

On Sustainability of Selective Macroeconomic Problems*

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I. Introduction

To date, there have been investigations in theory and in empirics in Japan on the sustainability of such problems as accumulated government deficits, public pension system in face of the declining birthrate and rapidly aging population, and speculative bubbles of land and stock prices, from rather negative, pessimistic viewpoints. In addition to these, rising concerns are directed toward the coexistence of economic development and sustaining natural environment as envisaged by endangered crises of diminishing biodiversity, drier and expanding deserts, global warming and sea surface elevation, and so on.

It was the sustainable development goals or SDGs, which all the members of the United Nations (then 193 countries) unanimously adopted in 2015 in foreseeing the target year 2030, that have clarified what ought to be the desired future state of world and stimulated preferentially worldwide, global strategic actions to pursue the sustainable economic and social development as individually familiar issues. Then as extensions or applications of SDGs, quite new sustainable goals such that the sustainable local economy, sustainable firm management, sustainable neighborhood relations and the like have arisen and been occasionally referred to even over people's daily conversations.

Looking around the globalized international economies, many national economies nowadays confront simultaneously with common difficulties of global warming, acid rains, marine plastic pollution, and so on which basically were drastically worsened by the economic development of once underdeveloped national economies, although these global environmental issues were incipiently generated and accumulated through earlier development of now industrialized economies. The new coronavirus (COVID-19) pandemic that had spread, registering several waves, globally through 2020-23 brought about in a short time large recessions in a number of national economies that were comparable with the United States Great Depression of the 1930s, or in some nations worse than USGD statistics. This pandemic experience newly reminds us of the fact that national economies are interrelated and simultaneously face common crises and cooperate against such crises, which leads us to the awareness that global interconnectedness and co-movement indicates that the sustainability of individual national economies should also ask as a whole the sustainability of the global economy.

I organized, as an editor in *The Financial Review* No. 150 published in Japanese in

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2023, a special issue on the sustainability of selective macroeconomic problems. The following papers in this issue, papers in this *Public Policy Review* (PPR), reorganize compactly the original contributions. My introductory paper, Asako (2023), overviews four macroeconomic problems whose sustainability is questioned and examines their mutual interconnections. More concretely, as those relevant to the national economies, we investigate both theoretically and empirically accumulated government deficits, the public pension system as a going concern, booms and busts of speculative bubbles of land and stock prices, and as those relevant to the global economy that is beyond national economies the convergence to some sustainable steady state under environmental external diseconomy.

II. Sustainability of Government Deficits

Japanese government deficits, according to several official statistics, are at the worst level among industrialized OECD countries. The outstanding government debts (sum of outstanding government bonds, government loans, and short-term government bills) at the end of 2020 amounted to 1,212 trillion yen and was 225% of 538 trillion GDP (183% if government bonds only). These figures are by far the number one statistics from the bottom and Japan could naturally be judged on the edge of a sovereign default or national fiscal collapse. In fact, Japan had kept trying to establish fiscal reform beginning as early as the 1980s; and Japan once enacted the government fiscal reform law in 1997. Unfortunately, however, it was the year of the Asian economic crisis outside Japan and moreover the serious financial system crisis inside Japan, resulting in the reversal of the reform in 1998 and ultimately the perpetual retreat of enactment.

II-1. Dynamics of Government Deficits

Let G denote government expenditure, T tax revenue, r the interest rate of government bonds, Y GDP, g the economic growth rate, and B the outstanding government bonds or the accumulated budget deficits. Then, the dynamics of the outstanding government bonds is as follows:

$$\Delta B = G - T + rB \quad (1)$$

where ΔX in general means the dynamic change in a variable X . Equation (1) indicates that changes in the government bonds are caused by deficits of primary balance ($G-T$) and the interest payments of the government bonds issued in the past.

From (1), the transitional dynamics of the government bond GDP ratio, B/Y , is obtained as an approximation

$$\Delta(B/Y)/(B/Y) = \Delta B/B - \Delta Y/Y = (G-T)/B + r - g \quad (2)$$

when changes in each variable are small. Therefore, whether the government bond GDP ratio converges to 0 (or to some constant) or dynamically diverges is dependent upon whether

the far right-hand-side of (2) is negative or positive. Not surprisingly the state of primary balance is crucial to the sign of (2). But let this term be sufficiently small or zero.

Then the government bond GDP ratio in the long run is best characterized by the relative magnitude of the bond interest rate and the economic growth rate. If $r > g$, B/Y keeps diverging and ends up with the sovereign default. Conversely, if $r < g$, B/Y converges to a particular value. In summary, under the condition that the primary balance is kept in equilibrium, the condition that a sovereign default is avoided is that the economic growth rate is greater than the interest rate of government bonds. The paper by Eguchi and Hatano (2023) in this *Public Policy Review* (PPR) issue also points out this condition and names it the Domar condition after Domar (1944). Although this condition is merely a momentary sufficient condition under a changing fiscal position, its simplicity helps invite many references as one of the fiscal safety measures.

The answer to the question regarding the convergent destination of the B/Y ratio, once $r < g$ is satisfied and the government budget is sustainable, the far left-hand-side of (2) is equal to 0 provided that government expenditures and tax revenues grow at the same rates as the economic growth rate. Then in the long-run destination, we have

$$(G-T)/B = g-r \quad (3)$$

or equivalently

$$B = (G-T)/(g-r). \quad (4)$$

Equation (4) implies that the ultimate outstanding government bonds equal the capitalized value (*i.e.*, sum of the infinite series) of the sustained annual primary balance, where the discount rate is the economic growth rate minus the interest rate of government bonds.

Suppose that the annual primary balance amounts to 30 trillion yen deficits, the economic growth rate is 2%, and the interest rate of government bonds is 1%. Then, from (4), the sustainable outstanding government bonds are equal to $30/0.01 = 3,000$ trillion yen. Since the outstanding government bonds at the end of 2020 amounts only to 1,000 trillion yen, there is still sufficient room before fearing the sovereign default. Of course, although the Domar condition presupposes the long-run equilibrium of the primary balance, this in reality is apparently not satisfied. The Domar condition alone is not sufficient for the long-run sustainability of government deficits. More stringent conditions concerning the primary balance must be imposed on.

Since we can rewrite (4) as

$$(g-r)B/Y = (G-T)/Y, \quad (5)$$

the admissible B/Y is computed as $B/Y = 6$ when the primary balance GDP ratio is set at 6%, and the economic growth rate and the interest rate of government bonds are 2% and 1%, respectively, as before in computing (4). The real value of B/Y at the end of 2020 was less than 2, implying again the pessimism against the sustainability of government deficits is eased. Nonetheless the figures here are arbitrary rather than empirical actuality, more elabo-

rate empirical works are expected as are in fact done by Eguchi and Hatano (2023) in this PPR issue.

II-2. Fiscal Deficits and MMT

Modern Monetary Theory (MMT), proposed for example by Kelton (2020), has recently been spread among economists and journalists which concludes that we do not have to worry about the sustainability of government debts. This theory insists that “by increasing government expenditures financed by a country’s own currency the output level of the national economy is raised up to the potential maximum,” or “any national economy can avoid long-run stagnation once government debts financed with its own currency are increased appropriately.” Although MMT began controversies on fiscal and monetary policies, there is no solid theoretical foundation. Most mainstream economists criticize MMT on the basis of two rationales.

First, there should arise the crowding out of private investment due to the induced increases in the interest rate. Second, there also arises a fear of hyperinflation when unlimited rises in government deficits and thereby in money stock are built in. Controversies between MMT and the mainstream economics have continued for a certain time, and throughout the controversies MMT points out the importance of uniting government deficits and the balance sheets of the central bank. More concretely, MMT claims the equivalence as liability between the government bonds and the outstanding money stock within the balance sheet of “unified government.” Insofar as liabilities are equivalent, there is no need worrying too much about government bonds.

In addition to the introduction of the unified government balance sheet, MMT responds to two rationales of mainstream economics in the sense that MMT requires the government to improve the skill of policy management. On the ground that MMT admits the effectiveness of fiscal policy, as is the case with Keynesian economics which allows for involuntary unemployment, a certain degree of crowding out is unavoidable. But MMT devises additional policies optionally. Namely, for the first fear of crowding out, the central bank should maintain low interest rate policy and finance the government deficits by issuing new money stock, thus resulting in no chance of crowding out because no liquidity shortage of private investment occurs. For the second fear of inflation, design not monetary policy but tax reforms as any inflation — not necessarily hyperinflation — has been caused when demand and supply imbalances occur in specific sectors.

The fundamental source for the confrontation between MMT and mainstream economics is that, unlike Keynesian economics and neoclassical economics, MMT lacks for a concise macroeconomic model that reflects a basic economic view. Concerning fiscal policy, for example, while the mainstream economists express views based upon Keynesian economics or neoclassical economics, MMT economists are versatile in the sense that they combine like patchworks any utilizable theorem or proposition of economics. For fear of crowding out or hyperinflation, MMT argues two or three combinations of policies that are against a rule

prescribed by Tinbergen's theorem on the number of independent policy targets and the number of independent policy tools. Unlike selecting the most effective policy tool, more than two compensating policy tools are put in use at a time. Too many policy tools, even though a policy target could be maintained over time, invite divergent paths of policy tools resulting in the consequence of the instrument instability of Holbrook (1972).

II-3. Three Key Words on the Sustainability of Government Deficits

The paper by Eguchi and Hatano (2023) in this PPR issue presents, as is apparent from its subtitle, three key words or jargons on the sustainability of government deficits. These are the transversality condition, the Domar condition, and the fiscal theory of the price level (FTPL). When we can sort out the intra-relationship between the three key words consistently, then we can identify the differences between the mainstream economics and the other economics including MMT.

We have already referred to the second Domar condition in Subsection *II-1*, and we have seen that it can be a kind of litmus paper test for the sustainability of government deficits. Nonetheless, as Eguchi and Hatano (2023) point out when uncertainties in the economic growth rate and the interest rate of government bonds are present, in theory there arise additional factors to be taken into account that are not important without uncertainties. The first transversality condition is something to do with the intertemporal budget constraint, and this is not dealt with by mainstream macroeconomics such as ISLM analysis and ADAS (aggregate demand · aggregate supply) analysis. In cases of micro foundation of macroeconomics within mainstream economics, however, the transversality condition is imposed on the dynamic rational behavior of economic agents. In this sense, it is not at all true that the transversality condition has nothing to do with mainstream economics. Rather, in the analysis of dynamic stochastic general equilibrium macroeconomics (DSGE), the transversality condition is imposed to identify the unique long run optimal resource allocation. In discussing the sustainability of government deficits, the transversality condition is utilized in the intertemporal balance sheet of the unified government budget constraint including the central bank, which leads to the third key word of the fiscal theory of the price level (FTPL).

FTPL *per se* replaces the quantity equation (equilibrium equation of the money market) within mainstream macroeconomics. This phenomenon of the departure of the quantity equation is in accordance with the experience in Japan after its collapse of the bubble economy of the latter part of the 1980s where no evident price level hikes have occurred even under the continued long period of monetary loosening (except only for 2022-23 triggered by COVID-19 and rises in energy prices after the Russian invasion to Ukraine). However, comparing many non-mainstream economics to mainstream economics, the former is apparently subordinate to the latter in the sense that non-mainstream economics is neither general nor lucid as a theoretical model as is typically the case with the introduction of unified government.

Let us maximize the sum of discounted per capita social welfare under the transitional

dynamics of the outstanding government deficits or equation (1). Per capita social welfare depends on per capita consumption. To solve this optimization problem, let the discount rate be represented by the growth rate of population n , then the transversality condition is given by

$$\lim_{t \rightarrow \infty} e^{-nt} B_t = 0 \quad (6)$$

once the model is formulated by a continuous time version. When the discount rate is positive, $n > 0$, (6) is satisfied insofar as B_t converges to a bounded positive value. It is also satisfied even if the outstanding government bonds increase as fast as its interest rate r , once we identify n with the economic growth rate g and assume the Domar condition, $g > r$, in (3) and (4).

Because the spirit of the transversality condition may presuppose $B = 0$ in the end, implying that all government bonds are ultimately redeemed, present-day government deficits are completely offset by future government surpluses thus fulfilling the perfect sustainability. In summary, the transversality condition *per se* can be interpreted to show the sustainability. If the sustainability is questioned, then the transversality condition is to be denied.

II-4. Expectation of Government Deficits and Non-Keynesian Effect

Examining the sustainability of government deficits based on the underlying economic structure requires the exact knowledge of the underlying macroeconomic model. Additional issues such as (i) differences in the expectation formation of economic agents and (ii) which of the demand side or supply side is put emphasis on, etc. are to be considered appropriately as well. Mainstream economics, as is typically the case with DSGE, understands “forward looking models” based on the rational expectations from now to the ultimate future by utilizing all the information on the economic structures and future economic policies and examines the present-day outstanding government bonds and its future consequences. Non-mainstream economics including MMT, on the other hand, understands “backward looking models” based on the adaptive expectations utilizing only the information obtained from the past up to the present. The difference between forward looking versus backward looking models generates differences in the sources of aggregate demand and in causes of inflation, and thereby in economic fluctuations of the real economy.

Let examples be more concrete. When the government deficits are sustainable the transversality condition is satisfied, which implies government bonds are redeemed and thereby future increases in tax burdens. According to the life cycle hypothesis or the permanent income hypothesis of consumption, future tax burdens decrease the discounted sum of future disposable incomes. In this process, a case of the budget finance by government bonds and the other case of tax rises today generate no difference in life time disposable income provided that the market interest rate of government bonds and the interest rate (or the discount rate) of private loans are the same. In other words, when life-time disposable income does not change between the case of increases in government bonds and future tax burdens, the present consumption does not change either. After all, if government bonds increase in place

of present tax rises, voluntary savings by the amount comparable to bond issues decrease. Issues of new government bonds work as compulsory savings as they are certainly redeemed in the future, and thereby total savings as the inner solution (not a corner solution constrained by some restraints) of people's rational behavior are not altered at all.

The above logic is named the neutrality theorem of national debt or the Ricardian equivalence theorem and those who argue policy issues based on this theorem are called neo-Ricardian. Claims by neo-Ricardian include, firstly the private sector correctly anticipates future tax burdens and forms rational expectations, and secondly no liquidity constraint applies as the financial market works perfectly. As noted before, MMT neither claims the rational expectations hypothesis nor claims the transversality condition. But, in actuality, by resorting to the introduction of additional policies MMT arrives at the same conclusion as the one claimed by neo-Ricardians. This versatile flexibility is almost a regular course of tactful claims. The claim that no sovereign default occurs insofar as deficits are financed by one's own currency is a good example of such kinds of rhetoric.

Concerning the neutrality theorem of national debt, increases in future tax burden for financing the present government expenditure by bond issues oppresses the current consumption, and the Ricardian equivalence theorem insists two offsetting effects be just equal only to result in no change in the current GDP. According to another view insisting that the oppressing effect is greater than the original expansionary effect, called non-Keynesian effect of fiscal policy, it is quicker to expand the economy by raising tax or curtailing government expenditure. The non-Keynesian effect originates from the fear of future burdens and/or excessive risk aversion toward fiscal default. Certain empirical results were reported for countries in Europe when they are forced to tighten their fiscal stance before joining EU members.

However, even if there are expectation effects of counter intended policy, their effects are not universal and do not last for good. They may arise under special states of national economies with some unfortunate hysteresis experiences. Conclusions are somewhat different, similar unexpected policy results are claimed by Reaganomics of the United States during the 1980s, known as the Laffer curve trickle down policy, that tax revenue rather than increases by cutting tax rates as a result of raised economic activities. Like the Laffer curve, if the non-Keynesian effect of fiscal policy is widely known and it is regarded as a rationale for the government not to pursue active stabilizing fiscal policy, it cannot avoid criticisms of being an excessive short-cut conclusion. Non-Keynesian effects are emphasized by those who believe in neoclassical economics, and only Keynesians keep out of acceptance. Like against the issue of crowding out, Keynesian economics agrees in theory that a crowding out effect can occur, but it goes on to assert that presuppositions to obtain theory do not apply in actual national economies.

III. Sustainability of Pension System

A pension is one of the financial assets that assures future receipts of benefits for a per-

son at and older than the qualified age depending on the paid pension contributions during younger ages. There are two pension systems: the public pension and the private pension. The main private pension is insurance type individual pension with optional contracts of death and medical care. There are a variety of private pension contracts, but an essential role of private pension is basically the same as public pension in that older generations receive benefits while younger generations pay and accumulate pension contributions. The private pension is after all operated privately and any person judges whether or not to join the private pension system. This spontaneous decision making is what differentiates private pension from public pension as the enrollment to the latter system is compulsory. Because of this basic nature the sustainability of the private pension system is not at issue (there are private pensions in The Netherlands, France, Austria, etc. whose enrollment are in reality almost compulsory). Even if not sustainable, insofar as people anticipate so, that possibility should be imputed through the price mechanism to result in a higher premium of private pension contribution or fee. Without a competitive market price mechanism, then asymmetric information may generate opportunism activities such as moral hazard or adverse selection.

III-1. Public Pension System in Japan

The Japanese public pension system, which had started variously depending on jobs he or she belonged to, was reformed in 1985 and the present system began. At the reform the fact that many detailed subsystems were maintained enabled the present system to be very complicated due to hysteresis effects. The present public pension system consists of three main characteristics: ① all people must be enrolled, ② the social insurance system, and ③ support between generations.

The first characteristic of all people's pension (those living in Japan aged 20-59 irrespective of nationality) means that basic pension is shared by all people. What is complicated is that basic pension, as the first floor of the national pension system, is the only public pension shared in common by all people. Other public pension, welfare pension or employees' pension are those who work as salaried workers or public servants and get an additional amount, as the second floor, in parallel with their income levels or pension contributions during younger years. As for the contributions of basic pension, all people pay fairly in the sense that all costs of pension benefits are born by each institutional unit according to the number of people enrolled in it.

The second characteristic of the social insurance system implies that pension benefits are rewards of past contributions. The compulsory nature of pension enrollment for the public pension system stems partly from paternalistic policy to encourage savings during younger years and partly from the necessity of maintaining income insurance by enrolling all younger generations. Due to the second characteristic, people can earn more returns only if they can live long enough. Even when the people's living is severe and cannot afford standard contributions, he or she can still be qualified as a member of the public pension system and

may get contribution exemption.

The third characteristic of the Japanese public pension system is support between generations. Namely, to an individual, he or she pays contributions when young and receives benefits after becoming 65 years old. But take one time, we see that young generations pay pension contributions and at a time old generations receive pension benefits. Pension benefits for old generations come from the pension contributions of young generations meaning the support between generations, and this is an extension of family support for old parents to a system of social support. If we do this thoroughly we reach the pay-as-you-go pension system that needs no pension contribution fund. The opposite case is the reserve financing scheme or the funded pension system. The Japanese public pension system has a certain reserve fund and thereby it is a funded system. However, the reserve fund is not enough, and the public pension system has been operated in the past like a pay-as-you-go system. In this sense, the Japanese pension system is a modified funded system, meaning that pension benefits come both from contributions of young generations and the operated returns of the reserve fund. Moreover, half of the basic pension benefits are paid by the government, or from tax revenues. The 50% is raised from one third in 2004 in order to increase the reliability of the public pension system.

III-2. Pension Reform

The Japanese pension system consists of three floors. The first floor is the basic pension which is common to all people. The second floor pension is welfare pension or employees' pension, in which only the salaried workers and public servants are enrolled, and receive benefits in proportion to paid contributions. In 2015, old welfare pension and mutual aid pension merged to result in the current welfare pension. There is the national pension fund which is also a second floor pension for those who cannot be enrolled in welfare pension, but this is not a public pension but is a private pension system. The third floor pension is company pension which is offered by a company and is open to those working at the relevant company; and this company pension belongs to the private pension system. The defined contribution pension plan (DC) and the defined benefits pension plan (DB), introduced in 2001, are also private company pensions. In addition to company pension, both DC and DB are also open to individuals.

As such, the Japanese pension system is very much complicated, depending on whether or not working at companies, whether or not to join the second floor national pension fund, whether or not to join the third floor private company pension, and so on. Moreover, there was the legislators' pension for national and local government legislators, which was thought to be preferential by general people and abolished by 2006 for national diet members and by 2011 for local government members. Along with these complicated pension systems, the necessity of pension system reform has risen in the sense that there should be a single pension system under which everyone is entitled to be enrolled equally and get pension benefits in accordance with paid contributions.

In Japan, an aging population combined with a diminishing number of children has worsened year by year. During the high growth era, the pay-as-you-go pension system worked well even with surplus contributions. However, as the economic growth rate fell with a decreasing birthrate and aging population, the sustainability of the pension system is gradually apprehended. In preparing for the future difficulty, raising the contributions of young generations and postponing the beginning age of pension benefits, etc. have been discussed and some have actually been altered. In 2004, in avoiding excessive burdens on the future working generations, the government began to set the final contribution level and to adopt a macroeconomic slide formula, which is a mechanism to automatically adjust benefit levels according to changes in inflation rate, nominal wage growth rate, life expectancy, and so on. The basic pension system had fallen into deficit since 2002 and the welfare pension system, excluding temporal revenues, had also fallen into deficit since 2003. The welfare pension merged with the mutual aid pension in 2015 but further reform had been needed.

Yet another problem is being faced. Although, as we noted earlier, everyone must be forced to be a member of basic pension, many people do not pay contributions. According to the Social Insurance Agency, the rate of those who do not pay contributions has stayed stably at 36% in 2004 and 32% in 2018. Those unenrolled people are not necessarily the result of an intended decision but are just unaware of his or her own state. Those who quit a company must register basic pension after withdrawing welfare pension but, though the data is old, 920 thousand people did not register this change. As reference data, 630 thousand people had never been a member of the basic pension. Among them, some people have private life insurance and individual pension. Not only because of compulsory nature, the new pension system is desired to which those people are willing to join by their own decision.

III-3. Sustainability of Public Pension and Private Pension

It is claimed that not a few of those who do not enroll in any public pension doubt the sustainability of the Japanese public pension system. It is not due to the lack of information, but it should be understood to be claimed by them after deep contemplation; but then how serious is the sustainability of the pension system?

The expenditures on social security, not only public pension but also including medical care, have increased year by year. Partly because of the decreasing birthrate and aging population, the share of expenditures in the government budget rose from 23.9% in 1999 to 33.7% in 2022 (initial budget) as well as the absolute level of raised expenditures. About 10% point increases in 20 years are large changes and decreased the expenditure shares of public investment, education and science, and steady food supply. From these figures, it is evident that the sustainability of social insurance expenditures including on the pension system as a whole is a prerequisite for the sustainability of government deficits. In raising the consumption tax rate, “simultaneous reforms of social insurance and tax” is set to be a catchphrase that is a typical symptom of the importance of the macroeconomic fiscal sustainability to the variety of fields of microeconomic sustainability, which through aggrega-

tion bring about macroeconomic sustainability.

In responding to this reality in Japan, Nomura (2023) in this PPR issue presents to begin with the criterion to evaluate the pension system, be it public pension or private pension. The entire evaluation vector as a whole must include factors of, in addition to sustainability, sufficiency, burden possibility, equality, predictability, and robustness of the pension system. Microeconomic elements for sustainability include pension coverage, total asset, contributions, population dynamics, government debts, and economic growth rate. Obviously, these factors are related with the sustainability of financial funds of the pension system and a possible source of taxes is biased toward imposing heavily on future generations, resulting in a certain similar characteristic to the use of exhaustible resources.

In discussing the sustainability in general of the pension system, the compulsory enrollment of the public pension is assumed in comparison with the arbitrary enrollment nature of the private pension. However, as we noted, in some countries there are almost compulsory private company pension. In countries with a decreasing birthrate and aging population, in order to sustain the pay-as-you-go pension system, either cutting off the amount of pension benefits or if benefits are to be maintained contributions of young generations must be raised. When the sustainability of the compulsory public pension system alone is questioned, private pension is expected to complement the public pension. The 2014 pension reform in Japan was in line with this idea of actively utilizing private pension. Nomura (2023) in this PPR issue investigates how to raise people's incentive to join the private pension system.

III-4. The Role of Private Pension

Nomura (2023) analyses the conditions on which the pension system as a whole is sustainable in Japan. Taking for granted the declining birthrate and rapid population aging, she evaluates the sustainability of the public pension system and examines the sustainability of the private pension system given that it complements the public pension system. In executing those analyses, knowing extreme claims that the sustainability is assured only under decreased pension benefits, Nomura (2023) understands that the 2004 reform of the public pension system aimed at "100 years of relief" is working properly as witnessed by, for example, the introduction of the macroeconomic slide formula and its sustainability can be evaluated as passable and thereby regarded as given and reserved in advance for the examinations of the private pension system.

In evaluating the sustainability of public pension, traditionally we have utilized the "permanent equilibrium formula" to compute the necessary pension contributions to maintain the pension system, where the formula takes into account the present and expected future course of birthrate, average life expectancy, domestic economic conditions, and so on (in what follows, economic environmental state). However, the 2004 reform of the pension system altered the "permanent equilibrium formula" into the "limited time span equilibrium formula" which fixes pension contributions irrespective of the economic environmental state and predicts the sustainability of the pension system up to 100 years ahead and named its

formula “100 years of relief.” Although this alteration in formula is a sufficient step towards the genuine reform, Nomura does not go into such a depth. Instead, given the sustainability of the public pension system through the macroeconomic slide formula, Nomura confined her analysis to the sustainability of the private pension system that complements the public pension system to attain the sustainability of the pension system as a whole. The private pension in Nomura’s paper is not the mere source of additional benefits that are deficient by the compulsory public pension alone but is the means to earn additional pension benefits according to one’s own decision. To let it be effective, it is necessary to provide people with incentives to join the private pension plans.

The private pension in Japan, among the three floors pension system, has played a role of company pension on the third floor. There have been two kinds of company pension plans, *i.e.*, defined benefit plan (DB) and defined contribution plan (DC). Increasing interests have shifted recently from DB to DC and what Nomura (2023) focuses on is DC as well. DB as company pension is run and managed by companies and each employee is insured defined benefit at retirement. On the other hand, in the case of DC, companies first determine the original fund for retirement and distribute each month to employees. The employees select financial assets to invest in from the selection list and manipulate funds resulting in the different amount of retirement income depending on investment returns.

DB is older than DC which was first introduced as a company pension in 2001 referring to the 401k plan of the United States. In shifting to the reserve financing DC and thereby to the social security funding base, the motivation was emphasized that larger benefits coupled with smaller contributions make all generations better off through appropriate fund management of increased savings. If many people are myopic and lack sufficient savings, the DC type of social insurance system will surely raise the national savings. In this sense, not necessarily company pension but individual based private pension that adds benefits to the public pension as well will make anyone, including those not employed by companies, better off. Thus, individual type DC was added to the company pension DC and since 2017 the individual defined contribution plan (iDeCo) was introduced and everyone, from 20 years old to less than 65 years old, can arbitrarily open and operate private pension.

For iDeCo users three tax deductions are available. First, all reserve funds are deducted from income. Second, returns from fund management are tax-deductible and invested again, and third when benefits are received tax-deductible is applied either as a public pension deduction or as a retirement income deduction. These tax benefits are expected to strengthen the incentive for everyone to join the private pension. Note, however, that neutral tax deduction for saving in comparison with comprehensive income tax is tax on expenditure, and among three tax deductions, only the EET type tax imposition applies where there are no taxes at initial investment (Exempt) and during fund operation (Exempt) and tax imposition (Tax) at the time of receiving pension benefits. Incidentally, aside from private pension, the Nippon Individual Savings Account (known as NISA) is taxed according to the TEE type.

The paper by Nomura (2023) focuses on the private DC and examines the sustainability of the private pension system from three viewpoints, permanent and sufficient tax deduction,

maintenance of a sufficient number of enrollment, and the sustainability of private organization that operate DC. An emphasis is put on the plausibility of inviting heavier burdens on the future generations that will have to pay for the deducted taxes which is so in Japan with the risk of sustainability. Can Japan sustain the system of compensating the decreased social welfare by allocating certain resources to the deducted tax revenues? More concretely, is it possible to establish the system with which decreased tax revenue due to tax deduction on DC is offset by the increased tax revenue at the time of payment of pension benefits? If the fund is deficient, each individual has to shift from the younger consumption to future consumption. If this reallocation is possible, the government need not intervene into the market economy, but the reality in fact is that individuals are myopic and hardly rational, so government intervention through the private pension policy is justified.

III-5 Sustainability by DC

Nomura (2023) explains the requirement for the private pension and confirms which factors are necessary for the sustainability of the pension system. Because the expected role of the private pension is to complement the public pension, the utilization of private pension by only those with high literacy is not satisfactory but radical countermeasures to let a large number of people take initiative to join are required. Nomura identifies necessary countermeasures to be DC with tax deductions. Because how much a person is able to sacrifice the present consumption differs from person to person, an automatic enrollment system with optional opt-out is appropriate. Nomura tries to compute how much of DC is necessary for the long run sustainability. It is dependent on the income substitution rate, which is the ratio of pension income to working income, tax level of EET type, degree of participation of the private pension, average life expectancy, and macroeconomic indicators such as economic growth rate, productivity growth rate, declining birthrate and population aging, total population including foreign immigrants, and so on. Although Nomura does not attempt minute simulations for all factors, she does analyze the sustainability of the Japanese private pension system by referring to the experiences of the United States and European countries. Last but not least, she points out the sustainability of private organizations that operate DC is not given exogenously.

IV. Necessity of Bubble Collapse

The Japanese economy on the latter half of the 1980s belonged to the expansionary phase of the eleventh postwar business cycle, and stock prices of land, housing, mansions, and equity of firms rose persistently throughout this period. On entering the 1990s, however, the stock prices fell dramatically, resulting in the collapse of the bubble economy. In the course of the stock price hikes, there was a view that stock price hikes reflected the fundamentals of a strengthened Japanese economy; but this fundamental view turned out to be a mere house built on sand.

IV-1. Theory of Bubbles and Their Models

To begin with, we reorganize what Jinnai (2023) in this PPR issue calls the old generation bubble theory. The bubble is the residual part of stock prices that are not explained by fundamentals. Namely, we have

$$(\text{stock price}) = (\text{fundamentals}) + (\text{bubble}).$$

where fundamentals and the bubble are orthogonal to each other and thereby are not correlated. The fundamentals reflect the real value of stock, be it land, housing, or equity of firms, whereas a bubble is the part of the market price that has nothing to do with fundamentals. If intertemporal features are emphasized the bubble is called a speculative bubble.

There are several models of a speculative bubble. In what follows consider the speculative bubble model with bubble collapses. Let x_t denote the bubble part of the market price of some assets, say equity of a firm, and let the model of the speculative bubble be

$$x_t = \begin{cases} \beta_t x_{t-1} + u_t & \text{(A) with probability } \pi_t, \\ u_t & \text{(B) with probability } 1 - \pi_t, \end{cases} \quad (7)$$

where π_t indicates the probability that a bubble follows model (A), namely π_t equals the probability of bubble continuation from period $t-1$ to period t or equivalently $1 - \pi_t$ is the probability that a bubble crashes at period t . When a bubble crashes it returns instantly to 0 and model (B) applies. The term u_t appearing in both models (A) and (B) denotes the new bubble randomly generated at period t , and it represents a random variable with average 0, and constant variance σ_u^2 without serial correlation.

The most useful information in order to know the sustainability and feature of a bubble is the coefficient parameter β_t and the probability of bubble continuation π_t in (7). After all estimating the dynamic evolution of a bubble is tantamount to the estimation of these two unknown parameters. In the estimation we introduce two modifications into the model so as to make the recursive estimation possible.

First, a random walk is assumed on β_t , namely we have

$$\beta_t = \beta_{t-1} + v_t, \quad v_t \sim N(0, \sigma_v^2) \quad (8)$$

where v_t is a normally distributed white noise random variable. As the variance of u_t is assumed constant, the variance of v_t is also assumed constant. These two variances are unknown and are to be estimated. Second, the probability of bubble continuation depends on the absolute size of a bubble, so that we can write

$$\pi_t = e^{-\gamma - \alpha |x_{t-1}|}, \quad \alpha, \gamma > 0 \quad (9)$$

where α and γ are unknown parameters. Equation (9) means that as a bubble expands either positively or negatively the probability of a bubble crash in the next period is increased.

In specification (8) and (9), β_t and π_t are assumed independent. However, if the specula-

tive bubble is formed rationally, they cannot be independent. That is, let the rate of return on the substitutable asset to this relevant equity be r_t , then insofar as the transaction cost of arbitrage between assets is negligible, we must have

$$r_t = \pi_t \beta_t - 1. \quad (10)$$

Needless to point out, to establish (10) we need the perfect capital market in which loans are freely available and investors must be risk neutral in operating assets. Moreover when a bubble crashes (7) assumes model (B) applies instantly. But if a bubble crashes not all of a sudden but crashes step by step, then (10) needs modification. Which substitutable asset has to be selected is also important, and the establishment of arbitrage like (10) must be tested *ex post* empirically. Also on the random walk presumption (8), as far as the speculative bubble is on the divergent path, the inequality $\beta_t > 1$ is the necessary condition for the speculative bubble (for a bubble with crash, $\beta_t > 1$ is definitely a necessary condition). Without assuming this condition, we can judge the divergent feature of the speculative bubble by obtained estimates.¹

IV-2. Bubbles without Crash

In the above we presented a bubble model in which bubbles crash each period with certain probabilities. When a bubble continues, there definitely comes a period when the bubble crashes with probability one. In fact, it is certain that every bubble ends up with crashes. However, there is in reality a bubble that never crashes. A typical example is money that is traded again and again among traders in exchange for goods and services. Take an inconvertible paper money that is just printed on plain paper and has no physical value in terms of utility or productivity. Namely paper money is not endowed with fundamental value although it continues to be used as a medium of exchange, which in fact is evidence of a continued bubble. The reason for an un-collapsible bubble is that it is accepted by anyone, and this general acceptability is the essence of the un-collapsed bubble. Such is the case, when the general acceptability is lost, a paper money loses fundamentals and the money bubble collapses. That is the consequence of the hyperinflation.

Like a paper money bubble, it is said that a collapse of value never happens for virtual money such as Bitcoin, Japanese national bonds as discussed in Section II, immovable real estate in China, and so on. What is common with these examples is that there are those who sustain and avoid the collapses of values. Virtual money is sustained by firstly the same mechanism of fiat money and secondly the strong demand and the limited supply (as of mid-year 2023).

The value of Japanese bonds is sustained by public holdings of the Bank of Japan, Japanese pension funds, and many financial intermediaries of banks and insurance companies

¹ See Liu, Asako, and Kanoh (2011) and Asako and Liu (2013) for the detailed recursive estimation process and examples of estimation by utilizing actual data.

because these institutions do not shift in the short run to the seller side of bonds. Two or three lost decades after the collapse of the bubble economy have made it necessary as macroeconomic stabilization policies to loosen the financial market, and this basic stance of monetary policy has sustained relevant bubbles. The buyer side of the bond market has sustained bond prices by understanding the target of monetary policy. As for the real estate bubbles in China, government interventions to sustain the market are noteworthy as evidenced by policy announcements during the Lehman shock crisis and the recession caused by the COVID-19 pandemic over 2020-23. The difficulty surrounding the real estate market in China, especially to rather large real estate companies and to local governments, remain in obscurity and some observation predicts further burdens to come.²

IV-3. From Old Generation Bubble to New Generation Bubble

The paper by Jinnai (2023) in this PPR issue focuses on recent studies on bubbles, especially on the rational bubble and the repeated bubble, keeping in mind the misunderstanding between policy makers and academic researchers. Jinnai, referring to the cases of such misunderstandings and to certain empirical research, presents a model in which the repeated bubble occurs endogenously. This shifts the interest in bubbles from the old generation bubble to the new generation bubble.

As noted earlier, the rational bubble of an asset occurs even under the rational behavior of an individual economic agent.³ Jinnai explains this property concisely as “when the real interest rate is smaller than the economic growth rate, the rational bubble occurs.” This condition is the same as the Domar condition for the sustainability of government deficits, and this condition is sometimes referred as the inefficient state in terms of capital accumulation. Once we identify the real interest rate as the marginal productivity of capital, the golden rule for the maximum per capita consumption at the steady state is attained when the real interest rate equals the economic growth rate. Therefore, when the real interest rate is smaller than the golden rule economic growth rate, more than enough capital is accumulated. This excess capital provides room for the economy to increase the efficiency and thereby sustain rational bubbles.

The repeated bubble in Jinnai (2023) is, besides a rational bubble, an endogenous bubble in the sense that it repeats stochastically the period with a bubble and the period without a bubble. Among rational bubbles, a model where a new bubble emerges after a crash of the previous bubble is satisfied with specification (7). However, in the model of (7), new births of the bubble are random and their probability is given exogenously, implying that the endogenous mechanism of a new birth is left unanswered. Jinnai (2023) introduces heteroge-

² For the experience of the Japanese stock price bubble over the late 1980s to 1990s, see Asako (1992) for detailed observations of the occurrence, expansion, and crash of the bubble and policy responses. Here we do not repeat the empirical description as we focus on the theoretical aspect of the bubble.

³ There are several routes through which the rational bubble occurs. Asako (1991), for example, obtains the rational bubble in an economy consisting of the same area of building lot for sale. If the area of the building lot is freely selectable, this rational bubble vanishes.

neity to individuals in the sense that each person is qualified randomly either to be an investor who can invest in capital goods or to be a worker who cannot invest in capital goods. Each probability is given exogenously. However, once the probability of becoming a heterogeneous agent is given even exogenously, each agent plays the role of investor or worker endogenously and those who have become investors generate bubbles through an endogenous mechanism. This endogeneity differentiates Jinnai's model from (7).

In the Jinnai model, individuals return to the homogeneous agents at the end of each period, if there are certain costs in altering the roles of previous agents, then a hysteresis effect arises in that investors continue to be investors (or workers continue to be workers) and bubbles last certain times before their collapses.

V. Sustainable Economic Development

The first global environment summit held at Rio de Janeiro, Brazil in 1992 took up variety of global environment problems, with deep concerns of harmonizing environmental problems and economic development, or concerns of attaining the sustainable economic development. The concept of sustainable development was launched firstly by the Brundtland Commission and the *raison d'être* of it was to raise the satisfaction of the present generation by simultaneously satisfying the demand of future generations. This concept attempts for people in general to believe in the coexistence of good environment and good economic development, and thereby rendered people to believe in restrained economic development with reasonable environmental protection.

The second global environment summit held at Johannesburg, South Africa in 2002 elevated the concept of sustainability up to utilize it to the official title of sessions, and the political declaration of the Johannesburg treaty was adopted as the result document, and as an action plan where such objectives were adopted as to diminish poverty, to change the unsustainable production-consumption scheme, to protect and manage natural resources, to prescribe concrete policy actions, and to design each country's policy to promote economic development. At the second summit, representatives from many governments, world organizations, industries, and NGOs totaling in sum more than 20 thousand people participated and thereby it was indeed a large summit being proud of the twenty-first century.

V-1. Intergenerational Reconciliation of Interests and Sustainability

The sustainable economic development is defined by the feature: "to raise the satisfaction of the present generation by simultaneously satisfying the demand of future generations," and what is something closely related is the intertemporal equity of generations. On the other hand, when we pursue the sustainable growth path of the economy constrained by limited exhaustible resources or environmental problems within the framework of the extended neoclassical optimal growth model, we apply the utilitarian approach in the sense that we maximize the discounted sum of all future utilities. The utilitarian approach empha-

sizes the efficiency of resource uses and it does not pay due attention to the equity of generations. In fact the utility of future generations get lower than the present generation, provided that the discount rate is positive. Should this kind of time preference or social choice be accepted naturally? Aren't there any substitutable criterion? One possible answer to these questions is the optimal growth path under the max-min principle.

The max-min principle is the criterion that selects the maximum one from the set of minimum values. To see this more concretely, let $U^i(t)$ denote the utility of generation t under the scheme i , and let $\{\min U^i(t)\}$ denote the minimum utility of generation t among all scheme i , and let us select one generation t for which $\{\min U^i(t)\}$ takes the maximum value among all generations and denote it by $U^* = \max\{\min U^i(t)\}$. This max-min principle is known as the Rawlsian criterion of justice after Rawls (1971) when it is applied to measure the degree of inequality in income distributions, and here it is applied to measure the intertemporal inequality of utility over different generations. When there is no obstacle to render its realization, the max-min principle selects the scheme i under which the utility of all generations are equalized. If there are differences in utilities of generations, shifts of resources from generations of high utility to generations of low utility will increase the utility of originally low utility, the max-min principle select scheme i which renders utilities of all generations equal at the constant utility level $U^* = \max\{\min U^i(t)\}$.

Based on the growth path under the max-min principle, the most pressing problem for the intergenerational equity is against the decreasing generational utilities as time passes on. In fact, this criterion is the most general economical interpretation of the sustainable economic development. The problem of exhaustible resources and environmental issues was regarded as a same kind of problem for the Spaceship Earth and prescribed in the report of 'The Limits to Growth' by the Club of Rome in 1972 as the rationale for the global economy as a whole to head for a zero growth economy. However, there is a big difference between the two with respect to the involvement of external diseconomy. For the resource allocation of exhaustible resources, the growth path through the competitive decentralized market economy under the utilitarian approach is the same as the optimal growth path of the centralized planned economy and is Pareto optimum as no external effect is involved at all. Nonetheless, the intertemporal utility path of generations exhibits a decreasing feature as the utility of the future generations is discounted. In the case of environment issues, future generations in general incur disfavored situations so that the optimal growth path under the max-min principle should avoid intergenerational inequality.

However, although the intergenerational utilities are equalized under the max-min principle, there are three involved difficulties. First, to begin with a possibility that sustaining a certain constant utility level is technically impossible, or a possibility of a nonexistent steady state. The second difficulty is that the initial state determines everything, namely the case that the least favored generation is the initial generation. In this case, even if there is room for future development, the max-min principle prevents it from realization. Third, on the contrary to the second difficulty, the lowest utility is attained at the final steady state to which the economy converges at end. In this case, the resource allocation is Pareto ineffi-

cient.

Rawls himself was reluctant in applying his justice criterion to the problem of intergenerational equity because he was aware of the consequence of the second difficulty. His main concern was the case of decreasing utility owing to the sacrificing nature of future generations, indicating that there is a presumption that even if the present generation sacrifices its own utility by taking care of future generations it is not to be blamed on the basis of intergenerational inequality. As time goes unidirectionally, the requirement for intergenerational equity is after all “against the decreasing generational utilities as time passes on.”

Aside from a detailed analysis, when the max-min principle is applied to a problem of exhaustible resources and environmental issues which future generations will confront sufferings, there arises a hope that Rawl’s fear will vanish. But the fact is the third difficulty mentioned above arises. But if we do not pay due attention for mere theoretical possibility, then the second difficulty is overcome and the intergenerational equity is maintained. For the first difficulty, as long as the maintained constant utility is properly estimated, or as long as the constant utility is not overestimated, there will arise no fatal difficulty.⁴

V-2. Sustainable Growth and the Hartwick Rule

Understanding that keeping constant utility for all generations or at least avoiding the decreasing utilities over time implies the sustainable economic development, what are the minimum conditions to attain this feature? Of course, there is not a unique answer to this question, and it depends on the differences in situation setting (or in the underlying model), and one common idea shared with interested parties is the Hartwick rule proposed by Hartwick (1977). This is a rule to maintain a certain level of consumption within the economy faced with the constraint on the exhaustible resource, but the original idea is applicable to the environmental issues with a few modifications.

The Hartwick rule to the exhaustible resource requires, in addition to the standard Pareto efficiency condition for the resource allocation, to keep the rule that “at each period, accumulate reproducible capital by the amount equal to the user cost of exhaustible resource payable in the competitive market.” This in short renders the economy to take the Pareto optimum growth path on which the consumption is maintained. In order to maintain a certain level of consumption, maintaining the production with decreasing stock of exhaustible resources is necessary and to attain this target the accumulation of reproducible capital has to be executed.

In extending the Hartwick rule to the case of environmental issues, the appropriate Pigouvian tax or subsidy policy must be prescribed to begin with to internalize the external economy or diseconomy. Then, through economic growth, consumption must be increased adequately to compensate and offset the decreased utility brought about directly or indirectly by the worsened environmental issues. As long as the economy grows environmental cap-

⁴ See Asako (1980) for more in detail.

ital or environmental stock need not be maintained at the fixed level, thus allowing for certain worsening of the environmental issues. If there occur some technical progress thanks to economic growth, or some resource is allocated to R&D investment to abate the environmental issues, the Hartwick rule can be relaxed accordingly.

Notwithstanding such a favorable prospect, when the environmental worsening becomes fatal, an optimistic stance is not at all advisable. In order to avoid the worst scenario, understanding the functioning of environmental issues is by far most important, and by properly internalizing the external economy and diseconomy by Pigouvian policy, then the national economy can trace the optimal growth path. If environmental issues extend to a wide space and a long period, evaluating correctly the functioning of the environment is an extremely hard task.

V-3. Endogenous Rate of Time Preference

Whether or not discounting the utility of future generations has been a long debated almost philosophical issue, the value of the discount rate in fact exerts a large influential impact on prescribing the appropriate environmental policy, indicating that careful dealing is required.⁵ Above all, because the environmental issues include really long-term problems, the discounting by how high the rate of time preference is a crucial matter. The paper by Hosoya (2023) in this PPR issue in fact examines the sustainability of economic development path when the rate of time preference changes endogenously. The environmental issues influence both on the households' utility through the production that necessitate dirty inputs with discharged materials and on the effects on altering the rate of time preference.

With these settings Hosoya (2023) examines, in addition to the max-min constant utility principle and the Hartwick rule, the endogenous growth model or the so called AK model. Each economic agent maximizes the discounted sum of utilities under the utilitarian criterion, and since the model as a whole is the AK model the optimal steady state growth path is chosen at each period without experiencing the transition dynamics. This feature is shared with both the decentralized market economy and the centralized planned economy, provided that the external diseconomy of the environmental issues are internalized by proper Pigouvian policy.

The constant utility growth path and the Hartwick rule are discussed in Hosoya (2023) as the possible sustainable development paths and he concludes that the balanced growth path with the constant utility over generations is the consequent outcome of the sustainable economic development including the environmental issues. The necessary condition for the sustainability is the nonchanging rate of time preference over generations. However, when the time preference is endogenously determined, the constant discount rate requires certain relations among factors that alter the time preference. Hosoya attempts to interpret this par-

⁵ There are many simulation analyses with different discount rates. For example, Asako and Kuninori (2001) conduct simulations when the discount rates are different between the industrialized countries and the developing countries and find the drastic difference as a whole to the effects on global warming.

ticular relationship and notes the special role of the endogenous growth AK model for this relationship. He goes on to further examinations such as to explain the necessity to deal with the various settings of the environmental issues, and to explain the source and the way to control the endogenous time preference. He concludes his analyses with the future prospects of the remaining problems.

V-4. Economic Development: Expanded Differentials and Farsighted View

It is said that there are “the wall of 2,000 dollars and the trap of 10,000 dollars” in terms of per capita GDP or GNP because of the establishment of democracy or the pitfall of fulfillment, and not all national economies are successful in converging to the stable growing paths. As a result, some national economies have succeeded the economic growth and development whereas the others have not succeeded so. Seeing back the past one or two decades we have witnessed phrases saying, on the one hand, there are rising sun newly industrialized countries and, on the other hand, there are countries left behind as the poorest ones. There are several common bottlenecks that deprive developing national economies of the potential growing power.

First, most national economies are based on the traditional monoculture relying on the primary industries which in turn support the national finance. Second, as a result of the monoculture economy, the share of the manufacturing industry is low with low technology. Moreover, the growth rate of the population is high, and no industry absorbs the surplus of population and labor. Third, the total factor productivity remains at low levels due to the unconstructed infrastructure. The financial sector is not developed, and the human capital remains unutilized. Fourth, many developing countries were once colonies of the developed countries and, even after independence, their total economy relied mostly on the dominant presence of the old suzerain countries.

There are more than 200 national economies even if limited to the United Nations member countries. G20 industrialized nations including the G7 (United States, Japan, Germany, United Kingdom, France, Italy, Canada) and BRICS (Brazil, Russia, India, China, South Africa) or OECD countries are by far the smaller groups. The G20 nations are either industrialized or categorized as developing countries and are winners. These nations are exceptional since the rest of many countries cannot escape from the trap of 10,000 dollars or are blocked by the wall of 2,000 dollars. In short, the differentials between the winners and the rest have widened rather than narrowed.

Concerning the widened economic differentials, we are inclined to judge that every national economy wishes for economic development. Although many people may agree with this value judgement, there are few countries which do not target economic development that just scale up economic activities but target an increase in the level of living and thereby total national happiness. This country is Bhutan situated in the Eastern Himalayas with a population of about 770 thousand and with a per capita GDP equal to 3,240 dollars in 2020, and is famous for being the happiest country in the world or for being a country with 97% of

the population feeling happiness. The per capita GDP in Bhutan exceeds the wall of 2,000 dollars, but is not successful in economic development. The location in the Eastern Himalayas to begin with is unsuitable for manufacturing-driven economic activities, and then the question why people answer to be the happiest in the world arises.

Let us think here about the difference between economic growth and economic development. In discussing the sustainable economic development, we suppose that the national economy in question has experienced economic growth and has attained a certain level of GDP. The main concerns of economic growth center around the scale of the economy and the GDP or per capita GDP are expanding is an indicator of national performance. On the contrary to this observation, when economic development is under review there is a tendency that emphasis is on the process through which the national economy shifts from an underdeveloped economy to the modernized manufacturing and service industries through capital accumulation and technological progress. In other words, by economic growth only, quantity is noticed while by economic development, in addition to the quantity indicator, the quality indicator such as quality of life (QOL) and happiness is questioned as well. The focus on the environment and exhaustible resources are the result of high national income thanks to economic growth and of the increased interest on QOL and happiness, so that the phase of such national economy shifts from the stage of mere economic growth to the stage of economic development.

Partly because of such a background, though widening of economic differentials is feared through economic development, the sustainable development goals (SDGs) as we touched on in Section I are adopted. It was the sustainable development goals or SDGs, which all the members of the United Nations unanimously adopted in 2015 by foreseeing the target year 2030. The exact contents of SDGs consist of 17 global goals and 169 targets. Because all the United Nations member countries agreed, no particularly biased goals toward particular countries/areas and no biased goals and targets particularly apart from daily life are included. As a total, SDGs are to live a better life irrespective of the stage of economic development and thereby are neutral as development goals.

VI. Concluding Remarks

In this paper, we examined the sustainability of selective macroeconomic problems. Namely, we take up four macroeconomic issues to which the sustainability of the present system is feared. These issues are the accumulated government deficits, public pension system, booms and busts of speculative bubbles, and development of economies with global environmental issues. For each issue, we first briefly surveyed the literature, and then introduced new original attempts by authors published in this PPR issue. Some of the factors for the sustainability of these four issues are common and shared with other issues while other factors are particular to their own issues and are not shared with other issues. The common factor is the relative magnitude between the economic growth rate and the rate of increase of respective issues. That is, the sustainability depends on the relative growth rate of econo-

my in comparison to the growing speed of the accumulation of government deficits, contributions and benefits of public pension funds, birth and crash of speculative bubbles of land and stock prices, and the external economy or diseconomy of environmental issues. Insofar as the growth rate of national economy as represented by GDP is greater than the worsening rate of individual problems, the general evaluation on sustainability is in the affirmative.

Such an evaluation on sustainability is the same with respect to both the national economy and global economy as a whole, implying that the worldwide economies suffer from the common problems simultaneously. Examples are global warming, unusual weather, marine plastic pollution, and so on, which necessitate the urgent policy measures to stop its worsening. The COVID-19 pandemic during 2020-23 has witnessed that the world is literally united in terms of epidemic prevention as well as economic activities. The sustainability of the global economy will sharpen hereafter.

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