

# Chapter 3

## Ratio of Positive Net Investment to Deficit Required for the Reinforcement of the 3% Golden Rule

### 3.1 Introduction: Preliminary Questions

This chapter, based on the theory and practice integrated by an endogenous system, reviews the 3% 'golden rule' as one of fiscal constraints at the Economic and Monetary Union (EMU), finds a unique condition of positive net investment after capital consumption by country, and proposes policy-oriented rules endogenously hidden in the balance of payments and deficit. The endogenous system is composed of the endogenous model and corresponding data-sets, KEWT, for 81 countries, whose original data come from *International Financial Statistics Yearbook*, IMF. The endogenous system is summarized with the literature and at the same time, KEWT is compared with the current databases.

The total economy shows the weighted aggregation of two sectors, the government and private, and reflects real-assets reality, calculated just before final distribution of wages to households and profits to enterprises/corporations at the system of national accounts (SNA). Endogenous results expressed at KEWT differ from the effects of econometrics estimated using the current databases. These effects remain partial yet, within a certain range of endogenous results that exist wholly as a system. For example, tax multiplier often discussed in the literature, most cases, shows a range of 2 to 7 times, each as the inverse of the ratio of endogenous taxes to output at KEWT, where if deficit is zero, government spending of consumption and investment in the literature equals endogenous taxes.

Questions to the methodology of econometrics: Is the methodology able to distinguish the result of increase in taxes with decrease in deficit simultaneously? Is the methodology able to specify the causes of deflation under heavy accumulation of deficit by year, as observed in Japan for the last twenty years after 1991 when government saving turned to negative? Is the methodology able to examine the relationship between a minus rate of inflation (deflation) and the growth rate of output in equilibrium? Does the market principle as the second best express disequilibrium just before recovering equilibrium? Since general equilibrium remains the price-equilibrium static, the methodology hardly controls vector and linear dynamically as a whole.

Suppose that the endogenous-equilibrium prevailing in KEWT holds as a surrogate for the price-equilibrium. Then, all the parameters and variables are simultaneously and rigidly measured--instead of estimated or forecasted; by year and over years; and by country and sector. The current databases correspond with flow-methodology under an

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assumption of perfect competition. The flow-methodology is continuous and log growth-oriented while databases have to be discrete. Typically, there has been no accurate measurement of the relative share of capital/labor.

Then, is the 3% golden rule accurately interpreted and politically reinforced with financial and market policies? Does individual utility function,  $u(c)$ , maximize consumption in reality and under globalization or, is individual utility by country compatible with globalization? Two questions need to get correct answers with solutions.

### **3.2 Brief Comparisons of the Literature and Databases Used for Econometrics with the Endogenous System**

Economic models and analyses in the literature are all historically based on general equilibrium with price level by goods and consumption maximizing by individual. The current databases, published by OECD, UN and UNU, Penn World Table (PWT and EPWT), EU KLEMS of the Conference Board, and IMF and the World Bank, are all eligible for the price-oriented analyses. Models and data are separated. Mostly, economic models work at the continuous time and make use of Log growth. The databases are solely composed of flows without direct connection to corresponding stock: typical is the real-time analysis at EU KLEMS. Exceptionally, discrete models make use of Total Factor Productivity (TFP) as a statistics residual, as shown by Herberger, A. C. (1998). Ex-post TFP analysis makes it possible to estimate an internal rate of return. Common goal of continuous and discrete models is forecasting and consumption maximization. Towards this goal, econometrics has developed surprisingly since the first appearance of the framework of econometrics by Samuelson, P. A. (1941) when there were no appropriate data.

On the other hand, the endogenous system is based on the endogenous-equilibrium. The endogenous system is composed of a unique integration of theory and practice simultaneously measured within the system. There is no externality and all the parameters and variables are simultaneously endogenous within the system and consistent each other once measured over years, with no correction later. The endogenous differs from the endogenous in the literature and called 'purely endogenous;' whole as a system versus partial. 'Purely endogenous' holds only when externalities and assumptions are all disappear, as shown by scientific proofs of mathematicians at KEWT.

The endogenous system is traced back to the above Samuelson's (ibid., 97-120) 'stability of equilibrium: comparative static and dynamics.' Linear, vector, and unknown variables are designed under the price-equilibrium between discrete and continuous time. Since then, econometrics as a methodology has progressively improved by year, using continuous time and utilizing flow data up to date. The endogenous system inserts a certain number of statistics data into KEWT, based on a discrete Cobb-Douglas production

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function, and endogenously measures the rate of technological progress, simultaneously with *seven* endogenous parameters that control the whole system. Seven endogenous parameters are totally policy-oriented and Lucas's (1976) critique is solved. Rival capital and labor work politically within the discrete C-D production function and cooperate with non-rival factors such as education, R & D, learning by doing, and human capital, each as a strategy to support policy-oriented rival capital and labor. Policies of real assets, financial assets, market values and ratios, are all integrated in the long run, each following the neutrality of the financial assets to the real assets in the system of national accounts (SNA, 1993).

The endogenous system is composed of non-linear equations, which are each reduced to hyperbolic equations. The endogenous-equilibrium requires no assumptions and thus, holds under perfect competition and constant returns to scale. The marginal productivity of capital (*MPK*) equals the rate of return and the marginal productivity of labor (*MPL*) equals the wage rate and also the marginal rate of substitution is measured as 1.0 by year, which is confirmed using recursive programming by the same year. The endogenous-equilibrium holds in an open economy supported by the structure of the balance of payments, deficit, and the difference between saving and net investment at the private sector, just before redistributing taxes into households and enterprises.  $Y = \text{income} = \text{expenditures} = \text{output}$  is rigidly measured and realizes the three equality of Meade, J. E. (1960, 1962) and Meade, J. E. and Stone, J. R. N. (1969).

The endogenous-equilibrium is directly measured by the speed years for convergence by country and sector and shows the processes from disequilibrium to equilibrium, with simultaneous causes and results at the real assets. Arrow, K. J. and Debreu, G. (1954, 265-290) has been a decisive article for equilibrium up to date. Wold, H. (1954, 168, 173) earlier arranged for the relationship between causality and econometrics. However, the price-equilibrium only shows the conditions immediately after recovering equilibrium and looks for hypotheses, expecting real, financial, and market causes to repeat towards the future, under unknown changes in policies by year.

This chapter examines the appropriateness of the 3% rule to *GDP* or *Y*. A problem is that the relative share of capital or labor is unknown in the current databases. Compensations/wages and profits/returns are estimated in econometrics and there is no connection between the rate of return and the growth rate of output. Phelps, E. S. (1961) theoretically proved the connection yet not empirically.

### 3.3 Simple Method: How to Endogenously Trace Back the 3% Rule

Fiscal policy proposal in this chapter is based on the real assets and presents a simple method. This method guarantees sustainable growth by country and year, and at any area. 'The ratio of deficit to *GDP* should be less than 3%'. This rule is plausible alone in the case of a closed economy or when the balance of payments is zero by country. In the

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case of open economies, cash flow-in and -out deficit must be replaced by an open structure of 'saving less net investment,' by sector and at the real assets. If net investment (=gross investment–depreciation) is negative as a result of excessive deficits over years, the rate of technological progress is hardly guaranteed at any country.

Why has the EMU 3% rule remained untouched up to date, while suffering from repeating bubbles? This rule was empirically set in Dec 1992. This rule must be a second best since the rule matches the endogenous system. Two questions: (1) Why is deficit often discussed apart from the balance of payments? (2) Why is deficit set the difference between the cash flow-in and -out at the government sector? The two questions are interrelated and present a clue for solution. There must exist a presumption that the cash flow-in and -out at the government sector equals the saving less net investment at the government sector. This presumption, however, remains unrealistic: The cash flow-in and -out does not produce returns while saving less net investment produces plus or minus returns. A fact is that the rate of return at the government sector is zero only if deficit is zero, where taxes equal government output and also government spending equals taxes in the endogenous equilibrium.<sup>1</sup> When the SNA aims at records for accounting, the SNA is justified.

What is an obstacle for mitigating the above presumption inherent in the SNA? The obstacle is a final distribution settlement of income such that returns/profits are absorbed by enterprises and wages by households. Due to this settlement, the rate of return is never calculated by sector. As a result, three-equality of national income, expenditures, and output, has remained unrealistic. Recall nine assumptions thoroughly arranged by Meade, J. E. (1962, 1-9) and also three-equality conceived by Meade, J. E. and Stone, J. R. N. (1969, 320-346). These two distinguished articles are alive even today and require a realistic solution.

Both Keynesians and neoclassicists rely on the market principle that works at plural markets, e.g., labor, money, capital, commodities and so on. The author respects the market principle since no other yet hits yet. The market principle expresses general equilibrium. Both schools, however, have not successfully integrated each market as a whole system, and this fact is unavoidable under a thought that the macro level is a result of the micro level. Further, both schools have to mix up the financial/market assets with the real assets. Financial assets and real assets are interrelated in the SNA and this system is unavoidable since purely endogenous idea has been out of thought. Relying on the market principle, prices are always indispensable means for theories. Prices, however,

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<sup>1</sup> For proof: Define government spending,  $E_G = C_G + I_G$ . Then,  $T_{AX} - E_G = (S_G - I_G)$  holds;  $C_G$  is consumption and  $S_G$  is saving at the government sector. Then,  $T_{AX} = C_G + S_G$  holds, and thus,  $T_{AX} = Y_G$  holds. As a result, when deficit,  $\Delta D$  is zero,  $T_{AX} = C_G + I_G$  since  $T_{AX} - \Delta D = C_G + I_G$ .  $T_{AX} = C_G + I_G$  is simple: The higher the size of government,  $Y_G/Y$ , the more net investment. Remember, using the related hyperbola: a high net investment is against a maximum rate of return by a minimum net investment and also against stop-bubbles.

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cannot simultaneously show causes and effects/results. This defect presents a limit of the market principle.

The endogenous system is organic and policy-oriented instead of records-oriented and answers the severe critique indicated by Lucas, R.E. (1976, 19-46). The endogenous system clarifies processes to close-to-disequilibrium, where simultaneous causes and results are two-way by sector and deny two ways of 'from causes to effects' and 'effects to causes.' Further, the endogenous system is based on the macro level just before final redistribution of income and, nine rigid assumptions all disappear. It is true that some assumptions are required at micro enterprises and corporations but, this is an issue to discuss separately from the macro level. The endogenous system measures the speed years as a quantitative unit to clarify the level of the endogenous-equilibrium. Disequilibrium, close-to-equilibrium, and moderate equilibrium, by country and sector, are each measured by the speed years. Marginal productivities of capital and labor,  $MPK$  and  $MPL$ , are each measured. The rate of return  $r$  and the wage rate  $w$  are separately each measured. And,  $MPK=r$  and  $MPL=w$  are each confirmed so that an assumption of perfect competition disappears.

Why is the endogenous system able to clarify the above measurement? This is because non-linear equations are involved in the 'discrete' Cobb-Douglas (C-D) production function at the KEWT by year and at corresponding recursive programming for the transitional path by the same year. Econometrics in the literature preferably uses linear equations, by applying Taylor's theorem, often cutting quadratic equations and estimating indispensable errors. Econometrics methodology, therefore, is much more reinforced once linear data are compared with non-linear endogenous data, and able to contribute to sustainable economic growth and policy changes.

This chapter presents a simple method using a few vital endogenous data selected from all the related data for 65 countries. The ratio of net investment to deficit,  $i/\Delta d$ , is a base, where  $i = I/Y$  is the ratio of net investment to output,  $\Delta d = \Delta D/Y$  is the ratio of deficit to output and, three equality of output=income=expenditures is endogenously measured. The rate of technological progress is a unique core and shown by  $g_A^* = i(1 - \beta^*)$ ;  $i = I/Y$  fluctuates by year while the qualitative net investment coefficient,  $1 - \beta^*$ , changes totally as a system. Endogenous data well express personality--national taste/preferences, culture, and history--by country yet are compatible with globalization, as shown empirically by country. The individual feature by country is measured by a macro relative utility function, which is distinguished with micro utility functions prevailing in the literature. This is because the macro relative utility function works simultaneously with all the other parameters and variables consistently over years.

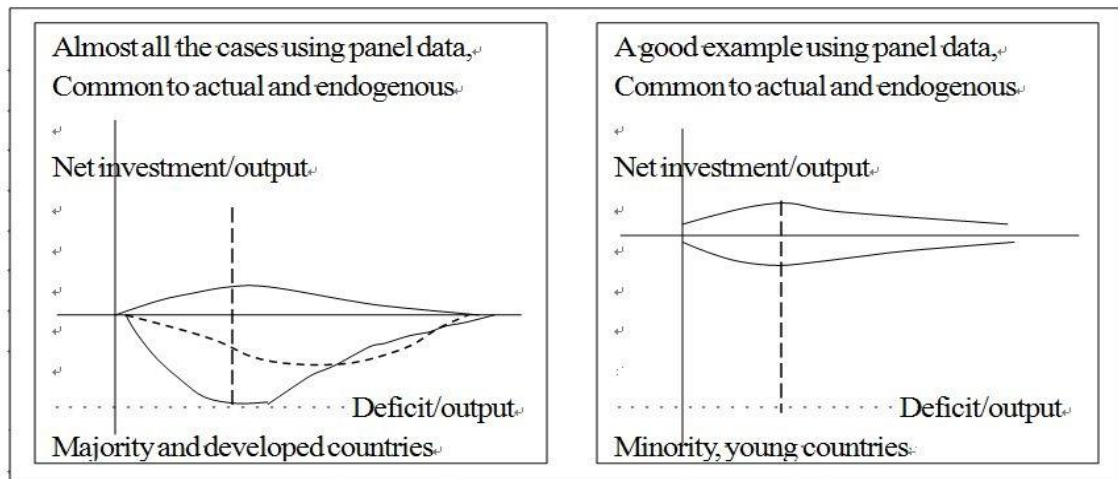
The simple method is illustrated by Figs. D1 and D2. Each figure is consistent with empirical results and divided into the LHS and RHS by sub-figure.

Let the author first explain **BOX 3-1**. BOX 3-1 takes net investment divided by output on the y axis and deficit divided by output on the x axis, to make it easier to

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compare net investment with deficit by using the ratio of each to output. Almost all the 65 countries respectively show up and down deficits over years, except for minority countries. On the LHS, (i) deficit countries express ‘deep’ mode, while net investments reduce to a lower level and (ii) some developing/young countries express ‘shallow’ mode and the range of deficits is widened, as shown by dotted line. The (i) and (ii) show a fact that deficit significantly decreases net investment. From the viewpoint of sustainable technological progress, any close-to-zero positive level of net investment and any negative level of net investment are rejected by nature. On the RHS, net investment unit is one-half unit on the LHS. The higher the net investment the shallower the mode of deficit is, and even if deficit becomes large, deficit is flexible by year. This shows a fact that some countries have deficit controlled by policy-makers. It implies that uncontrollable deficit sacrifices sustainable technology and growth over years.

**BOX 3-1** Illustrative results common to four areas: using 81 country panel data, 1990-2010, for net investment/deficit, by area



Data sources: KEWT 6.12, 1990-2010, for 81 countries

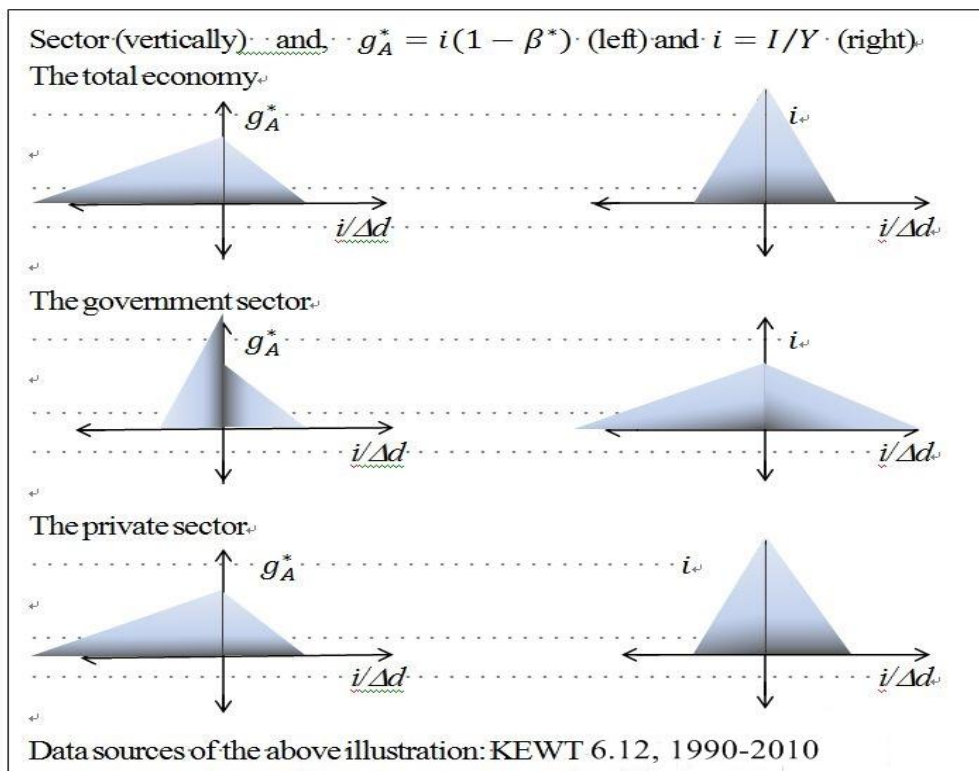
Next, let the author explain **BOX 3-2**. The LHS of BOX 3-2 takes the rate of technological progress,  $g_A^*$ , on the y axis and, deficit divided by output,  $i/\Delta d$ , on the x axis, comparing  $g_A^*$  at the total economy with  $g_{A(G)}^*$  and  $g_{A(PRI)}^*$  at the government and private sectors. The RHS takes net investment to output by sector on the y axis and, net investment to deficit by sector on the x axis and illustrates each sector's results. The government sector's movements generally differ from those at the total economy and the private sector. It is natural that the total economy and the private sector are similar since the private share is considerably high at the total economy. Yet, the results at the government sector are important since final distribution is absorbed into the private sector.

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Fiscal policy, in fact, inherently determines the private sector and accordingly, the total economy as the weighted aggregation.

Results of the above simple method correspond with each inverse of the multipliers to taxes and government spending in the literature. The author tested the multipliers comparing with each inverse of endogenous ratios, by using KEWT. What are differences between the multipliers and their inverse ratios? Blinder and Solow (1973, 319-337) is exactly essential to understand the whole picture behind. Differently but, this chapter objectively answers the above question. Blinder and Solow pursues the conditions for price-equilibrium and clarifies the essence of the multiplier, by formulating equations that combine real and monetary items with some fixed parameters and by referring to Say's Law. Blinder and Solow hit an inevitable limit of the literature due to the price-equilibrium. The limit is that the multiplier and its inverse each show the same result but, the multiplier cannot clarify the causes at the real assets. Basic ratios made of endogenous parameters, each as the inverse of multipliers, contrarily disclose causes; causes and results are simultaneously one-way.

**BOX 3-2** Illustrative results common to four areas: using 81 country panel data, 1990-2010, for the rate of technological progress and net investment/output



This chapter hereafter focuses the following two points to support the 3% rule of the EMU. The 3% rule needs its theoretical backbone, i.e., fiscal policy rules: i) Fundamental analyses of  $i/\Delta d$  as a base, using  $g_A^* = i(1 - \beta^*)$  and  $i = I/Y$  by sector. ii) Endogenous policy rules to reinforce the 3% rule of the EMU, forming a

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highlight at this chapter and driving ten endogenous facts and fiscal policy rules at Conclusions.

### 3.4 Core Analysis of $i/\Delta d$ as a Base: $g_A^* = i(1 - \beta^*)$ and $i = I/Y$ by Sector

This section first explains the ratio of net investment to output,  $i/\Delta d$ , as a base and then, empirically clarifies the patterns of technology to net investment, using *four* Technology-Patterns.  $i/\Delta d$  is immanently related to the rate of technological progress,  $g_A^* = i(1 - \beta^*)$ , in the endogenous-equilibrium since deficit endogenously determines the size of government and net investment (see Note 1). The rate of technological progress is endogenously most fundamental: Once  $g_A^* = i(1 - \beta^*)$  is measured, other variables are wholly and simultaneously measured by country, sector, and over year. Principal ratios among other variables are the growth rate of output per capita, the growth rate of output, the rate of return, and the relative shares. Vital analysis of  $g_A^*$  to  $i/\Delta d$  proves why deficit weakens the power to growth and profitability; particularly when  $g_{A(PRI)}^*$  at the private sector is compared with deficit,  $\Delta D$  or  $\Delta d \equiv \Delta D/Y$ , by year.

The rate of return is connected with the growth rate of output:  $r^* = (\alpha/(i \cdot \beta^*))g_Y^*$ , where  $r = r_0 = r^*$  is the rate of return and,  $g_Y^* = (g_A^*(1 + n)/(1 - \alpha)) + n$ , is the growth rate of output, as earlier proved by Solow, R. (1956).  $\alpha/(i \cdot \beta^*)$  is defined as an ‘endogenous’ Phelps coefficient, which connects  $r = r_0 = r^*$  with  $g_Y^*$  in the endogenous-equilibrium. The rate of change in population,  $n_E$ , equals the actual growth rate of population,  $n$ , under moderate equilibrium, where  $n_E = n$  holds.

Before stepping into endogenous facts and logics/rules found in vital analysis, let the author summarize the figures used for vital analysis. Vital analysis of  $g_A^*$  to  $i/\Delta d$  is shown by panel and time series figures, 1990-2010: (1) Panel data BOX 3-3 and BOX 3-4 for four area (Euro, Non-Euro, Asia & Pacific, and Rest area, where total number of countries is 65=14+15+17+19). (2) Time series data **Figures 1 to 3** for 14 countries at Euro currency area and similarly, **Figures 4 to 6** for 15 countries at Non-Euro Europe area. This section mainly uses BOX 3-3 and BOX 3-4 and the next section takes advantage of Figures 1 to 3 and Figures 4 to 6, to derive policy rules and evaluate and reinforce an appropriate 3% golden rule set empirically earlier.

BOX 3-3 for panel data is divided into (i) the rate of technological progress,  $g_A^*$  (the y axis) to  $i/\Delta d$  (the x axis) and (ii) the  $g_A^*$  (the y axis) to the private net investment to output,  $i_{PRI/Y} = I_{PRI}/Y$  (the x axis; where  $i_{PRI} = I_{PRI}/Y_{PRI}$  should not be used), each at the total economy. BOX 3-4 for panel data is divided into (iii) the  $g_{A(G)}^*$  (the y



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axis) to  $i_G/\Delta d$  (the x axis) and (iv) the  $g_{A(G)}^*$  (the y axis) to  $i_G = I_G/Y_G$  (the x axis), each at the government sector.

Denominators of endogenous ratios at the government sector are government output,  $Y_G$ , which is equal to endogenous taxes.  $i_G/\Delta d$  is a sort of hybrid since  $\frac{i_G}{\Delta d} = \frac{I_G}{Y_G} \cdot \frac{Y}{\Delta D}$  connects  $i_G = I_G/Y_G$  with  $g_{A(G)}^* = i_G \cdot \beta_G^*$ .

Now, let the author explain **BOX 3-3** and **BOX 3-4** for panel data, starting with ‘ $g_A^*$  to  $i/\Delta d$ ’ and ‘ $i = I/Y$  to  $i/\Delta d$ ’ and setting up *four* ‘Technology-Patterns.’

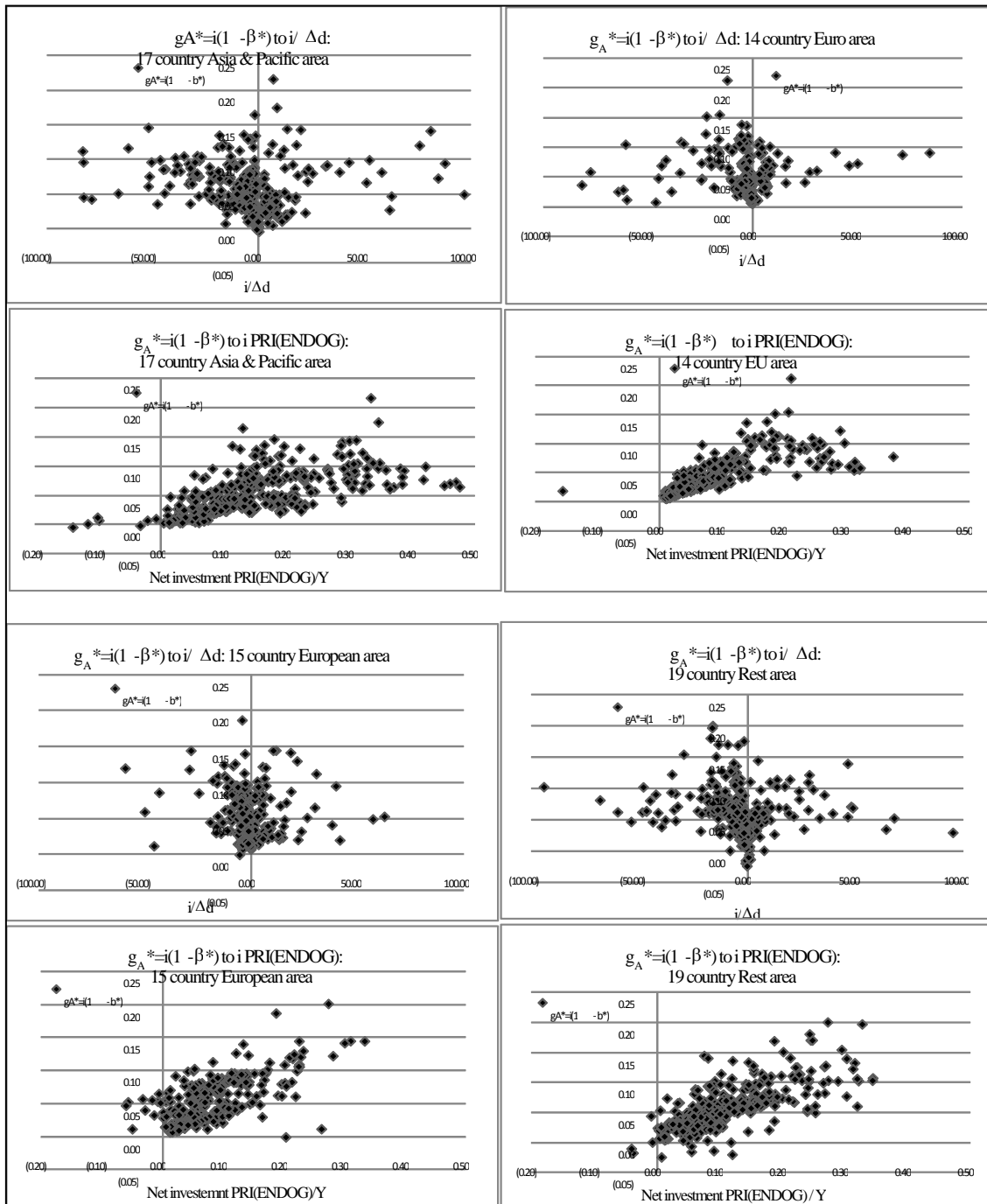
1.  $g_A^*$  to  $i/\Delta d$ : The total economy and the private sector seem to have similar results. On the x axis,  $i/\Delta d$ , is widely scattered but mostly below zero under deficit by country. Contrarily, the government sector contrasts the total economy and the private sector in that the closer to minus zero the  $i/\Delta d$  the wider the range of  $g_A^*$  is. It implies; results of fiscal policy differ significantly by country and at the government sector. For example, the same amount of net investment results in high  $g_A^*$  at one country while it results in low  $g_A^*$  at the other country and, differently by year. This fact asserts the importance of dynamic balance between the government and private sectors.
2.  $i = I/Y$  to  $i/\Delta d$ : Results of ‘ $i = I/Y$  to  $i/\Delta d$ ’ wholly contrast results of ‘ $g_A^*$  to  $i/\Delta d$ .’ Results of ‘ $i = I/Y$  to  $i/\Delta d$ ’ in the government sector completely differ from the total economy and the private sector: The government sector cannot raise net investment highly or net investment in the government sector must be enough low within a certain range so as to maintain a moderate range of the endogenous-equilibrium by country. Despite, ‘ $i = I/Y$  to  $i/\Delta d$ ’ at the total economy and the private sector spreads much wider by country and by year. Most countries show deficit so that  $i/\Delta d$  spreads at a wide minus range. The total economy and the private sector apparently show similar results. Suppose the ‘ $i_{PRI/Y} = I_{PRI}/Y$  to the  $i_{PRI}/\Delta d$ ’ at the private sector by country. The private sector shows results much more severely than those at the total economy. This is a condensed fact. Unbalanced situations appear most delicately at the private sector by country.

Next, let the author combine two ideas: the idea of ‘ $g_A^*$  to  $i/\Delta d$ ’ with the idea of ‘ $i = I/Y$  to  $i/\Delta d$ .’ In this case,  $i/\Delta d$  is common to the two ideas and the difference between  $g_A^*$  and  $i = I/Y$  is seemingly vague, since  $i = I/Y$  is independent of  $g_A^*$ . Let the author replace  $i/\Delta d$  by  $g_A^*$ . Then, **BOX 3-3** and **BOX 3-4** are set up each for the total economy and the government sector, where  $g_A^*$  commonly stands at the y axis,

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stressing the work of  $1 - \beta^*$ . The difference between  $g_A^*$  and  $i = I/Y$  comes from the difference of net investment qualitative coefficient,  $1 - \beta^*$ .

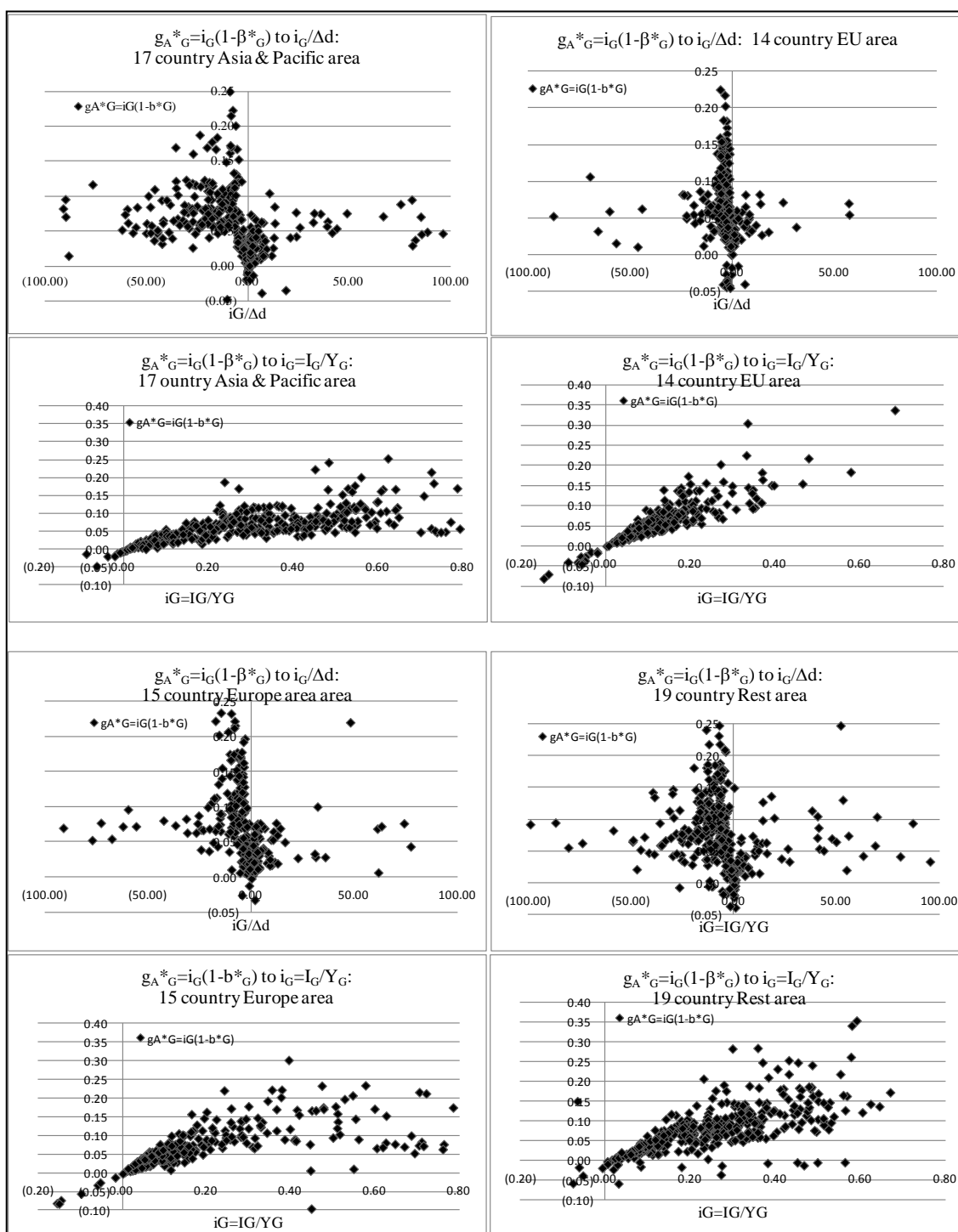
**BOX 3-3** The rate of technological progress to the net investment/ deficit and also, to the private net investment/output; at the total economy average by area



**Data source:** KEWT 6.12-1, -2, -3, and -4, by country and sector, 1990-2010, whose original data are from *International Financial Statistics Yearbook*, IMF

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**BOX 3-4** Government rate of technological progress to Government net investment/deficit and also, to the G net investment to the G output; at the G sector average by area



**Data source:** KEWT 6.12-1, -2, -3, and -4, by country and sector, 1990-2010, whose original data are from *International Financial Statistics Yearbook*, IMF

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Nevertheless, apart from logic, compare the trend of  $g_A^*$  with the trend of  $i = I/Y$  by country over years. The trend of  $g_A^*$  are invaluable and overlaps the trend of sustainable growth of an economy. Suppose that the net investment qualitative coefficient,  $1 - \beta^*$ , is constant for the last twenty years. Then, the trend of  $g_A^*$  each overlap the trend of  $i = I/Y$ ; there is no difference of the trend between  $g_A^*$  and  $i = I/Y$  by country over years. It confirms that each situation by country and by year holds under the endogenous-equilibrium.

The literature starts with the situation under the price-equilibrium; using constant propensity to consume and/or constant propensity to invest over years by country and, apart from any rate of technological progress. BOX 3-3 contrarily presents the difference between  $g_A^*$  and  $i/\Delta d$  by area. Most countries quickly recover a moderate range of the endogenous-equilibrium. It implies; most countries are rather stable in technological progress over years, except for some countries.

Let the author set up *four* Technology-Patterns and classify it by sustainable technology and net investment, by using 2007-2008 data.

### Four Technology-Patterns by country

Technology-Pattern 1. $g_A^*$ <i>up</i> and $i = I/Y$ <i>down</i> :	Robust in sustainability; Germany, Japan, Korea.
Technology-Pattern 2. $g_A^*$ <i>flat</i> and $i = I/Y$ <i>flat</i> :	Stable in sustainability; Norway, Sweden, Brazil, China.
Technology-Pattern 3. $g_A^*$ <i>down</i> and $i = I/Y$ <i>up</i> :	Increasing risk to bubbles from sustainability; France, Greece, Spain, Iceland, Turkey, Russia.
Technology-Pattern 4. $g_A^*$ <i>down</i> and $i = I/Y$ <i>down</i> :	Weak in sustainability; Ireland, Italy, the UK, the US, Mexico.

There is no exception, from 2008 to 2010, all the countries stay at the above Technology-pattern 4. It implies; deficit-rescue to financial institutions or enterprises does not strengthen economic sustainability and remains the shift of income distribution. Moreover, huge deficit makes the 'real' cost of capital minus and, each government neutralizes deficit by the minus cost of capital (here 'real' as nominal rate less endogenous inflation rate; see Fisher, Irving. (1907, 87-116). This is related to the break-even point of deficit, as will be discussed in Chapter 4. All the countries suffer from the unbalance between the rate of technological progress and the ratio of net investment to output. Each shape and angle of sub-figures found at BOX 3-3 and BOX 3-4 differ significantly by area. The scale unit of  $g_A^*$  is set the same by sub-figures on the y axis. Results of fiscal policy

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by country are all condensed and, the differences lying between BOX 3-3 and BOX 3-4 are much more obvious by sub-figures, reflecting differences of fiscal policy. Author's interpretation is summarized as follows:

1. The real assets-side is not so much bad as the market is afraid of. Yet, once the ten year debt yield by country rises due to some symptoms, the real assets-side is influenced significantly.
2. Bubbles are foreseen at the real assets-side by year, as shown by Technology-pattern 3. When net investment rises, policy-makers must pay attention to the trend and take actions as soon as possible. Then, the market will be stabilized. Look at the trends of net investment after 2002. All the countries fall into Technology-pattern 3. It implies that the current situations in the world are unavoidable after 2008. Causes and results simultaneously occur always by country.
3. Net investment is a fundamental key for having a range of the endogenous-equilibrium dynamically balanced. Net investment effectively realizes maximum returns with minimum net investment and is delicate, following the rate of return hyperbola to net investment. This causes bubbles so that anyone cannot blame bubbles. Bubbles are foreseen and should be within the controllability of policy-makers or under a moderate equilibrium.
4. Finally, watch the trends of technological progress. A typical case is Japan after 2002. Japan is the worst country in that deficit by year has been accumulated without thinking of the next generations. The sustainability is the worst in that the growth rate of output will be close to zero forever, unless deficit reduces tremendously by year. One definite cause comes from group-oriented mind of people, some government officers, and enterprises that are indifferent of unborn descendants. Nevertheless, look at the zigzag up and down trends of  $g_A^*$  after 2002. It implies; the private sector endeavors to challenge for innovation through precise manufacturing and other industries, even under minus net investment at the private sector.

In short, any country has its hopeful future when the endogenous are utilized to policy-makers. Needless to say, leaders' philosophy and decision-making by country should not be selfish but think of others, under democratic system and even at any political system. This is an only way for human to universally survive. Matching econometrics has similarly proved the right direction.

### 3.5 Endogenous Policy Rules to Support the Golden Rule of the EMU

This section discusses three sorts of pattern classification using net investment to deficit/surplus,  $i/\Delta d$ . These patterns endogenously show the qualitative level of fiscal policy activities. Particularly the author is interested in setting up a new definition of the

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‘shock of  $i/\Delta d$ ’ or G-PRI Shock-Patterns. These classifications are: (1) G-PRI Fiscal-Stages, (2) G-PRI Policy Balances, and (3) G-PRI Shock-Patterns.

Let the author revisit the results of fiscal analysis by country and seek policy-oriented endogenous rules to reinforce the 3% golden rule of the EMU (for figures, see below soon). Balassone and Franco (207-229, 2000), for the golden rule, compares three types with the ‘stylized version’ of the EMU fiscal constitution. The stylized version is shown by  $\Delta D/GDP \leq 0.03$ , and  $\Delta D/GDP \in (0.00, 0.01)$ . This stylized version is consistent with author’s  $\Delta d = \Delta D/Y$ , once the version is reinforced by policy-supporting rules. The three types are; i) Modigliani et al (1998), ii) the German model, and iii) the UK model. The three types each compare  $\Delta D/GDP$  with gross or net investment to  $GDP$ , which corresponds with author’s  $i = I/Y$ , in the case that uses net investment after deducting capital consumption. The stylized version seemingly treats ‘deficit to  $GDP$ ’ and ‘net investment to  $GDP$ ,’ similarly to those in the endogenous-equilibrium.

The above stylized version, however, definitely differs from author’s  $i/\Delta d$  as follows: (i) The price-equilibrium *versus* endogenous-equilibrium; (ii) Rival and non-rival together linearly *versus* rival and non-linear under the discrete Cobb-Douglas (C-D) production function; (iii) Actual data *versus* endogenous data; (iv) A closed steady economy (deficit alone) *versus* an open dynamic economy (consistent with the endogenous structure of the balance of payments and deficit); (v) No relationship between causes and effects, where causes are unknown, *versus* two-way simultaneous causes and results. The above three types each show an inequality ( $<$  or  $>$ ). Author’s  $i/\Delta d$  replaces the inequality by  $\Delta d + i$ ;  $\Delta d + i = i - (-\Delta d)$ , where minus deficit is shown by minus and surplus by plus.

**Figures 1, 2, and 3**, for the total economy by country, are shown after the text, using time series (TS) results. **Figures 4, 5, and 6**, for the government sector by country, are similarly shown for comparisons, primarily using government net investment,  $i_G = I_G/Y_G$ . The total economy is mostly expressed by the private sector. For example, in the case of net investment to output in equilibrium,  $i = I/Y$  is close to  $i_{PRI} = I_{PRI}/Y$ . If the government sector sacrifices the total economy, it definitely decreases private net investment, which is known as crowding out. If the government sector promotes the activities of the private sector, it increases private net investment. It is surprising that 81 countries show a variety of endogenous results, 1990-2010. It is difficult to find a similar trend by country among countries. Differences of national taste, preferences, culture, and history influence the propensity to consume and accordingly, saving and net investment, as shown by  $(rho/r)(c)$ . Differences by country essentially come from seven endogenous parameters: three; the ratio of net investment to output, the rate of change in population, and the relative share of capital, and four; the qualitative net investment coefficient, the relative share of capital, the capital-output ratio, and the speed year

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coefficient. Combinations of real, financial, market and the central bank policies follow seven endogenous parameters.

Let the author focus on  $i/\Delta d$  and  $\Delta d + i$  and find fiscal policy rules in the endogenous-equilibrium. **Figures 1 to 3** each show  $i/\Delta d$ ,  $i_{PRI/Y} = I_{PRI}/Y$ , and  $g_A^* = i \cdot \beta^*$  by year, instead of using  $i = I/Y$ . **Figures 4 to 6** each show the government sector, using  $i_G/\Delta d$ ,  $i_G = I_G/Y_G$ , and  $g_{A(G)}^* = i_G \cdot \beta_G^*$  by year. Policy rules are empirically clarified, based on time series data, 1990-2010, by country, for 65=14+15+17+19 countries (for figures, omit 17+19 countries).

Fiscal policy rules are summed up here, comparing deficit and net investment. Broader rules are wholly summed up in Conclusions soon below.

Fiscal policy rules here are classified from deficit to surplus, while shifting from the worst to moderate and extreme equilibriums, as shown using *six* G-PRI Fiscal-Stages:

### Six G-PRI Fiscal Stages

Fiscal-Stage 1	The worst, $i <  \Delta d $ .
Fiscal-Stage 2	$i =  \Delta d $ ; where $i/\Delta d = 1.0$ or $i/surplus = 1.0$ .
Fiscal-Stage 3	Slightly better, $i >  \Delta d $ .
Fiscal-Stage 4	Moderate, $i \gg  \Delta d $ .
Fiscal-Stage 5	Slightly better, $i > surplus$ .
Fiscal-Stage 6	Extreme or too much, $i > surplus$ .

Fiscal-stage 4 is moderate and balanced in terms of controllability for sustainable economy. Too much is not controllable, as shown by Fiscal-stages 1, 2, 5, and 6. The endogenous structure of the balance of payments and deficit is deeply involved in the above six G-PRI Fiscal Stages. Further, the balance of payments differs from deficit in that the balance of payments has its plus and minus moderate range to output and that deficit=zero is the best since growth power is most high and sustainable. This is logical since net investment  $I$  is higher if  $BOP$  stays at a certain range of minus:  $I = S - BOP$  due to  $BOP = S - I$  or  $i = s - bop$  due to  $bop = s - i$ .

Author's policy proposal by area is immediately connected with the above six G-PRI Fiscal Stages. For example, within Euro currency area, modest countries at Fiscal-Stages 2, 3, and 5, particularly Fiscal-stage 3, are eligible to help extreme countries at Fiscal-stages 1 and 6. This realizes sustainable area cooperatively. Money supply, for example, does not guarantee sustainability of Euro area, except for urgent help. Cooperative countries also get merits in that each country easily avoids bubbles, as the

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author stressed already above. In short, plus net investment by country is a necessary and sufficient condition to sustainability common to all the countries.

Next, let the author strictly and empirically inspect Figures 1 to 6. Note that Monograph first inspects empirical results by aspect and chapter by chapter. Look at Figures 1 to 6. Why do many countries show their own endogenous results under the same policy-oriented logics and rules? The author answers this question from three viewpoints: (1) Summary of the rate of technological progress,  $g_A^*$ , and the ratio of net investment to deficit,  $i/\Delta d$ , (2) The Shape of the shock of  $i/\Delta d$ , and (3) The G-PRI Policy Balances, between government (G) and private (PRI) policy activities. (3) is most policy-oriented and, the author thoroughly discuss the balances between G and PRI at Chapters 12 and 13 later. (3) is preliminarily illustrated below using *three* G-PRI Policy Balances and *five* G-PRI Shock-Patterns.

### (1) Summary of $g_A^*$ and $i/\Delta d$

$g_A^*$ :  $g_A^*$  differs by country and by sector (G and PRI) significantly. The level of  $g_A^*$  is judged by a fact that  $g_A^*$  is stable under a low levels of net investments,  $i$ ,  $i_G$ , and  $i_{PRI}$ . The rule of  $r_{MAX}^*$  and  $i_{MIN}$  is an ideal target of the endogenous system. This ideal is most severe and only realized under a minimum level of net investment by sector. Most policy-makers, however, stay at a high level of net investment comfortably: the higher net investment the more stable their positions and votes are. Some people welcome bubbles while other not welcome bubbles. Underlying cause comes from the spirit of people rather than statesmen. In this sense,  $i/\Delta d$  is another expression of people's spirituality by country.

### (2) The Shape of the shock of $i/\Delta d$

1. The Shape usually stands at minus. Sometimes, the shock turns to plus. It implies; after a sudden improvement/reduction of deficit, the level of extremely low level of deficit turns to extremely low level of surplus. Therefore, this occurrence is a good sign to strengthen the trend of  $g_A^*$ .
2. There are a few exceptional countries that there have been no shock of  $i/\Delta d$ . It implies; policy-making is not stubborn but strict so as to have  $g_A^*$  steady for many years.

### (3) The G-PRI Policy Balances, between G and PRI policy activities

There are three sorts of G-PRI Balances, between G and PRI policy activities. The G-PRI Policy Balances implicitly include two balances of (i) the balance of payments and (ii) the deficit or surplus. The purpose of Monograph is always directed towards dynamic balances existing between G and PRI plan-do-see policy executions. The author deepens the essence of the balances wholly at Chapters 12 and 13.



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### Three G-PRI Policy Balances

**Balance N:** Negative. Most of 81 countries now suffer from this situation under the pressure of voting and cash scattering, far from long-sighted.

**Balance C:** Cooperative and compatible between two sectors; fortunately within a range of long-sighted.

**Balance I:** Ideal. When deficit=0, the balance is most welcome. This was proved by Samuelson (1942). Chapter 12 and 13 focus this proof theoretically and empirically.

Also, there are *five* G-PRI Shock-Patterns using two sign combination of  $i/\Delta d$ ; (+·+), (—·—), (+·—), (—·+), and (no shock). The first sign indicates G and the second sign, PRI. Each country, 1990-2010, is classified soon below:

The G-PRI Shock-Patterns work most dynamically. The patterns show typical results executed by policy-makers by country. Dynamic efforts done by some policy-makers are intuitively beyond description, even apart from endogenous results. Figures 1 to 6 clarify that the 3% rule has worked as a good rule. The endogenous system clarifies that the 3% rule was given fortunately without theoretical proof. The market principle and the 3% rule become solid and are justified theoretically and empirically by the existence of the endogenous system. The seed was already sowed in 1942 by Samuelson (for the essence, jump to Chapters 12 and 13).

### Five G-PRI Shock-Patterns by country

(+·+): Euro area average, Finland, Luxemburg; Iceland, Sweden, the UK, Bulgaria, Russia, Ukraine; Bangladesh, Canada, China, New Zealand, (Sri Lanka), Philippines, (Thailand); Chile, Colombia, Peru, Iran, (Kazakhstan), South Africa, Tanzania.

(—·—): Austria, Germany, Netherlands, Slovak, Slovenia; Denmark, Norway, Switzerland, Czech Republic, Hungary, Poland, Romania, Turkey; the US, Mexico, Australia, India, Indonesia, Singapore, Thailand, Vietnam; Argentina, Brazil, (Iran), Kazakhstan, Pakistan, Algeria, Morocco, Saudi Arabia, Nigeria.

(+·—): Belgium, Spain; (Japan).

(—·+): France, Ireland, Italy, Portugal; 15 Europe average, Latvia, Ukraine; 17 Asia & Pacific average, Sri Lanka, Korea; Paraguay, Kenya.

(No shock): Some countries have no shock but only for some periods, not for the last 21 years throughout.

## 3.6 Conclusions: Ten Endogenous Facts and Fiscal Policy Rules

The 3% to *GDP* rule was consented empirically twenty years ago. Nevertheless the 3% rule is influential like a constitution by country even today; without theoretical proof for i) net investment to output, ii) the 3% to output, and iii) the growth rate of output. One reason is that the 3% to *GDP* is a result that matches the theory inherent in the

## **Ratio of Positive Net Investment to Deficit Required for the Reinforcement of the 3% Golden Rule**

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endogenous-equilibrium. The constitution will last when the golden rule is reinforced by 'plus net investment' or 'gross investment > depreciation' by country and by year, as proved endogenously and empirically in this chapter. Therefore, each country, with its people, is able to grow sustainably and in harmony of national taste, culture, and history, even under the current globalized world economies. Severe one-sided decrease in deficit without this reinforcement does not successfully make the 3% golden rule enjoyable.

The current financial world crisis will definitely be mitigated when policy-makers and leaders execute to shift actual data closer to the corresponding endogenous data. Read the following ten paragraphs for endogenous facts, while watching Figures 1 to 6 by country at the end. This chapter stresses a fact that even under the same common endogenous logics/rules, each country and its G and PRI sectors each express different endogenous results partly depending on different national taste, culture, and history. One is unable to examine this fact when individual utility function is vaguely used based on the micro level. This fact is consistent with another fact that specified real-assets characters by country are brightly harmonized with the market principle under the current globalization.

### Ten facts endogenously found

1. The endogenous data by country have surprisingly digested close-to-disequilibrium and disequilibrium experiences. The current financial crisis is not so much grave compared with those disequilibrium experiences of many countries for the last 21 years. The close-to-disequilibrium is originally measured by the speed years for convergence by country and sector but, similarly and simultaneously by the ratio of net investment (after economic consumption) to output in equilibrium and more rigidly by the ratio of private net investment to output, as shown in this chapter.
2. Basically, an economy at the real assets and with the G and PRI sectors is dynamic and sustainable. The market and financial assets are too much sensitive to the current circumstances and future forecasting under the general static equilibrium. Policy-makers must be more relaxed, free from sticking to market reactions too much. This chapter is generous to sensitive market reactions as long as the endogenous system works. Market reactions are indispensable since decision-making is done by human who is by nature greedy for money.
3. The tie to connect the real assets and the financial assets is the neutrality of the financial assets to the real assets, as proved earlier. The endogenous fact of the neutrality is stably proved and strengthened by the current KEWT 6.12 data-sets, 1990-2010, by sector, for 81 countries, as shown in this chapter.
4. This chapter primarily compares data-sets of 14 Euro currency countries with those of 15 non-Euro countries in Europe, also paying attention to the characteristics of 65

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countries for four areas. There are common endogenous logics/rules, whose results appear differently by country. The data-sets of 16 (=81–65) countries show insufficient levels of statistics so that the author will continue to observe the 16 country data for coming few years, watching IMF statistics data.

5. Each country has shown dynamic and balanced movements by year and has never repeated the same results for the last 21 years. Yet, the actual statistics data are always within a certain range of the corresponding endogenous data. This endogenous fact indicates that an economy -- by sector; the total economy, the government sector, and the private sector -- is able to recover by country.
6. The endogenous data simultaneously show causes and results. The causes are clarified by the seven endogenous parameters, where three parameters are constant by year: net investment to output, the rate of change in population, and government net investment to government output as the size of government. When policy-makers are able to control seven endogenous parameters, each country attains its sustainable and robust economy, no more repeating bubbles.
7. The key that directly controls fiscal policy is the ratio of net investment to deficit,  $i/\Delta d$ , which is based on the endogenous structure of the balance of payments and deficit in an open economy. This chapter presents *six* G-PRI Fiscal Stages; *three* G-PRI Balances; and *five* G-PRI Shock Patterns, each using  $i/\Delta d$ . Endogenous equation and its hyperbola are policy-oriented at the endogenous system and, are fitted for any social and accounting system. A condition to sustainable growth is that net investment must be above zero. The zero is immeasurable at any system and shown by the vertical asymptote and/or horizontal asymptote at the endogenous system. Instead of asymptotes, a close-to-zero point is measured, which appears as 'a shock' due to its large divisional magnitude (think of a case of division whose denominator is close-to-zero). When the point of close-to-zero slightly moves to a moderate point, for example, the optimum equilibrium of the rate of return appears. The optimum point implies that the maximum rate of return and accordingly, the maximum growth rates of output and per capita output realize, with the minimum net investment. In the case of the parabolic equation, a similar maximum or minimum is estimated yet, without specifying any quadrant at the plain, as shown in the literature. Almost all the countries have often realized high net investment periods but, this fact is endogenously incorrect. A definite endogenous fact is that growth and returns are maximized at the point of zero deficits, but this point is not measured so that a low/minimum plus net investment becomes a target of various fiscal policies. An extremely high level of net investment indicates a symptom of bubbles.
8. An economy is sustainable and robust when the government and private sectors are well balanced and moderate in equilibrium. This endogenous fact is that it is risky when policy-makers cannot control dynamic balances between government and private

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sectors (i.e., G-PRI Policy Balances). This is partly because infrastructure by government is apt to be huge for several years and results in the sacrifice of the private sector. In this aspect, the private net investment must be observed wholly, as shown in Figs. 1 to 6 by country.

9. Bubbles often occur when net investment becomes rise up. However, the qualitative net investment coefficient,  $1 - \beta^*$ , differs significantly by country and over years. Watch the trend of  $1 - \beta^*$ .  $1 - \beta^*$  contains essential elements wholly at the endogenous system and reflects the results of policies by year, sector, and over years. The ‘rival’ capital and labor and ‘non-rival’ education, R & D, human capital, and environment, are wholly integrated. Sustainable growth and returns are primarily managed by  $\beta^*$  or  $1 - \beta^*$ , and a plus low net investment is its direct partner and increases its environmental and energy-saving share over years in the last 21 years. Also, sustainable growth and returns are primarily controlled by the endogenous Phelps coefficient,  $\alpha/(i \cdot \beta^*)$ :  $r_0 = r^* = (\alpha/i \cdot \beta^*)g_Y^*$ . This is related to the cost of capital, as discussed in Chapter 5.
10. Typical actual results of an unbalanced close-to-disequilibrium economy are unstable unemployment and vicious inflation/deflation circles. These given results come from the unbalance between macro demand and supply, but nobody knows true causes that come from the real assets. The rate of return hyperbola has the horizontal asymptote and the hyperbolic curve. The rate of inflation or deflation is the differences between the rate of return and its horizontal asymptote. If this hyperbola reaches a moderate range of endogenous equilibrium, seven endogenous parameters are all controllable and thus, the rate of inflation is stably low under full-employment. When actual data approaches endogenous results, full-employment and a low rate of inflation are in reality.

In short, ‘the methodology used in the endogenous system produces tasty fruits through a universal level of decision-making and its execution.’ This statement guarantees a hypothesis that democracy is in harmony with human economic life and society, supported by the neutrality of the financial assets to the real assets at the SNA. The author proves that independent and separated policies of the real/fiscal, financial/market, and central bank functions are integrated wholly and endogenously by country and all over the world. This is a sustainable way not only to recover the reliance on the markets and the market principle but also to construct a new way to realize harmonious fiscal, economic, environmental, and democratic society; to people, for people, and by people and citizens, with peace in mind and, without fighting.

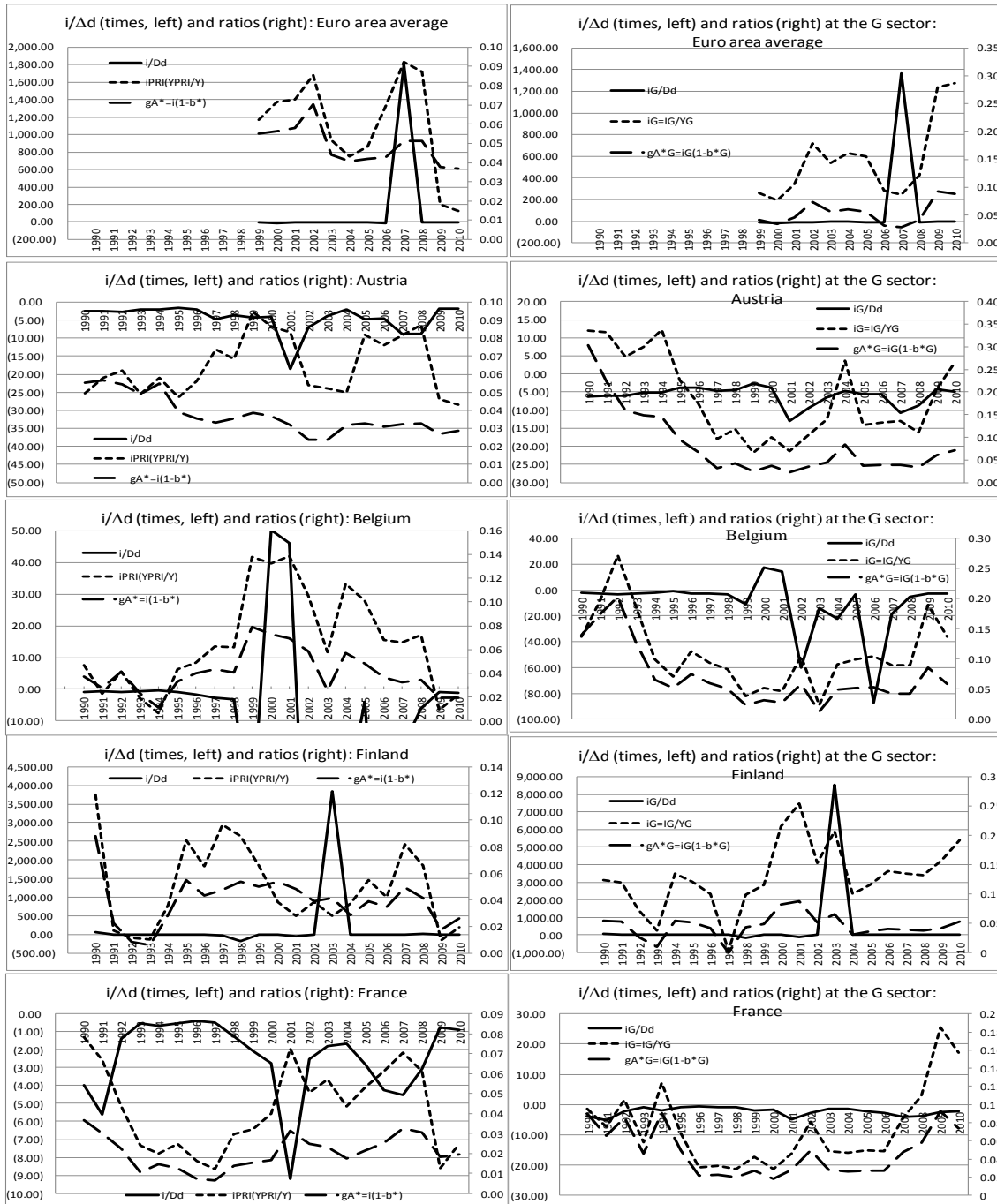
Deficit should be reduced for a guarantee of an optimum/maximum level of the growth rate of per capita output and, this is only possible through consecutive

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technological progress coupled with a plus net investment by country. One key,  $i/\Delta d$  or  $i - \Delta d$  in equilibrium, where  $i = I/Y$  is the ratio of net investment to output and,  $\Delta d = \Delta D/Y$  is the ratio of deficit to output, is one proposal in this chapter while the literature is unable to subtract deficit from net investment in equilibrium.  $i/\Delta d$  equals net investment divided by deficit after reduction by reduction and clarifies the current Fiscal-stage among six G-PRI Fiscal Stages, for a country to approach sustainable, modest, and balanced equilibrium between actual and endogenous data and between government and private sectors; as shown empirically using 65 country endogenous data, 1990-2010. *Four* Technology-Patterns clarify the priority between stable technological progress and fluctuating net investment over years. Policy-makers are able to watch whether or not the current Technology-pattern is controllable, stepping into *five* G-PRI Shock-Patterns of  $i/\Delta d$  by sector. In short, the endogenous rate of technological progress,  $g_A^* = i(1 - \beta^*)$ , is a key to economic sustainability by country and is deeply involved in  $i/\Delta d$  or  $i - \Delta d$ . This is an answer to the compatibility between increase in taxes and sustainable growth.

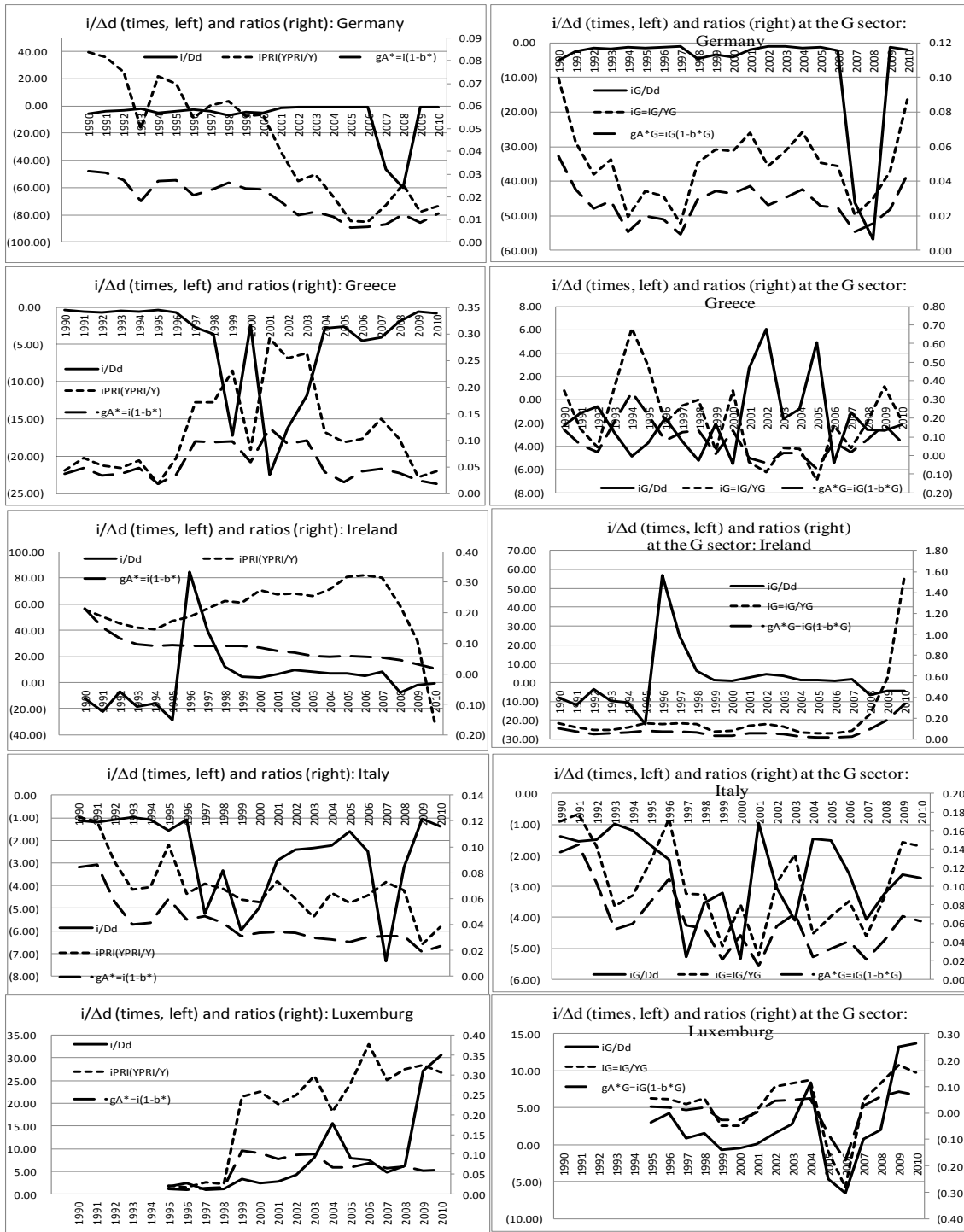
# Ratio of Positive Net Investment to Deficit Required for the Reinforcement of the 3% Golden Rule



**Data source:** KEWT 6.12-2, by country and sector, 1990-2010, whose original data are from *International Financial Statistics Yearbook*, IMF

**Figure 1** Deficit, net investment, and the rate of technology, at the total economy and the G sector, 1990-2010: 14 country Euro area average; Austria; Belgium; Finland; France

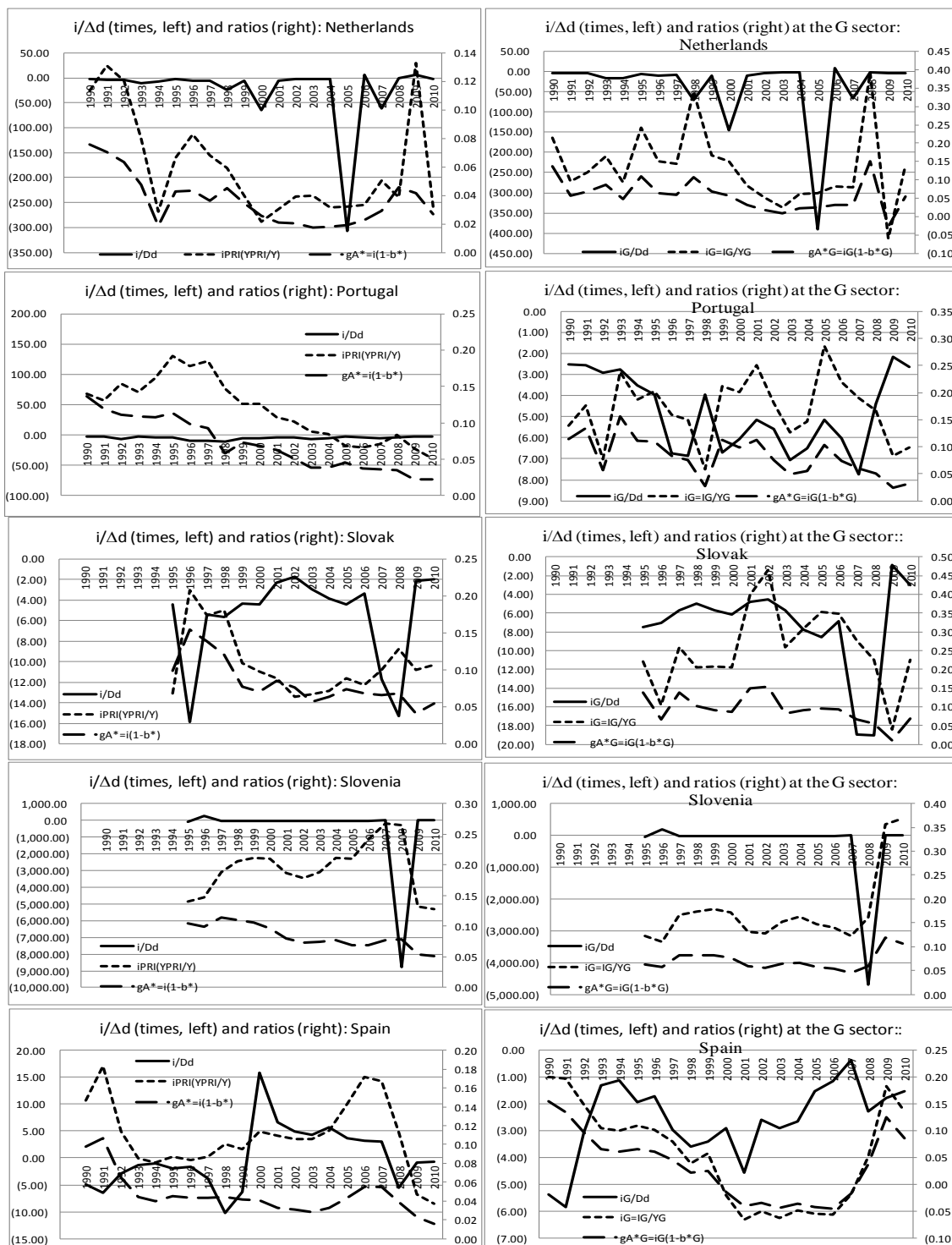
# Chapter 3



**Data source:** KEWT 6.12-2, by country and sector, 1990-2010, whose original data are from *International Financial Statistics Yearbook*, IMF

**Figure 2** Deficit, net investment, and the rate of technology, at the total economy and the G sector, 1990-2010; Germany; Greece; Ireland; Italy; Luxemburg

## Ratio of Positive Net Investment to Deficit Required for the Reinforcement of the 3% Golden Rule

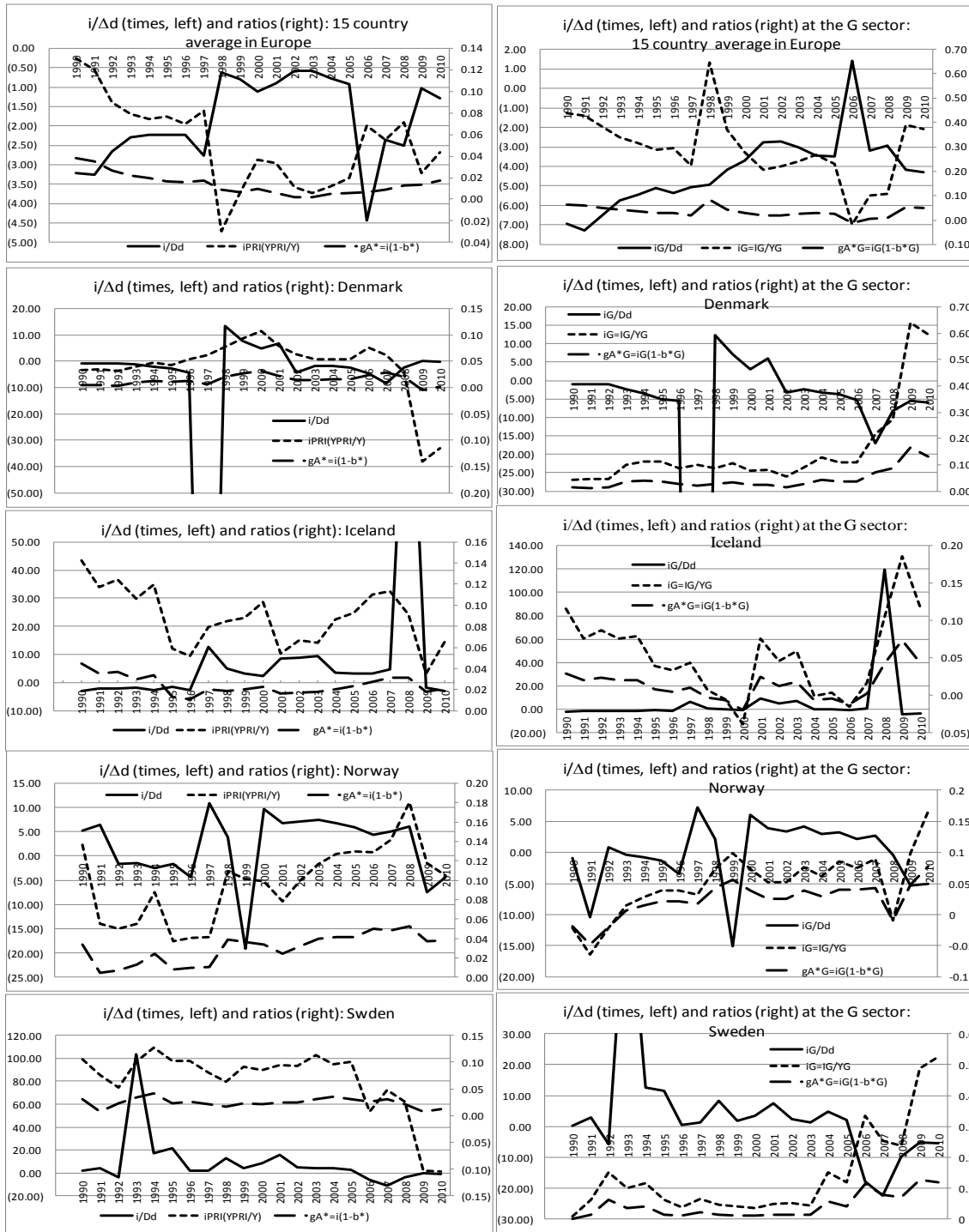


**Data source:** KEWT 6.12-2, by country and sector, 1990-2010, whose original data are from *International Financial Statistics Yearbook*, IMF

**Figure 3** Deficit, net investment, and the rate of technology, at the total economy and the G sector, 1990-2010: Netherlands; Portugal; Slovak; Slovenia; Spain



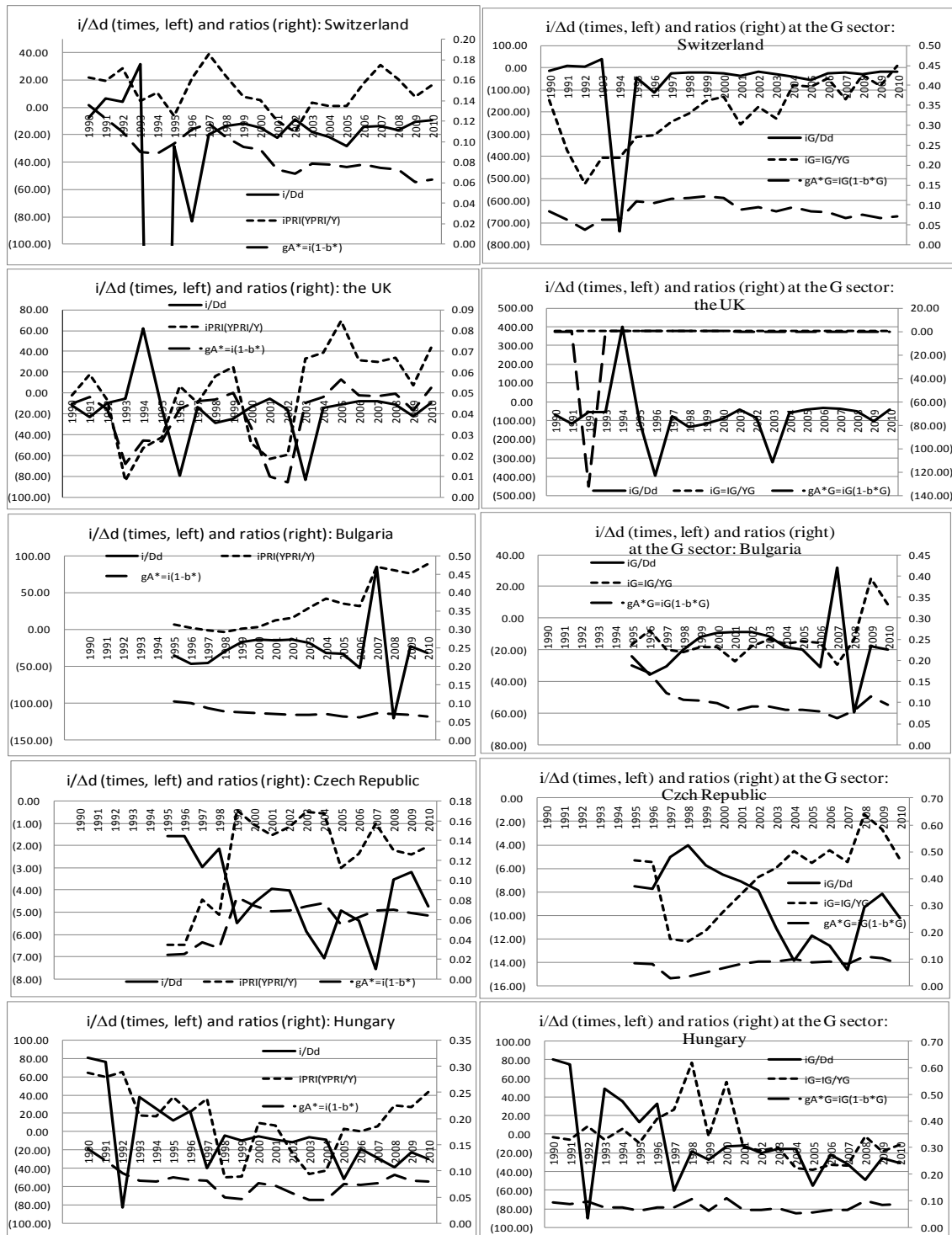
# Chapter 3



Data source: KEWT 6.12-3, by country and sector, 1990-2010, whose original data are from *International Financial Statistics Yearbook*, IMF

**Figure 4** Deficit, net investment, and the rate of technology, at the total economy and the G sector, 1990-2010: 15 country average in Europe; Denmark; Iceland; Norway; Sweden

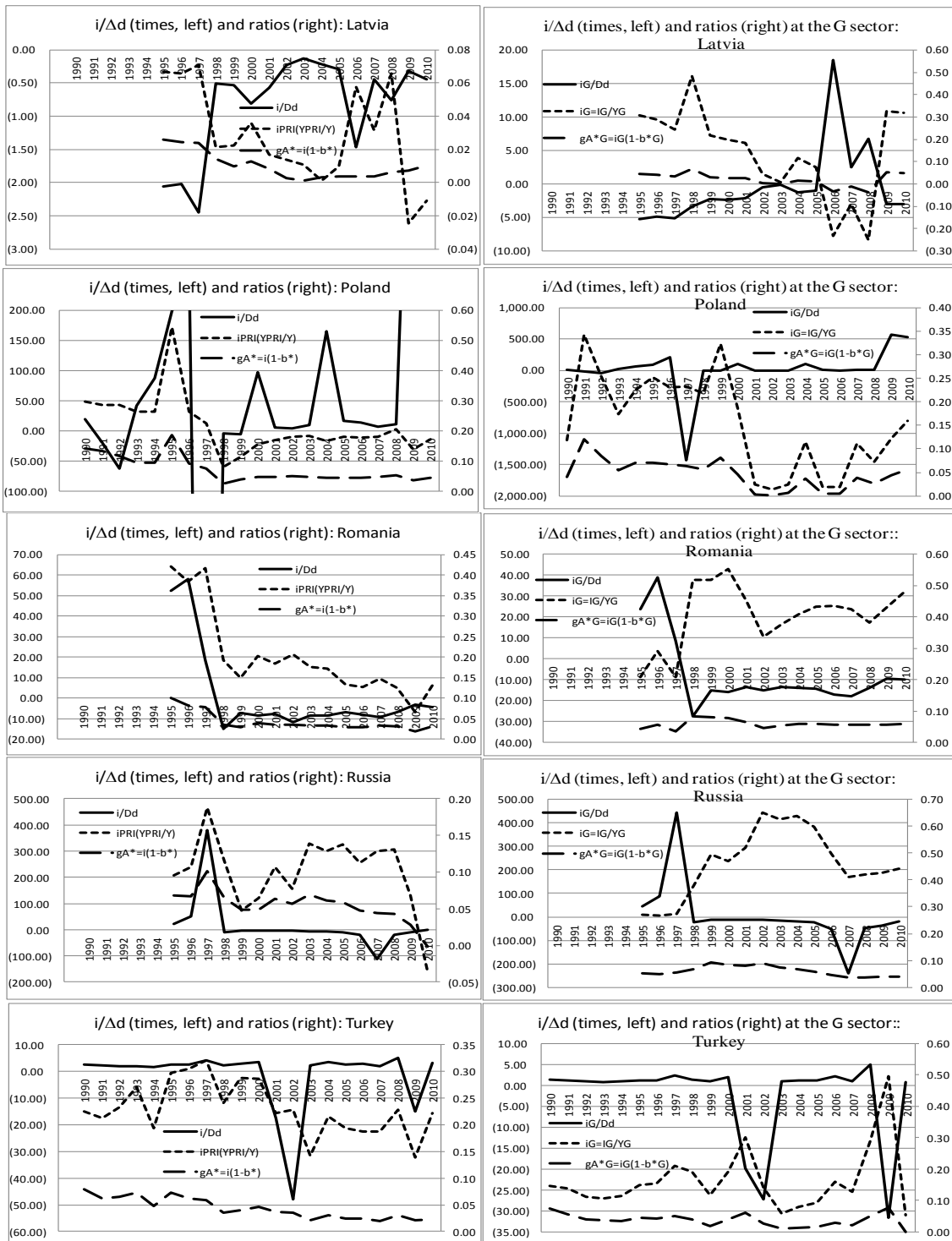
## Ratio of Positive Net Investment to Deficit Required for the Reinforcement of the 3% Golden Rule



Data source: KEWT 6.12-3, by country and sector, 1990-2010, whose original data are from *International Financial Statistics Yearbook*, IMF

**Figure 5** Deficit, net investment, and the rate of technology, at the total economy and the G sector, 1990-2010: Switzerland; the UK; Bulgaria; Czech Republic; Hungary

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Data source: KEWT 6.12-3, by country and sector, 1990-2010, whose original data are from *International Financial Statistics Yearbook*, IMF

**Figure 6** Deficit, net investment, and the rate of technology, at the total economy and the G sector, 1990-2010: Latvia; Poland; Romania; Russia; Turkey

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