Empirical Study of Interest Rate Pass-Through Before and After Subprime Mortgage Crisis: An International Evidence

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Abstract. The emergence of financial crisis in 2008 that shook many countries in the world has made essential changes in the path of monetary policy transmission mechanisms in various countries. One of the critical changes in the transmission mechanism is the change in the magnitude of interest rate channel adjustment in the period before and after a crisis. This study aims to evaluate the performance of monetary policy by examining and testing the magnitude of lending and savings interest rates adjustment in response to changes in market interest rates in the period before and after the global financial crisis. This study covers 41 world countries representing three groups: regional, income, and inflation targetting policy groups. The method used in this research is Autoregressive Distributed Lag (ARDL) which calculates the long-term coefficient, and Error Correction Model (ECM), which calculates the short-run coefficient. The results show that long-term coefficients of pass-through into deposits for all regions are greater than the pre-crisis period in the post-crisis period, except for North America and Inflation Targeting Countries. Meanwhile, long-term pass-through coefficients into lending have smaller coefficients in the post-crisis period than before the crisis for all regions except Latin America and the Caribbean, Europe, and Inflation Targeting Countries.

Keywords: ARDL, ECM, Interest Rate Pass-Through, Subprime Mortgage.

1 Introduction

Various world economies have widely implemented the current stabilization monetary policy to take on a country's economic crisis shocks. Monetary policy has very short inside lags so that it can be decided and applied very quickly compared to fiscal policy. Over the last few decades, the policy of interest rates has been seen as a standard tool of monetary policy used by various world economies. As the monetary authority, the central bank influences the economy through the official interest rate only if the government policy through the central bank can be

successfully transferred through the money market interest rate. Furthermore, the market interest rate changes will ultimately affect the retail interest rate, namely the landing and deposit interest rate [1]. Any adjustments that are responded to by the retail interest rate will affect various macroeconomic indicators.

The most fundamental issue in discussing interest rate adjustments is knowing how the banks in a financial system through retail interest rates will respond to changes in money market interest rates. The changes in the money market interest rates are due to the central bank's policy rate shocks. The shape of a change response on the retail interest rate to changes in the benchmark interest rate or the money market is called interest rate pass-through. The pass-through mechanism plays a crucial role in monetary policy. The speed and fulfilment pass-through of the benchmark interest rate to the money market rate becomes a monetary policy transmission force within an economy [2]. A proper understanding of retail interest rate adjustment from market interest rate changes is essential to assess the development of monetary policy through interest rate transmission.

Studies on the transmission mechanism through the interest rate channel have been conducted. For example, conduct monetary policy transmission research through interest rate channels by considering the symmetrical transmission mechanism hypothesis. Their research generally only looks at the degree of pass-through coefficients adjustment on retail interest rate in response to changes in money market interest rates or benchmark interest rates [2][3][4]. Unlike the case conducted [1][5][6][7] whose research complementary to previous research, where the studied pass-through takes into account an asymmetric hypothesis. Therefore in a study of the information adjustment process interest rates on conditions up and down can be seen clearly.

Based on the above literature studies, this study developed a more focused study to explain the transmission mechanisms of the interest rate adjustment phenomenon before and after crisis shocks. The global financial crisis that occurred in 2008 is one type of shock that can change the path of the monetary policy transmission mechanism [8]. One of the changes occurring in the transmission mechanism is the change in interest rate pass-through adjustment due to the subprime mortgage crisis. Such changes can occur before and after the crisis because the financial situation of the lender - the banking system - incurs losses. Meanwhile, after the crisis, they are confronted with constraints on access to capital. In addition, the crisis caused a change in banking behavior. Where the banks tend to be cautious and tightening the process on the channel lending began to be applied by the banking system. It is for maintaining banking health in monetary transmission mechanism policy. This change of behavior and banking system can then lead to changes in the adjustment of interest rate pass-through between the period before and after the crisis.

Therefore, our study focuses on the interest rate transmission mechanism that might be changing due to the 2008 financial crisis. Further, we can see the impact of changes in the mechanism of transmission lines globally by representing the 41 countries into three group characteristics. The countries are divided into the regional groups, income groups, and the group of inflation targeting adopted. So this study will provide more empirical descriptions and comprehensive observation results due to the crisis analysis and the expansion of countries' objects.

2 Theory and Literatur Review

The interest rate pass-through basically has two essential stages concerning the flow mechanism of the central bank interest rate affecting the retail interest rate. The first stage occurs when the central bank influences short-term money market rates by determining the policy rate. Then, the policy rate will affect the money market interest rate with a longer maturity. Subsequently, in the second stage, the changes in money market interest rates will affect the retail bank interest rate, either lending rates or savings rates. The reveals that the world is in perfect competition with complete information, so the market has prices equal to marginal cost [2]. In addition, the price derivative of marginal cost is equal to one. The price derivative typically becomes less than one when the information assumption and perfect competition are relaxed. The application of this idea to the resulting price setting of the bank in the marginal cost model of the equation follows:

$$br = \gamma 0 + \gamma 1 mr \tag{1}$$

Where br is the price set by the bank or the bank's interest rate, $\gamma 0$ is a constant markup, and mr is the estimated marginal cost price with a comparable market interest rate. The basic idea is that interest rates mostly correspond to marginal cost prices, as they reflect on their marginal cost of financing confronted by banks.

The coefficient $\gamma 1$ depends on the elasticity of deposit and loan demand by complying with retail bank interest rates changes. If the demand for deposits and loans is not fully elastic, the parameter $\gamma 1$ is expected to be less than one. Demand deposits are expected to be elastic relative to the level of banking deposits when close substitutes for deposits exist, for example, money market deposits. At the same time, the elasticity of loan demand, among other factors, is related to whether the borrower has the opportunity to source alternative financing.

Parameters $\gamma 1$ will be less than one if the bank has some market power. Retail rates in a less competitive market structure or oligopolistic segmentation will adjust with a delay. In contrast, banks with interest rate sets in a competitive environment respond rapidly to market interest rates [2]. Another factor affecting market power is the barriers to entry in the banking sector with institutional regulation, creating one of the prerequisites for the degree of monopoly power and administrative pricing.

Various studies have been conducted to see the degree of interest rate adjustment on the scale of countries, regions, and even internationally. Crespo-cuaresma using the Autoregressive Distributed Lag (ARDL) method, examined the interest rate passthrough in the Czech Republic, Hungary, and Poland [3]. The results found significant differences for all market interest rates of each country for long-term elasticity in response to changes in the policy rate. In addition, some interest rates have a complete pass-through state in Poland, the Czech Republic, and Hungary. Different results were found for the case of a short-term loan rate in Hungary. The pass-through coefficients in Hungary are found in incomplete pass-through states.

Karagiannis et al. took a broader study to test whether there is symmetric or asymmetric interest rate pass-through adjustment in the Southeast Europe region [5]. This study used a general-to-specific (GETS) model and tested cointegration between dependent and independent variables.

The result was found that there was a symmetrical adjustment of the retail rate in Greece in response to changesin central bank interest rates. It is in contrast to Slovenia, which found an asymmetric adjustment in the loan interest rates and deposit rates in response to changes in market interest rates. The results for Bulgaria have adjusted the asymmetric lending rates in response to changes in market interest rates and central bank interest rates.

Jamilov & Égert analyze and evaluate the interest rate pass-through as an empirical evaluation for the Caucasus region: Armenia, Azerbaijan, Georgia, Kazakhstan, and Russia [9]. They use the autoregressive distributed lag (ARDL) method. The results found that incomplete pass-throughs occur in all countries in the Caucasus region and adjustments for long-term balance are slow and rigid. The long-term balance looks rigid, indicating instability of macroeconomic conditions, interest rate volatility, and inflation. Also, there is no competition in the banking sector in Caucasus countries.

Another development is to see whether a crisis can affect the degree of interest rate adjustment. Tai, Sek, & Har have a case study of seven countries in the Asian region of Thailand, Singapore, Philippines, Malaysia, Korea, Indonesia, and Hongkong have compared pass-throughs before and after the period 1997 Asian financial crisis [10]. The results found that the interest rate pass-through in lending rates and savings varied for all economies in Asia. Interest rate pass-through on deposit rates decreased after the crisis except in Malaysia. Similarly, the pass-through coefficient of lending rates has declined in most economies except for Malaysia, Korea, and Hong Kong. The inflation targeting policy was implemented by the South Korean, Filiphine, and Thailand in the post-crisis period. The result found that monetary policy for Thailand was ineffective in the post-crisis period. This indicates that the policy of inflation targeting used is still not effective.

Similarly, Blot & Labondance studied monetary policy by adjusting business lending rates before and after the financial crisis in 2008 [11]. The research objects are countries located in the Eurozone region, namely Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Spain, and Portugal. Using the Seemingly Unrelated Regression-Error Correction Model (SUR- ECM), it was found that the financial crisis has drastically affected the interest rate pass-through in the Eurozone region. Research results in countries within the Eurozone region show that business lending pass-through has decreased or is more rigid in the long run.In addition, it was found that pass-through since the crisis was incomplete compared to the pre-crisis period. The last conclusion of thisstudy is that homogeneity among Eurozone members has increased.

3 Methodology

3.1 Data

The data used in the study is quantitative secondary data in the form of monthly time series from January 2000 to December 2013. Data is divided into two periods before and after the global financial crisis of 2008. Data for the period before the crisis used monthly data from January 2001 to December 2006, while after the global financial crisis used monthly data from January 2009 to December 2013. Research objects to be observed are 41 countries in the world. Then the results of the 41 countries will be averaged based on the three characteristics of the group,

namely: regional area, income, and inflation targeting. Data sources are obtained from World Bank and International Financial Statistics (IFS). The data used in the research are deposit interest rate (deposit rate), lending rate (lending rate), and money market rate (money market rate).

3.2 Empirical Model

Before and after the 2008 global financial crisis (subprime mortgage), the market to retail pass-through model formulation wasdescribed and formulated using the cost of fund approach de Bondt [2]. It states that perfect competition with complete market information has prices equal to the marginal cost. In addition, the derivative of the price in connection with a marginal cost equals one. The derivative of the price will become less than one when imperfect competition assumptions and incomplete information occur. The cost of fund theory states that bank interest rates depend on short-term loans. The theory illustrates a positive relationship between money market interest rates and retail interest rates, namely deposit rates and lending rates are formulated in the following models:

$$i^R = \alpha + \beta . i^M \tag{2}$$

where i^R is the retail interest rate or bank pricing, and i^M is the money market rate or is proportional to the marginal cost. β is the long- term pass-through coefficient, and α is the intercept. If β is equal to one, then there is a complete pass-through phenomenon which implies perfectly elastic banking interest rates against changes in money market rates. The equation of standard marginal cost theory above shows the long-term equilibrium relationship. Error Correction Model is the best model to explain the out-of-equilibrium:

$$\Delta i^R_t = \mu + \rho(i^R_{t-1} - \alpha - \beta(i^M_{t-1}) + \gamma \Delta i^M_t + \varepsilon \tag{3}$$

short-term dynamics can further explain equations of Error Correction by following the lag form of the Autoregressive Lag model asfollows:

$$\Delta i^R_t = \mu + \rho(i^R_{t-1} - \alpha - \beta(i^M_{t-1}) + \sum_{k=0}^{n} \gamma_k \Delta i^M_{t-k} + \sum_{k=1}^{n} \delta_k \Delta i^R_{t-k} + \varepsilon \tag{4}$$

or by substituting $\Delta it = it - it\text{-}1$ and forming the equation,

$$\Delta i^R_t = \theta + \sum_{k=0}^{n+1} \beta_k \Delta i^M_{t-k} + \sum_{k=1}^{n+1} \alpha_k \Delta i^R_{t-k} + \varepsilon \tag{5}$$

In the above equation, β_k denotes short-term interaction elasticity where α_k reflects compliance with retail interest rates. Based on the above equation, the long-term market-to-retail pass-through coefficients can be calculated as follows:

$$\beta = \frac{(\sum_{k=0}^{n+1} \beta_k)}{(1 - \sum_{K=0}^{n+1} \alpha_K)} \tag{6}$$

In the above equations must meet some requirements because β must be positive [12] with:

$$\sum_{k=0}^{n+1} \beta_k > 0 \tag{7}$$

which shows the contemporary cumulative impact of money market interest rates on retail interest rates is positive. The followingequation indicates a condition of convergence of the stability of the retail interest rate.

$$\sum_{k=0}^{n+1} \alpha_k < 1 \tag{8}$$

4 Result and Discussion

4.1 Data Explorative Analysis

Preliminary analysis was conducted by giving a graph of the development of lending, deposit, and money market interest rateused in the research. In Figure 1 and Appendix 1, each group characteristic generally shows a larger lending rate than the deposit rate. The difference in the magnitude of the numbers is very significant. It is because lending rates have a high cost of funding, the cost of pricing in the face of the default credit risk, and the choice of differences in the domestic financial market.
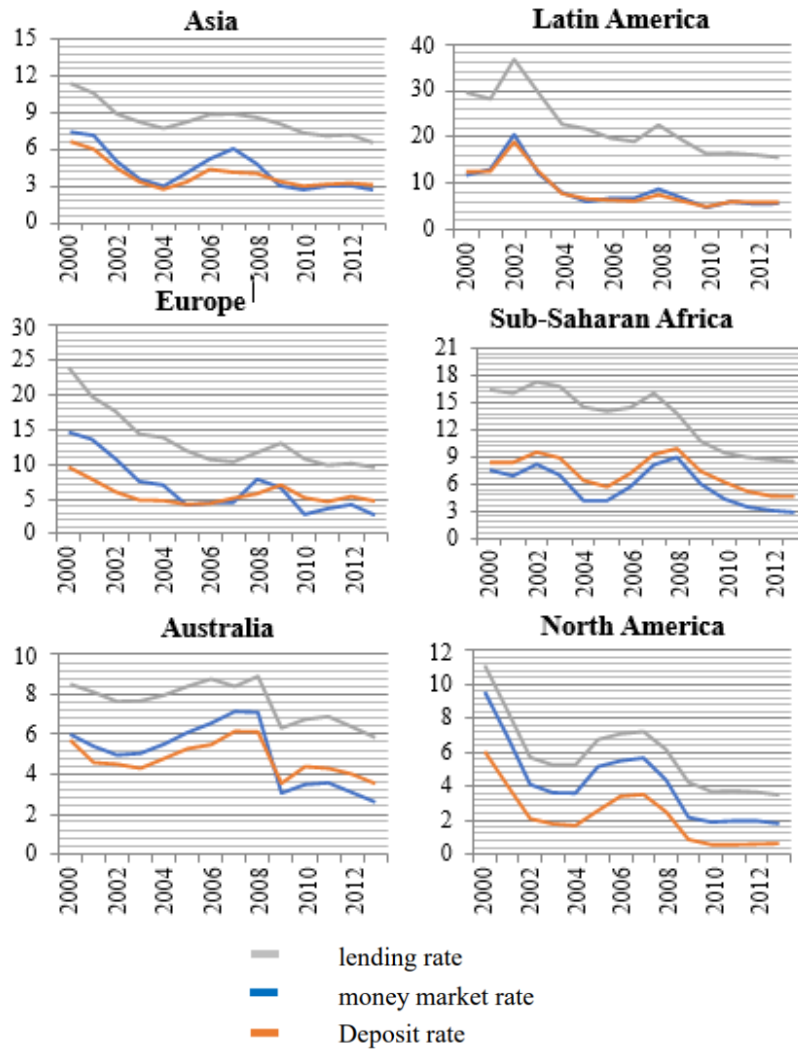
Fig.1. Plot of Deposit, Lending Rate and Money Market Rates.

The magnitude of lending rate rates between regions varies greatly (Appendix 1). The difference in figures is due to differences in financial market risk among each region. Figure 1 also shows the similarity of trends in money market rate, lending rate, and deposit rate despite having different figures. When there is a change in the size of the money market interest rates, it will be followed by changes in the direction of lending and deposit rates. In addition, each region has a downward trend in money market rates and retail interest rates for each period. The downward trend in interest rates in each region could be due to intense competition in the banking market. Then the competition in the banking market caused a cut in lending rates. The cuts in bank lending rates will be compensated by reducing their deposit rates [13]. The trends of each region also look the same for the crisis period between 2007 and 2008. The global financial crisis is based on a history of low interest rates due to the short-term rate cuts made by The Federal Reserve of

about 6.5 percent to 1 percent in 2002 [14]. It can be seen in the North America region consisting of the United States, Canada, and Mexico, wherein in 2002, interest rates were low due to the low-interest-rate policy. Each region showed a rapid increase in market interest rates during the crisis, followed by retail bank interest rates.

The following discussion is about the average number of variables. The purpose of this discussion is to know the average number of each variable used in the study and provide an overview of the behavior of the banking market structure between regions. Figure 2 represents the average rate of money market interest rates and retail interest rates, namely lending and deposit rates. Figure 2 shows that the region's characteristics found the money market interest rates, loan interest rates, and deposit rates are the lowest in North America, namely: 4.2 percent, 2.2 percent, and 5.9 percent. Due to the low interest rate program in the United States, most regions have low interest rates on the money market and the retail interest rate.
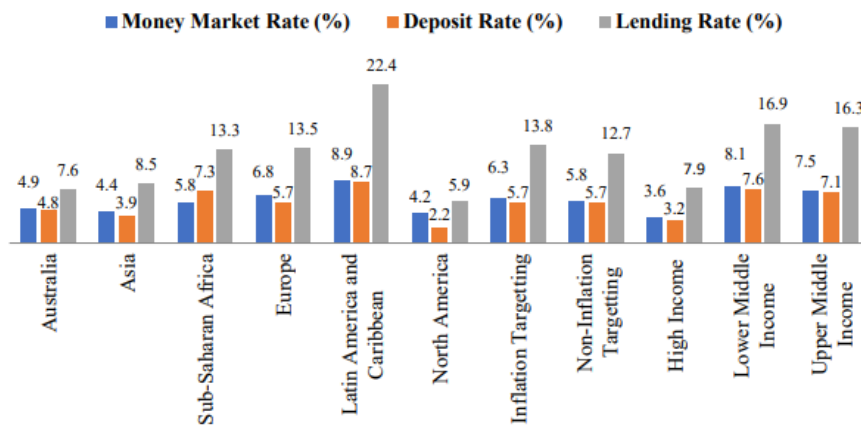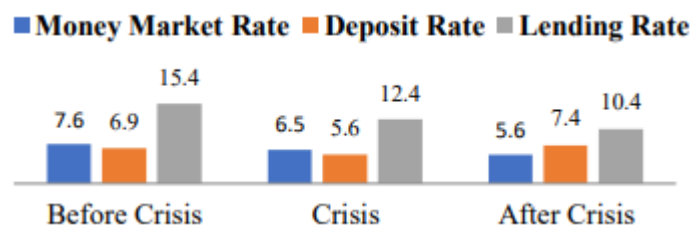

Fig. 2. Average Money Market and Retail Interest Rates 2000-2013.

Latin America and the Caribbean have market interest rates and high retail interest rates. It is mainly due to high-interest rates in Latin America and Caribbean countries, namely Brazil, Uruguay, and Jamaica. The high-interest rates in the region due to the high operational costs and the high reserve requirements required by banks are thus compensated by high-interest rates [15]. According to the characteristics of the income group, high-income countries have lower interest rates compared to upper-middle-income countries and lower-middle-income countries. It is due to the condition of the banking market in high-income countries, which are generally more competitive than the other regions. The intense competition in the banking industry causes the domestic interest rate to be lower.

Fig. 3. Average Money Market Rates and Retail Interest Rates in 41 Countries (Before, During, and After the Crisis of 2008).

Next, we discuss the magnitude of the average variables of market and retail interest rates (before, during, and after the crisis of 2008). The average variable is obtained by averaging the variable of market interest rate in 41 countries researched. Figure 3 shows the behaviour of different deposit rates in the post-crisis period before and during the crisis. Before and during the crisis, the deposit interest rates are always below the money market interest rate. But after a period of crisis, on average, the deposit rate increases beyond the money market interest rate. It happens because of the global financial crisis (subprime mortgage) that hit the world. According to De Nederlandsche Bank, the financial crisis caused liquidity problems in the world banking industry and the difficulty for manybanks to find financing in money and capital markets [16]. The problem is solved by increasing the deposit interest rate (saving) and exceeding the money market interest rate to protect banks' sufficient financing.

4.2 Coefficient Pass-Through into Lending and Deposit among Regions in the World

Pass-through coefficient testing is performed on 41 countries of the world which is then represented by the average value of the pass-through coefficient based on the characteristics of the group, namely: regional groups, income groups, and the inflation targetting system adopted. In this study, the phenomenon of complete pass-through is shown by ARDL and ECM-ARDL estimates withvalues equal to one. It indicates that changes in the money market interest rates are fully responsive to retail interest rate adjustments in the short and long runs. The incomplete pass-through phenomenon occurs if the short-run and long-term coefficients of the pass-through value are less than one. The changes in money market interest rates responded by the retail interest rate of banks. It is smaller than changes in money market rates. At the same time, the phenomenon of overcomplete pass-through occurs when the short-run and long-term coefficients are greater than one. It indicates that the changes in the money market rates are responded to by changes in retail interest rates that are greater than changes in the money market rates themselves.

Table 1: Summary Comparison of Pass-Through Coefficients Into Lending and Deposit Between Regions of the World.

| | Short-Run Pass-Through | | | |
| | Into Deposit Rate | | Into Lending rate | |
	Before Crisis	After Crisis	Before Crisis	After Crisis
Australia	0.81	0.47	0.47	0.72
Asia	0.34	0.43	0.19	0.27
Europe	0.21	0.11	0.12	0.23
Latin America and Caribean	0.50	0.55	0.46	0.38
North America	0.80	0.98	0.98	0.99
Sub-Saharan Africa	0.38	0.35	1.55	1.21
High Income Countries	0.58	0.62	0.56	0.46
Lower Middle Income Countries	0.24	0.21	0.29	0.24
Upper Middle Income Countries	0.35	0.46	0.53	0.53
Inflation Targeting Countries	0.57	0.56	0.67	0.60
Non-Inflation Targeting Countries	0.20	0.66	0.31	0.25
	Long-Run Pass-Through			
	Into Deposit Rate		Into Lending rate	
	Before Crisis	After Crisis	Before Crisis	After Crisis
Australia	0.59	0.61	0.86	0.70
Asia	0.78	1.30	0.74	0.59
Europe	0.42	0.57	0.58	0.64
Latin America and Caribean	0.69	0.72	0.94	1.42
North America	1.35	0.51	0.91	0.88
Sub-Saharan Africa	0.66	0.83	1.04	0.86
High Income Countries	0.67	0.89	0.98	0.82
Lower Middle Income Countries	0.67	0.95	0.83	0.70
Upper Middle Income Countries	0.77	0.84	0.81	0.80
Inflation Targeting Countries	0.91	0.86	0.91	1.20
Non-Inflation Targeting Countries	0.58	0.92	0.94	0.75

Table 1 compares the estimated interest rate of pass-through before and after the sub-prime mortgage crisis. Table 1 aims to see how high the responsibility of both deposit and lending rates are in response to changes in money market rates. The short-run and long-run pass-through coefficients illustrate the degree of responsiveness to lending and deposits rates. Table 1 compares two time periods before and after the 2008 global financial crisis (subprime mortgage). The regions divided into regional groups obtained interesting results to be observed. The results show an overcomplete pass-through into lending in the Sub-Saharan Africa region. As forthe pass-through coefficient of prior and post-crisis coefficients, there are similarities in the North America region, both in lending anddeposit rates. While in the long run, there is the phenomenon of overcomplete pass-through into lending in the aftermath of the crisis in Latin America and the Caribbean region.

The smallest short-term pass-through coefficient based on the characteristics of the income-level region lies in the lower- income countries, both before and after the crisis. It could be due

to the weak competition between the banking sector and the high cost of change and interest rate adjustment. As for the area based on the inflation targeting adopted, the result is that countries using the inflation targeting framework policy have high short-run coefficient value, especially on pass-through into lending, both in the period before and after the global financial crisis. However, in the long run, there is a phenomenon of overcomplete pass-through into lending during the period after the crisis in the inflation targetting countries region.

4.3 Pass-Through Coefficient in Deposit Rate Before and After Subprime Mortgage

The exposure in this section explains the process of adjusting the deposit interest rate in response to changes in market interest rates before and after the crisis. The pass-through coefficient shows a difference in the magnitude of pass-through coefficients before and after the subprime mortgage crisis. Figure 4 shows the results of the short-run and long-term coefficients estimation of pass-through into deposit rate. The results found different coefficients of pass-through into deposits in the short run for each region both before and after the crisis. If we compare before and after the crisis, the lowest short-run pass-through coefficient based on regional characteristicsis in Europe, whereas the lowest coefficient for income level is in lower-middle-income countries. Meanwhile, the lowest short-run pass-through coefficient based on the inflation targeting group is in non-inflation targeting countries (after the crisis). It means that theinterest rate adjustment process is very rigid in countries. In contrast, North America has the highest short-run pass-through coefficientbased on the regional group. Also, the highest short-run pass-through coefficient is from the high-income countries. Meanwhile, from the inflation targeting group, it goes to the countries that implement the inflation targeting framework (before the crisis).

The comparison of pass-through coefficients on the before and after crises using the long-term coefficients is shown in Figure 4. After the crisis, the long-run pass-through to deposit phenomenon in the three group characteristics increased. The increased coefficient pass-through into deposits for the post-crisis period can be seen in Sub-Saharan Africa (from 0.66 to 0.83), Latin America and Caribean (from 0.69 to 0.72), Europe (from 0.42 to 0.57), and Australia (from 0.59 to 0.61). On the contrary, North America experiences the opposite. Similarly, the characteristics of income groups whose pass-through to deposit coefficients increased during the post-crisis period in the high-income countries from 0.67 to 0.89, the upper-middle-income countries from 0.77 to 0.84, and the lower-middle-income countries from 0.67 to 0.95. Based on the group of inflation targeting adopted, only the non-inflation targeting countries experienced an increased coefficient of pass-through in deposit from 0.58 to 0.92. The opposite condition happens for the inflation targeting group with a decreased pass-through coefficient in deposit rate from 0.91 to 0.86.
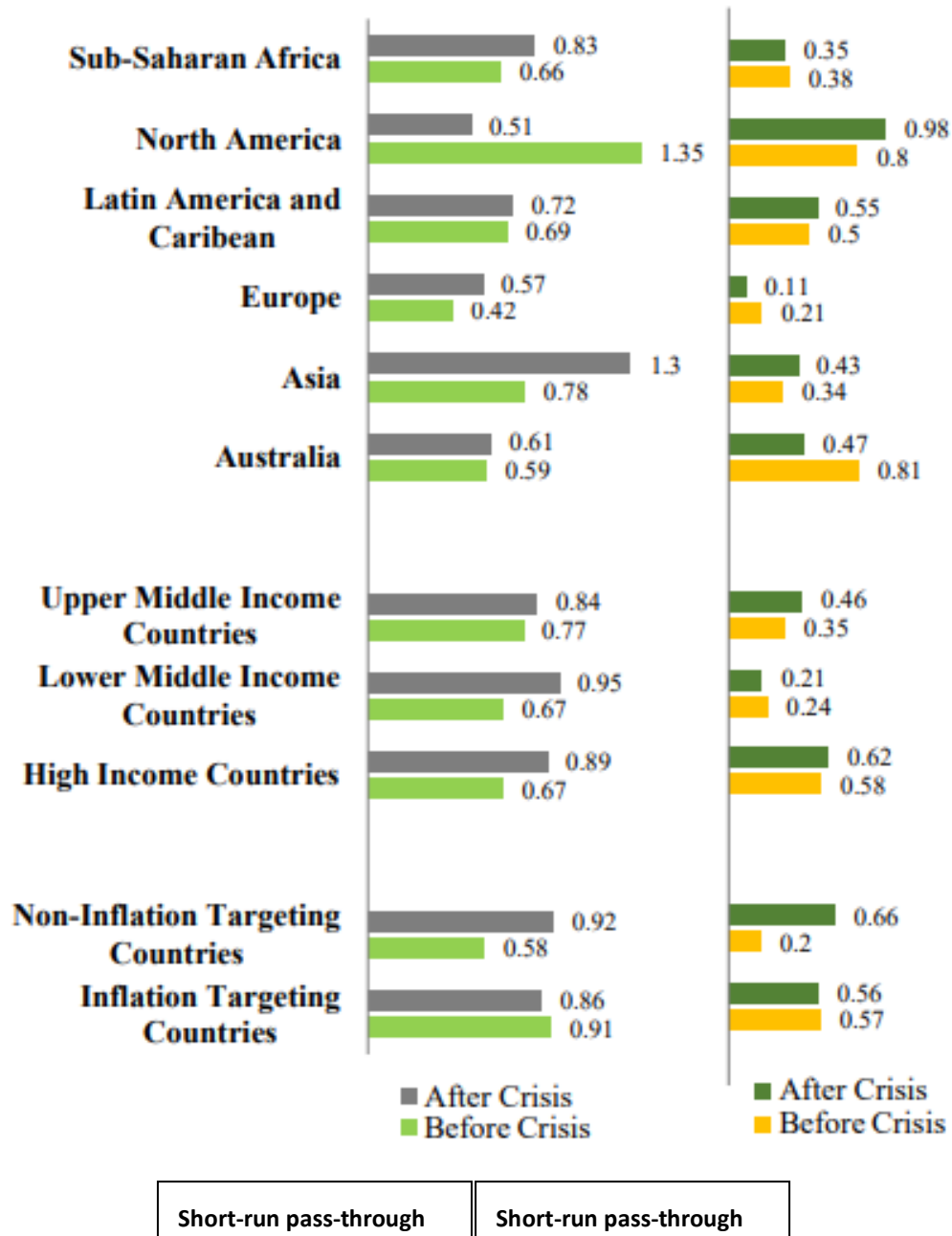
Fig. 4. The Long-Term and Short-Term Pass-Through Coefficients in Deposits Rate Before and After the Subprime Mortgage Crisis.

The phenomenon of the pass-through coefficient increase after a global financial crisis. The global financial crisis caused scarcity in access to banking financing sources obtained from depositors. This financing crisis led to an increase in deposit interest rates in response to changes in market interest rates due to the fast response of banking behaviour in adjusting the deposit interest rate. Increasing the deposit interest rate will attract the public to save money in the banking sector. Interest rate response very quickly can also make the individual increase the level of savings so that the increase in savings will be a source of financing for banks experiencing capital scarcity. Therefore, it triggers the phenomenon of increased pass-through coefficients in many groups of countries in the periodafter the crisis.

Interestingly, North America is in the opposite condition, where the coefficient of pass-through into deposit after the crisis hasdecreased and is more rigid. The phenomenon of incomplete pass-through after the crisis in the North America region from 1.35 (beforethe crisis) to 0.51 (after the crisis) consisting of the United States, Canada and Mexico were allegedly due to a confidence crisis in financial markets between banks and costumer. Thus, there was a crisis of confidence followed by a downward trend in money marketinterest rates in the period after the crisis was responded rigidly by banks in the North America group.

4.4 Pass-Through Coefficient in Lending Rate Before and After Subprime Mortgage

This section explains the process of adjusting the lending rate in response to a change in market interest rates before and afterthe crisis shown in Figure 5. The results found that lending rates' pass-through coefficients are different before and after the crisis period. Based on regional, income level, and inflation targeting groups, the lowest short-term pass-through coefficient is in Europe, the lower-middle-income group and the non-inflation targeting group. It indicates that adjusting the lending rate to the money market interest rate in the groups is rigid. On the other hand, the highest short-term pass-through coefficients are in Sub-Saharan Africa, the high-income countries and the inflation-targeting countries.

Interestingly, the highest pass-through coefficient in lending rate is in Sub-Saharan Africa, an over-pass-through condition before and after the crisis. It is because of many foreign banks that enter the South Africa region and spread to countries around South Africa. The large current of foreign banks and well-used technology has led to increased competition in the banking sector in the region [17]. Therefore, a high level of competition at the banking level causes the pass-through coefficient to be over. Another interesting point is a short-run complete pass-through of North America before and after the crisis. It suggests that the short-term pass-through into lending coefficient in North America responds perfectly to changes in the money market rate.
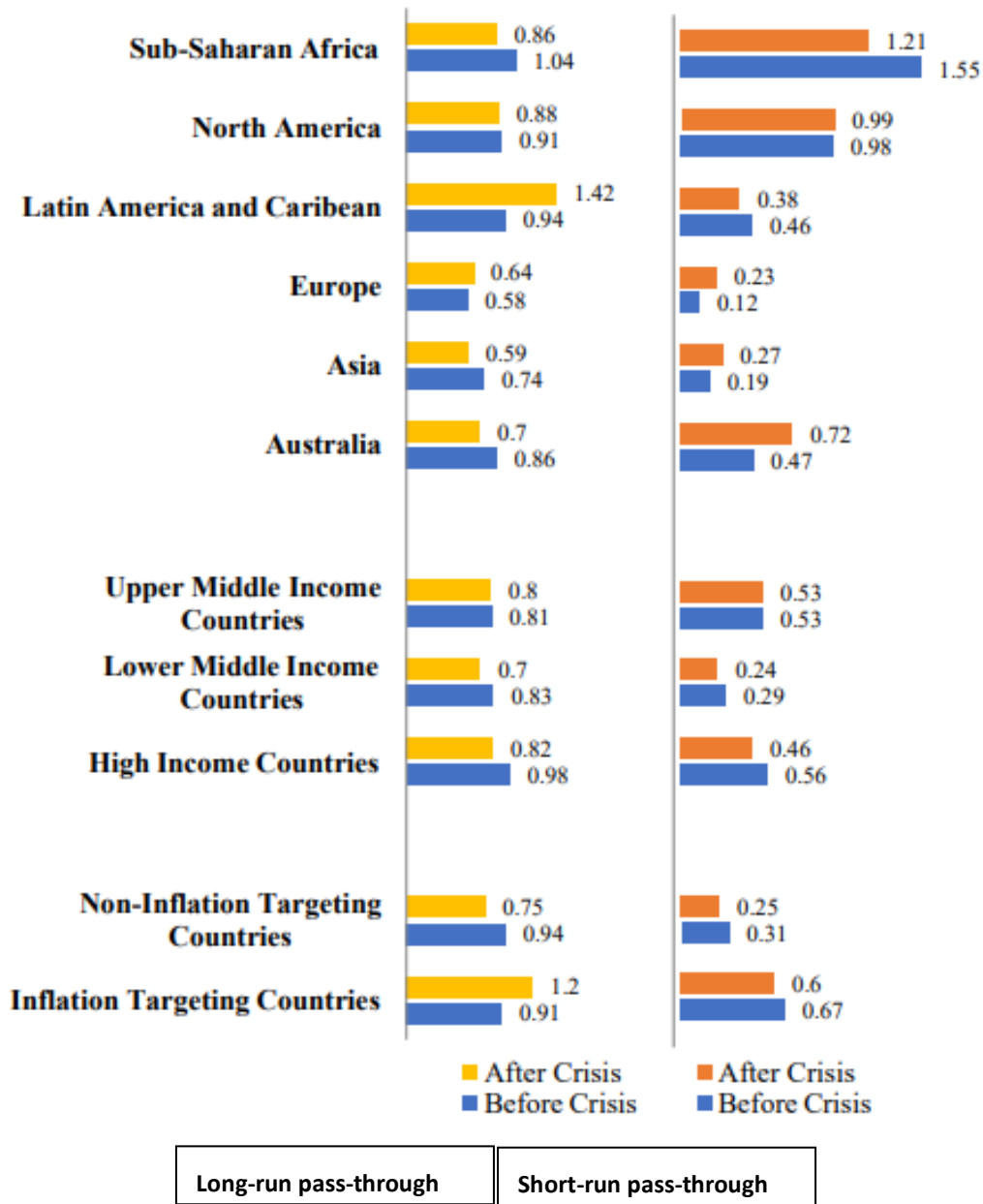
Fig. 5. The Long-Term and Short-Term Pass-Through Coefficients in Lending Rate Before and After the Subprime Mortgage Crisis.

The comparison of the pass-through into lending coefficients before and after the crisis uses the long-term coefficients shown in Figure 5. The long-term pass-through into a lending phenomenon in the majority groups decreases. The decrease in pass-through in lending coefficients in the post-crisis period can be seen in the sub-Saharan Africa region (from 1.04 to 0.86), North America (from 0.91 to 0.88), Asia (from 0.74 to 0.59), and Australia (from 0.86 to 0.70). Meanwhile, Europe, Latin America, and Caribean are experiencing the opposite. Likewise, based on income groups, the pass-through coefficient in lending rate declined after the crisis. The high-income countries decrease from 0.98 to 0.82, the upper-middle-income countries fall from 0.81 to 0.80, and the lower-middle- income countries also drop from 0.83 to 0.70. As for the group of inflation targeting adopted, only the non-inflation targeting countries group experienced a decrease in the pass-through coefficient from 0.94 to 0.75.

The phenomenon of decreasing pass-through into lending coefficient after crisis in this research is similar to the result of research conducted by [10]. The decline coefficients of long-term pass-through in lending rates are due to a loose monetary policy after the global financial crisis. The existence of a loose monetary policy followed by a decrease in policy interest rates is expected to be adjusted by banks to adapt to lower interest rates. However, the crisis made banks unable to follow the lower interest rate and respond rigidly. It is due to the financial crisis experience that was initially the occurrence of bad loans (default) by the borrower. Afterwards, after the crisis, banking worldwide tends to be careful in adjusting their lending rates to respond to any changes in money market rate. This unresponsive adjustment causes the pass-through coefficients in lending rates to become more rigid in the period after the subprime mortgage crisis.

5 Conclusions and Recommendation

The short-run and long-run adjustments of pass-through in deposit and lending rates from changes in money market rates are still not effective. It is shown in almost every region in both the pre-and post-crisis periods, except Sub-Saharan Africa and high-income countries for long-term pass-through in lending rate and North America for pass-through in lending rate in the short run. It indicates that changes in money market interest rates are not fully responded to by changes in deposit rates and lending rates. Long-term adjustment of pass-through in deposits after the global financial crisis (subprime mortgage) is higher than in the pre-crisis period for all regions except North America and Inflation Targeting Countries. The phenomenon of the pass-through coefficient increased after the global financial crisis. The global financial crisis caused scarcity in access to banking financing sources obtained from depositors. This financing crisis led to an increase in deposit interest rates in response to changes in market interest rates.

Meanwhile, the long-term pass-through into lending adjustment after the global financial crisis (subprime mortgage) is more rigid than the pre-crisis period for all regions, except Latin America and the Caribbean, Europe and Inflation Targeting Countries. The phenomenon of decreasing pass-through coefficients in the period after the crisis is because banks worldwide tend to be careful to hold lending rates. Thus, they are not very responsive to make adjustments to changes that occur in market rates. Based on the empirical results, the monetary authorities should pay attention to the effectiveness and stability of monetary policy adopted to stabilize macroeconomic conditions. Weak financial market structures such as banking competition and

high cost of interest rate adjustment areexpected to be serious attention so that the mechanism of transmission through the effective interest rate to be done to achieve the established goals.

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