}_N^H, \hat{t}_N^F)$$
$$= hy(\hat{t}_N^H, \hat{t}_C^F) + j(\hat{t}_C^F - \hat{t}_N^H) + \frac{\delta}{1-\delta}\left(hy(\hat{t}_N^H, \hat{t}_N^F) + j(\hat{t}_N^F - \hat{t}_N^H)\right)$$

$$\hat{y}(\hat{t}_C, \hat{t}_C^*) = \frac{1}{2b} + \frac{2t_C - 1}{(1+r)(1-t_c)} \tag{10}$$

$$\hat{y}(\hat{t}_N, \hat{t}_C^*) = \frac{1}{2b} - \frac{(hr-j)^2 - h^2(r-1)^2 + t_c(hr-j)^2(r-1)}{(hr-j)^2 - rh^2(r-1)^2 + t_c(hr-j)^2(r-1)}$$

Now, we check the condition where the cooperative regime is self-enforcing. The condition when the cooperative regime is self-enforcing is as follows:

$$\begin{aligned}
&\sum_{i=1}^{\infty} W_i(\hat{t}_C^H, \hat{t}_C^F) \geq \sum_{i=1}^{\infty} W_i(\hat{t}_N^H, \hat{t}_C^F) \\
&\Rightarrow \frac{1}{1-\delta} W(\hat{t}_C^H, \hat{t}_C^F) \geq W_{i=1}(\hat{t}_N^H, \hat{t}_C^F) + \sum_{i=2}^{\infty} W_i(\hat{t}_N^H, \hat{t}_N^F) \\
&\Rightarrow \frac{1}{1-\delta} hy(\hat{t}_C^H, \hat{t}_C^F) \geq hy(\hat{t}_N^H, \hat{t}_C^F) + j(\hat{t}_C^F - \hat{t}_N^H) + \frac{\delta}{1-\delta}\left(hy(\hat{t}_N^H, \hat{t}_N^F) + j(\hat{t}_N^F - \hat{t}_N^H)\right) \\
&\Rightarrow \frac{1}{1-\delta} hy(\hat{t}_C^H, \hat{t}_C^F) - hy(\hat{t}_N^H, \hat{t}_C^F) - j(\hat{t}_C^F - \hat{t}_N^H) - \frac{\delta}{1-\delta}\left(hy(\hat{t}_N^H, \hat{t}_N^F) + j(\hat{t}_N^F - \hat{t}_N^H)\right) = D \geq 0
\end{aligned} \tag{11}$$

Then based on a comparative static analysis of condition (11) with respect to each country's welfare elasticity to financial stability (h), and to foreign capital inflow (j), we obtain the following policy implication.

Proposition 1. When a country shows deterioration in current account balances, and as a result, when a country's foreign reserves are not sufficient, then the country is less likely to abide by the cooperative Tobin tax rate, and policy coordination.

Proof: See Appendix A.

The intuition behind the Proposition 1 is that when a country is more dependent on capital inflows, such as a country with chronic current account deficits, it is less likely that the country will keep the policy coordination with the Tobin tax system. For foreign exchange speculators, a Tobin tax reduces the expected profit from the frequent speculative foreign exchange transactions, and therefore, the speculators will switch to a new country with a lower or no transaction tax. These arguments have been proved by demonstrating that with the increase of the parameter value which represents a country's dependency on foreign capital inflows, j, the difference between the profit from the

policy coordination and the profit from the deviation strategy (D) is decreased in the Appendix A.

Proposition 2. When a country is more dependent on international trade in goods and service, and less dependent on the short-term financial transaction business in its total GDP, the country is more likely to abide by the policy coordination with Tobin tax system.

Proof: See Appendix B.

When an economy of a country is more dependent on real sector business and less dependent on short-term arbitrage profit oriented financial businesses, it is more likely that the economy prefers the long-term investment strategy rather than a short-term speculative investment. Therefore, a country, which is more dependent on real sector transactions, is more likely to keep the policy coordination with the Tobin tax system, which penalizes short-term speculative transactions. This argument is proved by showing that with longer investment durations, h, the difference between the profit from cooperative strategy with the Tobin tax system and the profit from deviation strategy, D, gets larger in Appendix B.

4. THE POLICY IMPLICATION ON INTERNATIONAL COORDINATION AND CONCLUDING REMARKS

The most difficult problem in the actual implementation of Tobin tax system is to design a multilateral tax coordination mechanism because each country has an incentive to deviate from the policy coordination to induce more capital inflows to its territory as discussed before. To examine the feasibility of policy coordination, the model assumed that two countries compete for foreign capital inflows, and at the same time pursue the market stability through imposing a transaction tax while a speculator from a third country maximizes its profit from capital investment in two countries. The Proposition 1 shows that when a country's foreign exchange reserves are decreasing or its current account deficit is increasing, the country has more incentive to deviate from the Tobin tax policy coordination. This means that international efforts to arrange a Tobin tax regime will be more successful if the participating countries show more stable records in their current account balances and foreign exchange reserves. From this result, we can derive the following policy implication: In the early stage of arranging international policy coordination to introduce Tobin tax in the Asian region, it is more likely that the policy coordination will succeed when the participating countries are relatively stable in their current account balances and foreign exchange reserves.

If a country is heavily dependent on the foreign exchange transaction business in its gross national income, or the political influence commanded by international investors are stronger, that country is more likely to deviate from the policy coordination. This result implicates that Singapore and Hong Kong, which are heavily dependent on the foreign exchange transaction business in their national income, might have larger incentives to deviate from the Tobin tax system coordination. Considering these aspects, it would be proper to design the Tobin tax system, which allows each country has 100% control of tax revenues from Tobin tax system. In that case, even

Hong Kong and Singapore will have a larger incentive to participate and keep the coordinated Tobin tax rate. In addition, considering the fact that the actual costs involved with migrating the foreign exchange dealing site is not insignificant from the perspective of the speculators, as long as the tax revenue is totally given to each participating government, it is highly likely that the system can be sustained. In the same context, if a country's economy is more dependent on the international trade in goods and service instead of the profit from the short term financial transactions in the total GDP, then it is more likely that the country abides by the coordinated Tobin tax system.

These results show that at the initial stage of the introduction of Tobin tax, it would be more probable for the policy coordination to be sustained when the participating countries are more stable in terms of the current account balances, and the share of financial business in the total GDP is relatively small in each country. However, foreign exchange markets and business are essential parts of the economy in Hong Kong and Singapore, as shown in the fact that two countries take the share of 4% and 7% in the volume of world foreign exchange transactions respectively. Therefore, even if these two countries might not be strongly motivated to participate in the Tobin tax coordination system, as long as the whole tax revenue is given to the sovereign government, they will have enough incentive to join the tax coordination system.

The international policy coordination with respect to Tobin tax system becomes more complicated when the short-term speculators have relatively strong political influences, just as in UK and US. As has been observed, the US government has emphasized the necessity for more efficient information distribution systems. However, the US government has taken quite reserved attitude with respect to introducing any concrete government measure to regulate short-term financial transactions, and it is unlikely that the US government can join the Tobin tax coordination policy in short time. Theoretically, it might be assumed that as long as the big players such as the US and UK

do not join the Tobin tax regime, this tax system might not work. However, considering the financial shocks in the US stock market when the financial crisis was transmitted to Brazil, at least in long term, we cannot exclude the possibility that the US government might understand the necessity to take a measure to reduce the financial volatility. Especially, in BIS's Annual Report 1999 and IMF's World Economic Outlook 1999, both institutions recognize that some government intervention to reduce the financial volatility is required. Considering these recent trends of international organizations, we cannot exclude the possibility of US government to join the Tobin tax program.

However, even if the US government does not join this Tobin tax program, when most of the major Asian countries agree to produce a financial transaction tax system, it would still produce a positive effect in reducing the financial volatility in the Asian markets. There are several examples of successful unilateral capital controls in reducing the financial volatility such as the unilateral deposit requirement system of Chile, and Chinese direct control of exchange rate and foreign exchange transactions. Especially, China, India and Sub-Saharan African countries, which have weathered recent financial crises reasonably well, have a common feature, i.e., taking a unilateral financial market control. In that sense, when Asian countries coordinate with the Tobin tax system, it is highly likely that the policy coordination will be effective in reducing the financial volatility as long as the system includes most of the major trading countries such as Japan, China, Hong Kong, Singapore, Korea and other Asian countries. In addition, the Latin American countries might share the idea of necessity to introduce some policy measures to reduce financial volatility. Therefore, it is also a possible idea for Asian countries to coordinate with Latin American countries.

Finally, regarding the role of international institution such as IMF and BIS, if the US and UK government agree to join the Tobin tax system, then both institutions can play a really big and important role in actual implication of the tax system, such as setting the tax rate, and collecting the tax revenue, and the disposition of the revenue.

However, if the US and other major western countries do not join the Tobin tax policy coordination, there would be a serious limit of these organizations to contribute in actual implication of the Tobin tax system. The only role played by these institutions would boost up the public opinion for the policy measure to reduce the financial volatility. If the US and other leading western countries do not join this policy coordination, then Asia Development Bank or other newly founded institution in Asia may coordinate the actual implication of the Tobin tax system, such as setting the tax rate and other possible issues of policy coordination. Once this transaction tax system is launched in the Asian region, even if the international short term hedge funds might hesitate to invest in the Asian region, and might fly to other emerging markets where the transaction tax is not levied, the Asian markets will become more stabilized and as a result, the long term rate of return will be improved. In that case, the more stable long term foreign investment will inflow to Asian region, and the stable condition for long term investment and development will be prepared.

This paper examined the feasibility issue of introducing the Tobin tax system based on a simple model assuming a quadratic profit function of a speculator and two governments trying to maximize their social welfare simultaneously with a tax rate as a strategic variable. This simple model formula produced some intuitive results discussed in section 4, such as the higher probability for the successful policy coordination when the Tobin tax regime starts with member countries which show stable current account balances and higher dependency on international trade in goods and services rather short term financial transactions in their GDP. This result also provided several policy implications such as the necessity to allow the control of total tax revenue to each sovereign government and the necessity to start the regime with only a few countries, which have lower political and economic barriers against this system in the initial stage. The contribution of this paper can be interpreted just as an initial trial to understand the international policy coordination issue with the Tobin tax system based on an analytical model. However, financial volatility issue can be best understood in the volatility of

exchange rates instead of foreign capital investment duration. In that sense, it is required to develop a model which incorporates the Tobin tax coordination issue into the exchange rate volatility in the future studies.

Finally, this paper used the strictly restricted definition of 'rationality' as an instrumental rationality to maximize each economic agent's utility. In that context, cooperative equilibrium was described as a socially rational equilibrium. However, with the definition of utility as the level of satisfactions or happiness of each economic agent, not confined to represent the level of satisfaction from physical consumptions, 'rationality' is not defined as the maximization of physical consumption, but as the maximization of happiness or satisfaction of each economic agent. Through the introduction of the comprehensive definition of utility, the traditional conflict between 'instrumental rationality' and other behavioral definition of rationality might be reduced. However, it is still an unsolved issue whether each economic agent has really consistent and complete preference system and attitude towards its level of happiness and satisfaction as described by utility. Many inconsistent and incomplete attitudes toward their happiness are observed in realities. The incorporation of the inconsistencies and incompleteness of preference in the policy coordination would be the issue of future studies with the ongoing findings from evolutionary economics.

Appendix A. The proof of Proposition 1

When we take a partial derivative of condition (11) with respect to *j*, we obtain the negative sign as follows.

$$\frac{\partial D}{\partial j}=\frac{1}{1-\delta}h\frac{\partial y(\hat{t}_C^H,\hat{t}_C^F)}{\partial j}-h\frac{\partial y(\hat{t}_N^H,\hat{t}_C^F)}{\partial j}-(\hat{t}_C^F-\hat{t}_N^H)-\frac{\delta}{1-\delta}\left(h\frac{\partial y(\hat{t}_N^H,\hat{t}_N^F)}{\partial j}+(\hat{t}_N^F-\hat{t}_N^H)\right)$$

$$=0-h\underset{+}{\frac{\partial y(\hat{t}_N^H,\hat{t}_C^F)}{\partial j}}-(\underset{+}{\hat{t}_C^F-\hat{t}_N^H})-\frac{\delta}{1-\delta}\left(h\underset{+}{\frac{\partial y(\hat{t}_N^H,\hat{t}_N^F)}{\partial j}}+(\underset{+}{\hat{t}_N^F-\hat{t}_N^H})\right)<0$$

Therefore, a country with higher *j*, has a larger incentive to deviate from Tobin tax coordination Q.E.D.

Appendix B. The proof of Proposition 2

When we take a partial derivative of condition (11) with respect to *h*, we obtain the positive sign as follows.

$$\frac{\partial D}{\partial h}=\frac{1}{1-\delta}(y(\hat{t}_C^H,\hat{t}_C^F)+h\frac{\partial y(\hat{t}_C^H,\hat{t}_C^F)}{\partial h})-y(\hat{t}_N^H,\hat{t}_C^F)-h\frac{\partial y(\hat{t}_N^H,\hat{t}_C^F)}{\partial h}+j\frac{\partial \hat{d}_N^H}{\partial h}$$

$$-\frac{\delta}{1-\delta}\left(y(\hat{t}_N^H,\hat{t}_N^F)+h\frac{\partial y(\hat{t}_N^H,\hat{t}_N^F)}{\partial h}+j\frac{\partial(\hat{t}_N^F-\hat{t}_N^H)}{\partial h}\right)$$

$$=\frac{y(\hat{t}_C^H,\hat{t}_C^F)-(1-\delta)y(\hat{t}_N^H,\hat{t}_C^F)-\delta y(\hat{t}_N^H,\hat{t}_N^F)}{\underset{+}{1-\delta}}+h(\frac{1}{1-\delta}\frac{\partial y(\hat{t}_C^H,\hat{t}_C^F)}{\partial h}-\underset{+}{\frac{\partial y(\hat{t}_N^H,\hat{t}_C^F)}{\partial h}}-\frac{\delta}{1-\delta}\frac{\partial y(\hat{t}_N^H,\hat{t}_N^F)}{\partial h})$$

$$+j(\frac{\partial \hat{d}_N^H}{\partial h}-\frac{\delta}{\underset{+}{1-\delta}}\frac{\partial(\hat{t}_N^F-\hat{t}_N^H)}{\partial h})>0$$

Therefore, a country with higher *h*, has a larger incentive to abide by the Tobin tax coordination Q.E.D.

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< 요약문 >

Keywords: Individual versus social Rationality; International Policy Coordination
(주제어: 개별적 합리성과 사회적 합리성, 국제정책조정체계)

요약문: 본 논문은 국제정책조정체계에 있어, 사회적으로 합리적인 체제에 도달하는 과정에서, 반복정책조정게임 및 협조적 전략을 강제하는 제도적 장치의 역할을 분석하였다. 일반적으로 정책조정게임에 있어, 개인적 합리성이 추구될 경우, '죄수의 딜레마'형태의 비협조적 내쉬전략이 균형전략으로 도출된다. 그러한 경우, 반복정책게임의 도입은, 비록 비협조적인 개인적 합리성이 추구되더라도, 협조적 전략을 선택하도록 유도하게 된다. 반복정책게임의 구조분석 및 매우 낮은 거래비용에 의해 초래되는 외환시장에서의 사회적 비합리성의 구조분석을 통하여, 본 논문은 국제외환시장의 안정성을 확보하기위한 정책조정게임의 균형체계를 확인하였다. 즉 비록 외환시장에서의 시장지배력을 가진 국가들이 정책조정체계에 참가하지 않는 경우에도, 다수 국가들이, 외환거래세제 정책과 같은, 외환시장의 안정성을 도모하는 정책조정체계에 참가할 경우, 낮은 거래비용에 의해 초래된 사회적 비합리성을 보완하는 효과를 가질 수 있음을 확인하였다. 즉 거래비용이 매우 낮을 경우, 금융시장에서 개별적 합리성을 충족시키는 전략은, 금융정보의 진위를 분별하기 이전에, 금융시장의 흐름에 편성하는 전략이다. 그러나, 다수 국가들이 참가하는 외환거래세제가 도입될 경우, 금융정보의 진위를 분별하도록 유도하여, 허위정보에 의하여 외환시장의 위기가 도래하는 확률을 줄이는 사회적 합리성을 회복할 개연성이 커지게 된다.

논문제목: 국제정책조정게임에서의 사회적 합리성
(Social Rationality in International Policy Coordination Game)

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