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《論　文》

Effectiveness of monetary policy:

Choice of exchange rate regimes

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Abstract

In this study, we introduce an Error correction model (ECM) to investigate the role of using an exchange rate regime as a shock absorber in the case of terms of trade shock. We investigate this role with various criteria. First, we investigate this role by using different definitions of exchange rate regime classifications, such as De Jure classification and De Facto classification. De Jure classification is referred to as an official exchange rate regime which is used by the International Monetary Fund (IMF), while De Facto classification is the actual performance of each countries exchange rate regime. Furthermore, we check this relationship and consistency by separating samples into three groups using criteria of export commodities, development level, and openness level. As for the purpose of this study, we attempt to measure the ability of different exchange rate regimes to absorb the terms of trade shock on the growth rate of real gross domestic product (GDP) per capita of different exchange rate regimes. Finally, we try to compare the results from different groups of countries.

Keywords: Exchange rate regime; Error correction model (ECM); Panel data

1. Introduction and Objectives

Throughout the world today, choices of exchange rate regimes are still controversial. Many discussions are launched regarding this topic. Some studies have found that a flexible regime is the best option, but some theories preferred a more rigid regime[1]. We will point out some examples of the advantages of each exchange rate regime. Initially, the conventional advantage of the fixed exchange rate regime is that firms who perform as exporters and importers will have a stability in estimated profits from a stable exchange rate, thus this confidence can increase a firm international trade, which consequently results in improving its welfare. Moreover, the following works of Robert Mundell and William Poole in late 1960s indicate that the fixed exchange rate regime automatically protects the real economy from the effects of a domestic money market shock. Money supply will increase as the monetary authority buys foreign reserves to prevent the appreciation of the local currency, and the real output is left unchanged. In contrast, the flexible exchange rate regime requires income to fall, so that the real money demand is reduced back to the unchanged level of the real money supply. Therefore, if these shocks predominate in the economy, this is an argument in favor of a fixed exchange rate regime. On the other hand, there are also a number of studies which show advantages of the flexible exchange rate regime.

Mundell (1963) and Poole (1975) have also pointed out that when the shocks are real, the floating exchange rate regime tends to be the more effective choice. One of the most important benefits, commonly attributed to the fully floating exchange rate regime, is its allowance of smooth adjustment to the real shocks. When domestic prices are sticky, and thus change at best slowly in response to shocks, a negative real shock, a fall in export demand or in the terms of trade, leads to a depreciation of the nominal exchange rate. This depreciation in the exchange rate reduces the price of tradable goods precisely at the moment that their demand has fallen, and therefore partially offsets the effect of the negative shock.

That is, the exchange rate acts as an automatic stabilizer in the flexible exchange rate regime. Moreover, Edwards and Levy Yeyati (2005) found out that the more freely float the regime has, the greater the ability to absorb terms of trade shock. This implies that the cycle of an economy with the floating exchange rate regime will be more stabilized compared to the rigidity regime when there are terms of trade shock. Lastly, this finding is pointed out by Meade (1951) and Broda (2003) as well. Although, choices of exchange rate regimes and theories of these are still ambiguous, the relationship between regimes and their economic performance is evidently found in many studies, such as the study by Gosh, Gulde, Ostry and Wolf (1995), which suggested a strong link between the choice of the exchange rate regime and the macroeconomic performance. Adopting the pegged exchange rate regime can lead to lower inflation, but also to slower productivity growth. According to Edwards and Levy Yeyati, from 1969 to 2002, there were only three papers, whose topics involve exchange rate regimes, terms of trade, and growth while others involved terms of trade and growth or exchange rate regimes and growth. This study is an extension of the topics of exchange rate regimes, terms of trade, and growth. Our objectives are as follows;

1.1. To determine the ability to absorb terms of trade shock on economies of two types of De Facto classification; the fixed exchange rate regime and the flexible exchange rate regime.
1.2. To determine the ability to absorb terms of trade shock on economies of two types of De Jure classification; the fixed exchange rate regime and the flexible exchange rate regime.
1.3. To determine whether there is a different ability to absorb terms of trade shock on an economy between the two classifications of exchange rate regimes.
1.4. To determine whether there are any distinctions of an absorber's ability between different groups of countries, which are based on main export commodities, development level, and openness level.

2. Data sources and Measurements

To accomplish our objectives, we focus on estimating the ability to absorb the terms of trade shock on the growth rate of the real gross domestic product (GDP) per capita of different exchange rate regimes, by using 15 sets of data from 105 selected countries[2] around the world. The dataset consists of the growth rate of the followings: the growth rate of real gross domestic

product (GDP) per capita, the percentage change of terms of trade, the initial gross domestic product (GDP) per capita, the ratio of the growth rate of government consumption to gross domestic product (GDP), the ratio of investment to gross domestic product (GDP), the degree of openness, the dummy of Latin American countries, the dummy of Sub-Saharan African countries, the dummy of transitional economies, the dummy of De Jure exchange rate regime, the dummy of De Facto exchange rate regime, the fixfix dummy, the dummy of manufactured-exporting-countries, the dummy of developed countries, and the dummy of openness. This study uses annual data in the range of 1989–2007 and we defined broadly the regime of exchange rate into two groups consisting of the fixed exchange rate regime and the flexible exchange rate regime for both De Jure classification and De Facto classification. The fixed exchange rate regime is a group of exchange rate regimes which consists of formal dollarization, currency board, and currency union. This fixed exchange rate regime is similar to the hard pegged exchange rate regime definition of the International Monetary Fund (IMF).

Lastly, the flexible exchange rate regime in this study is defined as an independent float, a managed float without a predetermined exchange rate path, a soft pegged exchange rate, and a tightly managed float. De Jure classification of exchange rate regime is based on annual reports on exchange arrangements and exchange restrictions of the International Monetary Fund (IMF). De Facto classification of exchange rate regime is based on Levy Yeyati and Sturzenegger (2003). Both regime classifications are used in terms of a dummy variable, which results in unity for the fixed exchange rate and zero for the flexible exchange rate. However, in the first part of this study, we will use cross section analysis instead of pooled data, thus the regime classification will be based on 50% of regimes used for each country in the period of 1989–2007. We define an economic shock as an external term of trade shock, which is a percentage change in terms of trade, and an economic growth rate as the growth of real gross domestic product (GDP) per capita. We also define terms of trade as the value of exports in current price, deflated by the imported price index. As for the criteria used to classify countries into specific groups, we will separate countries into three groups; criteria used for export commodities, emerging countries by criteria used for development levels, which was already defined in the study of Edwards and Levy Yeyati (2005), and openness levels. Furthermore, as for the criteria used for openness, we will use 2 groups; high and low level of openness. The export commodity groups consist of agricultural, manufacturers, and fuel and mining exporting countries. In order to simplify this issue, we will categorize countries under this criterion into 2 groups; the manufactured-exporting-countries and the non-manufactured-exporting-countries.

It is noted that, some data are adjusted by the author. The method of calculation is mentioned in this section. To begin with, the proxy degree of openness is calculated by using the ratio of import of goods and services on gross domestic product (GDP) plus the ratio of export of goods and services on gross domestic product (GDP). The ratio from this calculation indicates the absolute size of openness of a specific country. The high ratio indicates that a country is more open to international trade in goods and service. The source for raw data of export and import referred to *the World Development Indicator 2009* is the World Bank.

Table 1　Data sources and Measurements

Data			
Descriptions	Variables	Range	Sources
Rate of growth of real gross domestic product (GDP) per capita	g	1989–2007	World economic outlook 2009
Percentage change of terms of trade	Δtt	1989–2007	World development indicator 2009
Initial gross domestic product (GDP) per capita (use in log form)	gdpin	1989–2007	World economic outlook 2009
Growth of government consumption to gross domestic product (GDP)	ggov	1989–2007	World development indicator 2009
Ratio of investment to gross domestic product (GDP)	invgdp	1989–2007	World development indicator 2009
Degree of openness	op	1989–2007	Author's calculation
Dummy of Latin American countries	latin	1989–2007	Author's calculation
Dummy of Sub-Saharan African countries	safrica	1989–2007	Author's calculation
Dummy of Transition economies	trans	1989–2007	Barro and Lee (2001)
Dummy of De Jure peg regimes	jpeg	1989–2007	IMF's annual report on exchange rate arrangements and exchange rate restrictions
Dummy of De Facto peg regimes	fpeg	1989–2007	Levy Yeyati and Sturzenegger (2003)
Dummy of manufactured-exporting-countries	man	1989–2007	WTO trade profile and Author's calculation
Dummy of developed countries	ind	1989–2007	Edwards and Levy Yeyati (2005)
Dummy of high openness countries	open	1989–2007	World development indicator 2009 and Author's calculation

$$Openness = \frac{Export + Import}{GDP}$$

Next, dummy of region and transitional economy indicates the value of unity when the observation is in that region or in a transitional situation. The classification of region is based on the World Bank classification, and the classification of transitional economy is based on Barro and Lee (2001).

3. Criteria for classifications of exchange rate regime and countries

De Jure classification: In this study, De Jure classification is based on the International Monetary Fund (IMF) annual report on exchange arrangements and exchange restrictions from 1989–2007. Due to the International Monetary Fund (IMF) basis, exchange rates will be classified as an annual declaration of central bank of each country. This declared regime might not

represent the actual regime of that country. By using this basis, we can separate regimes into two broad groups; floating exchange rate regime and hard pegged exchange rate regime. The floating exchange rate regime consists of independently floating, other managed float with no predetermined exchange rate path, tightly managed float and soft pegs, conventional fixed pegs, horizontal bands, crawling pegs, and crawling bands. Hard pegged exchange rate regime consists of currency board without separate legal tender, formal dollarization, and currency union. For dummy of De Jure exchange rate regime, dummy will have a value of unity if that country uses hard pegged exchange rate regime. Thus, this variable will be in the form of pooled data of the selected countries from 1989–2007.

De Facto classification: This variable is based on classification from "Classifying Exchange Rate Regimes" by Levy Yeyati and Sturzenegger (2003). If the exchange rate regime is flexible, the intermediate or fixed will be more than 50% of the duration of the study, respectively. The adaptation of this classification to our study is that the original classification indicates three groups of broad regime; flexible regime, intermediate regime, and fixed regime. We reduce the classification into two groups; the fixed exchange rate regime and the flexible exchange rate regime (original flexible and intermediate regime). This is because the consistency adjusts to De Jure classification from the International Monetary Fund (IMF). Thus, the De Facto exchange rate regime dummy has a value of unity when there is an actual hard pegged exchange rate regime, and a value of zero for others. This set of data is also in pooled data form.

Countries classification criteria: The criterion of export commodities depends on each country's profile from the World Trade Organization (WTO) website. We categorize countries into two groups, which are the manufactured-exporting-countries and the non-manufactured-exporting-countries. This criterion is based on the percentage of export by commodity group to country's gross domestic products (GDP), which referred to trade statistics and trade profiles from the World Trade Organization (WTO) website. The highest percentage of each country for each year will be used as the main export commodity for that year. The most frequent main export commodity of each country will be used as a category, and the value of the dummy will be unity for the manufactured-exporting-countries while zero for the non-manufactured-countries-countries. The classification of development level criteria is based on Edwards and Levy Yeyati (2005), which separated countries into two groups; the developed countries (23 from 183 selected countries) and the developing countries. As for this type of dummy, the value will be unity for the developed countries and zero for the developing countries. Lastly, for a case of openness criteria, we will separate countries into two groups by ranking the average degree of openness of 1989–2007 time range. The rank above the median of the samples will be categorized at a high openness degree, and the rest will be categorized at a low openness degree. The dummy will be set as unity for high openness countries and zero for low openness countries.

4. Comparison of the ability to absorb terms of trade shock between the fixed exchange rate regime and the flexible exchange rate regime

First, we will estimate the level of the long run growth rate by using a set of determinations.

This long run level will be used to estimate the error correction model, and the terms of trade change will be set as a shock in this equation. The determination of growth is chosen as a literature. Initial gross domestic product (GDP), investment, and government final consumption form a conventional set of determinations as the components of the gross domestic product (GDP).

In order to fulfill the study purposes, two basic models are used to investigate the role of exchange rate regime in terms of trade shock absorber. The first model is an estimation of the economic growth steady state. The second equation is an error correction mechanism of the growth rate which is used for estimating the ability to absorb terms of trade shock for each regime. The estimation of the first equation is only to find the proxy of the long run growth rate, which is used in an error correction term.

Equation 1　Long run growth rate determination; role of exchange rate regimes

$$g_j^* = \alpha_1 + \alpha_2 GDPIN_j + \alpha_3 INVGDP_j + \alpha_4 GGOV_j + \alpha_5 OP_j + \alpha_6 LATIN_j + \alpha_7 TRANS_j + \alpha_8 SAFRICA_j + \alpha_9 PEG_j + \omega_j,$$

While, subscribe j is a specified country. g_j^* refers to the long run growth rate of the real gross domestic product (GDP) per capita of country j. $GDPIN_j$, $INVGDP_j$, OP_j, GOV_j, $SAFRICA_j$, $LATIN_j$, and $TRANS_j$ are determinations of the long run growth rate. These determinations are based on the previous studies of Dollar (1992), Barro and Sala-I-Martin (1995), and Sachs and Warner (1995a, 1995b) which indicated that the set of the long run growth determinations consists of the log of initial gross domestic product (GDP) per capita, ratio of investment to gross domestic product (GDP), degree of openness, ratio of government consumption to gross domestic product (GDP), Sub-Saharan African countries dummy, Latin American countries dummy, and dummy for transitional economy. We adjust this dummy by defining the pegged dummy as unity if that country, according to our definition, uses the fixed exchange rate above 50% during the time range. All variables in this model are recalculated into an average term of time range of the study, except for the regime dummy mentioned in the previous section. We will estimate this equation by using the ordinary least square (OLS) technique for cross sectional data. The estimated g_j^* will be used as the proxy of the long run growth in Equation 4.

Equation 2　the estimation result of long run growth rate under De Facto classification

$$\begin{aligned} G^* = & -2.699864899 + 0.06458452449 \times GDPIN + 0.1940314102 \times INVGDP \\ & [1.552104]^* \quad [0.105192] \qquad\qquad [0.058281]^{**} \\ & + 0.05507191559 \times GGOV + 0.0003195745588 \times OP - 0.575534489 \times LATIN \\ & [0.028810]^* \qquad\qquad [0.004553] \qquad\qquad [0.388183] \\ & - 0.5675529887 \times TRANS - 1.000824821 \times SAFRICA - 0.5601368953 \times FPEG \\ & [1.484124] \qquad\qquad [0.561619]^* \qquad\qquad [0.272119]^{**} \end{aligned}$$

$$R^2 = 0.561565$$

The result of this model shows a level of each coefficient and the heteroskedasticity-consistent standard error in each parenthesis. One star refers to a 10% confidence interval, and

two stars refer to 5%. The estimation is based on the white heteroskedasticity-consistent standard errors and covariance method. We use this method instead of the ordinary least square (OLS) method because of the existence of the heteroskedasticity problem in cross sectional data. As shown on Equation 2, we found that private investment, government spending, and exchange rate regime play an important role in a determination of the long run growth rate while other variables are indicated to be indifferent from zero. R-squared of this equation is 0.561565. The interpretations of these determinants is that an increase by one unit growth in investment to gross domestic product (GDP) would lead to an increase in the growth rate of real gross domestic product (GDP) per capita by 0.194 unit, while an increase by one unit of growth of government spending per gross domestic product (GDP) will induce the growth rate of real gross domestic product (GDP) per capita to grow by 0.055 unit. We found that the fixed exchange rate regime lowers the growth rate of real gross domestic product (GDP) per capita by 0.56 units. This is consistent with Gosh, Gulde, Ostry, and Wolf (1995). Some notified points from this estimation are that private investment gives a slightly higher contribution to the growth rate of real gross domestic product (GDP) per capita than government spending, and the fixed exchange rate regime, which yields a lower growth rate of real gross domestic product (GDP) per capita than the flexible exchange rate regime.

Equation 3 the estimation result of long run growth rate under De Jure classification

$$
\begin{aligned}
G^{*} = & -2.637974241 + 0.03716592644 \times GDPIN + 0.1997466903 \times INVGDP \\
& [1.557268]^{*} \quad [0.102436] \qquad\qquad [0.057658]^{**} \\
& + 0.05498636209 \times GGOV - 0.0001847749847 \times OP - 0.5064283576 \times LATIN \\
& [0.028690]^{*} \qquad\qquad [0.004462] \qquad\qquad [0.387815] \\
& - 0.5099911383 \times TRANS - 0.9907475082 \times SAFRICA - 0.6258505332 \times JPEG \\
& [1.458258] \qquad\qquad [0.576930]^{*} \qquad\qquad [0.296523]^{**} \\
R^{2} = & \ 0.564096
\end{aligned}
$$

R-squared of this equation is 0.564096. The white heteroskedasticity-consistent standard errors and covariance method are also used to deal with the existence of heteroskedasticity and autocorrelation problems. The result from changing the definition of exchange rate regime gives us almost the same result. The role of investment in the growth rate of real gross domestic product (GDP) per capita is slightly higher than government, and both of them are positive, at 0.1997 and 0.0549 respectively. The role of exchange rate regime, De Jure classification announced by the International Monetary Fund (IMF), also points out that the fixed exchange rate regime leads to a lower growth rate of real gross domestic product (GDP) per capita by 0.6258 percent per year.

5. The error correction process of the growth rate

From Equation 1, we will estimate an error correction form of the economic growth by using the following equation.

Equation 4　the error correction mechanism

$$\Delta g_{t,j} = \lambda[g_j^* - g_{t-1,j}] + \varphi \Delta tt_{t,j} + \beta(\Delta tt_{t,j} \times PEG_{t,j}) + u_{t,j},$$

$\Delta g_{t,j}$ refers to a change in the growth rate of gross domestic product (GDP) per capita. λ is the speed of an adjustment to steady state, which is expected to be positive by this specification. This is because, if the past growth rate exceeds (less than) the long run rate, the adjustment will deduct (increase) the growth rate of next period. $\Delta tt_{t,j}$ is a terms of trade shock. $(\Delta tt_{t,j} \times PEG_{t,j})$ is an interact term between terms of trade shock and pegged dummy. The other shocks are represented in an error term. In this study, the political shock is not included in this model because the previous studies indicated that the proxy of this shock is insignificant in all models. This equation will be estimated under the method of feasible generalize least squares of panel data in order to correct the heteroscedasticity problem.

To investigate each objective, we will adjust the basic model as follows. Firstly, in order to determine the ability to absorb terms of trade shock on an economy based on two types of De facto and De Jure classification, we will regress Equation 4 by including dummy of pegged and also use the estimated long run level from the first equation to regress the second one. If β is significant, the exchange rate regime will affect the adjustment of the growth rate. On the contrary, without the separation of samples, we will compare the ability to absorb terms of trade shock by using β. If β is significantly positive, the result will point out the higher ability to cope with terms of trade shock in the flexible exchange rate regime. This procedure will be applied to both De Jure classification and De Facto classification to estimate the error correction form of the economic growth.

Equation 5　the estimation result of the error correction under De Facto classification

$$\begin{aligned}\Delta(G_{t,j}) = {} & \underset{[0.081264]^{**}}{0.6810305655} + \underset{[0.024589]^{**}}{0.5954081488} \times (G_{t,j}^* - G_{t-1,j}) + \underset{[0.006207]^{**}}{0.03417653157} \times TT_{t,j} \\ & + \underset{[0.008876]^{**}}{0.01974292792} \times (TT_{t,j} \times FPEG_{t,j})\end{aligned}$$

$$\text{Weighted} - R^2 = 0.392650$$

From the result in Equation 5, it indicates that all the components of the error correction model are significantly different from the zero to a 95% significant level. The error correction component also has the positive coefficient. This implies the convergence to equilibrium of the growth rate in the long run. This coefficient is called “speed of adjustment” at value of 0.5954. The economic interpretation of this speed of adjustment is that if there is a unit shock raising the growth rate over the long run rate, the next period the rate of growth will force back by 0.5954 percent. In addition, if there is a unit adverse shock on the growth rate in this period, next period the growth rate will increase by 0.5954 percent. This movement will continue from period to period until the rate of growth reaches the long run rate, and the error correction component reflects a zero value. Considering terms of trade shock by itself, higher terms of trade indicates a higher growth rate by 0.0341 percent. This result complies with the previous studies and also

our frame work, Mundell-Fleming. On the other hand, an adverse shock on terms of trade or terms of trade deterioration will force the growth rate down by 0.0341 percent for each period. Our main interest of this model is the last component, the interaction term between exchange rate regime and terms of trade change. The estimated coefficient of this term is significantly positive at a value of 0.0197. This implies that the fixed exchange rate regime has amplified the effect of terms of trade shock. The ability to absorb a shock of the flexible exchange rate regime is better than the fixed exchange rate regime by 0.0197 percent of the growth rate per a unit of shock. Therefore, if there is an adverse shock of terms of trade in this economy under the flexible exchange rate regime, the growth rate will drop by 0.0341 percent in the mean while it will drop by 0.0538 percent under the condition of the fixed exchange rate regime.

Equation 6 the estimation result of the error correction under De Jure classification

$$\Delta(G_{t,j}) = \underset{[0.081201]^{**}}{0.7062172179} + \underset{[0.023990]^{**}}{0.6139683921} \times (G^{*}_{t,j} - G_{t-1,j}) + \underset{[0.006835]^{**}}{0.06294885043} \times TT_{t,j} - \underset{[0.008609]^{**}}{0.03942593432} \times (TT_{t,j} \times JPEG_{t,j})$$

$$\text{Weighted} - R^2 = 0.405681$$

All components in Equation 6 are significantly different from zero at a 5% confident interval. The error correction component also yields a positive slope, which implies the convergence to the long run level of the growth rate. The speed of adjustment is 0.6139, which is slightly higher than the case of the De Facto defined model. This can be interpreted as a shorter period of adjustment to converge to the long run growth rate. Terms of trade shock also have a positive coefficient, and therefore it aligns with our frame work. An improvement of terms of trade increases the growth rate by 0.0629 percent per year and vice versa for terms of trade deterioration. However, the performance of exchange rate yields conflict with our expectation as well as De Facto defined model. The coefficient of −0.0394 reflects the greater ability to absorb terms of trade shock under the fixed exchange rate regime rather than the flexible exchange rate regime, according to the former model. To consider the total effect of terms of trade shock on the growth rate under the flexible exchange rate regime, if there is a unit deterioration of terms of trade, the growth rate will drop by 0.0629 percent per year. In contrast, under the condition of fixed exchange rate regime, a unit drop in terms of trade will push down the growth rate by 0.0234 percent.

To summarize, both models yield confliction about the performance in absorbing terms of trade shock under different exchange rate regimes. As for case of De Facto classification, the result complies with our frame work, Mundell-Fleming. The more rigid a country's exchange rate is, the more fluctuant the output and growth rate are. On the other hand, if we adopt the classification of exchange rate regimes by using De Jure classification announcements of the International Monetary Fund (IMF), the more rigid the exchange rate is, the more stable output and growth rate are. The reasons for this might be that some countries were afraid of real float a regime[3]. Thus, by announcing the flexible exchange rate regime, the government would continuously intervene in the exchange rate for stability. Consequently, the announced system of

exchange rate would not reflect the real movement of the exchange rate, so the model of De Jure definition yields the converse result.

6. Comparing De Jure and De Facto model

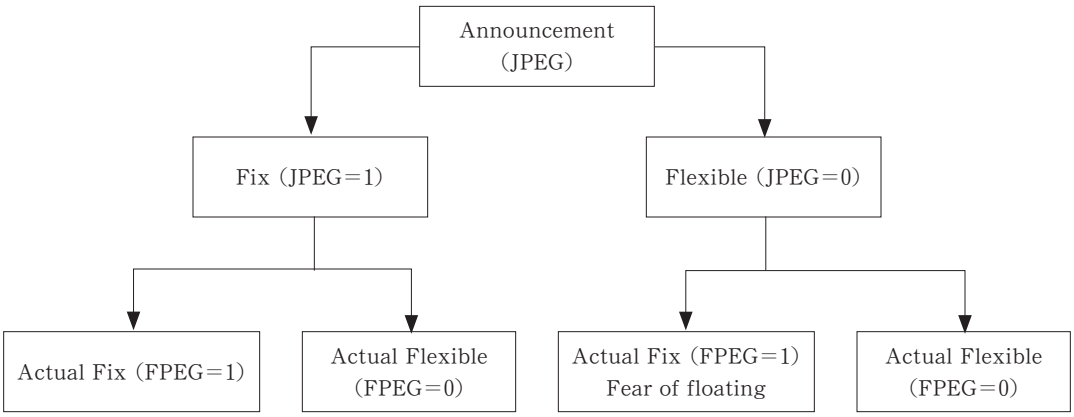
Comparing De Jure and De Facto model, we expect to find an overestimation and an underestimation of an ability to absorb shock in case of De Jure classification which is parameter of $JPEG_{t,j}$. As for the case of the overestimation, its value should be more than the actual value, in the case that the announcement is the fixed exchange rate regime, but the policy makers conduct a discretionary behavior instead of a strict rule. On the other hand, as for case of the underestimation, it should be less than the actual value in the case that the announcement is the flexible exchange rate regime, but they fear floating. This is because De Jure classification is believed to be the biased declaration. Some countries conduct more of the discretionary policy. Thus, we will rerun Equation 4 by adding a term of $\alpha(\Delta tt_{t,j} \times FPEG_{t,j})$. $FPEG_{t,j}$ dummy is unity when that observation is identified as the hard pegged exchange rate regime in De Facto classification. Therefore, the equation form will change into the following equation.

Equation 7　the error correction mechanism for De Jure VS De Facto classification

$$\Delta g_{t,j} = \lambda[g_j^* - g_{t-1,j}] + \varphi \Delta tt_{t,j} + \beta(\Delta tt_{t,j} \times JPEG_{t,j}) + \alpha(\Delta tt_{t,j} \times FPEG_{t,j}) + u_{t,j}$$

The estimated result expects that α should be significant and supposes to be positive. This section will be an analysis of the ability to deal with terms of trade shock by separating the effect of announcement as well as the effect of the actual behavior. As we mentioned in the previous section, a country may announce the fixed exchange rate regime but it actually allows the exchange rate to move flexibly, while the movement of the flexible exchange rate regime announcement actually sticks with rigidity because of the intervention. One of the reasons behind these two phenomena's is that, in the case of the flexible exchange rate regime announcement, the government has an incentive to interfere in exchange rate stability as we called "fear of float-

Figure 1　Deed and Words



ing" or "hidden pegged". This is due to the fact that the more stable the exchange rate, the more confidence for investors and traders who face the foreign exchange rate risk in their transactions. On the other hand, another main reason according to the study of Levy Yeyati and Sturzenegger (2003), dealing with the performance of the exchange rate regime on the inflation, explains that some countries announce the fixed exchange rate regime to provide a higher level of confidence on the inflation rate for investors. Moreover, their research tells that "the long pegs" (lasting five or more years) tends to associate with a lower inflation rate. Thus, there is the incentive to announce a more rigidity regime without tight implementation. For the sake of simplicity, we will depict the flow chart of deeds and words as well as 2 kinds of dummy, as the following illustration in Figure 1.

Equation 8 the estimation result of the error correction mechanism under De Jure VS. De Facto classification

$$\Delta(G_{t,j}) = \underset{[0.088021]^{*}}{0.7362648497} + \underset{[0.025045]^{**}}{0.653775945} \times (G^{*}_{t,j} - G_{t-1,j}) + \underset{[0.007466]^{**}}{0.04752305078} \times TT_{t,j}$$

$$- \underset{[0.008032]^{**}}{0.04537291453} \times (TT_{t,j} \times JPEG_{t,j}) + \underset{[0.008815]^{**}}{0.05735101789} \times (TT_{t,j} \times FPEG_{t,j})$$

$$\text{Weighted} - R^2 = 0.426103$$

As shown in the above equation, the result shows that all the components in this error correction mechanism are significantly different from zero at 95% significant level. Moreover, R-squared is slightly higher than the error correction mechanism of De Jure defined model. However, we can not conclude that this model is better. Further investigation about the fitness of the model, based on the F-test of the augmented term, is necessary. The calculation is as follows.

Equation 9 Choice of model between De Jure classification by itself and, Deeds and Words

$$F_{stat} = \frac{(R^2_{unrestricted} - R^2_{restricted})/M}{(1 - R^2_{unrestricted})/(Obs_{unrestricted} - N)}$$

$$= \frac{(0.426103 - 0.422836)/1}{(1 - 0.426103)/(1082 - 5)}$$

$$= 38.3248^{**}$$

M refers to a number of restrictions and N refers to a number of parameters in the unrestricted model. The solution indicates that the F-calculation exceeds the critical value; therefore, we rejected the null hypothesis of the restricted model. This calculation leads to an implementation that De Facto classification fits better with these sets of data. Hence, this finding is one of the confirmations of choosing De Facto classification for the economic modeling instead of the International Monetary Fund (IMF) announcement, because De Jure classification has some biases. Considering the result of Equation 5, the error correction component has a positive parameter which implies the convergence to the long run path. The sign of interaction term

between terms of trade shock and De Facto classification also has a positive slope as expected while the slope of interaction term of De Jure classification is still negative.

Next, we will focus on the cumulative effect of each case as shown in Table 2. The cumulative abilities to deal with terms of trade shock are provided in the table below.

Table 2　Cumulative effects of terms of trade shock[4]

De Jure / De Facto	Fixed	Flexible
Fixed	(0.0475＋0.0119)**	(0.0475＋0.0574)**
Flexible	(0.0475－0.0453)	(0.0475＋0)**

From Table 2, the implications are that, in case of the fixed exchange rate regime announcement and the actual fixed exchange rate regime behavior, the effect of terms of trade shock is amplified from the base case, 0.0475 by 0.0119 percent of the growth rate. However, if the policy makers conduct the flexible exchange rate regime, the cumulative would be 0.0022 (0.0475－0.0453) which is found to be indifferent from zero by the Wald test. On the other hand, in case of the flexible exchange rate regime announcement, if the policy makers commit the announcement, there will be none of the amplified effect. In other words, the flexible exchange rate regime can offset some of the terms of trade shock. However, if the policy makers conduct a fear of floating phenomena, the actual fixed exchange rate regime will increase the effect of terms of trade shock on the growth rate by 0.0574 percent.

In conclusion, the estimation results show that the deeds are more reliable than the words. Moreover, the actual flexible exchange rate regime from 4 cases above also yields a better result for absorbing terms of trade shock.

7. Ability to absorb terms of trade shock: Role of country characteristics

For the next step of study, we will try to determine whether there is a distinguishment of the absorber ability between different groups of countries based on main export commodities, development level, and openness level. We will regress the steady state level for each criterion and estimate the adjustment mechanism. The main hypothesis is that there are some differences in how each member of each category affects the change in the growth rate. In order to compare the ability to deal with terms of trade shock, we have to adjust the error correction mechanism for each criterion by adding new interaction terms as follows.

Equation 10　Role of country characteristics

$$\begin{aligned}\Delta g_{t,j} &= \lambda[g_j^* - g_{t-1,j}] + \varphi \Delta tt_{t,j} - \beta(\Delta tt_{t,j} \times FPEG_{t,j}) + \theta(\Delta tt_{t,j} \times MAN_j) \\ &\quad + \mu(\Delta tt_{t,j} \times FPEG_{t,j} \times MAN_j) + u_{t,j} \\ \Delta g_{t,j} &= \lambda[g_j^* - g_{t-1,j}] + \varphi \Delta tt_{t,j} + \beta(\Delta tt_{t,j} \times FPEG_{t,j}) + \theta(\Delta tt_{t,j} \times IND_j) \\ &\quad + \lambda(\Delta tt_{t,j} \times FPEG_{t,j} \times IND_j) + u_{t,j}\end{aligned}$$

$$\Delta g_{t,j} = \lambda[g_j^* - g_{t-1,j}] + \varphi \Delta tt_{t,j} + \beta(\Delta tt_{t,j} \times FPEG_{t,j}) + \theta(\Delta tt_{t,j} \times OPEN_j) + \rho(\Delta tt_{t,j} \times FPEG_{t,j} \times OPEN_j) + u_{t,j}$$

Equation 11 the estimation result of the error correction mechanism under the role of main export commodities

$$\Delta(G_{t,j}) = \underset{[0.082815]^{**}}{0.5312245767} + \underset{[0.023929]^{**}}{0.6791222283} \times (G_{t,j}^* - G_{t-1,j}) + \underset{[0.003664]}{0.001946666919} \times TT_{t,j} + \underset{[0.009434]^{**}}{0.05771426173} \times (TT_{t,j} \times FPEG_{t,j}) + \underset{[0.011547]^{**}}{0.1242127876} \times (TT_{t,j} \times MAN_{t,j}) - \underset{[0.019993]}{0.02426188362} \times (TT_{t,j} \times FPEG_{t,j} \times MAN_{t,j})$$

$$\text{Weighted} - R^2 = 0.468998$$

From this estimated result, almost all of the coefficients are significantly different from zero except for terms of trade shock and the interaction term between terms of trade shock, dummy of manufactured-exporting-countries, and De Facto classification. The positive of λ refers to the convergence to the long run level of the growth rate. The speed of adjustment is 0.6791 percent of the growth rate per year. The interesting points of this equation are the coefficients of interaction terms. As for the case of the interaction term among terms of trade shock, manufactured-exporting-countries, and De Facto classification, the coefficient is found to be positive. Nevertheless it is insignificant. Consequently, we can not give an interpretation that, comparing to the flexible exchange rate regime, terms of trade shock will increase the growth rate by 0.0242 percentage change of the growth rate in the manufactured-exporting-countries whose exchange rate regime is fixed. The interpretations of each regime for the manufactured-exporting-countries and the non-manufactured-exporting-countries depend on the cumulative coefficients. The cumulative effects of each case are as follows.

Table 3 Cumulative effects of terms of trade shock under the role of main export commodities[5]

Main export good / Regime	Manufactured	Non-manufactured
Fixed exchange rate	**0.159612**=0.001947+0.157665	**0.059661**=0.001947+0.057714
Flexible exchange rate	**0.12616** =0.001947+0.124213	**0.001947**

From Table 3, the expected result is a higher effect of terms of trade for the fixed exchange rate regime of both types of the main export commodities. As for case of the manufactured-exporting-countries, the fixed exchange rate regime amplifies the effect of terms of trade shock by 0.0334 percent of the growth rate. The same result is also given by the non-manufactured-exporting-countries. There will be a higher shock on the growth rate by 0.0577 percent if that country uses the fixed exchange rate regime. The next point is that the manufactured-exporting-countries receive more effect from terms of trade shock by 0.0999 (using the fixed exchange rate regime) and 0.1242 (using the flexible exchange rate regime) percent of the growth rate respec-

tively. The result complies with the economic reason that the manufactured-exporting-countries have more elasticity of supply. Thus, when there is an improvement of terms of trade, the exporters will be able to produce more outputs, but when there is an adverse shock, the exporters will contract outputs faster than the non-manufactured-exporting-countries.

Equation 12　the estimation result of the error correction mechanism under the role of development level

$$\Delta(G_{t,j}) = \underset{[0.089039]^{**}}{0.6715495093} + \underset{[0.025359]^{**}}{0.65685182}\times(G^{*}_{t,j} - G_{t-1,j}) + \underset{[0.003536]^{**}}{0.007148452462}\times TT_{t,j}$$
$$+ \underset{[0.009653]^{**}}{0.0568107789}\times(TT_{t,j}\times FPEG_{t,j}) + \underset{[0.020605]^{**}}{0.1033733977}\times(TT_{t,j}\times IND_{t,j})$$
$$- \underset{[0.026061]^{**}}{0.05240489006}\times(TT_{t,j}\times FPEG_{t,j}\times IND_{t,j})$$

$$\text{Weighted}-R^2 = 0.414823$$

From the calculation above, we found that all the parameters are significantly different from zero at 5% confident interval. The error correction component indicates the long run convergence by speed adjustment of 0.6568 percent per year. The positive slope for all the interaction terms refers to the greater effect of terms of trade shock under the fixed exchange rate regime and the developed countries. Our consideration is based on the cumulative effects of terms of trade shock, which are provided in Table 4.

Table 4　Cumulative effects of terms of trade shock under the role of development level[6]

Development / Regime	Developed country	Developing country
Fixed exchange rate	**0.114927**＝0.007148＋0.107779	**0.063959**＝0.007148＋0.56811
Flexible exchange rate	**0.110521**＝0.007148＋0.103373	**0.007148**

From Table 4, the cumulative effects of both the developing countries and the developed countries indicate the greater ability to insulate terms of trade shock in the flexible exchange rate regime. The higher shock for the fixed exchange rate regime is 0.0044 percent of the growth rate in the developed countries, and 0.5681 percent in the developing countries. The effect of shock is amplified by 0.0509 percent in the developed countries comparing to the developing countries, whose exchange rate regimes are fixed. Furthermore, under the flexible exchange rate regime, the developed countries also have more effect of shock by 0.1034 percent. This finding aligns with the previous study of Edwards and Levy Yeyati (2005).

Equation 14　the estimation result of the error correction mechanism under the role of openness level

$$\Delta(G_{t,j}) = \underset{[0.086613]^{**}}{0.800523294} + \underset{[0.034096]^{**}}{0.6530234252}\times(G^{*}_{t,j} - G_{t-1,j}) + \underset{[0.006652]^{**}}{0.04241796312}\times TT_{t,j}$$

$$+0.02592722226\times(TT_{t,j}\times FPEG_{t,j})-0.03782194416\times(TT_{t,j}\times OPEN_{t,j})$$
$$[0.012617]^{**} \qquad [0.019111]^{**}$$
$$+0.04294983185\times(TT_{t,j}\times FPEG_{t,j}\times OPEN_{t,j})$$
$$[0.025267]^{*}$$

Weighted $-R^2 = 0.421182$

All the coefficients in this equation are significantly different from zero at a 95% significant level except the interaction term among terms of trade shock, exchange rate regime, and dummy of openness, which is significantly different from zero at a 90% significant level. As for the previous two roles, the role of degree of openness is also determined by the cumulative effects. The cumulative effects are shown in the following table.

Table 5 Cumulative effects of terms of trade shock under the role of openness level[7]

Degree of Openness / Regime	High openness	Low openness
Fixed exchange rate	**0.073473**=0.042418+0.031055	**0.068345**=0.042418+0.025927
Flexible exchange rate	**0.004596**=0.042418−0.037822	**0.042418**

From Table 5, a highly open country faces more amplified effect of terms of trade shock in case of the fixed exchange rate regime by 0.005128 percent of the growth rate. However, in the flexible exchange rate regime, a highly open country faces less terms of trade effect on the growth rate of real gross domestic product (GDP) per capita by 0.03782 percent per year. Both highly open and low open countries have more terms of trade effect on the growth rate in case of the fixed exchange rate regime compared to the flexible exchange rate regime by 0.068877 and 0.025927 percent respectively. This result leads to one implication that the more openness to international trade activities, the more benefit of an ability to absorb shock the country will gain, by using the flexible exchange rate regime.

To summarize, this section identifies the roles of main export commodities, development level, and degree of openness on an ability to absorb terms of trade shock for the fixed exchange rate regime and the flexible exchange rate regime in the sense of comparative ability. Main findings are that the manufactured-exporting-countries face more terms of trade shock than the non-manufactured-exporting-countries, because of the better ability to adjust as a response to an external price shock. In other words, the manufactured-exporting-countries have more elasticity of supply. Both the manufactured-exporting-countries and the non-manufactured-exporting-countries earn benefit of the ability to absorb terms of trade shock by using the flexible exchange rate regime, instead of the fixed exchange rate regime. Moreover, in case of development level, the developed countries face more effect of terms of trade shock, and both types of countries yield a benefit of the ability to absorb terms of trade shock by using the flexible exchange rate regime. Lastly, for the case of openness, both high openness and low openness to international trade activities gain the ability to cope with terms of trade shock as well by using the flexible exchange rate regime. Furthermore, the more openness a country is, the higher benefit to deal

with terms of trade shock, using the flexible exchange rate regime, the more a country gains.

8. Conclusions

Our study is completed using an estimation the ability to cope with terms of trade effect on the growth rate of real gross domestic product (GDP) per capita. The idea is separated into 4 cases; the role of the classification of De Facto classification compared to De Jure classification, the role of main export commodity, the role of development level, and the role of degree of openness for the insulation ability.

The results of all cases strongly indicate that the flexible exchange rate regime (more flexibility than hard pegged classification of the International Monetary Fund (IMF)) is preferable as a term of trade shock absorber. However, by separating countries into 4 cases, some minor findings are found. The first one explains that De Facto classification compared to De Jure classification gives more accuracy on a determination of terms of trade shock absorption. Moreover, the case of hidden pegged may lead to the worse situation than the announcement of the fixed exchange rate regime and the actual fixed exchange rate regime as the shock is amplified more. The second finding illustrates that the manufactured-exporting-countries face terms of trade shock more than the non-manufactured-exporting-countries do. Lastly, highly open countries tend to gain more benefit from adopting the flexible exchange rate regime than relatively closed countries.

The recommendation from this finding is that a country should allow exchange rate to move as an insulation of terms of trade shock. All in all, the greater number of manufactured goods to export, the higher level of development, and the higher openness level of a country, will lead to more benefits gained from the exchange rate regimes.

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Notes

1 In this study, a rigid exchange rate regime is used interchangeable with a fixed exchange rate regime.
2 Some observations may be excluded due to unbalance pooled estimation.
3 Levy Yeyati and Sturzenegger (2003) found that in particularly, de facto pegs have remained stable throughout the last decade, although an increasing number of them shy away from an explicit commitment to a fixed regime ("hidden pegs").
4 Star refers to rejection of null hypothesis of zero of summation value by Wald test and 0.0475 is the base case of terms of trade shock.
5 All cumulative effects reject the null hypothesis of zero from Wald test for 95% significant level.
6 All cumulative effects reject the null hypothesis of zero from Wald test for 95% significant level.
7 All cumulative effects reject the null hypothesis of zero from Wald test for 95% significant level.

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