

Dollarization, Inflation and Foreign Exchange Markets: A Cross-Country Analysis

Hail Park[†] and Jong Chil Son[‡]

Abstract

This paper investigates determinants of deepening dollarization and the relationship between exchange rate and inflation across foreign exchange regimes and degrees of dollarization. To this end, the fixed effect models are adopted using 28 country-level panel incorporating countries that have experienced dollarization. The overall estimation results show that first, high inflation, less flexible exchange rate movements, deterioration of the real economy, and the inadequacy of the institutional environments are contributing factors to intensify the dollarization. Secondly, the estimation results using the de-dollarization country group indicates that real appreciation of the domestic currency is an important factor in mitigating the degree of dollarization. And finally, a high dollarization or a high depreciation rate of the domestic currency tends to increase inflation, while real depreciation is a factor contributing to lowering inflation.

Key Words: Dollarization, Inflation, Foreign Exchange

JEL Classification: F31, F33, E31

[†] Assistant Professor, Department of International Business and Trade, Kyung Hee University, Tel: +82-2-961-2170, Email: hailpark@khu.ac.kr

[‡] Associate Professor, Division of Economics, Hankuk University of Foreign Studies, Tel: +82-2-2173-3043, Email: jkson@hufs.ac.kr

I. Introduction

Dollarization can be defined as a situation where the ratio of foreign currency (or dollar) deposits in commercial banks exceeds 20%. Once dollarization is in progress, its benefits and costs can exist at the same time. According to Balino et al. (1999) and Kokenyen et al. (2010), heightened dollarization can be a sign of increasing integration of a country's economy into the world market and this can generate the following benefits to it. First, closer integration into the world economy could enhance the development of domestic financial markets. Second, dollarization can mitigate foreign investors' exchange rate risk for domestic investment. Lastly, lending in foreign currency with low credit cost can have a positive impact on domestic consumption and investment. Accordingly there may well be an optimal degree of dollarization depending on structural factors.

Dollarization can not only yield some benefits but involve significant disadvantages for an economy. According to Ize and Yeyati (2005), dollarization limits the effectiveness of monetary policy. In other words, if control of the local currency is weakened, it will constrain the independence of monetary or foreign exchange market policy. Secondly, as the analysis of Rennhack and Nozaki (2006) indicates, a high degree of dollarization has been closely correlated with unstable and high inflation, exchange rate volatility and lack of monetary policy discipline. Thirdly, according to De Nicole et al. (2005), Fischer et al. (2013) and Yeyati (2006), a high degree of dollarization can leave an economy more vulnerable to economic crises. Fourth, Ize and Yeyati (2005) and Leiderman et al. (2006) argue that dollarization can deepen the transmission channels running from the foreign exchange rate to inflation. In other words, the fluctuations of inflation can be more readily brought about by external factors than by internal factors.

Under the impossible trinity, if the capital liberalization factor is regarded as a given prerequisite because of the progress of global capital liberalization since the 1980s, policy makers face the problem of choosing between a fixed exchange rate regime and independent monetary policy. If the choice is

dollarization, this is one of the extreme forms of the fixed exchange rate regime. In other words, while there are some benefits in terms of significantly lowering the volatility risk of the foreign exchange market and promoting the inflow of foreign investment funds under the international trend of capital liberalization, the costs must be paid in the form of giving up the independent monetary and exchange rate policies with which to respond to domestic business fluctuations.

In this context, this paper explore the causes of deepening dollarization and the relationship between exchange rate and inflation across foreign exchange regimes and degrees of dollarization using country-level panel data incorporating countries that have experienced dollarization. The estimation results can be summarized as follows. First, the factors that intensify the dollarization are high inflation, less flexible exchange rate movements, deterioration of the real economy, and the inadequacy of the institutional environments in terms, for example, of social and market systems. Secondly, further estimation results using the de-dollarization country group suggests that real appreciation of the domestic currency is an important factor in mitigating the degree of dollarization. And finally, a high dollarization or a high depreciation rate of the domestic currency tends to increase inflation, while real depreciation is a factor contributing to lowering inflation.

The remainder of this paper proceeds as follows: In Section 2 we review the related literature. In Section 3, the data and basic specification are presented and explained, and in Section 4 the estimations are conducted to investigate the determinants of dollarization, and the relationship between inflation and foreign exchange markets under dollarization. In Section 4, finally, we conclude.

II. Literature Review

Researches on dollarization and currency substitution have been steadily continuing since the 2000s. After the 1980s, dollarization spread out because of the occurrence of the outbreak of frequent currency or financial crises around the

world. Garcia-Escribano and Sosa (2010) analyse de-dollarization in four Latin America countries; namely Bolivia, Paraguay, Peru and Uruguay. The study shows that the deposit dollarization ratio on average dropped from 82.1% in 2001 Q1 to 55.3% in 2010 Q3. The reasons for the decline in the degree of dollarization are analyzed from the aspect of financial institutions' loans and deposits. The main reason for deposit de-dollarization was the appreciation of the domestic currency. In addition, driving factors for credit de-dollarization were attributed to prudential measures such as reserve requirement differentials across local and foreign deposits, development of domestic local-currency capital markets in local currency, and de-dollarization of deposits.

Catao and Terrones (2016), on the other hand, analyze the case of Peru's dollarization mitigation more specifically. In the case of Peru, the ratios of dollar deposits and loans, which had both been around 80% in 1993, showed a steady decline to around 30-40% in 2015. They present the external and domestic factors respectively for the weakening of dollarization. In terms of external factors, weaker trends in preference for safe assets, low international interest rates and rising prices for international commodities are suggested. Domestic factors include prudential regulation such as enforcing higher interest rates on dollar loans, and overall stabilization in inflation after the introduction of inflation targeting.

Naceur et al. (2015) analyze the dollarization factors for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan Tajikistan, Turkmenistan and Uzbekistan countries belonging to the Caucasus and Central Asia country group. As of the fourth quarter of 2013, dollar-denominated deposits account for 46% of total deposits in these countries. This paper regards the volatilities in inflation and exchange rate, the undeveloped financial markets, and the domestic-currency depreciation policies as factors reinforcing dollarization. Thus, to mitigate the degree of dollarization, it is necessary to raise the credibility of monetary and foreign exchange policy, attain stable and low inflation and foster the development of the domestic financial market.

Kokenyne et al. (2010) construct monthly-frequency country-level panel data from January 1999 to March 2009 for 32 countries undergoing dollarization, rather than a small group of countries limited to individual countries and regions. Factors strengthening dollarization are analyzed using the panel data. According to this analysis, high inflation, highly volatility exchange rate and real depreciation of the local currency are presented as the main factors at work.

The relationship between exchange rate fluctuations and inflation is often known as pass-through. This means that if domestic currencies are devalued, the domestic currency denominated price of imported goods initially denominated in the US dollar will be subject to upward pressure on inflation. The penetration effect of exchange rate fluctuations is known to be different depending on the structure of industry and the foreign exchange market in each country. According to Ize and Yeyati (2005) and Leiderman et al. (2006), the transmission effect of exchange rate fluctuations on prices is twice as strong the dollarization countries. In the case of dollarization countries, it is possible to directly affect the inflation rate not only due to the depreciation of domestic currencies but also due to appreciation of foreign currency deposits and market prices denominated in the US dollar. In the case of dollar deposits, if the US dollar appreciates, aggregate demand may increase through a kind of wealth effect from the dollar deposits, which may cause pressure for inflation over the medium to long term.

III. Data and Estimation Specification

1. Country Panel and Determinants of Dollarization

Reinhart et al. (2003) measure the degree of dollarization by using three indicators such as foreign currency deposits, foreign currency denominated domestic debt and foreign debt for 90 countries in the world. And then Reinhart et al. (2003) reviewed how the degree of dollarization can affect the effectiveness of monetary and foreign exchange policies. In this paper, we have constructed country-level panel data including countries having a more than 20% ratio in foreign currency deposits among the 90 nations in Reinhart et al. (2003),

because according to Duma (2011), the criterion for successful de-dollarization is less than 20% of foreign currency deposits. Meanwhile this paper adds Israel, Poland, Mexico and Liberia to the panel data based upon the related literature. In addition, in Reinhart et al. (2003), the some countries classified as dollarized ones with a higher than 20% foreign currency deposit ratio were not included in this paper's country panel dataset due to limited availability of the key data.

The reason for establishing the country panel data based on Reinhart et al. (2003) is that the countries with high dollarization ratios around 2000, can be separated into two group; those with a continuing high degree of dollarization and those now having a de-dollarized economy. In this chapter, we analyze whether the factors of dollarization are differentiated across degrees of dollarization and foreign exchange regimes. There are some differences between the country group selected on the basis of Reinhart et al. (2003) and the country group of Kokenyne et al. (2010). As can be seen in <Table 1>, only nine of the 29 countries used in this paper overlap with the country group of Kokenyne et al. (2010). In other words, Kokenyne et al. (2010)'s estimation technique, involving monthly frequency data framework, is applied to a different country group with a yearly frequency data framework.

<Table 1>

Country Panel Differences between Previous Literature and This Paper		
	This paper (28 countries)	Kokenyne et al. (2010) (32 countries)
Common countries	Indonesia, Costa Rica, Honduras, Jamaica, Nicaragua, Saint Kitts, Uruguay, Belarus, Ukraine	
Different countries	Armenia, Cambodia, Laos, Mongolia, Pakistan, Argentina, Mexico, Belarus, Poland, Russia, Slovenia, Egypt, Israel, Jordan, Turkey, Angola, Liberia, Sao Tome and Principe, Tanzania, Zambia	Azerbaijan, Babados, Bolivia, Burundi, Canada, Cape Verde, Chile, Dominica, Grenada, Guatemala, Haiti, Kenya, Kuwait, Lithuania, Saint Lucia, Moldova, Paraguay, Qatar, Romania, Seychelles, South Africa, St. Vincent

Following Kokenyne et al. (2010), the empirical specification on driving factors for dollarization is presented as in Equation (1).

$$\Delta Dollarization_{it} = \alpha_i + \beta_1 \Delta Dollarization_{it-1} + \beta_2 FXflex_{it-1} + \beta_3 \Delta Rer_{it-1} + \beta_4 \pi_{it-1} + \beta_5 Others_{it-1} + \epsilon_{it} \quad (1)$$

Dollarization indicates the degree of dollarization in a form of annual differences as the triangle, Δ , implies. *FXflex* is a proxy for flexibility of foreign exchange rate, *Rer* indicates the real exchange rate between local currency and the US dollar, and π implies inflation. Finally, *Others* indicates other control variables such that real GDP growth, openness and a proxy for the quality of market institution. Descriptions of the variables used in the analysis will be discussed in more detail in the next section.

On the other hand, since the number of individual variables that determine the size of the cross section of the panel is no greater than 28, the time series characteristic can be dominant. Thus, the level variables are strongly assumed to have unit roots in general, and subsequently all level variables are transformed into stationary time-series by a form of growth rate or difference. In addition, we try to alleviate the endogenous problem between independent and dependent variables by using the one-year lags. This lagged dependent variable model could be well matched with dynamic panel estimations such as system GMM. This estimation, however, is usually applied to panel structure having short time-dimension and long individual variables which is not the case for this paper.

2. Data and Basic Statistics

<Table 2> shows sample countries for panel data. Many countries from Latin America are included. However, countries that have undergone dollarization or continued to date, are distributed all over the world whether in Asia, Europe or Africa.

<Table 2>

Countries Included in the Empirical Analyses

Region¹⁾	Country
Asia	Armenia, Cambodia, Indonesia, Laos, Mongolia, Pakistan
South America	Argentina, Costa Rica, Honduras, Jamaica, Mexico, Nicaragua, St. Kitts and Nevis, Uruguay
Europe	Belarus, Poland, Russia, Slovenia, Ukraine
Middle East and Northern Africa	Egypt, Israel, Jordan, Turkey
Central and Southern Africa	Angola, Liberia, Sao Tome and Principe, Tanzania, Zambia

Note: 1) It follows the IMF's regional classification criteria.

The variables included in the empirical analyses are as follows. Unfortunately, we are not able to track the statistics of foreign currency deposits in publicly accessible databases such as the IMF IFS. Inevitably, the ratio of foreign debt to savings deposits is used as an alternative for foreign currency deposits. The differences in yearly ratios ($D.flia_{sav}$) are used, not the level itself, due to both mitigating the unit root characteristics of the time series and minimizing the distortions from the two-level variables between foreign liabilities and foreign deposit ratios. As shown in <Table 4>, the ratio of foreign liabilities is 28.4%, which is somewhat lower than Reinhart et al. (2003)'s 43% foreign deposit ratios on average between 1996 and 2001. However, as can be seen from comparison of the statistics between the de-dollarization countries and the on-going dollarization countries shown in <Table 7>, the foreign liabilities ratio in de-dollarized countries is significantly lower than that in on-going dollarization countries. In other words, although there are basic limitations to the statistics, it can be said that the foreign liabilities ratios can approximate more or less the trend of foreign deposit ratios.

<Table 3>**Explanations of Variables**

Variables	Explanations
Foreign liabilities over saving deposits (flia_sav)	Proxy for degree of dollarization or foreign currency deposits; deposit money banks; local currency basis
Inflation (inf)	Annual rates of increase in consumer price index; %
Growth in foreign exchange rate (fxr_g)	Proxy for exchange rate's flexibility; yearly growth rates in local currency unit/US\$; rising values implying depreciation of local currency against the US\$
Real exchange rate (rer)	Proxy for real exchange rate's flexibility; (local currency unit/US\$)*(US price index/local price index); price index's base 2010; growing values implying real depreciation of the local currency
Real GDP growth (y_g)	Yearly growth rates in GDP; constant 2010 US\$
Openness (open)	(Exports plus imports)/GDP; %
Government effectiveness (govt_eff)	Proxy for the quality of (market) institutions; index ranging from -2.5 to +2.5

Note: () means abbreviation for variable

Sources: except government effectiveness, all the data are from IMF's International Financial Statistics; government effectiveness is from World Bank Worldwide Governance Indicators

As seen in <Table 3>, Inflation implies yearly rates of increase in the consumer price index. Nominal exchange rate is defined as local currency per one US dollar (local currency/US\$), which definition is applied for every country. Thus, an increase in the nominal exchange rate indicates depreciation of the local currency against the US dollar. In addition to the nominal exchange rate, the real exchange rate, including the price index ratio of the developing country over the US, is also considered as an independent variable. In addition, we used real GDP growth rate, trade openness, and government efficiency index as other control variables reflecting the characteristics of each country.

The basic statistics of the variables used in panel estimation are listed in <Table 4>. Here, the variables D.flia_sav, D.rer and D.govt_eff represent the annual differentials. A number of heterogeneous developing countries around the world are included in the national panel data, indicating that standard deviations, minimums and maximums have very huge bounds.

<Table 4>**Basic Statistics**

Variables	Mean	S.D	Min	Max
flia_sav (%)	28.4	25.8	0.3	153
D.flia_sav (%p)	0.3	12.2	-77.3	81.6
inf (%)	27.6	204.9	-2.3	4145.1
fxr_g (%)	10.6	32.9	-220.8	384.1
rer	125.8	49.2	9.8	431
D.rer	-1.6	21	-125	173.7
y_g (%)	4.3	5.4	-35.9	72.4
open (%)	69.1	35.1	6	152
govt_eff	-0.3	0.7	-2	1.4
D.govt_eff	0.01	0.1	-1	0.9

Note: () means abbreviation for variable

Sources: except government effectiveness, all the data are from IMF's International Financial Statistics; government effectiveness is from World Bank Worldwide Governance Indicators

A brief overview of the variables included in the estimations is as follows. Inflation turns out to be 27.6%, on average for annual rates of increase of the CPI, which is significantly higher than that of other major countries. In particular, the highest inflation rate was recorded at 4,145.1% per annum, since hyper-inflation occurred in Angola from 1991 to 1999. In addition, it showed an average depreciation of about 10% per year against the US dollar. On the other hand, as of 2010, the real exchange rate, reflecting changes both from the nominal exchange rate and the relative price level of the developing country over the US, has increased to 125.8. This implies a real depreciation of the domestic currency against the US dollar. The average annual economic growth rate is 4.3% and the trade openness on average is 69.1% of GDP. In the case of the government efficiency index, it can be considered that the overall market and social system quality of the panel countries that underwent dollarization are somewhat below the world average in that the index is assumed to be of normal distribution with zero mean set as the world average.

The time series of major variables are shown in <Figure 1>. This time-series trend implies the average value of the corresponding variable for all countries for each year. First, the ratio of foreign liabilities (flia_sav) shows that the proportion of foreign liabilities fell steadily until 2004, then it rose consistently

until the 2008 global financial crisis. Since the data for foreign liabilities ratio from 2009 are limited, the time series trends are exhibited until 2008 due to series-break concerns. After the 1997 Asian Crisis had subsided, from the 2000s the foreign liabilities steadily increased due to an increase in capital inflows into emerging market and developing countries before the 2008 global financial crisis. This increase in foreign liabilities is estimated to be correlated with increase in the proportion of dollar denominated foreign currency deposits. The difference (D.flia_sav) of the ratio of foreign liability by year also shows a steady increase from 2004 to 2008 after fluctuating up to the mid-2000s.

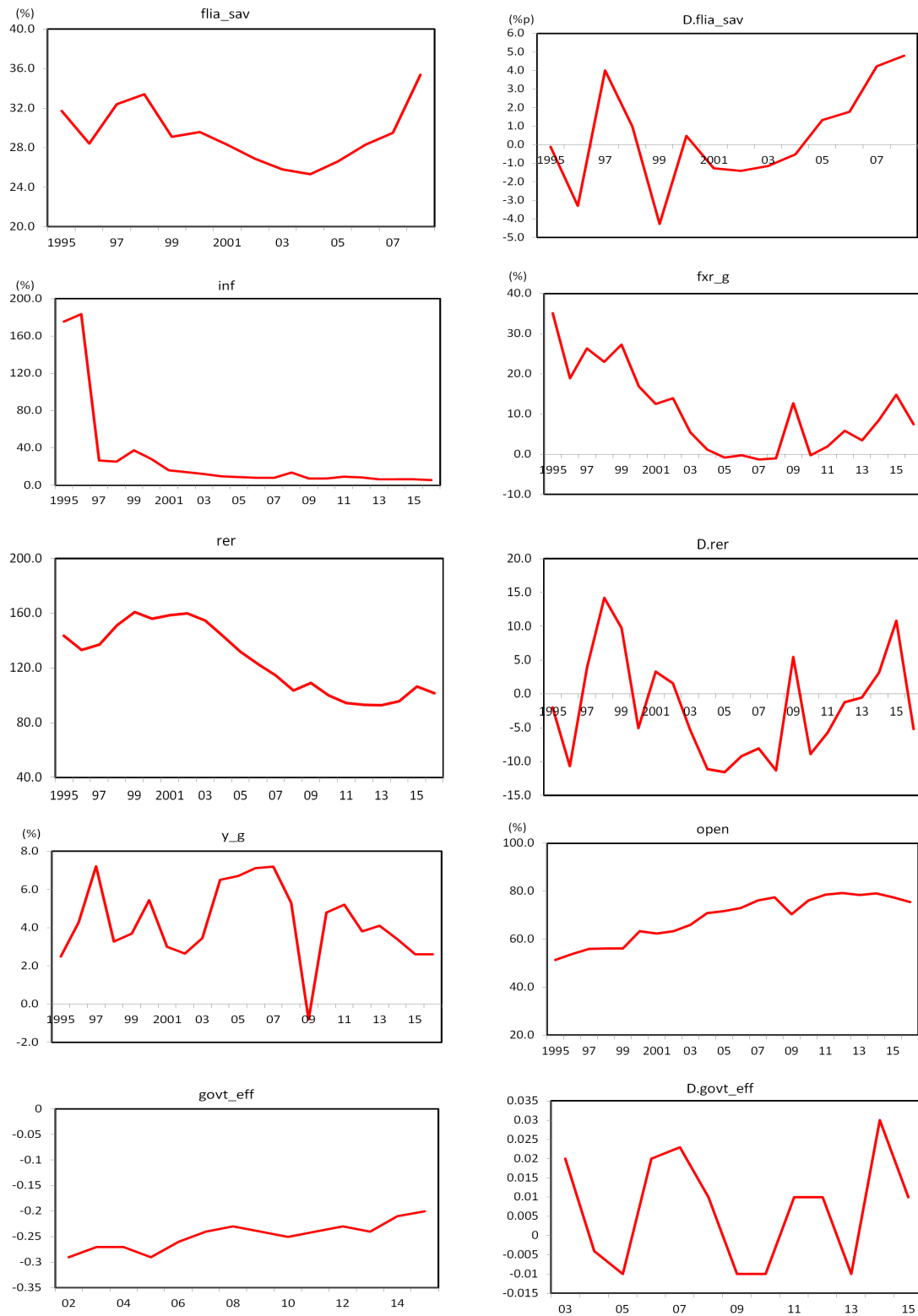
Inflation (inf) was very high in 1995-97 due to the effect of hyperinflation in Angola, but has steadily declined since then. In this paper, the transition over time of inflation within one country figures is more important, than the between variations across countries, on the ground that the empirical approach using the fixed effect model can sufficiently control the characteristics of each country. Therefore, the huge variations in inflation as an overall average of the country panel do not pose a crucial problem.

The annual rate change in the exchange rate (fxr_g) showed a steady appreciation against the US dollar until the global financial crisis in 2008, once the Asian Crisis in the late 1990s subsided. However, as the flight to safe assets has strengthened since the 2008 crisis, the depreciation of domestic currencies against the US dollar has continued steadily.

The trend of the real exchange rate (rer) involving inflation rates at first continued to decline substantially compared to the US dollar, implying real appreciation of domestic currencies. The trend, however, has stopped since the global financial crisis. Meanwhile, unlike the reduction of the nominal exchange rate against the US dollar, there has been real appreciation in local currencies as inflation in each country rose faster than the US. The yearly difference (D.rer) of the real exchange rate continues to fluctuate.

<Figure 1>

Time-Series Trends for the Variables (yearly averages on countries)



The real GDP growth rate (y_g) fluctuated from around 5%, but fell sharply after the global financial crisis in 2008. The average growth rate has generally fallen below 4% after rebounding from the crisis. With the progress of international trade and capital flows, the openness of the country has been risen from 50% in 1995 to 80% in 2016. Looking at the government efficiency ($govt_eff$) index, the absolute level of the country does not reach the global average, i.e. zero, but the efficiency index has been gradually improving as time goes by. The yearly differential variable ($D.govt_eff$) of the variable has been fluctuating without any trends.

IV. Estimation Results

1. Determinants of Dollarization

In this section, the fixed effect model is mainly used, and panel estimation results are shown in <Table 5>. The random effects model can capture cross-country variations of the relationship between independent and dependent variables over time. On the other hand, the fixed effect model is more suitable for capturing changes over time in within-country. In this paper, we will mainly use the fixed effects model taking into account the individual characteristics of each country on the grounds that the financial and economic systems or institutions are quite different across the panel countries.

As discussed above, the dependent variable replacing foreign currency deposits (or dollar deposits), a proxy for the degree of dollarization, is the ratio of foreign liabilities to savings deposits. In <Table 5>, the English capital letter L refers to the first lagged variable. The capital letter D is an abbreviation of the difference, which indicates that the differential variable is used to transform the variable suspected of having a unit root, into a stationary time series.

The use of first-order lagged variables is to alleviate the problem of endogeneity between dependent and independent variables by enhancing the degree of the exogeneity of independent variables. Since the data frequency is

one year, the fixed effect model, which assumes correlation between the individual effect (α_i) and the explanatory variables, can alleviate the endogeneity problem to a greater or lesser degree. However, it can be said that if contemporary variables are used as independent variables at the individual country level, it is difficult to prevent the possibility of reverse causation in that dependent variables may have effects on independent variables. Therefore, the independent variable is constructed as a one-year lagged form. In addition, various models are estimated by different combinations of independent variables in order to verify whether there is a difference in statistical significance for influences on the dependent variables due to multi-collinearity among the independent variables.

Estimation results are overall consistent with the stylized facts presented in previous studies. In other words, high inflation, low flexibility in exchange rate, depression of the real economy, and a decline in trade openness have contributed to deepening dollarization. Meanwhile, the dollarization can be eased when the quality of the market and social system improves despite the statistical significance being somewhat low.

<Table 5>

Panel Estimations¹⁾²⁾

Variable	Random effect	Fixed effect	Fixed effect	Fixed effect
L.D.flia_sav	0.1147* (0.0584)	0.0382 (0.0604)	0.0652 (0.0592)	0.3305*** (0.0879)
L.inf	0.1853* (0.0720)	0.2118*** (0.0738)	0.1805*** (0.0499)	
L.fxr_g	-0.2505** (0.1121)	-0.3569*** (0.1216)	-0.2829*** (0.0555)	
L.D.rer	-0.0002 (0.0606)	0.0519 (0.0665)		-0.1301* (0.0718)
L.y_g	-0.2037 (0.1498)	-0.2636 (0.1625)	-0.2789* (0.1632)	-0.1395 (0.1514)
L.open	-0.0161 (0.0187)	-0.1190 (0.0747)	-0.0650 (0.0729)	-0.2621*** (0.0807)
L.D.govt_eff				-5.0899 (7.3627)
# of obs.	263	263	273	131
# of countries	23	23	24	23
Adj. R-sq/ Within R-sq.	0.2579	0.0995	0.1025	0.2607

Notes: 1) Detailed explanations for each variable are given in <Table 3-3>

2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively

Sources: All the data are from IMF's International Financial Statistics except government effectiveness; government effectiveness is from World Bank Worldwide Governance Indicators

However, the flexibility of the nominal and real exchange rate among the estimation results needs to be interpreted with some caution. This variable represents the nominal and real depreciation rate of the local currency against the US dollar. Here, depreciation of domestic currencies is a factor that strengthens dollarization because local currency depreciation directly indicates relative appreciation of the US dollar. However, panel estimation results show that overall depreciation of the local currency in previous year moderates the degree of dollarization in the following year. We conjecture that this result seems to depend on economic agents' expectations on the value of US dollar. In other words, if appreciation of US dollar has already been fully realized in the previous year, the expectation of its further appreciation will weaken, which can be interpreted as the incentive for economic agents to hold more US dollars having declined. Or it could reflect the data limitations of the foreign liabilities ratio replacing the foreign currency deposit ratio. Further research on this issue is needed in the future.

In order to verify whether the factors of deepening dollarization are differentiated according to degree of dollarization and exchange rate regimes, we classify the corresponding country groups and execute the same estimations. First of all, the exchange rate systems are divided into two groups as floating system and (managed) fixed exchange rate regime (pegging system) as of 2016. The floating exchange rate regime includes both fully floating systems and managed floating system. The fixed exchange rate regime includes hard-pegging systems including currency board and soft-pegging allowing movements within a certain band. In addition, as of 2008, when the statistics of foreign liabilities ratio are available for most of the panel countries, we divide the countries into two groups; i.e. de-dollarization countries with a foreign currency deposit ratio of less than 20% and on-going dollarization countries with a foreign currency deposit ratio exceeding 20%. <Table 3-6> shows the countries belonging to each group.

<Table 6>

Groups of Countries According to Exchange Rate Regimes¹⁾ and Degree of Dollarization²⁾

	Floating	Pegging
De-dollarized ³⁾	Israel, Indonesia, Mexico, Tanzania	Argentina, Egypt, Honduras, Liberia, Pakistan
Dollarized	Armenia, Mongolia, Poland, Russia, Slovenia, Turkey, Ukraine, Uruguay, Zambia	Angola, Belarus, Cambodia, Costa Rica, Jamaica, Jordan, Laos, Sao Tome, Principe, St. Kitts

Notes: 1) Exchange regimes based on the year of 2016

2) Degree of dollarization based on the year of 2008

3) Foreign deposit ratio is below 20% as of 2008.

<Table 7> shows main features of each country group according to the exchange rate system and degree of dollarization. The figures in the table indicate the average of each group for the sample period. First of all, there is no significant differences between floating and pegging countries. The size of the foreign liabilities ratio is similar. Pegging countries show slightly higher GDP growth and openness but there is no huge gap between them. However, floating countries show significantly lower inflation than pegging countries. One interesting fact is that the rate of increase in the exchange rate in pegging countries is higher than in floating countries, which presumably reflects huge

temporary devaluations by the foreign exchange authority in pegging regime countries.

<Table 7>

Main Features of Country Group

variable	Floating	Pegging	De-dollarization	Dollarization
	average	average	average	average
flia_sav (%)	29.9	27.5	20.3	32.6
inf (%)	14.4	39.5	8.3	36.3
fxr_g (%)	9.1	11.8	6	12.8
rer	137.7	116	113.7	131.9
y_g (%)	3.9	4.6	4.3	4.3
open (%)	61.9	78.8	48.9	80.6

Looking at de-dollarization and dollarization country groups, we can see that there are some differences in several key economic indicators. First, the foreign liabilities ratio, representing the degree of dollarization, is lower in de-dollarized economies than in the dollarization countries as expected. In addition, the inflation and exchange rate growth or the depreciation of the domestic currency are more stable in the de-dollarization countries. Foreign trade openness also showed a difference. In the case of the de-dollarization countries, 48.9% was recorded, while the degree of openness was nearly double at 80.6% in the dollarization countries. However, the annual economic growth was 4.3%, indicating no difference between the two groups.

<Table 8> shows panel estimation results between floating and pegging foreign exchange regime country groups. Overall estimates show no significant difference between the two groups except for inflation and economic growth. It is worth noting that the exchange rate system applied to the national group classification is based on the present point of view as the past exchange rate system is not reflected due to information constraints. In the case of inflation, it influences the

degree of dollarization in the floating exchange rate system more significantly. In the fixed exchange rate system, the increase of economic growth plays a more important role in mitigating the degree of dollarization.

<Table 8>

Panel Estimation: Floating vs. Pegging

Variable	Floating fx regime		Pegging fx regime	
	Fixed effect	Fixed effect	Fixed effect	Fixed effect
L.D.flia_sav	0.0485 (0.0815)	0.0971 (0.0785)	0.0134 (0.0980)	0.0118 (0.0977)
L.inf	0.3221*** (0.1217)	0.2797*** (0.0846)	0.1980* (0.1176)	0.1514* (0.0774)
L.fxr_g	-0.3639** (0.1626)	-0.2614*** (0.0686)	-0.3879* (0.2257)	-0.2820*** (0.1031)
L.D.rer	0.0578 (0.0771)		0.0846 (0.1604)	
L.y_g	0.0216 (0.2467)	-0.0226 (0.2475)	-0.4045* (0.2262)	-0.4061* (0.2254)
L.open	-0.0210 (0.1228)	0.1172 (0.1136)	-0.1502 (0.0990)	-0.1501 (0.0987)
# of obs.	138	148	125	125
# of countries	12	13	11	11

Notes: 1) Detailed explanations for each variable are given in <Table 3>

2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively

Sources: All the data are from IMF's International Financial Statistics except government effectiveness; government effectiveness is from World Bank Worldwide Governance Indicators

<Table 9> displays the results of the same panel estimations by classifying into de-dollarization and on-going dollarization country groups as of 2008. Unlike the previous estimates of floating and pegging country groups, marked differences between the estimates of the two country groups can be found. First of all, the effect of inflation on the degree of dollarization is mostly derived from the on-going dollarization country group. In addition, the real economy and the active foreign trade are also important factors in lowering the degree of dollarization, which is also significant in the de-dollarization country group. In addition, real depreciation of the local currency has also shown statistically significant increasing effects on dollarization in the de-dollarization country group. On the other hand, the exchange rate flexibility is shown to lower the

degree of dollarization in both country groups with the magnitude of the coefficient being larger in the de-dollarization country group.

<Table 9>

Panel Estimation: De-Dollarization vs. Dollarization

Variable	De-dollarization		Dollarization	
	Fixed effect	Fixed effect	Fixed effect	Fixed effect
L.D.flia_sav	-0.0424 (0.0985)	-0.1015 (0.0993)	-0.0113 (0.0802)	0.0290 (0.0774)
L.inf	0.0706 (0.1829)	-0.1899 (0.1607)	0.2129** (0.0985)	0.2701*** (0.0686)
L.fx_r_g	-0.5529*** (0.1688)	-0.1325* (0.0681)	-0.2865* (0.1685)	-0.3910*** (0.0916)
L.D.rer	0.2434*** (0.0899)		-0.0620 (0.0882)	
L.y_g	-0.5010*** (0.1612)	-0.5045*** (0.1665)	0.0037 (0.2918)	-0.0724 (0.2891)
L.open	-0.4972*** (0.1088)	-0.4606*** (0.1116)	-0.0358 (0.0991)	0.0167 (0.0953)
# of obs.	106	106	157	167
# of countries	8	8	15	16
Within R sq.	0.3049	0.2496	0.1272	0.1381

Notes: 1) Detailed explanations for each variable are given in <Table 3>

2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively

Sources: All the data are from IMF's International Financial Statistics except government effectiveness; government effectiveness is from World Bank Worldwide Governance Indicators

2. Inflation and Foreign Exchange Markets Under Dollarization

The empirical analysis of correlation between exchange rates and prices in dollarization countries is not easy to find. Moreover, there are many questions about whether the effectiveness of the transmission of the foreign exchange rate to inflation can be differentiated according to various exchange rate regimes and the degree of dollarization. In this section, hence, we analyze the effect of the foreign exchange rate on inflation using panel data of various country groups.

The analytical model was modified from the previous estimation model to perform a country panel analysis on inflation determinants as shown in Equation

(2). As discussed earlier, all the independent variables are first-order lagged forms to mitigate the endogeneity problem. The fixed effect model was used mainly to control unobserved heterogeneous factors of the countries. Based on the estimated coefficients of Equation (2), we can gauge the average causality of the dollarization country group to see how policy makers' exchange market policy changes, such as easing exchange rate flexibility, could have an impact on inflation.

$$\pi_{it} = \alpha_i + \beta_1 \Delta Ddollarization_{it-1} + \beta_2 FXflex_{it-1} + \beta_3 \Delta Rer_{it-1} + \beta_4 \pi_{it-1} + \beta_5 y_g_{it-1} + \epsilon_{it} \quad (2)$$

<Table 10>

Panel Estimation: Inflation and Exchange Rate

Variable	Pooled OLS	Fixed effect	Fixed effect	Fixed effect
L.inf	-0.0592*** (0.0086)	-0.0498 (0.0092)		-0.0524*** (0.0076)
L.D.flia_sav	0.2455** (0.1029)	0.2151* (0.1093)	0.2993*** (0.1104)	
L.fxr_g	1.2138*** (0.0619)	1.0511*** (0.0755)	0.7280*** (0.0486)	1.0390*** (0.0608)
L.D.rer	-0.3067*** (0.0554)	-0.2193*** (0.0606)	-0.0604 (0.0551)	-0.2584*** (0.0492)
L.y_g	0.8983*** (0.2603)	0.6060** (0.2925)	0.2589 (0.2971)	0.7493*** (0.2127)
# of obs.	365	365	366	521
# of countries	..	27	27	27
Adj. R sq./ within R sq.	0.6114	0.4863	0.4403	0.4764

Notes: 1) Detailed explanations for each variable are given in <Table 3>

2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively

Sources: All the data are from IMF's International Financial Statistics except government effectiveness; government effectiveness is from World Bank Worldwide Governance Indicators

First, the estimation results for the whole country sample are shown in <Table 10>. The coefficient estimates of all explanatory variables are found to be largely consistent with the theoretical expectations. The higher the degree of dollarization, the stronger the penetration effect of exchange rate fluctuations accelerated inflation. In addition, depreciation of the domestic currency has a significantly positive (+) effect on inflation through the rise in import prices.

The quantitative effects can be measured based upon the estimated coefficients as follows. A 1%p increase in the foreign liabilities ratio representing the foreign currency deposit ratio, can raise inflation by 0.2-0.3%p on average for dollarization countries. In addition, a 1%p depreciation (appreciation) of domestic currencies can lead to a 0.7% to 1.2%p increase (decrease) in inflation throughout the dollarization countries. The stabilization of domestic prices (D.rer) relative to US prices in terms of goods, real exchange rate, shows that the effect on inflation in the next year differs from the nominal exchange rate. Real depreciation, involving the changes in nominal exchange rate, indicates that the domestic price level is lower than the US. According to the estimation results, a real depreciation of 1%p reduces the average inflation by 0.2-0.3%p. In addition, a 1% increase in real GDP has an increasing effect on inflation of 0.6-0.9%p on average for dollarization countries

<Table 11>

Inflation and Foreign Exchange Rate: Floating vs. Pegging

Variable	Floating fx regime		Pegging fx regime	
	Fixed effect	Fixed effect	Fixed effect	Fixed effect
L.inf	0.0935 (0.1020)		-0.0579*** (0.0120)	
L.D.flia_sav	0.2680*** (0.0750)	0.2791*** (0.0740)	-0.0583 (0.1842)	0.0986 (0.1851)
L.fx_r_g	0.6003*** (0.1330)	0.7014*** (0.0742)	1.1094*** (0.1013)	0.7203*** (0.0649)
L.D.rer	-0.1633*** (0.0643)	-0.2031*** (0.0473)	0.0158 (0.1060)	0.1949 (0.1047)
L.y_g	0.3785* (0.2262)	0.3792* (0.2261)	0.4116 (0.4405)	-0.0457 (0.4539)
# of obs.	159	159	286	207
# of countries	12	12	15	15
Within R sq.	0.4669	0.4637	0.5291	0.4403

Notes: 1) Detailed explanations for each variable are given in <Table 3>

2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively

Sources: All the data are from IMF's International Financial Statistics except government effectiveness; government effectiveness is from World Bank Worldwide Governance Indicators

Next, the same estimation was carried out by dividing the country group by exchange rate regime and the degree of dollarization as in the previous analysis. First, the estimation results for each exchange rate regime are shown in <Table

11>. There are some differentiated effects on inflation determination across the country groups by exchange rate regime. The degree of dollarization shows a significant increase in inflation under a floating exchange rate regime, but under a pegging exchange rate regime, it is not statistically significant presumably because of the rigid exchange rate movements.

On the other hand, as shown in the previous analysis, the effect of the depreciation of the domestic currency on inflation was greater in the fixed exchange rate countries than in the floating exchange rate. In other words, a 1%p depreciation in the country group of floating exchange rate increases inflation by 0.6-0.7%p, while it increases it by 0.7-1.1%p in the fixed exchange rate country group. In addition, a 1%p real depreciation implying relative price stabilization of domestic goods as against US' goods lowers inflation by 0.2%p with more significant effects in the floating group. Finally, a 1% increase in real GDP leads to 0.4%p increase in inflation, which indicates that the spillover effect of the real economy on inflation is more dynamic under a floating exchange rate than a fixed exchange rate.

<Table 12> shows the results of dividing countries by dollarization level. First, in the case of the de-dollarization country group, the foreign exchange market variables do not have statistically significant effects on domestic inflation unlike the case of the dollarization country group. That is, a 1%p depreciation of the domestic currency does not have any effects on inflation or increases it by just 0.2%p in the de-dollarization country group, while it increases the inflation by 0.8-1.1%p with statistical significance in the dollarization country group. In addition, the degree of dollarization does not appear to have a significant effect on inflation in de-dollarization country group. In other words, in the case of dollarization countries, external variables through the foreign exchange market have a significant influence on inflation, while in the case of de-dollarization countries, domestic factors are more influential.

According to the above estimation results, mitigation of the degree of dollarization, appreciation of the domestic currency, and gradual implementation

of the floating exchange rate are necessary in order to stabilize the impact of exchange rate fluctuations on inflation.

<Table 12>

Inflation and Exchange Rate: De-Dollarization vs. Dollarization

Variable	De-dollarization		Dollarization	
	Fixed effect	Fixed effect	Fixed effect	Fixed effect
L.inf	0.2321* (0.1288)		-0.0553*** (0.0108)	
L.D.flia_sav	0.0221 (0.0753)	-0.0083 (0.0650)	0.4253*** (0.1427)	0.5406*** (0.1480)
L.fxr_g	0.0855 (0.1138)	0.2223* (0.0831)	1.1490*** (0.0907)	0.7962*** (0.0585)
L.D.rer	-0.0202 (0.0606)	-0.0711 (0.0529)	-0.0598 (0.0799)	0.1120 (0.0756)
L.y_g	0.1177 (0.1243)	0.1162 (0.1245)	0.5221 (0.4720)	-0.1537 (0.4748)
# of obs.	123	124	242	242
# of countries	9	9	18	18
Within R sq.	0.1261	0.0999	0.5576	0.5086

Notes: 1) Detailed explanations for each variable are given in <Table 3-3>

2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively

Sources: All the data are from IMF's International Financial Statistics except government effectiveness; government effectiveness is from World Bank Worldwide Governance Indicators

V. Conclusion

According to several existing studies, a certain degree of dollarization is a token of integration with the world economy, and conveys some benefits, such as promoting domestic financial markets and foreign investment. However, if high dollarization continues, there will be significant costs, such as a deterioration in policy effectiveness as independent monetary and foreign exchange market policies are constrained, as well as the heightened vulnerability of the domestic economy to external shocks.

From this point of view, this paper has constructed panel data for countries that have experienced or are experiencing dollarization and conducted empirical

analysis of the exchange rate and inflation under dollarization. First, estimation results of the determinants of dollarization are overall similar to those of previous discussions. In other words, the factors that increase dollarization are high inflation, rigid or sticky exchange rate fluctuations, a slump of the real economy, and qualitative deterioration of social and market institutions. On the other hand, real appreciation of the local currency is an important factor in mitigating the degree of dollarization in view of country group studies such as those concerning de-dollarization and dollarization.

Analysis on the correlation between inflation and the key variables in the foreign exchange market is executed using the same country panel data. As expected, high dollarization and a high depreciation rate of domestic currency are found to increase inflation. On the other hand, the results of additional analysis on the de-dollarized country group show that the pass-through effect and the degree of dollarization have no significant effect on inflation. In contrast, foreign exchange related variables are found to have significant effects on inflation in the on-going dollarization country group. Based upon the empirical estimation results, the effect of such exchange rate fluctuations on the inflation rate would be reduced when the degree of dollarization is eased or when adopting a floating exchange rate system.

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