Structural and Cyclical Movements of the Current Account in the U.S. : 1976-2007

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Abstract

The purpose of this study is to analyze fluctuations in the current account of the U.S. by deconstructing structural and nonstructural components with a new method. At the beginning of the 1980s, most components of the U.S. current account were structural. After the Plaza agreement in 1985, the U.S structural current account gradually improved. Since the end of the 1990s, the structural current account deficit increased to nearly 3% of GDP. These movements are generally associated with the structural components of private savings and residential investments. The upheaval in the US sub-prime home-loan market since 2007 sharply contracted housing investment and weakened consumption. Some simulations explored herein suggest a high possibility that these dynamics in domestic demand may considerably ameliorate the external imbalances of the U.S. and deteriorate of the dollar.

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1. Introduction

The U.S. current account was roughly in balance throughout the late 1970s. However, it underwent a large and sustained deterioration in the first half of the 1980s, reaching a peak deficit of 3.4% of GDP in 1987. The deterioration process was reversed by a sharp fall in the dollar during the second half of the decade. Thanks to the payments resulting from the Gulf War in 1991, the current account balance managed to return a tiny surplus that year. Since the 1990s, however, The United States has been experiencing large and persistent current account deficits. By 2000, these deficits had reached nearly 4 percent of GDP. When the U.S. was still an emerging market in the late nineteenth century, its deficits never were more than 4% of GDP[1]. In 2006, the current account deficit reached $800 billion, almost 7 percent of U.S. GDP and more than doubles the previous modern record of 3.4 percent in the mid 1980s.

The story seems to have changed since 2006. The current account deficit improved from 6.2% to 5.3% of GDP during 2007. From $810 billion in 2006, it decreased 9.0% to $740 billion in 2007. Despite the improvement, the United States still borrowed more than $2 billion every day in 2007 to finance its deficit. These huge imbalances will eventually prove unsustainable, leading to a slump in the dollar. At this writing, they herald a hard landing for the U.S. economy.

The above problems necessitate answers to pressing questions: To what extent will the U.S. current account deficit continue? What are the structural parts of the U.S. current account? From a policy perspective, a precise understanding of the factors underlying structural and long-term movements in current account is indispensable. Despite their importance, little is actually known about these factors. A deconstruction of current account into structural and cyclical components is not easy to test empirically. Moreover, the test methodology is still an open question.

Awareness of the above issues first took root in Japan during the 1980s as a consequence of serious trade friction with the U.S[2]. Pioneering work has been done by Ueda (1988), who developed a two-country macroeconomic model in which savings and investments determine the current account levels. He estimated the structural or autonomous components of these functions during 1971–1984. Then, he created an equation that relates current account to these components and cyclical variables, concluding that at the beginning of the 1980s most components of Japan's current account were structural. In that period, the U.S. budget deficit was responsible for the structural part of Japan's current account. Fukao (1987), examined the period from 1979Q-(1) to 1984 -Q (4), and applied the following method of analysis. First, savings and investment functions are estimated using GDP and other key variables. Second, full-employment GDPs are substituted into the above estimation, and fitted values are stored. Third, the fitted values (calculated in Step 2) are put into the current account identity to obtain an estimate

[1] This was pointed out by Obstfeld and Taylor (2004)

[2] Kindleberger (1955) originally used the term 'structural imbalances', after which Ichimura (1965) and Kanamori (1965) referred to the terminology. However, no theoretical or empirical study has been done based on the structural and cyclical factors of the current account.

of the full-employment current account. He regarded this estimate as a structural component of current account. Finally, the cyclical component of current account is derived by subtracting the value calculated in Step 3 from the actual current account. At the beginning of the 1980s, most parts of Japan's current account were structural because of government expenditure restraints. Honma et al. (1987) for the period 1970–1983, and Chigira and Takeda (1992) for the period 1980-Q(1)–1990-Q(2), constructed small macro econometric models and concluded that the fluctuations in Japan's current account during the 1980s could be explained by structural factors.

Outside of Japan, empirical studies on this topic are scarce. Debelle and Faruqee (1996) and Chinn and Prasard (2000) examined the short- and long-run determinants of current account using two approaches. The first approach is based on cross-sectional data, which is assumed to reflect long-run or structural factors. The second approach used panel data that affected both structural and cyclical factors. Debelle and Faruqee (1996) used a savings-investment perspective to motivate empirical specification and found that developmental stages and demographics have a significant impact on structural factors. On the other hand, fiscal policy stances, real exchange rate changes and GDP fluctuations are important factors for cyclical current account movements. Chinn and Prasard (2000) estimated current account par GDP as a dependent variable and pointed out the significance of budgetary balance, financial deepening and openness to international trade as medium-term or structural determinants of current account in developing and industrial countries. In these studies, the concepts of the structural current account do not necessarily correspond to the circumstances of an economy with full employment[3].

Clarida and Prendergast (1999) empirically examined movements of G3 current accounts by time series analysis. From 1980-Q(1) to 1997-Q(2), they estimated structural VAR, which is constructed by current account, home and world GDP growth and real exchange rate. Then, they defined the structural component of a country's current account as a projection conditional on past variables equal to their respective long-run means. They concluded that the big surges since 1994 in the U.S current account deficit and since the middle of 1996 in the Japanese current account have been cyclical.

Some central banks have also been concerned with the structural and cyclical movements of external imbalances. Deutsche Bundesbank (2001) decomposed the trade balance into structural and cyclical factors for the 1976–2000 periods. The amount of the trade balance, which they expressed as a nominal import/export ratio, is a function of Germany's GDP, weighted GDP of Germany's trading partners and the terms of trade. Structural and cyclical components are calculated by breaking down each of the equation terms into its trend and cyclical components. Banque de France (2002) examined France's trade balance from 1978 to 2001 using the same formulation as Deutsche Bundesbank (2001)[4].

[3]Kandil and Greene (2002) examined the cyclical factors affecting the U.S. current account and financial account. However, the concept of structural determinants was not considered.

[4]Komiya (1994), Mann (1999), and the Council of Economic Advisers (2000) indicated the significance of structural current account, but they did not investigate empirically.

The European Central Bank performed an analysis on the same concept. Bussière, Fratzscher and Müller (2004) estimated the variables for 33 countries, including the 10 EU member countries, and then derived structural current account positions accordingly. A key finding of their study is that, from an intertemporal perspective, current accounts in most member countries are broadly in line with their structural current account positions. Bracke, Bussiere, Fidora and Straub (2008) separated determinants of global imbalances into structural factors and cyclical factors to present a conceptual framework for analysis. They referred to the notion of imperfect financial globalization, which they regarded as a structural factor.

To some degree, the above studies successfully deconstructed current account into structural and cyclical components, but problems still remain. First, potential GDP may still contain cyclical movements; cyclical parts of current account can become entangled with structural parts. The second problem, which is more essential, is that savings and investment functions are not necessarily derived from optimal problems. Theoretical foundations based on empirical investigations are somewhat fragile. Savings can be defined as the acquisition of future consumption by deferring present consumption. A household 'tightens its belt' today to enjoy higher consumption in the future. Therefore consumption/saving decisions are basically intertemporal. Investment expenditures augment future production by adjusting capital stock. In other words, investment now increases future production possibilities. Like household consumption/saving decisions, investment must be decided optimally by firms over time. In an open economy, current account equals the difference between domestic savings and investment. This identity, 'the savings-investment balance', leads to a more subtle understanding of the mid- and long-term dynamics of current account, because personal savings and investment decisions are essentially intertemporal. Therefore, current account possesses a crucial intertemporal aspect.

After due consideration of the above problems, this study uses an alternative measure to re-examine the causes of the large surpluses in Japan's current account from the mid 1970s to the 1990s. We employ two distinct analytical differences compared to earlier works. First, intertemporal decisions of households and firms are explicitly considered herein. Private savings, residential investment, equipment investment and inventory investment functions are derived from the optimal intertemporal behaviours of individuals. In this study, we redefine 'structural current account' to include parts of the current account explained by the optimal behaviours of individuals in an economy that has full employment[5].

The past decade has produced a large amount of theoretical literature on intertemporal approaches to the current account derived from optimization by forward-looking agents. Obstfeld and Rogoff (1996) offer the most comprehensive framework. Flowing in the same stream as their approach, our study is

[5] As Shinkai (1985) clearly explained, the structural current account should be derived from a micro-structure of agents, such as preferences and technologies, for which an optimization-based econometric framework is indispensable.

based on an individual optimization model, and represents the first attempt to deconstruct the movements of the current account into structural and cyclical components[6].

The second distinctive feature of this study is to incorporate the techniques and recent developments of applied econometrics. From a long-term perspective, the main factor for household decisions is permanent income, that is, expected discount income. Marginal q, which represents the future discount profit rate, is the key element for a firm's investment decisions. These variables are 'hidden' because they include such unobservable elements as the future stream of labour income, profit rates and subjective discount factors. Therefore, to make proxy variables, time series techniques are utilized. As noted earlier in this section, one of the difficulties of previous studies was that measurements of full-employment GDP were often criticized because of measurement error related to production sectors such as productivity, capital, labour and utilization rates. Such errors may contaminate cyclical movements in the calculations of potential GDP. Careful consideration is given to the measurement of full-employment GDP herein, in light of recent studies on this topic.

The contents of the paper are as follows: In Section 2, the basic framework of the analysis is presented. In Section 3, data calculations are summarized. In Section 4, estimation results are shown. In Section 5, the current account is deconstructed into structural and non-structural components, and the determinants of the non-structural parts are examined. Equilibrium real effective exchange rate is also calculated. Conclusions are given in the last section.

2. The Model

This section extends an open economy model developed by Obstfeld and Rogoff (1996) and McKibbin and Sachs (1991). The economy faces world real interest rate and consists of three sectors: households, firms, and government.

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[6]Sheffrin and Woo (1990), Otto (1992), Gosh (1995) and Bergin and Sheffrin (2000) developed the present value model (PVM) to test intertemporal current account models. In PVM, intertemporal consumption decisions are explicitly considered. However, the firm's optimal decisions are not included, and structural and cyclical concepts of current account are deliberated. The methodology of this approach was introduced by Obstfeld and Rogoff (1996), and then Nason and Rogers (2003) summarized the empirical problems of PVM, and Bussière, Fratzscher and Müller (2004) investigated the structural factors on the current account along these lines. There exists another development in international macroeconomics: so called *New Open Economy Macroeconomics*, which emphasizes imperfect competitive markets and sticky price formation. These features are embodied in behaviour, such as pricing to market and pass-through of exchange rate into export and import prices. This new direction is very illuminating; investigation of the structural factors on the current account along these lines seems to be an important task for future research.

2-1 Household

The representative agent has full access to perfect international capital markets and chooses its consumption path so as to maximize its lifetime utility. The utility of the agent in any period is written as an additively separable function of the consumption of non-durable goods (C_s) and housing stock (H_s).

$$E_t \sum_{s=t}^{\infty} \beta^{s-t} U(C_s) \tag{2-1}$$

$$U(C_s) = \theta \log C_s + (1-\theta)\kappa \log H_s \tag{2-2}$$

where

C_s : Real consumption expenditure in period s

H_s : Real housing stock at the end of s

β : Subjective discount rate

κ : Transformation coefficient from housing stock to housing-service flow

E_t : Mathematical expectation operator conditional upon the information set in period t

The constraints are as follows.

$$BH_s + V_s x_s = (1+r_s)BH_{s-1} + (d_s + V_s)x_{s-1} + (1-\tau_{h_s})w_s L_s - p_s^{\,c} C_s - p_s^{\,h} RC_s \tag{2-3}$$

$$RC_s = H_s - (1-\delta_h)H_{s-1} \tag{2-4}$$

$$BH_s = BFH_s + BGH_s \tag{2-5}$$

where

BFH_s : Real foreign assets held by households at the end of s

BGH_s : Real domestic bonds held by households at the end of s

BH_s : Real risk-free assets held by households at the end of s

d_s : Real cash-flow in period s

L_s : Employee in period s

$p_s^{\,c}$: Price index of consumption goods in period s (Deflated by the price index of production goods)

$p_s^{\,h}$: Price index of residential investment goods in period s(Deflated by the price index of

production goods)

r_s : Real world interest rate in period s

RC_s : Real residential investment in period s

V_s : Real equity price in period s

w_s : Real wage rate in period s

x_s : Share of cash-flow owned by household at the end of s

τ_{h_s} : Tax rate on household income in period s

δ_h : Depreciation rate of housing stock

The financial wealth of households includes equity and risk-free assets. Net revenue consists of real financial wealth, plus after-tax labour income, less expenditure on consumption and residential investment. Risk-free assets are defined as domestic government bonds (BGH_s) and foreign private assets (BFH_s).

Maximizing (2-1) with respect to C_s and H_s ,subject to (2-3) and (2-4), gives the following three sets of equations. First, the arbitrage condition, in which households are indifferent to the margin between risk-free assets (domestic assets, foreign assets and government bonds) and domestic equity.

$$1 + r_t = \frac{E_t\left[d_{t+1} + V_{t+1}\right]}{V_t} \tag{2-6}$$

The second equation, which is shown in (2-7), represents the user cost of housing stock. The user cost is the net selling expenditure of purchasing one unit of housing stock at period t and buying it at period t + 1.

$$\mu_t = \left\{ p_t^{\,h} - E_t\left(\frac{1-\delta_h}{1+r_{t+1}} p^{h}{}_{t+1} \right) \right\} \frac{1}{p^{c}{}_{t}} \tag{2-7}$$

The third set of equations indicate the optimal consumption of non-durable goods and the holding of housing stock as shown in (2-8) and (2-9), respectively.

$$C_t = \theta(1-\beta)\left[\left(NHW_t + HW_t\right) / p^{c}{}_{t}\right] \tag{2-8}$$

$$H_t = (1-\theta)\beta\left[\left(NHW_{t-1} + HW_{t-1}\right) / p^{c}{}_{t-1}\mu_{t-1}\right] \tag{2-9}$$

$$NHW_t = (1+r_t)BH_t + \left(d_t + V_t\right)x_t + p^{h}{}_{t}(1-\delta_h)H_{t-1} \tag{2-10}$$

$$HW_t = E_t\left\{\sum_{s=t}^{\infty}\left(\frac{1}{1+r_s}\right)^{s-t}\left((1-\tau_{hs})w_s L_s\right)\right\} \tag{2-11}$$

The solution for the consumption of non-durable goods (2-8) is a familiar life-cycle permanent income (LCY-PIH) model, i.e. a function of real wealth, which comprises non-human wealth (NHW_t) and human wealth (HW_t). Non-human wealth in this model, shown in (2-10), consists of risk-free assets (foreign assets and government bonds), equity and housing stock. Equation (2-11) represents human wealth, which is the future discount stream of after-tax labour income (so-called permanent income). The optimal holding of housing stock shown in (2-9) is similar to the consumption decision of non-durable goods. The difference is that permanent income is adjusted by the user cost of housing stock specified in (2-7). If the purchasing cost is relatively high compared to buying gains, the user cost increases and permanent income adjusted by the user cost will decline and the consumption of housing stock will be restrained. Then optimal holding of housing stock for households depends on expected lifetime resources, defined as the sum of initial real non-human wealth and present discount value of future expected income adjusted by the user cost of housing stock.

2-2 Firm

A representative firm maximizes its total wealth, which consists of present discount value of current and future cash flow as shown in Equation (2-12).

$$W_t = d_t + V_t = E_t\sum_{s=t}^{\infty}\left(\frac{1}{1+r_s}\right)^{s-t} d_s \tag{2-12}$$

$$d_s = (1-\tau_{Fs})(Y_s - w_s L_s) - p^I{}_s I_s - p^z{}_s IV_t \tag{2-13}$$

$$Y_s = F(K_s, L_s) - GI(K_s, I_s) - GIV(IV_s, HV_s) \tag{2-14}$$

$$F(K_s, L_s) = A_s K_s{}^{\gamma} L_s{}^{1-\gamma} \qquad A_s > 0 \tag{2-15}$$

$$GI(K_s, I_s) = \frac{\varphi}{2}\left(\frac{I_s{}^2}{K_s}\right) \qquad \varphi > 0 \tag{2-16}$$

$$GIV(IV_s, HV_s) = \frac{\phi_0}{2} IV_s^2 + \frac{\phi_1}{2} HV_s^2 \qquad \phi_0 > 0, \phi_1 > 0 \tag{2-17}$$

$$K_s = (1 - \delta_F) K_{s-1} + I_s \tag{2-18}$$

$$HV_s = HV_{s-1} + IV_s \tag{2-19}$$

where

A_s : Productivity in period s

d_s : Dividends in period s

$F(.)$: Production function

$GI(.)$: Adjustment cost in the equipment investment

$GIV(.)$: Adjustment cost in the inventory investment

HV_s : Real inventory stock at the end of period s

I_s : Real equipment investment in period s

IV_s : Real inventory investment in period s

K_s : Real capital stock at the end of period s

p_s^I : Price index of investments goods in period s (Deflated by the price index of production goods)

p_s^Z : Price index of inventory investment in period s (Deflated by the price index of production goods)

W_t : Real corporate total wealth at the of t

Y_s : Real total sales in period s

δ_F : Depreciation rate of capital stock

τ_{Fs} : Tax rate on corporate profits in period s

The representative firm chooses the optimal level of equipment and inventory investment, as well as the inputs and production, so that the value of the firm can be maximized. The value of the firm is defined as a discounted sum of future dividends. Dividends in period s consists of

After-tax corporate income less equipment and inventory investment expenditures. The firm faces adjustment costs in equipment investment, $G(K_s, I_s)$, changes its capital stock and faces adjustment costs in inventory investment, $GIV(IV_s, HV_s)$ .he firm then chooses optimal levels for equipment investment, inventory investment and current input and production to maximize its value[7]. Maximizing

[7]Real total sales are defined as the subtraction of adjustment costs in equipment and inventory investment from production level. This assumption is followed by Ogawa and Kitasaka (1998).

(2-12) subject to (2-18), (2-19) gives the following conditions[8]

$$\frac{I_t}{K_t} = \frac{1}{\varphi}\left(q_t - 1\right)\frac{p_t^{\ I}}{\left(1-\tau_{Fs}\right)} \tag{2-20}$$

$$q_t = E_t \sum_{s=t}^{\infty}\left(\frac{1-\delta_F}{1+r_s}\right)^{s-t}\left[\left(1-\tau_{Fs}\right)\left\{\frac{\pi_s}{K_s}\right\}\right] + E_t \sum_{s=t}^{\infty}\left(\frac{1-\delta_F}{1+r_s}\right)^{s-t}\left[\left(1-\tau_{Fs}\right)\frac{\partial GI_s}{\partial I_s}\left(\frac{I_s}{K_s}\right)\right] \tag{2-21}$$

$$\pi_s = A_s K_s^{\ \gamma} L_s^{\ 1-\gamma} - \frac{\varphi}{2}\left(\frac{I_s^{\ 2}}{K_s}\right) - w_s L_s \tag{2-22}$$

Equation (2-20) is rewritten as a relationship in which the optimal investment ratio is a positive function of q. The economic implication of q is shown in Equation (2-21). It represents the future stream of the profit rate and the marginal change of the adjustment costs[9]. The profit rate expressed as (2-22) is the before-tax profits divided by the real capital stock. From (2-20), (2-21) and (2-22), one realizes the optimal investment is a function of the expected profitability (so-called Tobin's marginal q).

The optimal inventory investment is derived by the following steps. Combining the first conditions for inventory investment and inventory stock yields a stochastic Euler equation associated with the inventory investment.

$$p_t^Z + \left(1-\tau_{Fs}\right)\left\{b_0\left(HV_t - HV_{t-1}\right) + b_1 HV_{t-1}\right\} = \psi E_t\left\{p_{t+1}^Z + \left(1-\tau_{Fs}\right)b_0\left(HV_{t+1} - HV_t\right)\right\} \tag{2-23}$$

where $\psi = \frac{1}{1+\bar{r}}$ $\quad E_t\left[r_s\right] = \bar{r}, s \geq t$

Let's assume the price index of the inventory investment follows a first-order autoregressive process[10]:

$$p_t^Z = \rho p_{t-1}^Z + \varepsilon_t \qquad |\rho| < 1 \tag{2-24}$$

[8] q_t is the Lagrange multiplier of the constraint of Equation (2-18). The transversality condition in terms of the optimal equipment investment rule is assumed.

[9] Homogeneities of the production and the adjustment cost function are considered to derive Equation (2-21).

[10] The assumption that the lag length of auto regressive process is first-order is made to simplify the analysis. The extension of this assumption is an important task for future research.

$$\varepsilon_t \sim N\left(0, \sigma^2\right) \qquad E_t\left[\varepsilon_{t+1}\right] = 0$$

Substituting (2-24) into (2-23) and expressing the result by the lag operator (L) leads to

$$E_t\left[\left(1-\tau_{Ft}\right)\left\{b_0\left(L-L^2\right)+b_1 L-\psi b_0\left(1-L\right)\right\}HV_{t+1}\right] = \left(\psi\rho-1\right)p_t^Z \tag{2-25}$$

Equation (2-25) is a second order non-homogeneous difference equation that can be rewritten using the roots of the characteristic equation.

$$E_t\left[\left(1-\lambda_1 L\right)\left(1-\lambda_2 L\right)HV_{t+1}\right] = \left(\psi\rho-1\right)p_t^Z \tag{2-26}$$

Where λ_1 and λ_2 are the roots of the characteristic equation (2-25). Moving (2-26) one period backward and differentiating the equation yields the optimal inventory equation as follows[11]:

$$IV_t = c_0 IV_{t-1} + c_1\left(p_{t-1}^Z - p_{t-2}^Z\right) \tag{2-27}$$

$$c_0 = \lambda_1 \qquad 0 < \lambda_1 < 1$$

$$c_1 = \left(\psi\rho-1\right)\lambda_1\left(\rho\lambda_1 - \psi^{-1}\right)^{-1} > 0$$

Equation (2-27) indicates that the current inventory investment is affected by the lag and the fluctuation of the inventory price. The inventory investment in this model involves mainly finished goods and the price of the inventory investment nearly equals the finished goods price. This means that the firm holds the finished goods investment so that it can face any rise in the inventory investment price and therefore any increase in sales.

2-3 Government

The government finances its spending through government revenues (T_t) and by issuing government debt. The government budget constraint can be written as

$$D_t - D_{t-1} = DEF_t = G_t + r_t D_{t-1} - T_t \tag{2-28}$$

[11]These formulations were originally developed by West (1996), who applied the Linear Quadratic Model (LQ) to the optimal inventory investment.

Government revenues are defined as personal income taxes, corporation taxes and other sources. The government debt is held by both domestic residents and foreigners.

$$G_t = p_{t^{GC}} GC_t + p_{t^{GI}} GI_t \tag{2-29}$$

$$T_t = TH_t + TF_t + TO_t \tag{2-30}$$

where

D_t : Real government debt at the end of t

DEF_t : Real budget deficit in period t

G_t : Real total government expenditure in period t

GC_t : Real government expenditure on consumption in period t

GI_t : Real government expenditure on investment in period t

p_t^{GC} : Government consumption deflator in period t (Deflated by the price index of production goods)

p_t^{GI} : Government investment deflator in period t(Deflated by the price index of production goods)

T_t : Real total government revenue in period t

TF_t : Real corporation taxes in period t

TH_t : Real income taxes in period t

TO_t : Other sources of government in period t

2-4 Macroeconomic budget constraint

Combining the budget constraints of households, firms and the government, one can derive the macroeconomic budget constraint. First, the private sector's budget constraint is summarized by combining household's constraint shown in (2-3) and firm's cash-flow identity shown in (2-13)[12].

$$BH_t - BH_{t-1} = r_t BH_{t-1} + \left(1-\tau_{h_t}\right) w_t L_t - p_t^{\,c} C_t - p_t^{\,h} RC_t + \left(1-\tau_{F_t}\right)\left(Y_t - w_t L_t\right) - p^{I}{}_t I_t - p^{Z}{}_t IV_t \tag{2-31}$$

Then, the government budget constraint is rewritten as follows:

[12]It should be noted that the firm's constraint is implicitly considered in deriving Equation (2-31). It is specified as $d_s + V_s\left(x_s - x_{s-1}\right) = d_s x_{s-1}$. Left side of the equation equals cash flow and increase of capital by issuing equity. The right side equals the expenditure of dividends for households.

$$D_t - D_{t-1} = DEF_t = p_t^{GC} GC_t + p_t^{GI} GI_t + rD_{t-1} - T_t \quad (2\text{-}32)$$

$$D_t = BGF_t + BGH_t \quad (2\text{-}33)$$

where BGF_t : real government bonds held by foreigners

Equation (2-33) shows that government bonds are held by both domestic residents and foreigners. Combining private and government sectors' constraints, one obtains the macroeconomic budget constraint as follows:

$$CA_t = S_t^{\,p} - I_t^{\,p} + S_t^{\,G} - I_t^{\,G} \quad (2\text{-}34)$$

$$CA_t = CEX_t - CIN_t \quad (2\text{-}35)$$

$$CEX_t = BFH_t - BFH_{t-1} \quad (2\text{-}36)$$

$$CIN_t = BGF_t - BGF_{t-1} \quad (2\text{-}37)$$

$$S_t^{\,p} = S_t^H + S_t^F \quad (2\text{-}38)$$

$$S_t^H = r_t BH_{t-1} + \left(1 - \tau_{h_t}\right) w_t L_t - p_t^{\,c} C_t \quad (2\text{-}39)$$

$$S_t^F = \left(1 - \tau_{Ft}\right) w_t L_t \quad (2\text{-}40)$$

$$I_t^{\,p} = p_t^{\,I} I_t + p_t^{\,h} RC_t + p^{Z}{}_t IV_t \quad (2\text{-}41)$$

$$S_t^{\,G} = T_t - r_t\left(BGH_{t-1} + BGF_{t-1}\right) - p_t^{\,GC} GC_t \quad (2\text{-}42)$$

$$I_t^{\,G} = p_t^{\,GI} GI_t \quad (2\text{-}43)$$

where

$S_t^{\,F}$: Real corporate savings in period t

$S_t^{\,G}$: Real government savings in period t

$S_t^{\,H}$: Real household savings in period t

S_t^p : Real private savings in period t

I_t^p : Real private expenditure on investment in period t

I_t^G : Real government expenditure on investment in period t

CA_t : Real net capital outflow in period t

CEX_t : Real capital outflow in period t

CIN_t : Real capital inflow in period t

As shown in (2-38), (2-39) and (2-40), private saving consists of household saving and corporate saving. Household saving is defined as after-labour income minus consumption expenditure. Corporate saving equals after-corporate-tax profit. Private investments are household residential investment plus firm's equipment and inventory investment. Foreign capital flows in through the purchase of domestic government bonds by foreigners. Because domestic households hold foreign risk-free assets, capital also flows out. Therefore, net capital outflow equals net private savings plus net government savings, as shown in (2-34). Thus, this study has succeeded in deriving current account identity by combining each sector's budget constraints.

3. Data

All of the data on saving and investment are taken from the National Income and Product Accounts 2008 (Bureau of Economic Analysis). Total net saving is defined as the surplus of the nation in current transactions (which correspond to its current account) plus total investment minus total consumption of fixed capital. Investment series (private equipment investment, private residential investment and private inventory investment) are selected from Gross Domestic Product and Expenditure. Each gross investment series is adjusted by subtracting consumption of fixed capital. Public saving consists of general government saving and public enterprise saving.

In section 2, this study developed an open economy model in which the household and firm choose intertemporal optimization under a given world interest rate and full employment input factors. Therefore, the main variables that we should calculate are the world real interest rate, full-employment GDP and future variables that representative agents expect. The outlines of the calculations are summarized herein. In a world that has a perfect, integrated financial market, the world real interest rate is determined to equate the world aggregate investment to the world aggregate national income. Barro and Sala-i-Martin (1990) implemented this approach empirically by approximating the world aggregate from ten major countries. In this paper, however, we employ a more simplified calculation. The world real interest rate is defined as the GDP-weighted average of the group of seven (G7) countries' real interest rates. The real

interest rates selected here are the nominal long-tem government rates less the expected inflation rate. It is often pointed out that the measurement of full-employment GDP is difficult because of the measurement error of production sectors, such as productivity, capital, labour and utilization rate. Kamada and Masuda (2001) developed an alternative measure of full-employment GDP and output gap defined as the discrepancy between the actual and potential GDP. The method of calculating the full-employment GDP in this paper is basically the same, as shown in the Data Appendix.

Demand equations such as household consumption, residential investment and firm equipment and inventory investments are reduced, based on stochastic intertemporal optimization. The main factor for the household's decision from a long-term perspective is permanent income, that is, the expected discount income. The main factor for the firm's decision is the marginal q, which represents the future discount profit rate. These variables are unobservable because they include unobservable factors such as future stream of labour income, profit rate and discount factor. Therefore, to make proxy variables, one needs to know the stochastic structure underlying the labour income, profit rate and discount factor. Ogawa (1990) constructed a series of permanent income based on the above method. Abel and Blanchard (1976) and Ogawa and Kitasaka (1998) calculated a series of marginal q based on the univariate autoregressive specification of underlying factors. The approach in this paper is along the same lines. Moreover, taking into consideration full-employment, we adjust the series of permanent income and marginal q by the method in Honma et al (1987).

4. Estimation

Based on the theoretical framework developed in section 2, we estimate the main functions with some variables. Although the estimation form is basically the same as theoretical specification, cyclical factors are also considered. The estimation is performed with quarterly data for the period 1975 to 2007.

4-1 Private savings

First, we derive the private savings estimation function. Based on the consumption function expressed in (2-8), the private savings identity is given by

$$S^{p}{}_{t} = r_t B_t + (1-\tau_F)Y_t - TH_t + TF_t - (1-\theta)(1-\beta)$$
$$\left((1+r_t)B_t + (d_t + V_t)x_t + p^{h}{}_{t}(1-\delta_h)H_{t-1} + E_t\left\{ \sum_{s=t}^{\infty} \left(\frac{1}{1+r_s} \right)^{s-t} (1-\tau_{hs}) wL_s \right\} \right) \qquad (4\text{-}1)$$

Assuming that income taxes and corporate taxes depend on the real full-employment GDP, the private savings function can be specified as follows:

$$\frac{S_t^{\,p}}{Y^*_{\,t}} = \alpha_0 + \frac{rB_t}{Y^*_{\,t}} - \alpha_1 \left[\frac{(1+r_t)B_t + (d_t + V_t)x_t + p_t^{\,h}(1-\delta_h)H_{t-1} + E_t\left\{ \sum_{s=t}^{\infty} \left(\frac{1}{1+r_s} \right)^{s-t} \left((1-\tau_{hs}) w_s L_s \right) \right\}}{Y^*_{\,t}} \right] \tag{4-2}$$

$$\alpha_0 = 1 - \tau_F - \alpha_H + \alpha_F$$

α_H is the sensitivity of income tax for full-employment GDP and α_F is the sensitivity of corporate tax. All variables are then divided by the full-employment GDP (Y_t^*) and we estimate the following function[13].

[13]In our investigations of private saving, we have not mentioned corporate saving. It is often said that in the neoclassical framework, the firm is ultimately owned by the household. Therefore, the overall level of private saving is basically determined by the household and we can neglect corporate saving decisions. Matsubayashi (2008) conducted an empirical examination of the substitutability of savings among household, corporate and government sectors in the U.S. and Japan. First, theoretical micro-foundations were constructed, in which each sector behaves under the intertemporal optimization. Empirical investigations were conducted based on the theoretical formulation. The estimation results indicate that changes in corporate savings induced an offsetting effect on personal savings to some degree in both countries. On the other hand, the substitutability of savings between household and government is not clearly recognized in either country. In this paper, in order to check the robustness of this assumption, we performed Johansen's co-integration tests between the levels of household saving and corporate saving. The test results indicate that there is a long-term stable relationship between household saving and corporate saving and that it is probably safe to focus our attention on household decisions.

Table 1 Private savings

1975:3–2007:4

	Const	PY	GAP	VARH	R2(ad)	D.W	ρ
S-1	0.304	−0.012			0.948	2.256	0.958
	(4.366)	(−3.652)					
S-2	0.341	−0.014	0.270		0.953	2.236	0.959
	(5.029)	(−4.336)	(3.681)				
S-3	0.303	−0.012	0.277	0.113	0.959	2.192	0.956
	(4.707)	(−4.066)	(3.956)	(0.586)			

Dependent variable: private savings / full-employment GDP

Cons: Constant term

PY: Permanent income / full-employment GDP

GAP: GDP Gap

VARH: Index of uncertainty in households

R2 (ad): Adjusted coefficient of determination

D.W: Durbin-Watson Statistics

P: Estimate of autoregressive coefficient of residual

( ): t-value

In this paper Marquardt's Nonlinear Least Squares with AR(1) error was performed. The regression results are summarized in Table 1. (S-1) explains the basic case. The permanent income exerts strong negative effects on savings. (S-2) includes the cyclical factor, and shows the GDP gap (GAP). Cyclical factor has a significant role and permanent income also shows strong effects after including GAP. These results indicate that the savings behaviour is essentially long-term in nature and therefore the permanent income hypothesis regarding private consumption holds.

In our stochastic model, households are subject to uninsurable labour income variability; an increase in income uncertainty will result in greater saving due to people's precautionary motives (so-called *precautionary saving*). We regard such uncertainty for households as a variance of the lifetime innovation of after-tax labour income given by

$$\sigma^2{}_{PY_t} = \left(E_t \sum_{s=t}^{\infty} \beta^{s-t} YD_t - E_{t-1} \sum_{s=t}^{\infty} \beta^{s-t} YD_t \right)^2 \tag{4-3}$$

To obtain an estimate of $\sigma^2{}_{PY_t}$, we estimate the following ARCH (1) model

$$\Delta YD_t = \alpha_0 + \alpha_1 \Delta YD_{t-1} + \varepsilon_t \tag{4-4}$$

$$\varepsilon^2{}_t = \gamma_0 + \gamma_1 \varepsilon^2{}_{t-1} + \nu_t \tag{4-5}$$

Where ν_t is white noise. The transformation of (4-3) with (4-4) and (4-5) yields

$$\sigma^2{}_{PY_t} = \frac{1+\alpha_1(1-\beta)}{(1-\beta)(1-\alpha_1\beta)} \varepsilon^2{}_{t-1} \tag{4-6}$$

Given an estimate of α_1 and the value of β, we can estimate $\sigma^2{}_{PY_t}$. In Table 1, (S-3) indicates that in the U.S, the sign of uncertainty in households (VARH) is correct, though the impact is insignificant[14]. We then adopt the results of Table 1 (S-2) in order to deconstruct the current account.

4-3 Residential Investment

Housing stock is adjusted with the stock adjustment principle, given by

$$H_t - H_{t-1} = \lambda\left(H^*{}_{t-1} - H_{t-1}\right) \tag{4-7}$$

$$0 \le \lambda \le 1$$

Here, $H^*{}_{t-1}$ is the desired housing stock level. Equation (4-7) indicates that households adjust their actual housing stock gradually through a gap between the actual and desired levels. Because the desired housing stock was derived in (2-9), the residential investment function is given by (4-8)[15].

$$\frac{RC_t}{Y^*{}_t} = \alpha_2 + \alpha_3 \left[\frac{\left\{\left(NHW_{t-1} + HW_{t-1}\right) / p^c{}_{t-1}\mu_{t-1}\right\}}{Y^*{}_t} \right] + \alpha_4 \frac{D_{t-1}}{Y^*{}_t} \tag{4-8}$$

[14]The permanent income based on labour income with the ARCH (1) process was also performed and yielded almost the same results shown in Table 1. Other ARCH formulations, such as ARCH (2) or Generalized ARCH (GARCH), were also tried when calculating (4-7). However, the estimation results were almost the same as the result of ARCH (1).

[15]This formation is basically the same as in Ogawa (1992).

$$NHW_t = (1+r_t)B_t + (d_t + V_t)x_t + p^h{}_t(1-\delta_h)H_{t-1}$$

$$HW_t = E_t\left(\sum_{s=t}^{\infty}\left(\frac{1}{1+r_s}\right)^{s-t}(1-\tau_{hs})w_s L_s\right)$$

$$\alpha_3 = \lambda(1-\theta)(1-\beta) > 0$$

$$\alpha_4 = \delta_h - \lambda$$

Table 2. Residential Investment

1975:3–2007:4

	const	PY	MYU(-1)	KH(-1)	GAP	R2(ad)	D.W	ρ
H-1	0.019	0.009	−0.094			0.903	1.570	0.911
	(1.878)	(1.663)	(−4.075)					
H-2	0.023	0.019	−0.073	−0.022	0.135	0.955	1.531	0.970
	(0.684)	(1.201)	(−3.532)	(−1.215)	(5.631)			

Dependent variable: Residential investment / full-employment GDP

PY: Permanent income / full-employment GDP)

KH (-1): Real housing stock / full-employment GDP (first lag)

MYU: Residential user cost (μ_t)

GAP: GDP gap

Estimating in (4-8), we include permanent income and residential user cost separately as explanation variables because each variable inputs separate information into the estimation equation.

The regression results are summarized in Table 2. The results of (H-1) and (H-2) show that permanent income and housing stock exert the correct sign and its effect is not so strong. Residential user cost (MYU (-1)) has a strong negative effect. This implies that U.S residential investment is sensitive to fluctuations in housing loan rate and so the monetary policy imposed by the Fed may be effective through the adjustment of interest rates. We then adopt the results of Table.2 (H-2).

4-3 Private equipment investment

Private equipment investment is described by (4-9) and (4-10). Because the discount value of the marginal adjustment costs (the second term of (2-21)) seems to be relatively small, this term is ignored. Then (2-21) is transformed into (4-11) and yields the so-called marginal tax-adjusted q.

$$\frac{I_t}{K_t} = \alpha_5 + \alpha_6 Q_t \tag{4-9}$$

$$Q_t = \left(MQ_t - 1\right)\frac{p^I{}_t}{\left(1-\tau_{F_t}\right)} \tag{4-10}$$

$$MQ_t = E_t \sum_{s=t}^{\infty}\left[\left(\frac{1-\delta_F}{1+r_s}\right)^{s-t}\left\{\frac{\left(A_s K_s{}^{\gamma} L_s{}^{1-\gamma} - \frac{\varphi}{2}\left(\frac{I_s{}^2}{K_s}\right) - w_s L_s\right)}{K_s}\right\}\right]\frac{\left(1-\tau_{F_t}\right)}{p_t{}^I} \tag{4-11}$$

$$\alpha_6 = \frac{1}{\varphi} > 0$$

Table 3. Private equipment investment

1975:3–2007:4

	Const	Q	CASHR	VARF	R2(ad)	D.W	ρ
I-1	0.017	0.002			0.907	1.929	0.954
	(4.265)	(0.632)					
I-2	0.014	0.007	0.188		0.913	1.802	0.963
	(2.847)	(1.615)	(3.147)				
I-3	0.013	0.007	0.185	−0.248	0.914	1.752	0.965
	(2.626)	(1.635)	(3.098)	(−1.472)			

Dependent variable: equipment investment /capital stock

Q: marginal q

CASHR: current profit (divided by capital stock)

VARF: Index of uncertainty for firms

The regression results are summarized in Table 3. The marginal q with constant discount factor (Q1) exerts a significant positive effect on equipment investment in (I-2) and (I-3).

As a cyclical factor, current profit is included in (I-2) and (I-3). This inclusion is in line with Fazzari, Hubbard and Petersen (1988), who emphasize the usefulness of investment cash flow sensitivities for detecting financing constraints. As shown in Table 3, the current profit also has a positive effect. This result indicates that investment decisions in the U.S. are not always long-term in nature. The effect of uncertainty on investment, which was emphasized in Matsubayshi (1995), was examined in (I-5). The

stochastic process of profit rate was specified and the conditional variance series was calculated as the index of uncertainty for firms. Uncertainty was found to exert a negative effect on investment but its impact is not so strong. Therefore, we adopt the results of (I-2).

4-4 Inventory investment

As considered in section 2, the optimal inventory investment level is generally determined by the following two factors. One is the inventory level in the previous period. The other factor is the inventory price change. These two factors are included to estimate a basic formulation for the inventory investment. Results are summarized in Table 4.

Table 4. Private inventory investment

1975:3–2007:4

	const	INV(-1)	DPZ(-1)	SER	R2(ad)	D.W
Z-1	0.001	0.572	0.061		0.360	1.780
	(3.914)	(8.226)	(2.543)			
Z-2	0.001	0.592	0.055	−0.044	0.402	1.584
	(5.250)	(4.786)	(−1.613)	(−6.454)		

Dependent variable: private inventory investment /full-employment GDP

INV (-1): inventory investment / full-employment GDP (first lag)

DPZ (-1): Change of the price index for the inventory investment

SER: Forecast error of sales at t

The effects of lagged inventory and price change of inventory are significant. This estimation result indicates that the intended inventory stock in the U.S. is adjusted from a long-term perspective. For finished goods inventories, it is important to consider any unintended inventory caused by a shortage of goods or unsold goods. In order to contain inventories of this type, the proxy variable for forecast error of sales must also be included[16]. The positive value of the forecast error of sales (SER) represents the actual private demand such as consumption, investment and exports exceeding the expected level. Therefore, the desired sign of estimation coefficient is negative. Taking the forecast error into consideration, Table 4 (Z-2) shows that the explanatory power is strong. This means that inventory control was carried out

[16]The assumption of rational expectation for the forecast error of sales, $x_t = Y_t - E_t\left[Y_t \mid \Omega_{t-1}\right]$ and the stochastic process for the first difference of sales, $\Delta Y_t = b_0 + b_1 \Delta Y_{t-1} + \varepsilon_t$ yield the forecast error of sales as observable variable as $\xi_t = Y_t - b_0 - (1+b_1)Y_{t-1} + b_1 Y_{t-2}$.

successfully from a long-term perspective and the influence of unextended inventory was also indispensable. The result of (Z-2) was then adopted.[17]

4-5 Public savings

Let's assume that public investment is exogenous. Then, labour income taxes and corporate taxes increase with any business upswing. Considering this effect, we estimated public savings by the real GDP and the output gap defined as the discrepancy between actual and potential GDP. All variables exert significant effects.

Table 5. Public savings

1975:3–2007:4

	Const	YR	GAP	R2(ad)	D.W
G-1	0.268 (18.376)	0.163 (1.963)	0.901 (2.262)	0.840	2.443

Dependent variables: government revenue / full-employment GDP

GAP: output gap

YR: Real GDP

5. Calculations

5-1 Calculation of structural current account

Herein, we deconstruct the structural and non-structural components of the current account based on the estimation results shown in section 4. As defined in section 1, the structural current account includes the parts of the current account explained by the intertemporal optimal behaviours of agents under an economy of full employment. Accordingly, the structural parts of savings, residential investment, equipment investment and inventory investment are explained by the intertemporal optimal behaviours of agents: permanent income, marginal q, lagged housing stock, change of inventory price, etc[18]. In particular, public savings is difficult to derive theoretically. Instead, the structural components of public savings are calculated by substituting the full-employment GDP into the public savings function.

Before the specification of the goods market equilibrium conditions, it is necessary to understand the neoclassical saving-investment balance approach. If both savings and investment are not influenced by the real exchange rate, the structural current account can be calculated in such a way as to equal to the

[17]The Hodorick-Prescott filter was utilized for public investment to eliminate any cyclical component.

[18]It is necessary to recalculate the structural part of private savings, private residential investment, equipment investment, permanent income and marginal q under an economy of full employment. This procedure was performed in line with Honma et al (1987). For permanent income, the labour income under an economy of full employment was estimated using the full-employment GDP. Then the full-employment human wealth shown in (2.11) was calculated. Full-employment marginal q is also measured by the full-employment corporate income, using the full-employment GDP.

structural parts of savings minus the structural parts of investment. If savings and/or investment are affected by the real exchange rate, however, an equilibrium real exchange rate and structural current account are determined so as to balance the goods market. Because the effects of the real exchange rate on savings and investment are ambiguous (due to poor theoretical foundation), the following preliminary test was employed. The effects of the real exchange rate on permanent income (which is a key determinant of savings) and the effects of the real exchange rate on marginal q (which is a key determinant of investment) are examined by the Granger causality test. The test results indicate that neither type of exchange rate has any effect on permanent income and marginal q. Therefore, savings and investment decisions do not depend on the real exchange rate, from a long-term perspective.

In the next step, the structural current account ($STCA$) and non-structural current account ($NSTCA$) are determined, based on the goods market equilibrium condition. In (5-1) and (5-2), all variables are divided by full-employment GDP.

$$STCA_t = STPS_t - STINVFR_t - STINVHR_t - STINVZR_t + STGS_t - \frac{I_t^G}{Y^*_t} \qquad (5\text{-}1)$$

$$NSTCA_t = CAR_t - STCA_t \qquad (5\text{-}2)$$

where

$STCA_t$: Structural current account in period t

$STPS_t$: Structural part of private saving

$STINVFR_t$: Structural part of equipment investment

$STINVHR_t$: Structural part of residential investment

$STINVZR_t$: Structural part of inventory investment

$STGS_t$: Structural part of public saving

$NSTCA_t$: Non structural current account

CAR_t : Actual current account

[Figure.1]

[Figure.2]

The structural and non-structural movements of the current account during the period 1976 (Q1) to 2007 (Q4) are shown in Figures 1 and 2. At the end of the 1970s, the structural current account was below the actual value. The discrepancy between actual and structural savings and equipment investment is remarkable. This time period corresponds to the low growth caused by the second oil shock. However, the structural movements of residential investment were the same as the actual movements. Taking these movements into consideration, we conclude that the structural parts of the current account at the end of the 1970s were governed by private savings and equipment investment.

Most parts of the U.S. current account at the beginning of the 1980s were structural. This result is

consistent with the findings of Ueda (1988), Fukao (1987), Honma et al (1987) and Yoshikawa (1995) in Japan. At that time, the structural parts of each sector (household, firm and government) were the same as the actual values. Therefore, it seems natural to conclude that, at the beginning of the 1980s, the U.S. economy fit the conditions of a neoclassical economy. At the end of the 1980s, the structural current account was again below the actual value. At the beginning of the 1990s, however, the structural current account remained at equilibrium level. At the end of the 1990s, the structural current account deficit increased again and reached nearly 3% of GDP. The remarkable point is that the mid- and long-term movements of current account are basically determined by structural private savings and residential investment. Figure 2 illustrates the non-structural part of the current account. Until the mid 1990s, the movements of the non-structural part seem to be cyclical and match short-term fluctuations in the domestic economy. After the mid 1990s, however, the nonstructural part of the current account decreased gradually.

5-2 Determinants of the non-structural current account

The preceding deconstruction did not clarify what determined the movements of the nonstructural current account. The following estimations are employed to check this point. One dependent variable is the nonstructural series of current account measured by (5-2). Independent variables are domestic and foreign cyclical factors and real exchange rate. Output gap in the U.S. is defined as domestic short-term cyclical factors. World trade is selected as the index of total trade in the world published by the IMF. Real exchange rate is the real effective exchange rate of the U. S. dollar and the oil price index is also included.

Table 6 summarizes the estimation results. Not only domestic cyclical factor but also world trade index and real exchange rate have notable effects on the nonstructural current account. However, exchange rate does not have an effect on the structural current account. Taking these results into consideration, we suppose that non-structural parts of the U.S. current account were governed by domestic and foreign business fluctuations. U.S and emerging market countries enjoyed a strong boom especially at the end of the 1990s. The economic conditions in these emerging market countries had remarkable effects on the U.S current account

Table 6. Determinants of the nonstructural current account

1975:3–2007:4

	REER	REER(-1)	GAP	WT	OILP
Structural	0.012	−0.010	0.0003	−0.003	−0.001
	(1.179)	(−0.977)	(0.584)	(−0.305)	(−0.805)
Nonstructural	−0.006	0.082	−0.165	0.031	−0.002
	(−0.486)	(2.343)	(−2.307)	(1.875)	(−1.176)

Dependent variables:

Structural: Structural current account measured by (5-1)

Nonstructural: Nonstructural current account measured by (5-2)

REER: real effective exchange rate of U.S. dollar

GAP: output gap

WT: world trade index

OILP: oil price index

5-3 Calculation of the equilibrium exchange rate

In a macroeconomy where the exchange rate substantially fluctuates, not only economists but also policy makers are asked to evaluate the causes and consequences of the fluctuations. Therefore, it is worth considering the concept of an equilibrium rate of exchange as a standard level against which to measure actual exchange rate change[19]. However, the term *equilibrium exchange rate* has been used with different definitions. The most important point is the time horizon of the equilibrium exchange rate. The first and maybe the most criticized method is Purchasing Power Parity (PPP), which supposes that the *law of one price* holds. This theory defines the equilibrium according to a long-term perspective. Williamson (1985, 1994) proposed the notion of Fundamental Equilibrium Exchange Rate (FEER), which defines the equilibrium exchange rate in the medium-term by adjusting the country's internal and external balance to equilibrium simultaneously. Internal balance is defined as a stage of economy when GDP equals potential GDP. The external balance is interpreted as a normative stage, a sustainable position of current account over the medium-term.

Although there is no consensus or general approach to computing the sustainable position of current account, the calculated structural current account in this paper is a kind of sustainable level which is evaluated by the intertemporal prospects facing a country's private economy. Therefore, FEER can be estimated based on the structural part of current account obtained in the section 5.1. As explained therein, the structural current account is determined in such a way that it is consistent with the saving-investment structural balance, and the equilibrium real exchange rate is adjusted in such way that it is consistent with the level of the structural current account.

Based on these considerations, the following regression is performed:

$$REER_t = \alpha_0 + \alpha_1 STCA_t + \varepsilon_t \qquad (5\text{-}3)$$

[Figure.3]

[Figure.4]

[19]A comprehensive survey of equilibrium exchange rate is given in Williamson (1994), MacDonald (2000) and Driver and Westaway (2004).

Then equilibrium exchange rate is obtained as the fitted value of the regression[20]. Figure 3 illustrates the estimated equilibrium real effective exchange rate (Equilibrium REER). Throughout the sample period, the value of Equilibrium REER is about 1, which indicates that the relative price of home and foreign country in the tradable sector holds to the law of one price. Looking more carefully, we find that Equilibrium REER shows moderate appreciation since 2000 and the tendency of the U.S. dollar's gradual climb is remarkable. The discrepancy between the actual REER and equilibrium REER is shown in Figure 4. It vividly indicates the overly strong U.S. dollar in the early 1980s and the sharply weak dollar since 2004.

5-4 Forecast of the structural current account and Equilibrium REER

The upheaval in the US sub-prime home-loan market since 2007 sharply shrank housing investment and weakened consumption. These dynamics in domestic demand may ameliorate the external imbalances in the U.S. current account. Let us now make a mid-term forecast for the U.S structural current account and Equilibrium REER. Specifically, five scenarios of housing investment change are considered herein: 3% increase per period, 1% increase per period, 0% increase per period, 1% decrease per period and 5% decrease per period[21]. Changes in housing stock influence household assets and affect structural private consumption (structural private savings) and structural residential investment[22]. Figure 5 gives a graphic representation of simulation results for the structural current account. In the cases of decreasing housing stock, the U.S. structural current account deficit would improve over a decade. Especially in the scenario of 5% decrease per period, the structural current account deficit considerably improves. Figure 6 also summarizes the forecast of Equilibrium REER base on (5-3). In the case of 5% decrease in housing stock per period, equilibrium REER depreciate by 5%. These simulation results are summarized in Table. 7.

【 Figure.5 】

【 Figure.6 】

[20]The regression is calculated in more detail. First, the co-integration relationship between REER and STCA is checked by the Johansen test. Then, the dynamic OLS estimation is performed to get the consistent estimator of co-integration vector.

[21]The 5% decrease of housing stock per period corresponds to shrinkage of the current level to about 30% twenty years later. In Japan, the housing stock dropped to one-third of its 1980 value (before bubble) by 2000 (post-bubble). Therefore, the relevance of 5% decrease per period is supported by actual experience.

[22]Other structural factors, such as structural government net savings and structural equipment investment, are calculated based on the forecast of potential GDP announced by the Congressional Budget Office (CBO). CBO estimates quarterly GDP gap for the period 2008–2018. Structural inventory investment is calculated by the specification of the autoregressive model.

Table. 7 Forecast of structural current account and equilibrium REER

: The case of 5% decrease of housing stock per period

	2008Q1	2018Q3	Rate of change
structural current account	-2.3%	-0.4%	+2 %(+5%)
equilibrium REER	1.038	1.093	5 %(12.5%)

Obstfeld and Rogoff (2006) developed a three-country open DSGE model showing that the U.S current account deficit going from −5% to 0 means transfer to the rest of the world, which in turn means fall in demand for U.S. tradable goods and deterioration of terms of trade by about 15%[23]. This mechanism is quite similar to the analytical implications we have described in section 5. Further, it is interesting that 5% improvement of the U.S. current account deficit corresponds to over 10% deterioration in the real exchange rate. Therefore, our simulation results seem to be right on track in light of Obstfeld and Rogoff's experiments.

6. Conclusion

This is the first attempt at deconstructing the movements of the U.S. current account into structural and cyclical components based on an individual optimization model. The results of the first half of the 1980s were basically similar to the established approach in Japan, and this new method of deconstruction adequately explains those structural movements of the U.S. current account. The present study also uncovers some interesting findings from the 1990s. Structural parts of the current account deficit began to increase at the beginning of the 1990s, corresponding to declining tendencies of the structural part of private savings and residential investment. During the long boom of the Clinton Era private consumption and residential investment in the U.S. sharply increased, and current account movements were strongly influenced by these movements. Remarkably, structural current accounts are basically determined by the structural movements of private residential investment. Such a conclusion is very attractive because correlations between current account and housing investment in the mid- and long-term are empirically verified.

As explained in section 1 current account surpluses or deficits are the outcome of interetemporal rational choices of households, firms and governments. Therefore, by themselves, normative terms such as current account surpluses or deficits are neither good nor bad. The appropriateness of the current account position must be evaluated by the intertemporal prospects facing a country's economy. If national investment is determined by rational decisions, excessive national investment in comparison to national

[23] Hagiwara (2008) overviews the theoretical framework of Obstfeld and Rogoff (2006) in detail.

savings, that is to say, current account deficits would be excluded from consideration. In the specifications of this paper, structural current account imbalances of each country basically reflect the intertemporal optimal behaviour of private agents and mid- and long-term government policy stances. If the structural parts are governed by structural private savings and investment, chronic huge surpluses in the U.S. should not be criticized. Thus, from a normative view, nearly half of the huge current account deficit since the end of the 1990s was a result of optimal behaviour opportunities and not a bad thing at all.

One important issue remains: because governments often fail to act as intertemporal optimizers, huge budget deficits occur. Current account deficits or the gradual reduction of surpluses due to structural budget deficits are worth considering. Since the end of the 1990s, a major problem facing the U.S. economy has been its large budget deficit and the resulting high level of national debt. Now at 3% percent of GDP, the U.S. has one of the largest budget deficits among the major industrial countries, a tendency that may increase the influence of structural budget deficits on the current account from mid- and long-term perspectives. Moreover, the upheaval in the U.S. sub-prime home-loan market since 2007 has sharply shrunk housing investment and weakened consumption. There is a high possibility that these dynamics in domestic demand may improve the external imbalances in the U.S. current account and deteriorate of the dollar. It seems to be quite useful and timely to analyze this dramatic change empirically with the new method developed in this study.

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References

Abel, A. B. and O. Blanchard (1986),"The Present Value of Profits and Cyclical Movements in Investment," *Econometrica* Vol.54, No.2, pp.249-273.

Banque de France (2002), "The Structural Balance," Banque de France Bulletin Digest, No.106, pp.91-105.

Barro, R and X, Sala-i-Martin (1990), "World Real Interest Rates," NBER Macroeconomics Annual, Vol.5, pp.107-182.

Bergin, P. R. and S. Sheffrin (2000), "Interest Rates, Exchange Rates and Present Value Models of the Current Account," *Economic Journal* 110, pp.535-558.

Bracke,T, M,Bussiere, M, Fidora and R, Straub (2008)"A Framework for Assessing Global Imbalances, " ECB Occasional Papers, No.48.

Bussière, M., Fratzscher, M., and Müller G. J. (2004) "Current account dynamics in OECD and EU acceding countries – an intertemporal approach", ECB Working Paper Series, No. 311

Chigira, M and Takeda.Y (1992), "The Movements Full-Employment Current Account in the 1980's," (Japanese) *Japan Development Bank Discussion Paper* No.9208.

Chinn, M. D and E. Prasad (2003), "Medium Term Determinants of Current Accounts in Industrial and Developing Countries: An Empirical Exploration," *Journal of International Economics* Vol.59 (1), pp.47-76

Clarida, R. and J. Prendergast, (1999), "Recent G3 Current Account Imbalances: How Important are Structural Factors?" *NBER Working Paper*, No.6935.

Council of Economic Advisers (2000), *Economic Report of the President*. United States Government Printing Office.

Debelle,G and H, Faruqee (1996), "What Determines the Current Account? A Cross-Sectional and Panel Approach," IMF Working paper No.58.

Deutsche Bundesbank (2001), "Structural Current Account Balances: Longer-term trends and Determinants," *Deutsche Bundesbank Monthly Report* January.

Fukao,K.(1987), "The Current Account, Exchange Rate and Saving-Investment Balance in Japan," (Japanese) *Economic Research*, Vol.38(3).

Glick,R and K. Rogoff (1995),"Global versus Country-Specific Productivity Shocks and the Current Account," *Journal of Monetary Economics* 35 pp.159-192.

Ghosh, A. R (1995), "Capital Mobility among the Major Industrialized Countries: too little or much ? " *Economic Journal* 105.

Hagiwara, K (2008), "The Adjustment Process of External Imbalances; Recent Development of Theoretical Analysis," IMES Working Paper, 2008-J-12, Institue for Monetary and Economic Studies, Bank of Japan.

Honma, M,Kurosaka, Y,Ihori, T and Nakajima, T,(1987), "Re-examination of Full-Employment

Budget Surplus and Full-Employment Current Account," (Japanese) *The Keizai Bunseki* No.108, Economic Research and Institute Economic planning Agency.

Ichimura Shin-ichi (1955), *Nihon Keizai no Kozo*,(Japanese), Shobunsya.

Kamada, K and Masuda, K (2001), "Effects of Measurement Error on the Output Gap in Japan," *Monetary and Economic* Studies Vol.19, No.2, Bank of Japan, Institute for Monetary and Economic Studies.

Kandil, M and J, E. Greene (2002), "The Impact of Cyclical Factors on the U.S. Balance of Payments," IMF Working Paper, 02/45

Kindleberger, C. P (1955), *International Economics,* Richard, D. Irwin.

Komiya, R.(1994), *Economics of Trade Surplus and Deficits*, (Japanese) Toyo Keizai Shinposha.

Mann, C. L (1999), *Is the U.S. Trade Deficits Sustainable?* Institute for International Economics, Washington D.C.

Matsubayashi, Y (1995), "Expected Profitability, Uncertainty and Investment: Japan-U.S Comparison," (Japanese) *Japanese Economic Research*, Vol.28.

Matsubayashi, Y (2008), "Household saving, Corporate saving and Government saving; Substitutability for saving by sectors in Japan and the U.S.," (Japanese) *Economic Research*, Cabinet Office, (forthcoming).

McKibbin, W and J. Sachs (1992), Global Linkages : *Macroeconomic Interdependence and Corporation in the World Economy* The Brookings Institution.

Nason, J. M. and J. H. Rogers (2000), "Investment and the Current Account in the Short Run and the Long Run," *Journal of Money Credit and Banking*, 34, pp.967-86

Nason, J. M. and J. H. Rogers (2003), "The Present Value Model of the Current Account Has Been Rejected: Round up the Usual Suspects?" Federal Reserve Board International Finance Discussion Paper. No.760.

Obstefeld, M and K. Rogoff (1996), *Foundations of International Macroeconomics* MIT Press.

Obstefeld, M and A. Taylor (2004), *Global Capital Markets: Integration, Crisis, and Growth,* Cambridge University Press

Ogawa,K(1990), "Cyclical Variations in Liquidity-Constrained Consumers: Evidence from Macro Data in Japan," *Journal of Japanese and International Economics*, Vol.4,No.2,pp.173-193.

Ogawa,K(1992), "Housing Demand and Household Saving," (Japanese) Ogawa, K, Saito, M, and Ninomiya, S eds, *Empirical Study of Multi-Sector Economy Model*, Sobunsha.

Ogawa, K and S. Kitasaka (1998), *Asset Market and Economic Fluctuations* (Japanese), Nihon Keizai Shinbunsha.

Otto, G (1992), "Testing a Present Value Model of the Current Account: Evidence U.S and Canadian time series," *Journal of International Money and Finance* 11.

Sachs, J. D (1981), "The Current Account and Macroeconomic Adjustment in the 1970's,"

Brooking Papers on Economic Activity 1 pp.201-268.

Sheffrin, S. M and W. T. Woo (1990), "Present Value tests of an intertemporal model of the Current Account," *Journal of International Economics* 29.

Shinkai, Y (1985), "Review of International Macroeconomics, " (Japanese) *Tohyo Keizai Macroeconomic Series*, 73.

Ueda, K (1988), "Perspectives on the Japanese Current Account Surplus," *NBER Macroeconomics Annual,* Vol.3.

West, K (1995), "Inventory Models: The Estimation of Euler Equations," M.H.Pesaran and M.R.Wickens eds *Handbook of Applied Econometrics*, Vol.2, Blackwell.

Yoshikawa, H (1995), *Macroeconomics and the Japanese Economy*, Oxford University Press.

Figure.1

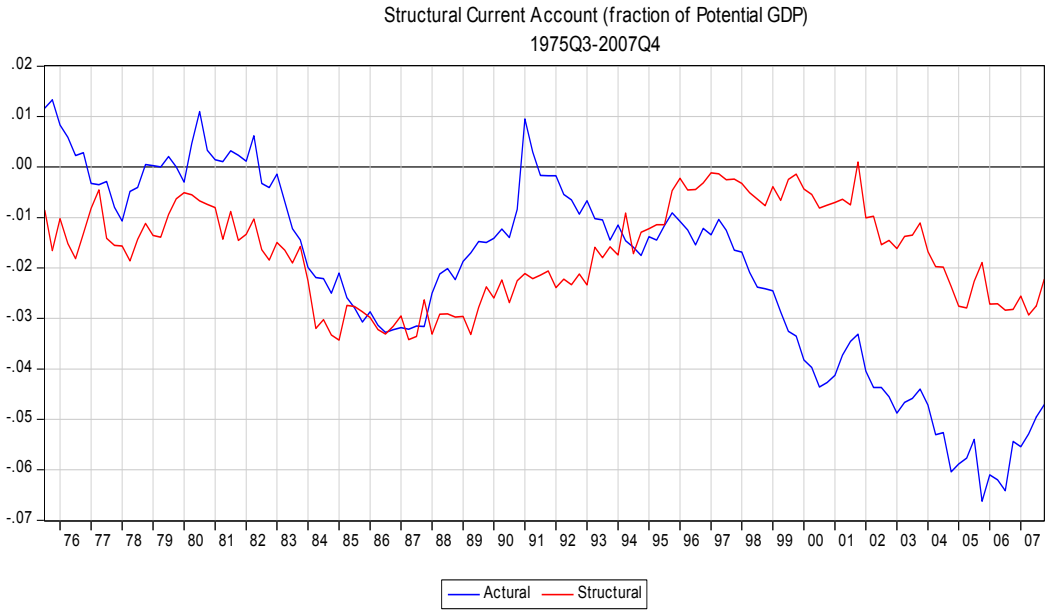
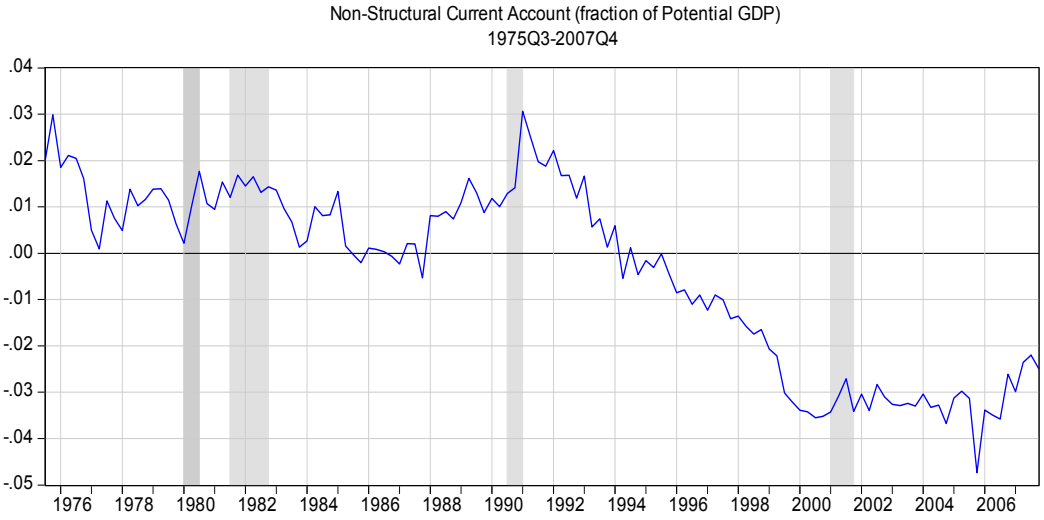


Figure.2



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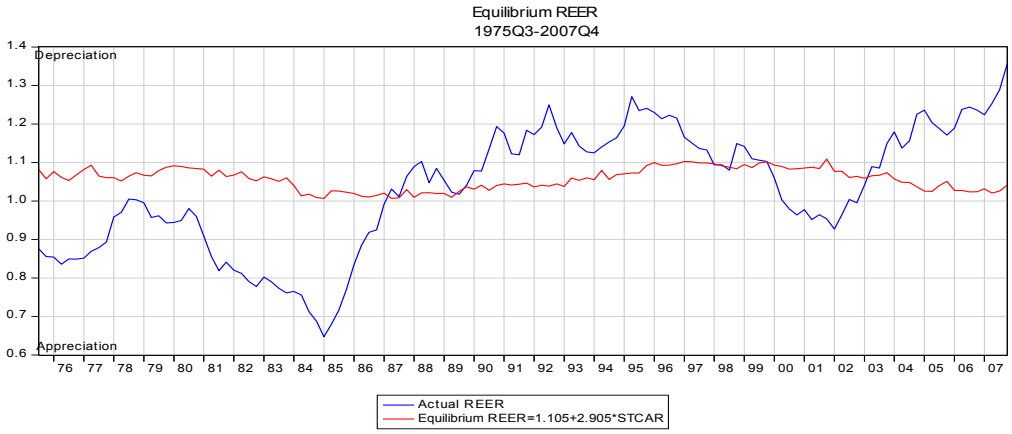

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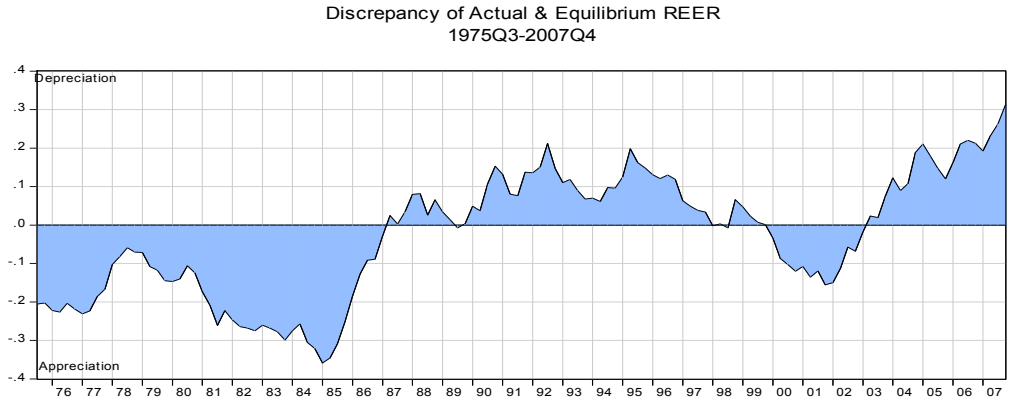

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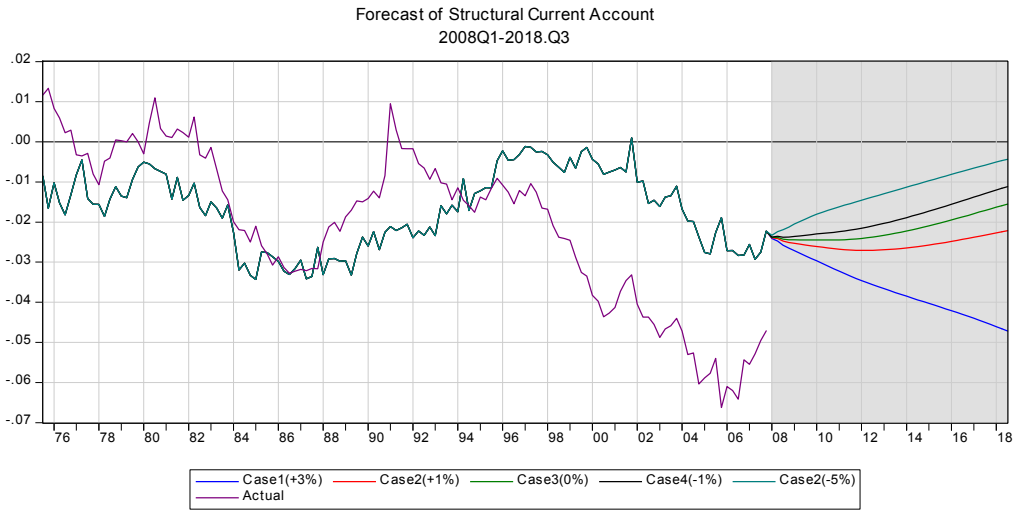
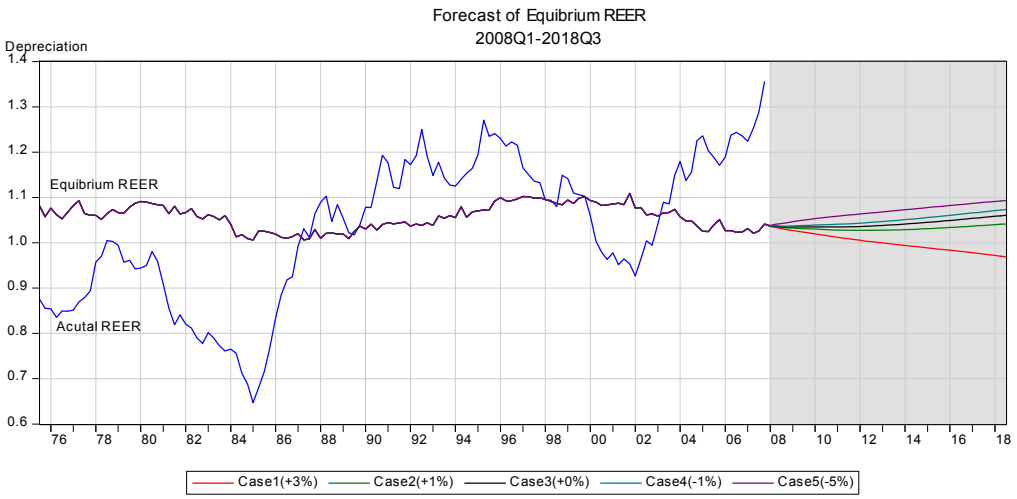


Figure. 6



Data Appendix Calculation of Full -Employment GDP

The method of calculating full-employment (potential) GDP in this paper is basically along the lines of Kamada and Masuda (2001), who calculated the GDP gap in Japan. A Cobb-Douglas production function with three factors (capital, labour and total factor productivity (TFP)) is considered. First, TFP is calculated using actual levels of capital and labour, based on the production function. Second, full employment (potential) GDP is measured by substituting the entire amount of labour and capital into the production function. In Figure.3, output gap, which is a deviation rate of actual output from potential GDP, is also shown. The output gap measured in this paper behaves almost the same as that described by the IMF and Congressional Budget Office. Figure 3 compares these calculation results.

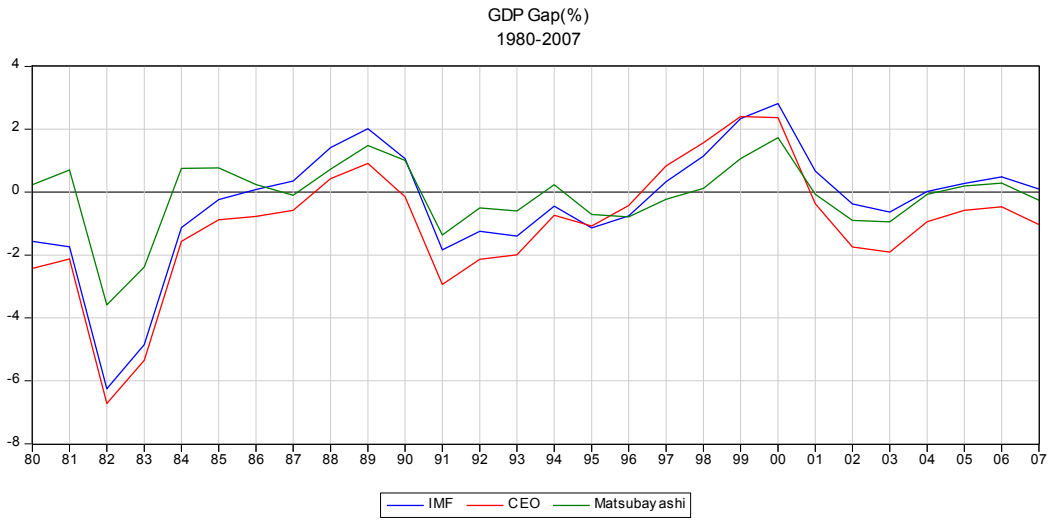



Figure.A-1