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A Transition from Consumption-Dependent Development to Investment-Driven Development: A Comparison of 40 Countries

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Abstract

Following up the contrasting behaviors that growing economies suffer from an autarky cycle between consumption and economic growth. Advancing and advanced economies allow GDP growth for inducing investments efficiently. An empirical analysis was conducted in 40 countries, inspired by Samuelson's multiplier-accelerator model, to examine a mechanism for switching from an autarky cycle to an investment-inducing virtuous cycle. The results suggest that a correlation between consumption growth and investment intensity is crucial to enable a shift from an autarky cycle to a virtuous cycle. The transition dynamism of economic cycles in these countries in the last three decades is also analyzed.

Keywords: *Consumption; growth; investment intensity; economic cycles; growing economies.*

INTRODUCTION

Growing economies have sustained their economic growth and positioned engines of global growth during the global financial crisis and its aftermath. Growing economies of Brazil, Russia, India and China, often referred to as BRIC, and ASEAN countries, are still growing and driven increasingly by higher domestic demand and lower export reliance (Kharas, 2010; Chin, 2011). However, it is criticized that growing economies had not created enough wealth and had not sufficiently developed the markets over the past decade of globalization to allow them to recover from the crisis on their own. While growth rate in growing economies are falling due to the far-reaching impacts of the global financial crisis, maintaining their growth will be especially important to preventing the overall economic slowdown in the world (Ravallion, 2010).

The structure of consumption effects on economic growth depends on levels of economic development (Fukuda and Watanabe, 2011). Currently, growing economies have the highest potential among three economic

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groups to boost their consumption. However, economic growth in growing economies largely depends on consumption growth. They have remained in an autarky cycle of consumption driven development where consumption leads to life improvement and then brings GDP growth. In contrast, advancing and advanced economies leverage investment for their growth. They maintain a virtuous cycle induced by investment where consumption increase induced investment, which stimulates further growth of GDP and consumption.

The structure of consumption effects on economic growth of each country has changed over the three decades as illustrated in Figures 1-1, 1-2 and 1-3. In the middle of the current decade, 40 major countries are divided into three economic groups:

- Group A: Growing Economies consisting of eight countries, Brazil, China, India, Indonesia, Malaysia, Philippine, Russia and Thailand;
- Group B: Advancing Economies consisting of eight countries, Czech Republic, Hungary, Korea, Mexico, Poland, Slovak Republic, Taiwan and Turkey; and
- Group C: Advanced Economies consisting of 24 countries, Austrlia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom and United States.

These countries were classified in a different way in the 1980s and the 1990s. In the middle of the 1980s, they were classified into two groups: (i) 17 countries of eight countries in Group A, eight countries in Group B and Singapore, and (ii) 23 countries in Group C except Singapore. In the middle of the 1990s, the former were divided into two groups: (iii) 11 countries including eight countries in Group A and three countries of Czech Republic, Poland and Slovak Republic in Group B, (iv) 6 countries of five countries in Group B and Singapore.

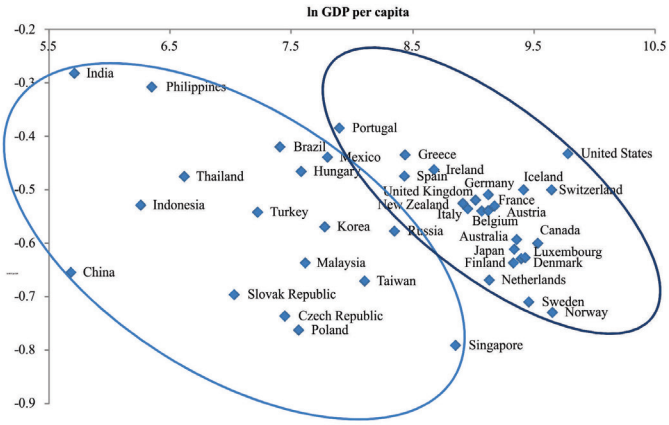

Figure 1-1: Correlation between Household Final Consumption Expenditure per GDP and GDP per capita in 40 Countries[a] (*1985*).

[a] 40 countries can be classified into three groups by their HFCE per GDP – GDP per capita correlation structure as depicted as follows:

$$c_t = av_{t-1}$$

D_1 and D_2 are dummy variables: D_1 = 1 in 8 countries of Group A , 8 countries of Group B and Singapore, 0 in others; D_2 = 1 in 23 countries of Group C except Singapore, 0 in others.

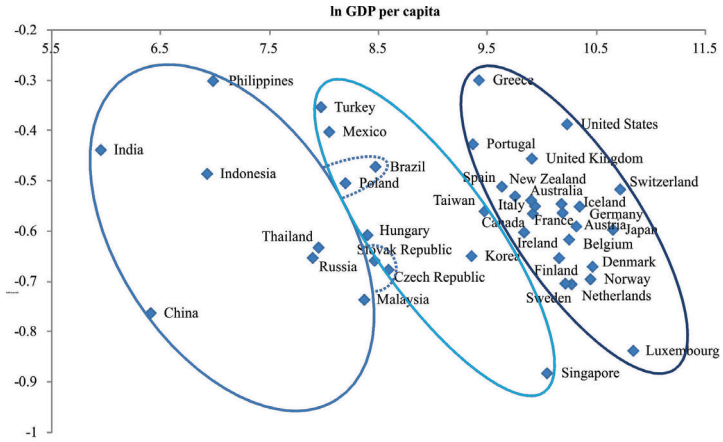

Figure 1-2: Correlation between Household Final Consumption Expenditure per GDP and GDP per capita in 40 Countries[b] (*1995*).

[b] 40 countries can be classified into three groups by their HFCE per GDP – GDP per capita correlation structure as depicted as follows:

$$\ln HFCE\ per\ GDP = 0.324 + (0.884D_1 + 0.898D_2 + 0.912D_3)\ln GDP\ per\ capita$$
$$(1.29)\quad (27.07)\quad (31.49)\quad (36.71)$$

D_1, D_2 and D_3 are dummy variables: D_1 = 1 in 8 countries of Group A , 3 countries of Group B (Czech Republic, Poland and Slovak Republic), 0 in others; D_2 = 1 in 5 countries of Group B and Singapore, 0 in others; D_3 = 1 in 23 countries of Group C except Singapore, 0 in others.

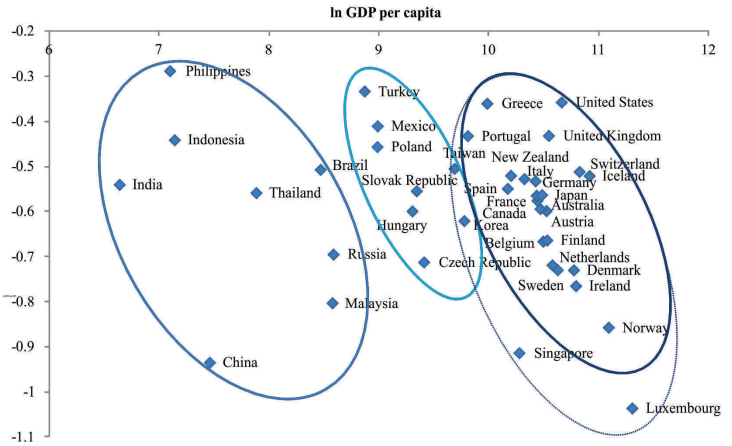

Figure 1-3: Correlation between Household Final Consumption Expenditure per GDP and GDP per capita in 40 Countries[c] (*2005*).

[c] 40 countries can be classified into three groups by their HFCE per GDP – GDP per capita correlation structure as depicted as follows:

$$\ln HFCE\ per\ GDP = 0.908 + (0.806D_1 + 0.846D_2 + 0.855D_3)\ln GDP\ per\ capita$$
$$(1.88)\quad (12.94)\quad (16.20)\quad (18.63)$$

D_1, D_2 and D_3 are dummy variables: D_1 = 1 in 8 countries of Group A, 0 in others; D_2 = 1 in 8 countries of Group B, 0 in others; D_3 = 1 in 24 countries of Group C, 0 in others.

The above trends indicate transitions of some countries between different economic levels. For instance, the current advancing economies in Group B had been at the same economic level as the current growing economies in Group A in the 1980s. Five out of eight countries in Group B had formed a new economic group in the 1990s and other three countries had joined the group in the 2000s. Singapore had shifted from the group with Group A in the

1980s to the group with Group B, and to the group of the current advanced economies in Group C. These countries might have switched over from an autarky cycle of consumption driven development to a virtuous cycle induced by investment during the period of transition while growing economies have stuck to an autarky cycle.

Modern business theory adopts the notion that economic growth and fluctuations are not distinct phenomena, and theories of business cycle should be consistent with the long-term observation about economic growth (Cooley and Prescott, 2005). Business cycles are a type of fluctuation found in the aggregate economic activity of nations in the long term (Burns and Mitchell, 1946). Samuelson introduced the multiplier-accelerator model of business cycles, and many studies followed to provide improved version (Samuelson, 1939; Puu et al., 2005; Westerhoff, 2006). While many models have been presented to explain more sophisticated mechanisms during recent decades, the core elements of Samuelson's model are still valid (Hommes, 1995; Lines and Westerhoff, 2006; Puu, 2006).

Inspired by Samuelson's multiplier-accelerator, an empirical analysis was conducted to elucidate a mechanism to switch from an autarky cycle and to an investment-inducing virtuous cycle. The transition dynamism of economic cycles in the current three economic groups over the last three decades is also examined.

The rest of this paper is organized as follows. Section 2 introduces the analytical framework. Section 3 describes the results of the analysis. Section 4 provides the interpretation of the results of the analysis. Section 5 briefly summarizes new findings and policy implications.

ANALYTICAL FRAMEWORK

Numerical Analysis

Samuelson's model demonstrates that fluctuations in economic activity are outcomes of the interplay between interacting mechanism of the multiplier and the accelerator principles. First, consumption is a constant fraction of the past product:

$$c_t = av_{t-1} \tag{1}$$

where c_t: per capita consumption at time t; v_{t-1}: per capita GDP at time t-1; and $0 < a < 1$ stands for the marginal propensity to consume in per capita term.

Second, investment is proportional to changes in consumption:

$$i_t = b(c_t - c_{t-1}) \tag{2}$$

Where i_t: per capita investment at time t; and $b > 0$ stands for the accelerator coefficient in per capita term.

Here, GDP per capita at time t, v_t, can be described as the sum of four components in per capita term: consumption, c_t, investment, i_t, government expenditure, g_t, and net trade, exports minus imports of goods and services, $(x-m)_t$. Therefore,

$$v_t = c_t + i_t + g_t + (x-m)_t \tag{3}$$

Combining equations (1), (2) and (3), GDP per capita at time t can be described as

$$v_t = a(1+b)v_{t-1} - abv_{t-2} + g_t + (x-m)_t \tag{4}$$

Given government expenditure and net trade are constant:

$$g_t + (x-m)_t = \bar{g} + (\bar{x} - \bar{m}) = \gamma \tag{5}$$

GDP per capita can be rewritten as a second-order linear difference equation:

$$v_t = a(1+b)v_{t-1} - abv_{t-2} + \gamma \tag{6}$$

which has a fixed point at

$$\bar{v} = \frac{1}{1-a}\gamma \tag{7}$$

The values of parameters a and b determines types of fluctuation (see details in Appendix A).

Given consumption level depends on GDP growth, the following equation can be obtained:

$$c_t = v_{t-1}{}^{\alpha} \tag{8}$$

where $\alpha > 0$. This equation can be expanded as

$$\ln c_t = \alpha \ln v_{t-1} \tag{9}$$

According to equations (1) and (9),

$$a = \frac{\partial c_t}{\partial v_{t-1}} = \frac{\partial \ln c_t}{\partial \ln v_{t-1}} \frac{c_t}{v_{t-1}} = \alpha \frac{c_t}{v_{t-1}} \tag{10}$$

In addition, the following equation can be given:

$$i_t = Bc_t^{\beta_1} c_{t-1}^{\beta_2} \quad (11)$$

where $B > 0$; and $\beta_1, \beta_2 > 0$. This equation can be expanded as

$$\ln i_t = \ln B + \beta_1 \ln c_t + \beta_2 \ln c_{t-1} \quad (12)$$

Using the average consumption growth rate in per capita term, r_c, consumption per capita can be described as

$$c_t = (1 + r_c) c_{t-1} \quad (13)$$

where $0 < r_c < 1$.

According to equations (2), (12) and (13),

$$\ln i_t = \ln b r_c + \ln c_{t-1} = \ln B + \beta_1 \ln(1 + r_c) + (\beta_1 + \beta_2) \ln c_{t-1} \quad (14)$$

Thus,

$$b = B(1 + r_c)^{\beta_1} \quad (15)$$

$$\beta_2 = 1 - \beta_1 \quad (16)$$

DATA CONSTRUCTION

The empirical analysis focused on 40 countries in three economic groups including 30 countries out of 34 OECD member countries, five countries out of 10 ASEAN member countries (original members), Taiwan, and BRIC, the countries of Brazil, Russia, India and China. The national accounts data for each country are constructed in per capita term based on data obtained from the World Bank's World Development Indicators published in December 2011 (see details of the procedures in Appendix B). All data are in current US dollars from 1980 to 2010, the latest available year. Data on GDP, consumption and investment in per capita term are used in the analysis. The average annual consumption growth rates in per capita term are computed based on data on consumption per capita for each country.

Results

The regression analysis on c_t and i_t inducement was conducted based on equations (9) and (12) by classifying 40 countries according to their past GDP

elasticity to consumption and consumption growth elasticity to investment in per capita term in each decade. The results are summarized in Tables 1-1, 1-2 and 1-3. It is noted that the values of parameters β_1 and β_2 in each decade are consistent with equation (16).

Table 1-1: Correlations between Consumption and Past Product and between Consumption Growth and Investment in 40 Countries – *in the 1980s*

$$\ln c_t = (A_{11}D_{11} + A_{12}D_{12} + A_2D_2) + (\alpha_1 D_1 + \alpha_2 D_2)\ln v_{t-1}$$

A_{11}	A_{12}	A_2	α_1	α_2	adj. R^2
-0.198	-0.382	0.394	0.977	0.906	0.985
(-2.74)	(-3.47)	(2.04)	(65.68)	(43.86)	

$$\ln i_t = (\ln B_{11}D_{11} + \ln B_{12}D_{12} + \ln B_2D_2) + (\beta_{11}D_1 + \beta_{12}D_2)\ln c_t + (\beta_{21}D_1 + \beta_{22}D_2)\ln c_{t-1}$$

$\ln B_{11}$	$\ln B_{12}$	$\ln B_2$	β_{11}	β_{12}	β_{21}	β_{22}	adj. R^2
-0. 928	-0. 591	-1.679	1.394	1.043	-0.414	0.042	0.958
(-2.04)	(-2.89)	(-5.05)	(8.68)	(8.05)	(-2.53)	(0.31)	

D_1, D_{11}, D_{12} and D_2 are dummy variables: D_1 = 1 in 8 countries in Group A, 8 countries in Group B and Singapore, 0 in others; D_{11} = 1 in 3 countries in Group A (India, Philippines and Thailand), 0 in others; D_{12} = 1 in 5 countries in Group A, 8 countries in Group B and Singapore, 0 in others; D_2 = 1 in 23 countries in Group C (except Singapore), 0 in others.

Table 1-2: Correlations between Consumption and Past Product and between Consumption Growth and Investment in 40 Countries – *in the 1990s*

$$\ln c_t = (A_1D_1 + A_{21}D_{21} + A_{22}D_{22} + A_3D_3) + (\alpha_1 D_1 + \alpha_2 D_2 + \alpha_3 D_3)\ln v_{t-1}$$

A_1	A_{21}	A_{22}	A_3	α_1	α_2	α_3	adj. R^2
0.019	0.927	0.793	1.776	0.927	0.847	0.768	0.985
(5.85)	(2.03)	(2.20)	(6.47)	(56.96)	(21.96)	(28.09)	

$$\ln i_t = (\ln B_{11}D_{11} + \ln B_{12}D_{12} + \ln B_2D_2) + (\beta_{11}D_1 + \beta_{12}D_2)\ln c_t + (\beta_{21}D_1 + \beta_{22}D_2)\ln c_{t-1}$$

$\ln B_1$	$\ln B_2$	$\ln B_3$	β_{11}	β_{12}	β_{13}	β_{21}	β_{22}	β_{23}	adj. R^2
-0.674	-4.503	-2.489	1.248	1.455	1.190	-0.263	-0.003	-0.032	0.948
(-2.98)	(-2.59)	(-4.37)	(8.02)	(5.77)	(5.40)	(-1.69)	(-0.01)	(-0.15)	

D_1, D_2, D_{21}, D_{22} and D_3 are dummy variables: D_1 = 1 in 8 countries in Group A and 3 countries in Group B (Czech Republic, Poland and Slovak Republic), 0 in others; D_2 = 1 in 5 countries in Group B and Singapore, 0 in others; D_{21} = 1 in 2 countries in Group B (Mexico and Turkey), 0 in others; D_{22} = 1 in 3 countries in Group B (Hungary, Korea and Taiwan) and Singapore, 0 in others; D_3 = 1 in 23 countries in Group C (except Singapore), 0 in others.

Table 1-3: Correlations between Consumption and Past Product and between Consumption Growth and Investment in 40 Countries – *in the 2000s*

$$\ln c_t = (A_1 D_1 + A_{21} D_{21} + A_{22} D_{22} + A_3 D_3) + (\alpha_1 D_1 + \alpha_2 D_2 + \alpha_3 D_3) \ln v_{t-1}$$

A_1	A_{21}	A_{22}	A_3	α_1	α_2	α_3	adj. R^2
0.220	0.937	0.831	2.124	0.909	0.857	0.744	0.982
(6.35)	(2.55)	(2.66)	(8.51)	(42.31)	(19.35)	(31.10)	

$$\ln i_t = (\ln B_1 D_1 + \ln B_2 D_{23} + \ln B_3 D_{31}) + (\beta_{11} D_1 + \beta_{12} D_2 + \beta_{13} D_3) \ln c_t + (\beta_{21} D_1 + \beta_{22} D_2 + \beta_{23} D_3) \ln c_{t-1}$$

$\ln B_1$	$\ln B_2$	$\ln B_3$	β_{11}	β_{12}	β_{13}	β_{21}	β_{22}	β_{23}	adj. R^2
0.352	-1.811	-2.231	1.791	1.616	1.728	-0.964	-0.519	-0.603	0.943
(5.01)	(-4.65)	(-5.25)	(6.02)	(6.39)	(8.93)	(-3.20)	(-2.10)	(-3.23)	

D_1, D_2, D_{21}, D_{22}, D_{23}, D_3 and D_{31} are dummy variables: D_1 = 1 in 8 countries in Group A, 0 in others; D_2 = 1 in 8 countries in Group B, 0 in others; D_{21} = 1 in 3 countries in Group B (Mexico, Poland and Turkey), 0 in others; D_{22} = 1 in 5 countries in Group B, 0 in others; D_{23} = 1 in 8 countries in Group B and Singapore, 0 in others; D_3 = 1 in 24 countries in Group C, 0 in others; D_{31} = 1 in 23 countries in Group C (except Singapore), 0 in others.

These results reveal that 40 countries examined can be divided into three clusters in each decade while constitutions of some clusters change over the last three decades. In the 1980s, they are classified into (a) three countries of India, Philippine and Thailand in Group A; (b) 14 countries of five countries in Group A, eight countries in Group B and Singapore; and (c) 23 countries in Group C except Singapore. In the 1990s, the first two clusters have different constituents: (d) eleven countries including eight countries in Group A and three countries of Czech Republic, Poland and Slovak Republic in Group B; and (e) six countries of five countries in Group B and Singapore. In the 2000s, 40 countries are classified into (f) eight countries in Group A, (g) eight countries in Group B, and (h) 24 countries in Group C.

Using the values of parameters identified, the values of the marginal propensity to consume, *a*, and the accelerator coefficient, *b*, in each decade

were computed based on equations (10) and (15). The average ratios of consumption to GDP and the average consumption growth rates for each cluster are calculated to compute these two values. The results are tabulated in Table 2.

Table 2: Values of Parameters for Each Cluster in the Three Decades

		Group A		Group B		Group C	
		IN, PH, TH*	Other 5	CZ, PL, SK**	Other 5	Singapore	Other23
1980s	α	0.977	0.977				0.906
	c_1 / v_{t-1}	0.711	0.580				0.621
	a	0.694	0.566				0.562
	r_c	0.034	0.059				0.076
	ln$B$	-0.928	-0.591				-1.679
	B	0.395	0.554				0.187
	β_1	1.394	1.394				1.043
	b	12.094	10.230				2.659
1990s	α	0.927			0.847		2.659
	c_1 / v_{t-1}	0.602			0.610		0.768
	a	0.558			0.517		0.583
	r_c	0.058			0.065		0.448
	ln$B$	-0.674			-4.503		0.019
	B	0.510			0.011		-2.489
	β_1	1.248			1.455		0.083
	b	9.476			0.186		4.435
2000s	α	0.909	0.857			0.744	
	c_1 / v_{t-1}	0.629	0.650			0.585	
	a	0.572	0.557			0.435	
	r_c	0.121	0.090			0.066	
	ln$B$	0.352	-1.811			-2.231	
	B	1.422	0.163			0.107	
	β_1	1.791	1.616			1.728	
	b	14.420	2.084			1.814	

*IN: India; PH: Philippine; TH: Thailand. **CZ: Czech Republic; PL: Poland; SK: Slovak Republic.

Using the values of parameters a and b, the type of economic fluctuation in each cluster was identified as summarized in Table 3 where three fluctuation patterns are observed: monotonic explosion (MO), explosive oscillation (EO), and damped oscillation (DO). The conditions of these patterns can be expressed as follows, respectively:

(MO)

$$\frac{\partial c_t}{\partial v_{t-1}} > \frac{4}{\left(1+\frac{\partial i_t}{\partial \Delta c_t}\right)\left(1+\frac{\partial \Delta c_t}{\partial i_t}\right)} \qquad (17)$$

where $\partial i_t > \partial \Delta c_t$;

(EO)

$$\frac{\partial \Delta c_t}{\partial i_t} < \frac{\partial c_t}{\partial v_{t-1}} < \frac{4}{\left(1+\frac{\partial i_t}{\partial \Delta c_t}\right)\left(1+\frac{\partial \Delta c_t}{\partial i_t}\right)} \quad (18)$$

where $\partial i_t > \partial \Delta c_t$; and

(DO)

$$\frac{\partial c_t}{\partial v_{t-1}} < \frac{4}{\left(1+\frac{\partial i_t}{\partial \Delta c_t}\right)\left(1+\frac{\partial \Delta c_t}{\partial i_t}\right)} \quad (19)$$

where $\partial i_t \leq \partial \Delta c_t$ or

$$\frac{\partial c_t}{\partial v_{t-1}} < \frac{\partial \Delta c_t}{\partial i_t}, \partial i_t > \partial \Delta c_t \quad (20)$$

where $\partial i_t > \partial \Delta c_t$.

In eight countries in Group A, MO has emerged over the three decades examined while they were divided into two groups in the 1980s, three countries of India, Philippine and Thailand and remaining five countries. By contrast, the fluctuation type of eight countries in Group B has changed through the decades: MO in the 1980s, damped oscillation (DO) in the 1990s while MO was maintained in three countries of Czech Republic, Poland and Slovak Republic, and explosive oscillation (EO) in the 2000s. In 24 countries in Group C, the fluctuation trend in Singapore is same as five countries in Group B while in other 23 countries a different trend was observed: EO in the 1980s and 1990s, and DO in the 2000s. It is noted that the condition for DO in the 2000s of Group C is different from that of in the 1990s of Group B: equation $\partial i_t \leq \partial \Delta c_t$ holds in the former while equation $\partial i_t > \partial \Delta c_t$ holds in the latter. The

equation $\partial i_t > \partial \Delta c_t$ holds in the all three economies over the period examined except in the 1990s of five countries in Group B and Singapore.

Table 3 Types of Economic Fluctuation for Each Cluster in the Three Decades

		Group A		Group B		Group C	
		IN, PH, TH*	Other 5	CZ, PL, SK**	Other 5	Singapore	Other23
1980s	*a*	0.694	0.566				0.562
	b	12.094	10.230				2.659
	$a(1+b)^2-4b$	70.672	30.477				-3.101
	ab	8.397	5.792				1.496
	Fluctuation***	ME					EO
1990s	*a*	0.558			0.517		0.448
	b	9.476			0.186		4.435
	$a(1+b)^2-4b$	23.296			-0.016		-4.509
	ab	5.284			0.096		1.986
	Fluctuation***	ME			DO		EO
2000s	*a*	0.572		0.557		0.435	
	b	14.420		2.084		1.814	
	$a(1+b)^2-4b$	78.340		-3.039		-3.812	
	ab	8.249		1.160		0.789	
	Fluctuation***	ME		EO		DO	

*IN: India; PH: Philippine; TH: Thailand. **CZ: Czech Republic; PL: Poland; SK: Slovak Republic. ***ME: Monotonic explosion; EO: Explosive oscillation; DO: Damped oscillation.

DISCUSSION

Given growing economies, there is an autarky cycle where consumption is the main driver of GDP growth while advancing and advanced economies benefit from a virtuous cycle induced by investment (Fukuda and Watanabe, 2011), Table 3 suggests generation of an autarky cycle and a virtuous cycle depends on three types of economic fluctuation: monotonic explosion (MO), explosive oscillation (EO), and damped oscillation (DO). An autarky cycle can attribute its creation to MO which has been observed in the current growing economies in Group A over the last three decades and in the 1980s of advancing economies while EO and DO can contribute to produce an investment-driven cycle over the period examined in the current advancing and advanced economies in Group B and C except in the 1980s of Group B. In addition, it can be considered that a mechanism to switch from an autarky cycle and an investment-inducing virtuous cycle is governed by the balance between consumption growth and

investment. Equation (17) of MO indicates that the past GDP elasticity to consumption drives an autarky cycle and the balance is insufficient to induce a virtuous cycle driven by investment. On the other hand, equations (18), (19) and (20) of EO and DO suggests that the balance surpasses the past GDP elasticity to consumption and enables investment to drive a virtuous cycle for sustainable economic development. It can be given that economic development shifts the fluctuation pattern from EO to DO under the condition $\partial i_t > \partial \Delta c_t$. According to equations (18) and (20), this shift can reach equilibrium described as

$$\frac{4}{\left(1+\frac{\partial i_t}{\partial \Delta c_t}\right)\left(1+\frac{\partial \Delta c_t}{\partial i_t}\right)} = \frac{\partial \Delta c_t}{\partial i_t} \qquad (21)$$

The solution of equation (21) is

$$\partial \Delta c_t = \partial i_t \qquad (22)$$

This equation implies that the size of investment is simply equal to the size of consumption growth in the closed cycle between consumption, investment and production in a mature economy.

Table 3 also indicates that the type of economic fluctuation shifts from MO to EO and to DO as an economy grows. While five countries in Group B demonstrates the shift from MO not directly to EO but through DO associated with a change from the condition $\partial i_t > \partial \Delta c_t$ to the condition $\partial i_t \leq \partial \Delta c_t$, the direct shift could be occurred under the condition $\partial i_t > \partial \Delta c_t$ as in other three countries in the same group. The transition corresponds to a change in the balance between consumption growth and investment sufficient to induce a virtuous cycle driven by investment. Looking at Table 3, the value of parameter *b*, $\partial i_t / \partial \Delta c_t$, in growing economies is higher, around 10.0 or more, than in advancing and advanced economies when EO and DO are observed, less than 5.0. This contrast implies that investment in growing economies largely relies on growth in government expenditure and net trade rather than consumption growth while the level of investment in advancing and advanced economies is determined by consumption growth. The balance changes in line with economic development and consequently shifts the fluctuation pattern from MO to EO and to DO.

The global centre of economic gravity has shifted from the mid-Atlantic around 1980 towards Asia and Africa (Quah, 2011). However, the recent studies point out that the transfer of economic power from advanced economies to advancing economies and growing economies is

likely to take longer than generally expected (The Economist, 2011a). While growing economies has enjoyed fast growth, it depends on the gap in economic production between growing economies and advancing and advanced economies. The recent sluggish growth in advanced economies means that countries in growing economies have to manage internal spending. It raises the risks of the overspending, excessive credit and inflation that have spurred past emerging market crises. Even if crises are avoided, growing economies are likely to suffer from sudden slowdown as they become richer. The recent rapid growth rates are unlikely to be sustained.

Countries in growing economies cannot rely indefinitely on other countries' spending as they grow importance in the global economy. While they have relied on exports to fuel their growth, they need to develop their domestic market and shift to internal sources of spending. As economies become richer, they have greater need of a skilled workforce and a financial system which could contribute to further economic development. Yet growing economies views advancing and advanced economies as a place easy to do business and get source of innovation. Many firms based in growing economies have been active in mergers and acquisition (M&A) in advanced economies in recent years (World Bank, 2011). M&A could be an effective option for these firms' expansion into advancing and advanced economies to reduce the legal, financial and regulatory risks and to find a skilled and well-educated workforce. Advancing and advanced economies also expect further growth in growing economies. A fast rate of catch-up by growing economies means that they would buy more of the goods and services in which advanced economies have a comparative advantage. Such a mutual dependence between growing economies and advancing and advanced economies is no guarantee that it will contribute to either improving growing economies' welfare or raising their living standards (Prahalad, 2004; Jenkins, 2005; Karnani, 2006).

The transition of growing economies from an autarky cycle to an investment-driven cycle will contribute to a global financial rebalancing. While the global financial crisis in 2008 resulted in significant changes in saving and investment patterns across the world and narrowed global financial imbalances considerably, global imbalances would threaten the nascent recovery and caused future financial crises (Blanchard and Milesi-Ferretti, 2009; Taylor, 2011). Growing economies could contribute to lowering global imbalances in the future by developing domestic demand in order to drive growth and raising internal consumption and investment.

Growing economies are required to maintain productivity in order to shift to an invest-driven cycle. According to research by Eichengreen et al. (2011), some growing economies with an undervalued currency and a low rate of consumer spending are more likely to suffer a growth slowdown associated

with productivity growth slowdowns. They need to mitigate the slowdown by changing their growth path depending on a cycle between consumption and production. The balance between consumption growth and investment is the key factor of the change as discussed above. The process of economic growth is accelerated by not pure productivity growth but investment increase (Hausmann et al., 2005), which could stimulate internal consumption growth and domestic market development. It is predicted that most of the global economic growth between 2010 and 2050 would be attributed to advanced technology (Buiter and Rahbari, 2011). Innovation based on advanced technology should be promoted to sustain productivity with a virtuous cycle between consumption, investment and production, which will enable growing economies to optimize the balance between consumption growth and investment.

Innovation in the next decades needs to go beyond economic value and meet broader social expectations. The outcome of this innovation is expected not only to achieve economic success but also to satisfy social, cultural, aspirational and emotional needs. Creation of new functionality beyond economic value will drive innovation in the next decades. The principle of new functionality includes not only creating economic value but also meet broader expectations of society. New functionality is a possible trigger to induce investment for innovation in the next decades (Fukuda and Watanabe, 2011). Especially in growing economies, frugality is the key to inducing investment. Frugality does not just mean second-rate or low cost but meets demand of people in growing economies from their own perspectives.

Co-evolution between growing and advanced economies could enhance innovation for creating new functionality (Fukuda et al., 2011). While growing economies have abilities to utilize advanced technology such as information and communications technology (ICT), their economic growth is more vulnerable than those of advancing and advanced economies. On the other hand, advancing and advanced economies need external resources to maintain their growth. Co-evolution between these three economies will provide all of them to opportunities to develop new functionality necessary for overcome constraints on future growth in each of three economies.

The global economic uncertainty threatens growth paths of all three economies. The euro crisis is diversifying European economies. Growth in some southern European countries such as Greek has been slowed due to massive budget deficit, which is a threat of the euro's collapse spreading through not only the euro zone's members but also those of non-members (The Economist, 2011b). The threat is likely to affect other countries in advanced economies including the US and Japan, suffering from economic stagnations, as well as other two economies. The mechanism to switch from an autarky cycle to an investment-driven cycle could suggest a new growth path to avoid a collapse of the euro and maintain growth in three economies.

CONCLUSION

The balance between consumption growth and investment is the key to a switch from a consumption-dependent development to an investment-driven development. While growing economies has enjoyed fast growth, they cling to an autarky cycle between consumption and economic growth due to the imbalance between consumption growth and investment. In contrast, advancing and advanced economies has maintained the balance sufficient to induce a virtuous economic development cycle driven by investment. The size of investment will come to be equal to the size of consumption growth in the closed cycle as an economy matures.

Generation of an autarky cycle and a virtuous cycle depends on three types of economic fluctuation: monotonic explosion (MO), explosive oscillation (EO), and damped oscillation (DO). While an autarky cycle is attributed to MO, a virtuous cycle driven by investment is produced when EO and DO are observed. A switch from an autarky cycle to a virtuous cycle will be associated with the transition from MO to EO and to DO as an economy grows.

Countries in growing economies need to develop domestic demand in order to drive growth and raising internal consumption and investment to optimize the balance between consumption growth and innovation. Innovation for creating new functionality could sustain their productivity growth and also contribute to lowering global imbalances. Co-evolution between growing economies and advancing and advanced economies could promote this innovation not only to achieve economic success but also to satisfy social, cultural, aspirational and emotional needs.

Further work should analyze growth paths of growing economies in the future. Their sustainable growth is decisive for global economic rebalances. The diversification of European economies is another important subject which will deeply affect the future global economic growth. Analysis on the trends in economic development in this area could clarify the process of diversification.

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Appendix A

The economic fluctuation demonstrated by equation (6) varies according to the values of two parameters in per capita term, the marginal propensity to consume and the accelerator coefficient. Figure A. illustrates different regimes in parameter space. In the regimes where $a(1+b)^2 - 4b \geq 0$, monotonic damping and monotonic explosion are generated when ab < 1 (regime I) and $ab > 1$(regime II) correspondingly. In the regimes where $a(1+b)^2 - 4b \geq 0$, damped oscillation and explosive oscillation emerge when $ab < 1$(regime III) and when $ab > 1$(regime IV) respectively. These four types of economic fluctuation can be defined as follows (Barras, 2009):

- Monotonic damping: after the initial disturbance, the economy moves smoothly back towards its equilibrium position.
- Monotonic explosion: the initial disturbance causes the economy to move further away from its equilibrium position.
- Damped oscillation: the initial disturbance induces cyclical oscillations which progressively die away.
- Explosive oscillation: the induced oscillations progressively increase in magnitude.

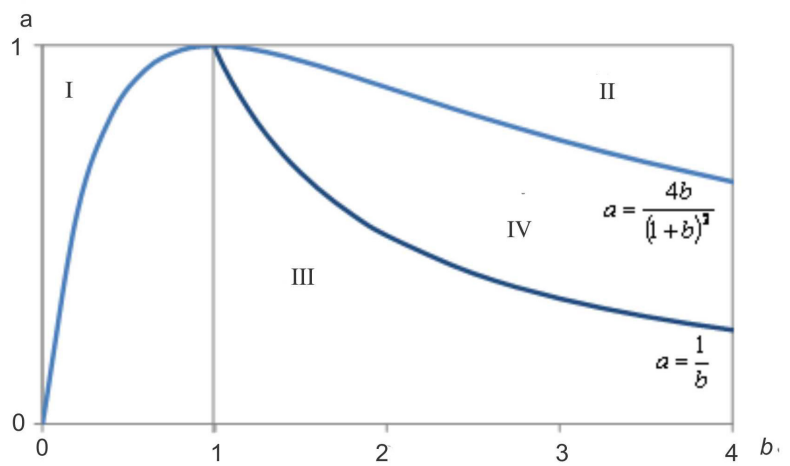

Figure A: Behavioral Regimes of Samuelson's model

I: Damped monotonic; II: Explosive monotonic; III: Damped oscillation; and IV: Explosive oscillation.

Appendix B

The national accounts data for 40 countries are constructed by the following steps:

I. Data collection

Data on the following 6 indicators are obtained from the World Bank's World Development Indicators released in December 2011: GDP (*V*), GDP per capita (*v*), Household final consumption expenditure (*C*), Gross capital formation (*I*), Exports (*X*) and Imports (*M*) of goods and services. All data are in current US dollars from 1980 to 2010. Data for Taiwan are extracted from the database of the Directorate General of Budget, Accounting and Statistics (DGBAS) of Executive Yuan, Republic of China. These data in New Taiwan dollars from 1980 to 2010 are converted to current US dollars at each annual exchange rate adopted by DGBAS.

II. Data estimation

Some data for 5 countries are estimated as follows:

a. Australia

- GDP and GDP per capita in 2010 and Gross capital formation in 2009 and 2010 are estimated based on data in the same years from the International Monetary Fund (IMF)'s World Economic Outlook Database released in September 2011.
- Household final consumption expenditure in 2009 and 2010 are estimated based on the growth rate between past two years.
- Gross capital formation in 2009 and 2010 are computed based on data on total investment as a percentage of GDP in the same years from IMF's World Economic Outlook Database released in September 2011.
- Exports and Imports of goods and services in 2009 and 2010 are estimated based on data in the same years from the World Trade Organization (WTO)'s Total merchandise trade data set released in October 2011.

b. Czech Republic

- GDP and GDP per capita from 1980 to 1989 are estimated based on data for Slovak Republic in the same period.
- Household final consumption expenditures and gross capital formations from 1980 to 1989 are estimated based on the average growth rate between

1990 and 1994.

- Exports and Imports of goods and services from 1980 to 1989 are estimated based on data in the same period from the WTO's Total merchandise trade data set released in October 2011.

c. New Zealand

- GDP and GDP per capita in 2010 and Gross capital formation in 2010 are estimated based on data in the same year from the IMF's World Economic Outlook Database released in September 2011.
- Household final consumption expenditure in 2010 is estimated based on the growth rate between past two years.
- Gross capital formation in 2010 is computed based on data on total investment as a percentage of GDP in the same year from IMF's World Economic Outlook Database released in September 2011.
- Exports and Imports of goods and services in 2010 are estimated based on data in the same year from the WTO's Total merchandise trade data set released in October 2011.

d. Poland

- GDP and GDP per capita from 1980 to 1984 are estimated based on the growth rate between following two years.
- Household final consumption expenditures from 1980 to 1984 are estimated based on the average growth rate between 1992 and 1996.
- Gross capital formations from 1980 to 1984 are estimated based on the average growth rate between 1985 and 1987.
- Exports and Imports of goods and services from 1980 to 1989 are estimated based on data in the same period from the WTO's Total merchandise trade data set released in October 2011.

e. Russia

- GDP and GDP per capita from 1980 to 1988 are estimated based on data in the same period from the National Accounts Estimates of Main Aggregates of the United Nations (UN) released in March 2011.
- Household final consumption expenditures and gross capital formations from 1980 to 1987 are estimated based on the average growth rate between 1991 and 1995.

- Exports and Imports of goods and services from 1980 to 1988 are estimated based on data in the same period from the WTO's Total merchandise trade data set released in October 2011.

III. Data calculation

Population (N) is calculated from GDP and GDP per capita, and government expenditure (G) is computed as the subtraction of the sum of four indicators, C, I, X and M, from GDP, V. Using these numbers, the following annual data for each country are constructed over the period from 1980 to 2010: GDP per capita (v), consumption per capita ($c = C/N$), investment per capita ($i = I/N$), government expenditure per capita ($g = G/N$) and net trade in goods and services per capita ($x - m = (X - M)/N$), where the following equation holds: $v = c + i + g + (x - m)$.