The Root Cause of Sovereign Default

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Abstract

Sovereign defaults have occurred more frequently in emerging countries and accompany significant currency depreciation and high inflation. The standard model of sovereign default cannot necessarily explain these facts sufficiently. In this paper, I examine the root cause of sovereign default on the basis of a model of inflation that is built on a micro-foundation of government behavior and conclude that the root cause of sovereign default is an insufficiently independent central bank. Without a sufficiently independent central bank, the government inevitably borrows money excessively, and as a result, inflation and currency depreciation accelerate. This situation will frustrate and anger the population, and the government may then declare a sovereign default in an attempt to place the blame on foreign lenders, at least temporarily.

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1 INTRODUCTION

Models of sovereign default mostly rely on the model of Eaton and Gersovitz (1981), which explains the mechanism of a sovereign default by incorporating the cost or penalty of default into the model (Kletzer and Wright, 2000; Neumeyer and Fabrizio, 2005; Aguiar and Gopinath, 2006; Arellano, 2008; Alfaro and Kanczuk, 2009, 2019; Yue, 2010; Auclert, 2016; Ayres et al., 2018; Bianchi et al., 2018). In these models, the costs of sovereign default and the credit ceiling for a government are endogenously determined. The amount of money a government borrows is the minimum of the amount it wishes to borrow and its credit ceiling. If some exogenous shock (e.g., the oil crisis in the 1970s) occurs, however, the government may be driven into a situation in which it is better for it to choose the option of sovereign default.

The model of Eaton and Gersovitz (1981) is very useful for analyzing the borrowing behavior of the government of a sovereign country, but it is not as useful when examining the root cause of sovereign default. First, it largely depends on exogenous shocks as the cause of sovereign default. Therefore, if a government (whether that of an emerging or developed country) and lenders behave rationally, a sovereign default cannot occur unless an unexpected exogenous shock such as the oil crisis in the 1970s occurs. This implies that the root cause of sovereign default is more or less bad luck. However, if bad luck is indeed the root cause, why have sovereign defaults occurred far more frequently, and in some cases repeatedly, in emerging countries than they have in developed countries? Are emerging countries far more unlucky than developed countries?

Clearly, some important heterogeneities with regard to sovereign default must exist between emerging and developed countries. Indeed, many models based on Eaton and Gersovitz (1981) attribute the frequent occurrences of sovereign default in emerging countries to the high levels of economic volatility in these countries (Neumeyer and Fabrizio, 2005; Arellano, 2008; Reinhart and Rogoff, 2011; Alfaro and Kanczuk, 2019). That is, the economies of emerging countries are more vulnerable than those of developed countries; therefore, they are more severely affected by shocks than developed countries. However, if lenders and the governments of emerging countries are aware of this vulnerability and the higher risks of sovereign default, they should behave rationally in expecting and considering these risks. Therefore, sovereign default should still occur only when a large unexpected exogenous shock occurs. The question of why sovereign defaults have occurred far more frequently in emerging countries than developed countries therefore remains unanswered. Furthermore, Tomz and Wright (2007) showed empirically that the relationship between sovereign default and real economic activities is surprisingly weak, which implies that a sovereign default can emerge regardless of external circumstances (i.e., bad luck).

As second problem is that the model of Eaton and Gersovitz (1981) ignores currency depreciation and inflation. Usually, a sovereign default is accompanied by significant currency depreciation and high inflation. The occurrence of these phenomena seems to be very natural because the government of a country in default has borrowed a large amount of money denominated in foreign currencies from foreign lenders. That is, sovereign default is very closely related to exchange rates and consequently also to domestic inflation. Nevertheless, the model of Eaton and Gersovitz (1981) does not incorporate prices, and all variables are expressed in real terms. Hence, by its very nature, the model cannot explain currency depreciation and domestic inflation.

Uribe (2006) emphasized the roles of prices and exchange rates in sovereign default, particularly the importance of regimes of monetary and fiscal policies and their effects on price level. Uribe (2006) showed that the risk of sovereign default will greatly differ depending on monetary-fiscal regimes (see also Schabert, 2010), meaning that a sovereign default can emerge regardless of exogenous shocks, depending on the monetary-fiscal regime. However, in the model of Uribe (2006), the behavior of government is set *ad hoc*; that is, there is no micro-foundation for government behavior. In addition, the behaviors of government and the central bank are not separated; therefore, it is unclear why and how a specific monetary-fiscal regime is chosen by the combined government/central bank entity.

In this paper, I examine the cause of sovereign default on the basis of the model of inflation presented by Harashima (2004, 2006[1], 2007a, 2007b[2], 2007c[3], 2008a, 2008b[4], 2013a, 2019a[5], 2019b). The model was built on a micro-foundation of government behavior, and the government and central bank are fully separated and therefore are treated as completely different entities. The conclusion derived from the model is common to that in Uribe (2006) in the sense that a sovereign default can emerge not only as a result of an exogenous shock but also from inappropriate monetary and fiscal policies. The models differ, however, in that the behaviors of the government and central bank are fully separated, and a micro-foundation of government behavior is incorporated in the proposed model.

I show that the root cause of sovereign default is that the central bank is not sufficiently independent. The preferences of the government and representative household are intrinsically heterogeneous. If these heterogeneous preferences are not modified, the government will borrow an excessive amount of money, motivated by its own intrinsic preferences. The model indicates that these heterogeneous preferences

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1 Harashima (2006) is also available in Japanese as Harashima (2016).
2 Harashima (2007b) is also available in Japanese as Harashima (2013b).
3 Harashima (2007c) is also available in Japanese as Harashima (2018a).
4 Harashima (2008b) is also available in Japanese as Harashima (2020a).
5 Harashima (2019a) is also available in Japanese as Harashima (2019c).

result in accelerations of currency depreciation and domestic inflation. These conditions will frustrate and anger the citizens. Under these conditions, some governments may choose the option of sovereign default because they can place the blame on foreigners (i.e., the lenders), at least temporarily.

To escape accelerating currency depreciation and inflation, the preferences of the government and representative household must be made identical, but this is not an easy task because preferences are not easily controlled by oneself. An independent third-party institution (in this case, a central bank) is needed to force the government to change its preferences so that they are identical to those of the representative household. If the central bank is not sufficiently independent, the government cannot stop borrowing excessively, and currency depreciation and inflation will continue to accelerate. In this case, if a government has borrowed money from foreign lenders, sovereign default is an option for the government to at least temporarily escape this situation. That is, a sovereign default can emerge without an exogenous shock. In addition, the model in this paper clearly shows that sovereign defaults and accelerations of currency depreciation and domestic inflation are closely related and inseparable.

The root cause of sovereign default is therefore an insufficiently independent central bank. It seems likely that central banks of many emerging countries are less independent than those of developed countries (see e.g. Cukierman et al., 1992), and therefore the model predicts that the probabilities of sovereign default in emerging countries will be higher than developed countries.

2 EXCHANGE RATE

2.1 Floating exchange rate

Suppose that there are two countries (Countries 1 and 2) that use different currencies, and a floating exchange rate system is adopted between them. Let χ_t be the depreciation rate of currency of Country 2 to that of Country 1 in period *t*. Note that a negative value of χ_t means that the currency of Country 2 appreciates relative to that of Country 1.

Suppose for simplicity that the exchange rate is kept identical to the purchasing power parity (PPP) between the two countries, and therefore

$$\pi_{2,t} = \chi_t + \pi_{1,t} \tag{1}$$

is always held, where $\pi_{i,t}$ is the inflation rate of Country *i* in period *t* for *i* = 1 or 2.

2.2 An exchange rate model under the RTP-based procedure

2.2.1 The model

Households are usually assumed to act such that they maximize their expected utilities discounted by the rate of time preference (RTP) on the basis of rational expectations. I refer to this behavior as the RTP-based procedure, and it is equivalent to the MDC (Maximum degree of comfortability)-based procedure that is explained in Section 2.3.

Suppose that Countries 1 and 2 are identical except for the RTPs of government and the representative household and that they commonly behave under the RTP-based procedure. Both countries are fully open to each other, and goods, services, and capital are freely transacted between them, but labor is immobilized in each country. All variables are expressed in per capita terms.

Let $\theta_{G,i}$ and $\theta_{P,i}$ be the RTP of the government and a representative household of Country i, respectively. It is assumed for simplicity that $\theta_{P,i} = \theta_P$ for any i where θ_P is a constant (i.e., the values of $\theta_{P,i}$ are identical between the two countries), but this assumption can easily be relaxed and the essential results are the same regardless of this assumption because of the concept of sustainable heterogeneity (SH) discussed in Section 5.1 (see Harashima, 2010[6], 2014a, 2014b, 2015, 2017b[7]). Unlike $\theta_{P,i}$, the values of $\theta_{G,i}$ are assumed to be heterogeneous between the two countries.

2.2.1.1 The average nominal interest rate for total government bonds

A government borrows money by issuing government bonds, and the returns on the government bonds are realized only after holding the bonds during a unit period, for example, a year. Government bonds are redeemed in a unit period, and the government successively refinances the bonds by issuing new ones in each time period.

Lenders in Country i will buy the government bonds if

$$\bar{R}_{i,t} \geq E_t \int_t^{t+1} \left(\pi_{i,s} + r_s\right) ds$$

in period t, where $\bar{R}_{i,t}$ is the nominal interest rate for government bonds bought by lenders in Country i in the currency of Country i, r_t is the real interest rate in period t, and E_t is the expectation operator. The real interest rate r_t is common to the two countries because capital is freely transacted between them. By arbitrage in markets, $\bar{R}_{i,t}$ is determined as

[6] Harashima (2010) is also available in Japanese as Harashima (2017a).
[7] Harashima (2017b) is also available in Japanese as Harashima (2020b).

$$\bar{R}_{i,t} = E_t \int_t^{t+1} (\pi_{i,s} + r_s)\, ds \,. \tag{2}$$

Here, by equation (2),

$$\bar{R}_{1,t} = \bar{R}_{2,t} + E_t \int_t^{t+1} (\pi_{1,s} - \pi_{2,s})\, ds \,. \tag{3}$$

By equations (2) and (3),

$$\bar{R}_{2,t} + E_t \int_t^{t+1} (\pi_{1,s} - \pi_{2,s})\, ds = E_t \int_t^{t+1} (\pi_{1,s} + r_s)\, ds \,. \tag{4}$$

By equations (1) and (4),

$$\bar{R}_{2,t} = E_t \int_t^{t+1} \chi_s\, ds + E_t \int_t^{t+1} (\pi_{1,s} + r_s)\, ds \,. \tag{5}$$

Since government bonds are redeemed in a unit period and successively refinanced, the bonds the government holds at t have been issued between $t - 1$ and t. Hence, the average nominal interest rate for all government bonds of Country 2 at time t ($R_{2,t}$) is the weighted sum of $\bar{R}_{2,t}$ such that

$$R_{2,t} = \int_{t-1}^{t} \bar{R}_{2,s} \left(\frac{\bar{B}_{2,s,t}}{\int_{t-1}^{t} \bar{B}_{2,v,t} dv} \right) ds$$

where $\bar{B}_{2,s,t}$ is the nominal value of bonds at time t that were issued by the government of Country 2 at time s. Combining this equation with equation (5),

$$R_{2,t} = \int_{t-1}^{t} \int_{s}^{s+1} \chi_v\, dv \left(\frac{\bar{B}_{2,s,t}}{\int_{t-1}^{t} \bar{B}_{2,v,t} dv} \right) ds + \int_{t-1}^{t} \int_{s}^{s+1} (\pi_{1,v} + r_v)\, dv \left(\frac{\bar{B}_{2,s,t}}{\int_{t-1}^{t} \bar{B}_{2,v,t} dv} \right) ds \,.$$

If the weights

$$\frac{\bar{B}_{2,s,t}}{\int_{t-1}^{t} \bar{B}_{2,v,t} dv}$$

between $t-1$ and t are somewhat similar, then approximately

$$R_{2,t} = \int_{t-1}^{t}\int_{s}^{s+1} \chi_v \, dvds + \int_{t-1}^{t}\int_{s}^{s+1} \left(\pi_{1,v}+r_v\right) dvds \tag{6}$$

(see Harashima, 2007c, 2008b). Therefore, the average nominal interest rate for Country 2's government bonds is determined by equation (6).

2.2.1.2 The government budget constraint

The budget constraint of the government of Country i is

$$\dot{B}_{i,t} = B_{i,t}R_{i,t} + G_{i,t} - X_{i,t} - S_{i,t} \ ,$$

where $B_{i,t}$ is total nominal government bonds, $R_{i,t}$ is the nominal interest rate for government bonds, $G_{i,t}$ is nominal government expenditure, $X_{i,t}$ is nominal tax revenue, and $S_{i,t}$ is the nominal amount of seigniorage of Country i at time t for i = 1 or 2. For simplicity, a lump-sum tax is assumed.

Let $b_{i,t} = \frac{B_{i,t}}{p_{i,t}}$, $g_{i,t} = \frac{G_{i,t}}{p_{i,t}}$, $x_{i,t} = \frac{X_{i,t}}{p_{i,t}}$, and $s_{i,t} = \frac{S_{i,t}}{p_{i,t}}$, where $p_{i,t}$ is the price level of Country i at time t . In addition, $\pi_{i,t} = \frac{\dot{p}_{i,t}}{p_{i,t}}$. By dividing by $p_{i,t}$, the budget constraint of the government of Country i is transformed to

$$\frac{\dot{B}_{i,t}}{p_{i,t}} = b_{i,t}R_{i,t} + g_{i,t} - x_{i,t} - s_{i,t} \ ,$$

which is equivalent to

$$\dot{b}_{i,t} = b_{i,t}\left(R_{i,t} - \pi_{i,t}\right) + g_{i,t} - x_{i,t} - s_{i,t} \ . \tag{7}$$

By equations (1) and (7),

$$\dot{b}_{2,t} = b_{2,t}\left(R_{2,t} - \chi_t - \pi_{1,t}\right) + g_{2,t} - x_{2,t} - s_{2,t} \ . \tag{8}$$

Note that $\pi_{1,t}$ in equation (8) is an exogenous variable for the government of Country 2.

2.2.1.3 Optimization of a government's behavior

The government of Country i maximizes its expected utility

$$E_0 \int_0^{\infty} u_{G,i}\left(g_{i,t}, x_{i,t}\right) \exp\left(-\theta_{G,i} t\right) dt$$

subject to its budget constraint (i.e., equation [7]), satisfying equation (6), where $u_{G,i}$ is the utility function of the government of Country *i*. The government maximizes its expected utility considering the behavior of the representative household reflected in $R_{i,t}$ in its budget constraint.

2.2.1.4 Optimization of the representative household's behavior

Consider a model based on Sidrauski's (1967) well-known model of money in the utility function such that the representative household of Country *i* maximizes its expected utility

$$E_0 \int_0^{\infty} u_{P,i}\left(c_{i,t}, m_{i,t}\right) \exp\left(-\theta_{P,i} t\right) dt$$

subject to the budget constraint

$$\dot{a}_{i,t} = \left(r_t a_{i,t} + w_{i,t} + \sigma_{i,t}\right) - \left[c_{i,t} + \left(\pi_{i,t} + r_t\right) m_{i,t}\right] - g_{i,t} ,$$

where $u_{P,i}$ is the utility function of the representative household of Country *i*, and $c_{i,t}$ is real consumption, $m_{i,t}$ is real money, $w_{i,t}$ is real wage, $a_{i,t}$ is wealth of the representative household, and $\sigma_{i,t}$ is lump-sum real government transfers of Country *i* in period *t*. In addition, $a_{i,t} = k_{i,t} + m_{i,t}$, where $k_{i,t}$ is real capital.

It is assumed that $r_t = f'\left(k_{i,t}\right)$, $w_{i,t} = f\left(k_{i,t}\right) - k_{i,t} f'\left(k_{i,t}\right)$, $\frac{\partial u_{P,i}\left(c_{i,t}, m_{i,t}\right)}{\partial c_{i,t}} > 0$, $\frac{\partial^2 u_{P,i}\left(c_{i,t}, m_{i,t}\right)}{\partial c_{i,t}^2} < 0$, $\frac{\partial u_{P,i}\left(c_{i,t}, m_{i,t}\right)}{\partial m_{i,t}} > 0$, and $\frac{\partial^2 u_{P,i}\left(c_{i,t}, m_{i,t}\right)}{\partial m_{i,t}^2} < 0$, where $f(\cdot)$ is the production function. Population is assumed to be constant.

2.2.2 The law of motion for the exchange rate

By the optimization of the representative household,

$$\theta_{P,2} = r_t = r \tag{9}$$

holds at steady state such that $\dot{c}_t = 0$ and $\dot{k}_t = 0$ where *r* is constant.

Next consider the optimization of the government of Country 2, keeping in mind that $\pi_{1,t}$ in equation (8) (i.e., the budget constraint of the government of Country 2) is an exogenous variable for the government of Country 2. By the optimization,

$$\theta_{G,2} = R_{2,t} - \chi_t \tag{10}$$

at steady state such that $\dot{g}_{2,t} = 0$, $\dot{x}_{2,t} = 0$, $\dot{s}_{2,t} = 0$, $\dot{b}_{2,t} = 0$, and $\dot{x}_{2,t} = 0$. Hence, by equations (6) and (10),

$$\theta_{G,2} = \int_{t-1}^{t} \int_{s}^{s+1} \left(\pi_{1,v} + r_v\right) dv ds + \int_{t-1}^{t} \int_{s}^{s+1} \chi_v \, dv ds - \chi_t \, . \tag{11}$$

Here, because $r_t = r$ = constant at steady state as shown in equation (9),

$$\int_{t-1}^{t} \int_{s}^{s+1} \left(\pi_{1,v} + r_v\right) dv ds = r + \int_{t-1}^{t} \int_{s}^{s+1} \pi_{1,v} \, dv ds \tag{12}$$

at steady state such that $\dot{c}_{2,t} = 0$ and $\dot{k}_{2,t} = 0$. Hence, by equations (11) and (12),

$$\theta_{G,2} = r + \int_{t-1}^{t} \int_{s}^{s+1} \chi_v \, dv ds + \int_{t-1}^{t} \int_{s}^{s+1} \pi_{1,v} \, dv ds - \chi_t \, . \tag{13}$$

By equations (9) and (13),

$$\int_{t-1}^{t} \int_{s}^{s+1} \chi_v \, dv ds = \chi_t + \theta_{G,2} - \theta_{P,2} - \int_{t-1}^{t} \int_{s}^{s+1} \pi_{1,v} \, dv ds \tag{14}$$

at steady state such that $\dot{g}_{2,t} = 0$, $\dot{x}_{2,t} = 0$, $\dot{s}_{2,t} = 0$, $\dot{b}_{2,t} = 0$, $\dot{x}_{2,t} = 0$, $\dot{c}_{2,t} = 0$, and $\dot{k}_{2,t} = 0$. Equation (14) indicates the law of motion for the exchange rate under the RTP-based procedure.

A solution of integral equation (14) is

$$\chi_t = \chi_0 + 6\left(\theta_{G,2} - \theta_{P,2} - \int_{t-1}^{t} \int_{s}^{s+1} \pi_{1,v} \, dv ds\right) \exp[z_t \ln(t)] \, . \tag{15}$$

If $\pi_{1,v} = 0$ and χ_t satisfies equation (14) for $0 \le t$ and $-\infty < \chi_t \le \infty$ for $-1 < t \le 1$, then

$$\lim_{t\to\infty} \chi_t = \chi_0 + 6(\theta_{G,2} - \theta_{P,2})t^2 \tag{16}$$

(see Harashima, 2008b).

2.3 A model of the exchange rate under the MDC-based procedure

2.3.1 Procedure based on the maximum degree of comfortability (MDC)

Before constructing a model of exchange rate under the MDC-based procedure, I explain the MDC-based procedure briefly following Harashima (2018b[8], 2019e, 2020c, 2021).

2.3.1.1 "Comfortability" with the capital-wage ratio (CWR)

Under the MDC-based procedure, a household should first subjectively evaluate the value of $\frac{\breve{w}_t}{\breve{k}_t}$ (the capital-wage ratio; CWR), where $\breve{k}_t$ and $\breve{w}_t$ are the k_t and w_t of the household, respectively. Let Γ be the subjective valuation of $\frac{\breve{w}_t}{\breve{k}_t}$ by a household and Γ_j be the value of $\frac{\breve{w}_t}{\breve{k}_t}$ of household j (j = 1, 2, 3, …). Each household assesses whether it feels comfortable with its current Γ (i.e., its combination of income and capital expressed by CWR). Let the "degree of comfortability" (DOC) represent how comfortable a household feels with its Γ. The higher the value of DOC, the more comfortable a household feels with its Γ. For each household, a maximum DOC exists. Let $\tilde{s}$ be a household's state at which its DOC is the maximum (MDC) and $\Gamma(\tilde{s})$ be a household's Γ when it is at $\tilde{s}$. $\Gamma(\tilde{s})$ indicates the Γ, at which a household reaches its MDC, and $\Gamma(\tilde{s}_j)$ is household j's Γ_j when it is at $\tilde{s}_j$.

Household j acts according to the following rules:

Rule 1-1: If household j feels that the current Γ_j is equal to $\Gamma(\tilde{s}_j)$, it maintains the same level of consumption for any j.
Rule 1-2: If household j feels that the current Γ_j is not equal to $\Gamma(\tilde{s}_j)$, it adjusts its level of consumption until it feels that Γ_j is equal to $\Gamma(\tilde{s}_j)$ for any j.

Harashima (2018b, 2019e, 2020c, 2021) showed that if households behave according to Rules 1-1 and 1-2, they can reach the same steady state as they reach under

[8] Harashima (2018b) is also available in Japanese as Harashima (2019d).

the RTP-based procedure. This means that the MDC-based and RTP-based procedures function equivalently and that CWR at MDC can be substituted for RTP as a guide for household behavior. The essential results are the same even if households are heterogeneous in $\Gamma(\tilde{s}_j)$ (see Harashima, 2018b, 2019e, 2020c, 2021).

2.3.1.2 Household MDC

Let $\Gamma(\tilde{s}_{i,j})$ be $\Gamma(\tilde{s}_j)$ in Country *i*. Suppose that all households in Country *i* are identical, and therefore $\Gamma(\tilde{s}_{i,j})$ is identical for any household *j* in Country *i*. Let $\Gamma(\tilde{s}_{i,j})$, which is identical for any household *j* in Country *i*, be $\Gamma_{P,i}$. Here, it is assumed for simplicity that $\Gamma_{P,i}$ is identical for any *i* (i.e., the value of $\Gamma_{P,i}$ is identical for any country), but this assumption can easily be relaxed and the essential results are the same regardless of this assumption because SH will still be achieved (Harashima, 2018b, 2019e, 2020c, 2021).

The production function in Country *i* is assumed to be Harrod neutral such that $y_{i,t} = A^{\alpha} k_{i,t}^{1-\alpha}$, where A (technology) and α ($0 < \alpha < 1$) are constant and common to all countries. Hence,

$$r_t = \frac{\partial y_{i,t}}{\partial k_{i,t}} = (1-\alpha)\frac{y_{i,t}}{k_{i,t}} \ . \tag{17}$$

Production ($y_{i,t}$) is distributed by

$$y_{i,t} = w_{i,t} + \frac{\partial y_{i,t}}{\partial k_{i,t}} k_{i,t} \ . \tag{18}$$

By equations (17) and (18),

$$\frac{w_{i,t}}{k_{i,t}}\left(\frac{1-\alpha}{\alpha}\right) = r_t \ . \tag{19}$$

As shown in Section 3.2.1.1, if household MDC is achieved under the MDC-based procedure,

$$\Gamma_{P,i} = \Gamma(\tilde{s}_{i,j}) = \frac{w_{i,t}}{k_{i,t}} \ . \tag{20}$$

Therefore, by equations (19) and (20),

$$\Gamma_{P,i}\left(\frac{1-\alpha}{\alpha}\right) = r_t$$

is satisfied at household MDC (i.e., at steady state) such that $\dot{c}_{i,t} = 0$ and $\dot{k}_{i,t} = 0$. Because r_t is constant at steady state (i.e., $r_t = r$), as indicated by equation (9), then

$$\Gamma_{P,i}\left(\frac{1-\alpha}{\alpha}\right) = r \,. \tag{21}$$

Note that by equation (21), $\Gamma_{P,i}$ is constant.

Note also that under the RTP-based procedure,

$$\theta_{P,i} = \frac{w_{i,t}}{k_{i,t}}\left(\frac{1-\alpha}{\alpha}\right) = r \tag{22}$$

at steady state such that $\dot{c}_{i,t} = 0$ and $\dot{k}_{i,t} = 0$. Therefore, by equations (21) and (22),

$$\Gamma_{P,i}\left(\frac{1-\alpha}{\alpha}\right) = \theta_{P,i} \,. \tag{23}$$

2.3.1.3 The government's MDC

The value of

$$-\frac{g_{i,t} - x_{i,t} - s_{i,t}}{b_{i,t}}$$

is constant at steady state such that $\dot{g}_{i,t} = 0$, $\dot{x}_{i,t} = 0$, $\dot{s}_{i,t} = 0$, and $\dot{b}_{i,t} = 0$. At this steady state, the government's MDC should be satisfied because it is the steady state that the government wants and has successfully managed to achieve. Let

$$\Gamma_{G,i} = -\frac{g_{i,t} - x_{i,t} - s_{i,t}}{b_{i,t}}\left(\frac{\alpha}{1-\alpha}\right) \tag{24}$$

at MDC of the government of Country *i* (i.e., at steady state). Because $-\frac{g_{i,t} - x_{i,t} - s_{i,t}}{b_t}$ at the government's MDC and α are constant, $\Gamma_{G,i}$ is constant. In addition, $\Gamma_{G,i}$ indicates the most comfortable combination of net revenues $-(g_{i,t} - x_{i,t} - s_{i,t})$ and debts ($b_{i,t}$), whereas MDC indicates the state at which the combination of revenues and assets is felt to be most comfortable. In this sense, $\Gamma_{G,i}$ can be seen as a parameter that indicates the preference of government concerning its MDC. Unlike $\Gamma_{P,i}$, it is assumed that the values of $\Gamma_{G,i}$ are heterogeneous across countries.

On the other hand, as shown in Harashima (2006, 2019e), the value of $-\frac{g_{i,t}-x_{i,t}-s_{i,t}}{b_t}$ indicates the rate of increase of the government's real obligation to pay for the return of its bonds; therefore,

$$R_{i,t} - \pi_{i,t} = -\frac{g_{i,t} - x_{i,t} - s_{i,t}}{b_{i,t}} . \tag{25}$$

Note that Harashima (2006, 2019e) has shown that under the RTP-based procedure,

$$\theta_{G,i} = -\frac{g_{i,t} - x_{i,t} - s_{i,t}}{b_{i,t}} \tag{26}$$

holds at steady state for a given value of $\theta_{G,i}$. By equations (24) and (26), therefore,

$$\Gamma_{G,i}\left(\frac{1-\alpha}{\alpha}\right) = \theta_{G,i} . \tag{27}$$

2.3.1.4 The law of motion for inflation under the MDC-based procedure

Before examining the open-economy case, for comparison, I examine the closed-economy case such that Country *i* is isolated from other countries. In this case, the government of Country *i* behaves so as to achieve and keep equation (24); that is, by equations (24) and (25), the government acts to achieve and maintain

$$\Gamma_{G,i}\left(\frac{1-\alpha}{\alpha}\right) = R_{i,t} - \pi_{i,t} .$$

In other words, the government of Country *i* behaves so as to make the rate of increase of its real obligation

$$R_{i,t} - \pi_{i,t} = -\frac{g_{i,t} - x_{i,t} - s_{i,t}}{b_{i,t}}$$

equal to $\Gamma_{G,i}\left(\frac{1-\alpha}{\alpha}\right)$. On the other hand, the representative household of Country *i* behaves so as to achieve and maintain equation (21).

Harashima (2019e) showed that, because of the government's and representative household's behaviors under the MDC-based procedure, inflation in Country i develops according to

$$\int_{t-1}^{t}\int_{s}^{s+1}\pi_v dvds = \pi_{i,t} + \left(\frac{1-\alpha}{\alpha}\right)\left(\Gamma_{G,i} - \Gamma_{P,i}\right) .$$

2.3.2 The model

Suppose that there are two countries (Countries 1 and 2) that are identical except for $\Gamma_{G,i}$. Suppose also that the government of Country 2 borrows money by issuing government bonds denominated in the currency of Country 1 from lenders in Country 1. In this case, lenders in Country 1 buy the bonds from (i.e., lend money to) the government of Country 2 if the nominal interest rate of the government bond is set equal to or exceeds the nominal interest rate in Country 1 ($R_{1,t}$). Therefore, by arbitrage in markets, the nominal interest rate of the bonds issued by the government of Country 2 is determined by $R_{1,t}$ in Country 1.

The nominal interest rate $R_{1,t}$ is the rate of increase of the "real" obligation of government of Country 2 because $R_{1,t}$ is given exogenously for the government of Country 2 and has to be paid for in the currency of Country 1 regardless of inflation in Country 2. That is, the determinant exogenous variable for the debts of the government of Country 2 is not the real interest rate (r_t) but the nominal interest rate in Country 1 $\left(R_{1,t}\right)$.

Here,

$$R_{2,t} - \pi_{2,t} = r_t = R_{1,t} - \pi_{1,t} ,$$

and therefore,

$$R_{1,t} = r_t + \pi_{1,t} = R_{2,t} - \pi_{2,t} + \pi_{1,t} .$$

That is, the rate of increase of the real obligation of the government of Country 2 to lenders in Country 1 in period t is $r_t + \pi_{1,t} = R_{2,t} - \pi_{2,t} + \pi_{1,t}$. This means that the real obligation consists of not only the real interest rate $r_t\left(= R_{2,t} - \pi_{2,t}\right)$ but also the inflation rate of Country 1 ($\pi_{1,t}$). In this case, the inflation rate of Country 1 is exogenously given and is a real burden for the government of Country 2.

Because $\pi_{2,t} = \chi_t + \pi_{1,t}$ as indicated by equation (1), the rate of increase of the government's real obligation ($R_{2,t} - \pi_{2,t} + \pi_{1,t}$) is equivalent to

$$R_{2,t} - \chi_t \ .$$

As a result, the government of Country 2 behaves so as to make the rate of increase of its real obligation equal to $\Gamma_{2,G}\left(\frac{1-\alpha}{\alpha}\right)$ such that

$$\Gamma_{G,2}\left(\frac{1-\alpha}{\alpha}\right) = R_{2,t} - \chi_t \ . \tag{28}$$

By equations (6) and (28), therefore, the government of Country 2 behaves to maintain

$$\Gamma_{G,2}\left(\frac{1-\alpha}{\alpha}\right) = \int_{t-1}^{t}\int_{s}^{s+1} \chi_v \, dvds + \int_{t-1}^{t}\int_{s}^{s+1} \left(\pi_{1,v} + r_v\right) dvds - \chi_t \ . \tag{29}$$

On the other hand, by equation (21), the representative household of Country 2 behaves so as to satisfy

$$\Gamma_{P,2}\left(\frac{1-\alpha}{\alpha}\right) = r = R_{2,t} - \pi_{2,t} \tag{30}$$

at steady state such that $r_t = r$.

2.3.3 The law of motion for the exchange rate

Because $\Gamma_{P,2}\left(\frac{1-\alpha}{\alpha}\right)$ is constant as indicated by equation (21), then by equation (30),

$$\begin{aligned}\int_{t-1}^{t}\int_{s}^{s+1} \left(\pi_{1,v} + r_v\right) dvds &= \int_{t-1}^{t}\int_{s}^{s+1} \left[\pi_{1,v} + \Gamma_{P,2}\left(\frac{1-\alpha}{\alpha}\right)\right] dvds \\ &= \int_{t-1}^{t}\int_{s}^{s+1} \pi_{1,v} \, dvds + \Gamma_{P,2}\left(\frac{1-\alpha}{\alpha}\right)\end{aligned} \tag{31}$$

at steady state such that $r_t = r$. By equations (29) and (31),

$$\int_{t-1}^{t}\int_{s}^{s+1} \chi_v dvds = \chi_t + \left(\frac{1-\alpha}{\alpha}\right)\left(\Gamma_{G,2} - \Gamma_{P,2}\right) - \int_{t-1}^{t}\int_{s}^{s+1} \pi_{1,v} \, dvds \tag{32}$$

at steady state such that $r_t = r$. Equation (32) indicates the law of motion for the exchange rate under the MDC-based procedure.

A solution of integral equation (32) is

$$\chi_t = \chi_0 + 6\left(\frac{1-\alpha}{\alpha}\right)\left(\Gamma_{G,2} - \Gamma_{P,2} - \int_{t-1}^{t}\int_{s}^{s+1}\pi_{1,v}\,dvds\right)\exp[z_t \ln(t)] \ . \quad (33)$$

If $\pi_{1,v} = 0$ and χ_t satisfies equation (32) for $0 \leq t$ and $-\infty < \chi_t \leq \infty$ for $-1 < t \leq 1$, then

$$\lim_{t\to\infty} \chi_t = \chi_0 + 6\left(\frac{1-\alpha}{\alpha}\right)(\Gamma_{G,2} - \Gamma_{P,2})t^2 \ . \quad (34)$$

2.4 Identity between the two procedures

Equations (23) and (27) indicate that equations (14) and (32), equations (15) and (33), and equations (16) and (34) are identical, respectively. That is, the law of motion for the exchange rate under the MDC-based procedure is identical to that under the RTP-based procedure.

2.5 Independent central bank

In Sections 2.2 and 2.3, a central bank is not explicitly mentioned. However, in the model and in actuality, a central bank plays an important and separate role from the government in the determination of the exchange rate, as well as the rate of inflation. The central bank needs to play such a role because otherwise the depreciation of currency of Country 2 accelerates.

Equations (14), (15), (16), (32), (33), and (34) indicate that if $\theta_{G,2} = \theta_{P,2}$ and equivalently $\Gamma_{G,2} = \Gamma_{P,2}$ are maintained, the depreciation of currency of Country 2 does not endogenously accelerate. If, however, $\theta_{G,2} > \theta_{P,2}$ and $\Gamma_{G,2} > \Gamma_{P,2}$ continue, depreciation accelerates. Therefore, it is crucially important to keep $\theta_{G,2} = \theta_{P,2}$ and $\Gamma_{G,2} = \Gamma_{P,2}$ to prevent the depreciation of Country 2's currency from accelerating. However, how can the government of Country 2 maintain these equations?

$\theta_{G,2}$ and $\Gamma_{G,2}$ are the government's preferences, and they cannot easily be controlled by the government itself. Controlling or adjusting preferences, regardless of whether they are an individual's or government's, usually requires help from other people or institutions. Because it is highly likely that $\theta_{G,2} > \theta_{P,2}$ and $\Gamma_{G,2} > \Gamma_{P,2}$ (see Harashima, 2004, 2007a, 2007c, 2008a, 2008b, 2013a), the government needs the help of some independent institution to achieve and maintain $\theta_{G,2} = \theta_{P,2}$ and $\Gamma_{G,2} = \Gamma_{P,2}$. Central banks were created to be these independent institutions. They are expected and delegated by the people to control the government's preferences by forcing the government to maintain $\theta_{G,2} = \theta_{P,2}$ and $\Gamma_{G,2} = \Gamma_{P,2}$ through the use of monetary policies.

In this paper, a central bank is assumed to be able to be independent from the government and play this important role. This means that government and central bank can be separate and different entities and that they can behave separately according to their own wills. The independence of the central bank is critically important. Unless it is sufficiently independent, $\theta_{G,2} = \theta_{P,2}$ and $\Gamma_{G,2} = \Gamma_{P,2}$ cannot be maintained, and $\theta_{G,2} > \theta_{P,2}$ and $\Gamma_{G,2} > \Gamma_{P,2}$ will remain as they are.

3 INFLATION

3.1 The law of motion for inflation

3.1.1 RTP-based procedure

By equations (1) and (14), the law of motion for inflation in Country 2 under the RTP-based procedure is described by

$$\int_{t-1}^{t} \int_{s}^{s+1} \pi_{2,v} dv ds = \pi_{2,t} + \left(\theta_{G,2} - \theta_{P,2}\right) - \pi_{1,t} \ . \tag{35}$$

Remember that $\pi_{1,t}$ is an exogenous variable for Country 2.

If $\pi_{1,t}$ is constant (i.e., inflation in Country 1 is stable), and if at the same time $\theta_{G,2} > \theta_{P,2}$ is left as it is, then inflation and currency depreciation in Country 2 accelerate by equations (14) and (15).

3.1.2 MDC-based procedure

Similarly, by equations (1) and (32), the law of motion for inflation in Country 2 under the MDC-based procedure is described by

$$\int_{t-1}^{t} \int_{s}^{s+1} \pi_{2,v} dv ds = \pi_{2,t} + \left(\frac{1-\alpha}{\alpha}\right)\left(\Gamma_{G,2} - \Gamma_{P,2}\right) - \pi_{1,t} \ , \tag{36}$$

where $\pi_{1,t}$ is again an exogenous variable for Country 2.

If $\pi_{1,t}$ is constant and if at the same time $\Gamma_{G,2} > \Gamma_{P,2}$ is left as it is, then inflation in Country 2 accelerates and its currency depreciation accelerates by equations (32) and (33).

3.1.3 Identity between the two procedures

Equations (23) and (27) indicate that equations (35) and (36) are identical. That is, the law of motion for inflation under the MDC-based procedure is identical to that under the

RTP-based procedure.

3.2 Independent central bank

Equations (35) and (36) indicate that if $\theta_{G,2} = \theta_{P,2}$ and equivalently $\Gamma_{G,2} = \Gamma_{P,2}$ are maintained, inflation in Country 2 does not accelerate endogenously, but if $\theta_{G,2} > \theta_{P,2}$ and $\Gamma_{G,2} > \Gamma_{P,2}$ continue, it accelerates. Similar to the case for the exchange rate, therefore, it is crucially important to keep $\theta_{G,2} = \theta_{P,2}$ and $\Gamma_{G,2} = \Gamma_{P,2}$ so that inflation in Country 2 does not accelerate. Hence, the central bank of Country 2 plays an essential role in controlling and stabilizing inflation, similar to the case of the exchange rate.

3.3 Effect of inflation in the other country

If $\pi_{1,t} = 0$ (i.e., inflation in Country 1 is nil), by equation (35),

$$\int_{t-1}^{t}\int_{s}^{s+1} \pi_{2,v} dvds = \pi_{2,t} + \left(\theta_{G,2} - \theta_{P,2}\right) \tag{37}$$

and equivalently by equation (36),

$$\int_{t-1}^{t}\int_{s}^{s+1} \pi_{2,v} dvds = \pi_{2,t} + \left(\frac{1-\alpha}{\alpha}\right)\left(\Gamma_{G,2} - \Gamma_{P,2}\right) . \tag{38}$$

In addition, by equation (37),

$$\pi_{2,t} = \pi_{2,0} + 6\left(\theta_{G,2} - \theta_{P,2}\right)\exp[z_t \ln(t)]$$

and by equation (38),

$$\pi_{2,t} = \pi_{2,0} + 6\left(\frac{1-\alpha}{\alpha}\right)\left(\Gamma_{G,2} - \Gamma_{P,2}\right)\exp[z_t \ln(t)]$$

where

$$\lim_{t\to\infty} z_t = 2 \ .$$

That is, for inflation in Country 2 neither to accelerate nor decelerate, $\theta_{G,2} = \theta_{P,2}$ and $\Gamma_{G,2} = \Gamma_{P,2}$ must be maintained.

However, if $\pi_{1,t} \neq 0$ (i.e., the inflation rate in Country 1 takes some positive or negative values), inflation in Country 2 $\left(\pi_{2,t}\right)$ is influenced by inflation in Country 1 $\left(\pi_{1,t}\right)$ through the channel of government borrowing in Country 2 denominated in the currency of Country 1 from lenders in Country 1. Equations (35) and (36) indicate that if $\pi_{1,t} \neq 0$, the central bank of Country 2 need not keep $\theta_{G,2} = \theta_{P,2}$ and $\Gamma_{G,2} = \Gamma_{P,2}$; rather it should keep

$$\left(\theta_{G,2} - \theta_{P,2}\right) - \pi_{1,t} = 0$$

and equivalently

$$\left(\frac{1-\alpha}{\alpha}\right)\left(\Gamma_{G,2} - \Gamma_{P,2}\right) - \pi_{1,t} = 0$$

for inflation not to accelerate. Therefore, for example, if $\pi_{1,t} > 0$, the central bank of Country 2 can allow its government to enjoy

$$\theta_{G,2} > \theta_{P,2}$$

as long as

$$\theta_{G,2} - \theta_{P,2} \leq \pi_{1,t} \ ,$$

and equivalently

$$\Gamma_{G,2} > \Gamma_{P,2}$$

as long as

$$\left(\frac{1-\alpha}{\alpha}\right)\left(\Gamma_{G,2} - \Gamma_{P,2}\right) \leq \pi_{1,t} \ .$$

That is, the government of Country 2 can enjoy behaving according to its intrinsic preference $\theta_{G,2}$ to some extent, thanks to inflation in Country 1.

4 SOVEREIGN DEFAULT

4.1 Insufficiently independent central bank

Equations (14), (32), (35), and (36) indicate that if $\theta_{G,i} = \theta_{P,i}$ and equivalently $\Gamma_{G,i} = \Gamma_{P,i}$ are maintained, currency depreciation and domestic inflation do not accelerate endogenously in Country i. Therefore, even though the government of Country *i* borrows money denominated in foreign currencies, it will not matter if the central bank of Country *i* is sufficiently independent and $\theta_{G,i} = \theta_{P,i}$ and $\Gamma_{G,i} = \Gamma_{P,i}$ are always kept.

However, if the central bank is not sufficiently independent, $\theta_{G,i} = \theta_{P,i}$ and $\Gamma_{G,i} = \Gamma_{P,i}$ are not kept, and $\theta_{G,i} > \theta_{P,i}$ and $\Gamma_{G,i} > \Gamma_{P,i}$ persist, currency depreciation and domestic inflation will endogenously accelerate in Country *i* as explained in Sections 2.4 and 3.2. The fundamental cause of acceleration, therefore, is an insufficiently independent central bank.

Note that adopting an exchange-rate peg does not necessarily guarantee $\theta_{G,i} = \theta_{P,i}$ and $\Gamma_{G,i} = \Gamma_{P,i}$. Unless a truly independent central bank forces its government to strictly achieve and maintain $\theta_{G,i} = \theta_{P,i}$ and $\Gamma_{G,i} = \Gamma_{P,i}$ (i.e., behave so as to maintain the exchange-rate peg), future currency depreciation and high domestic inflation are inevitable.

4.2 Options

The government of Country i with $\theta_{G,i} > \theta_{P,i}$ and $\Gamma_{G,i} > \Gamma_{P,i}$ may leave the accelerating currency depreciation and inflation as they are because all of its optimality conditions still continue to be satisfied. However, the people in Country *i* will not tolerate this situation for a long period. They will eventually begin to demand that the government take action to normalize the situation.

One normalization option is for the government to change its preference from $\theta_{G,i} > \theta_{P,i}$ and $\Gamma_{G,i} > \Gamma_{P,i}$ to $\theta_{G,i} < \theta_{P,i}$ and $\Gamma_{G,i} < \Gamma_{P,i}$, and then maintain them for a sufficiently long period of time. Notice that the preferences should be changed not to $\theta_{G,i} = \theta_{P,i}$ and $\Gamma_{G,i} = \Gamma_{P,i}$; they must be modified to $\theta_{G,i} < \theta_{P,i}$ and $\Gamma_{G,i} < \Gamma_{P,i}$ because government debts have already excessively accumulated because of its past behavior, and the excessive debts have to be reduced to correct the situation (see Harashima, 2007c, 2008b, 2013a). After the debts are sufficiently reduced, the government should again change its preference from $\theta_{G,i} < \theta_{P,i}$ and $\Gamma_{G,i} < \Gamma_{P,i}$ to $\theta_{G,i} = \theta_{P,i}$ and $\Gamma_{G,i} = \Gamma_{P,i}$ and then maintain these levels. Nevertheless, the necessity of having to first achieve and maintain $\theta_{G,i} < \theta_{P,i}$ and $\Gamma_{G,i} < \Gamma_{P,i}$ means that the government has to cut expenditures and increase taxes significantly for a long period.

If, however, a government has borrowed money from foreign lenders, another option is available. Instead of changing its preferences, the government may stop paying back debts to foreign lenders; that is, it could choose a sovereign default. In this case, the government and its people can escape the pain of lower expenditures and higher taxes at least temporarily because the responsibility is shifted to foreigners. In this case, the necessary reductions in government expenditures and increases in taxes may be lower than in the case of changing preferences. Nevertheless, of course, this option is not the perfect alternative because foreign lenders will no doubt retaliate by whatever means are available.

Some governments with insufficiently independent central banks may choose this imperfect alternative option because people often greatly dislike foreign lenders and they may support this option. In this way, the government leaders may reduce the probability that they lose power compared with the option of changing the government's preferences. By declaring a sovereign default, a government may escape the negative consequences of a correction (e.g., shrinking demand as explained in Section 5.2), at least temporarily, by shifting the blame to foreign lenders.

4.3 The root cause of sovereign default

The models based on Eaton and Gersovitz (1981) well describe what eventually pushes a government to make the decision to default once it reaches the point where sovereign default looms as an option. However, the important point here is not this last step but the reason the government reached this point. The model described in this paper clearly indicates that an insufficiently independent central bank is the root cause of sovereign default.

4.4 Roles of shocks

It is assumed in Section 2.1 that the exchange rate is kept equal to PPP for simplicity, but in reality, it will occasionally deviate substantially from PPP for a variety of reasons, for example, because of speculation in the exchange rate market or government interventions. If the exchange rate largely deviates from PPP, the probability of sovereign default in the future may substantially increase. For example, if the currency of Country i does not depreciate sufficiently for some reason even though $\theta_{G,i} > \theta_{P,i}$ and $\Gamma_{G,i} > \Gamma_{P,i}$ persist, the government of Country i may misinterpret this to mean that $\theta_{G,i} = \theta_{P,i}$ and $\Gamma_{G,i} = \Gamma_{P,i}$ are being kept. In this case, it may not cut expenditures and raise taxes even though it should actually do so. A sharp currency depreciation will inevitably occur at some time, perhaps suddenly, because of the persistent conditions ($\theta_{G,i} > \theta_{P,i}$ and $\Gamma_{G,i} > \Gamma_{P,i}$), and when it occurs, the unprepared government of Country i may have no choice other than a sovereign default. That is, an exogenous factor or shock like substantial deviation from PPP can trigger a sovereign default.

Nevertheless, the model in this paper indicates that sovereign defaults can occur without exogenous factors or shocks. Indeed, Tomz and Wright (2007) showed that the relationship between real economic activities and default is weak. An exogenous factor or shock such as an exchange rate deviation may raise the probability of a sovereign default, but even without any exogenous factors or shocks, a substantial correction or adjustment will eventually be needed if $\theta_{G,i} > \theta_{P,i}$ and $\Gamma_{G,i} > \Gamma_{P,i}$ remain unchanged. In this sense, a shock could be viewed as a kind of catalyst for sovereign default in that it provokes a reaction that would still otherwise occur.

4.5 Responsibilities of the International Monetary Fund and foreign lenders

4.5.1 International Monetary Fund (IMF)

When a sovereign default occurs, the IMF usually intervenes. The measures used to settle a case are wide-ranging. However, the most important measure the IMF should take is to ensure that the central bank of the defaulting country is kept sufficiently independent. A mere formal declaration of its independence is not sufficient action. An institutional mechanism through which the central bank's independence is maintained is necessary.

As discussed in Section 4.1, introducing an exchange-rate peg is not sufficient to prevent a future sovereign default. The central bank must be able to actually force the government to maintain the exchange-rate peg.

4.5.2 Foreign lenders

It seems likely that foreign lenders can expect the possibility of $\theta_{G,i} > \theta_{P,i}$ and $\Gamma_{G,i} > \Gamma_{P,i}$ when they decide to lend money to the government of Country i; that is, they should be able to anticipate that the central bank of Country i is not sufficiently independent. Furthermore, some foreign lenders make the loans (i.e., take the risks) fully aware of the risks associated with $\theta_{G,i} > \theta_{P,i}$ and $\Gamma_{G,i} > \Gamma_{P,i}$ to obtain high returns. That is, they are not completely innocent in the sense that they lend money to obtain the higher returns. Hence, foreign lenders bear some of the responsibility for the default, and the IMF should consider this point when it settles cases of sovereign default.

5 IMPACT ON REAL ECONOMIC ACTIVITIES

5.1 Sustainable heterogeneity (SH)

It is highly likely that not only the preferences of government but also those of the representative household are heterogeneous across countries; that is, not only $\theta_{G,i} \neq \theta_{G,j}$ and $\Gamma_{G,i} \neq \Gamma_{G,j}$ but also $\theta_{P,i} \neq \theta_{P,j}$ and $\Gamma_{P,i} \neq \Gamma_{P,j}$. Therefore, extreme economic inequalities among countries can emerge as Becker (1980) predicted. However, Harashima (2010, 2014a, 2017b) showed that SH can be achieved if an authority appropriately intervenes and transfers money among heterogeneous households, where SH means that all optimality conditions of all heterogeneous households are satisfied. In addition, Harashima (2015) showed that, under floating exchange rates, an international SH (i.e., SH among heterogeneous countries) is naturally achieved.

An international SH under floating exchange rates still holds even if the governments of heterogeneous countries borrow money denominated in foreign currencies from foreign lenders. This is true because the mechanism by which an international SH is achieved is irrelevant to the mechanism of accelerations in currency depreciation and domestic inflation resulting from $\theta_{G,i} > \theta_{P,i}$ and $\Gamma_{G,i} > \Gamma_{P,i}$ (see Harashima, 2015).

5.2 Impact of the correction in real terms

Whether the government of Country i chooses the option of sovereign default or not, it eventually has to correct its preference from $\theta_{G,i} > \theta_{P,i}$ and $\Gamma_{G,i} > \Gamma_{P,i}$ to $\theta_{G,i} = \theta_{P,i}$ and $\Gamma_{G,i} = \Gamma_{P,i}$ to stop the acceleration of currency depreciation and inflation. In this sense, a sovereign default does not represent a final settlement. It only temporarily postpones the actual correction (i.e., a significant decrease in demand).

As explained in Section 4.2, simply adjusting preferences from $\theta_{G,i} > \theta_{P,i}$ and $\Gamma_{G,i} > \Gamma_{P,i}$ to $\theta_{G,i} = \theta_{P,i}$ and $\Gamma_{G,i} = \Gamma_{P,i}$ does not end the need for a correction. The relationships must change to $\theta_{G,i} < \theta_{P,i}$ and $\Gamma_{G,i} < \Gamma_{P,i}$ and be maintained at those levels for some period of time.

In the correction, government expenditures are reduced and taxes are raised substantially because, as equation (24) indicates, it is necessary to make the value

$$-\frac{g_{i,t} - x_{i,t} - s_{i,t}}{b_{i,t}}$$

at steady state smaller than it was before the correction. Therefore, $\left(g_{i,t} - x_{i,t}\right)$ at steady state must be less than it was before, and $b_{i,t}$ at steady state must also become smaller. To achieve this goal at the *ex post* steady state, $\left(g_{i,t} - x_{i,t}\right)$ has to be kept very small (probably negative) during the period before reaching the *ex post* steady state. As a result, the overall demand in the economy will shrink significantly and a severe recession will be generated.

An important point is that the production (supply) capacity at the macro level is not affected by the correction because the quantities of technology, labor, and capital inputs are not changed by the correction. On the other hand, the demands for some products are significantly affected; for example, government demand for some products will decrease to nearly zero and the production (supply) of these products will also have to decrease significantly. That is, the demand and supply structure in the economy should be restructured or adjusted to one that corresponds to the government's adjusted behavior to maintain $\theta_{G,i} = \theta_{P,i}$ and $\Gamma_{G,i} = \Gamma_{P,i}$. This restructuring will take time, and during the adjustment period, a severe recession due to the imbalance between demand and supply will persist until the economy is eventually normalized.

6 CONCLUDING REMARKS

The model of Eaton and Gersovitz (1981) is very useful for analyzing the borrowing behavior of the government of a sovereign country, but it is not sufficiently useful for examining the root cause of sovereign default. Their model predicts that a sovereign default cannot emerge unless an expected exogenous shock occurs; essentially, the root cause of sovereign default is bad luck. However, sovereign defaults occurred far more frequently and, in some cases, serially in emerging countries than in developed countries even though luck should be distributed equally among emerging and developed countries.

In addition, the model of Eaton and Gersovitz (1981) ignores the effects of currency depreciation and domestic inflation although sovereign defaults usually are accompanied by episodes of significant currency depreciation and high inflation. Uribe (2006) emphasized the roles of prices and the exchange rate in sovereign defaults and showed that the risk of sovereign default will greatly differ depending on monetary-fiscal regimes. However, Uribe (2006) does not offer a micro-foundation of government behavior, and the behaviors of the government and the central bank are not separated.

In this paper, I examine the cause of sovereign default on the basis of a model of inflation that is built on a micro-foundation of government behavior (Harashima 2004, 2006, 2007a, 2007b, 2007c, 2008a, 2008b, 2013a, 2019a, 2019b). In addition, the behaviors of the government and central bank are fully separated. The root cause of sovereign default was found to be an insufficiently independent central bank. Because the preferences of the government and the representative household are basically intrinsically heterogeneous, if these heterogeneous preferences are left unchanged because the central bank is not sufficiently independent, the government will borrow money excessively, resulting in accelerating currency depreciation and inflation. These poor conditions will frustrate and anger its citizens, and the government may eventually declare a sovereign default to at least temporarily transfer the blame to foreign lenders.

It seems likely that the central banks of many emerging countries are less independent than those of developed countries (see e.g. Cukierman et al., 1992); therefore, the model in this paper predicts that the probability of sovereign default in emerging countries will be higher than that of developed countries. Moreover, a sovereign default can be explained without having to rely only on “bad luck”.

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