Relationship between Federal Funds Rate and House Prices of Asian Emerging Economies

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Abstract: The Federal Reserve rate will affect the global financial system at least to some extent. Contemporarily, the actions implemented by Fed caused wide public concern. The importance of studying the alteration in the Federal Reserve rate is essential for foreseeing the changes in the interest rates, mortgage rates, and foreign exchange rates, etc. In this paper, the Fed's impact on housing prices in emerging Asian countries will be mainly discussed and demonstrated. Specifically, we illustrate the effects of different factors on house prices in terms of declining interest rates including purchase power, stock market, and speculators' expectations to show how interest rates cause house prices to increase. The granger causality test was applied to prove if the house price index is influenced by the federal funds rate. According to the analysis, a small effect in the relationship between interest rates and house prices than hypothesized, and the research indicates that the cost of borrowing, stock prices, and speculators' expectations all lead to a rise in house prices. However, based on some data, the relationship is weakly negative. Following previous literature, these studies state that the relationship is not generally considered as the strong negativity because of the various data, from the different countries, that research collects and analyses, which explains a weakly negative correlation between declining interest rates and rising house prices. These results shed light on how the policy in America influences certain indexes in other economies.

1. Introduction

1.1 Background

Nowadays, in the latest prediction made by IMF in July, the US economic growth forecast raised to 7.0% [1]. Meanwhile, the US's inflation rate has also continued to rise, with the June PCE report showing prices rising by a record 3.5% year on year [2]. Against that backdrop, people all around the world pay high attention to the Fed rate, which is a kind of monetary policy that appertains to actions made by the American central bank. A lot of researchers made numerous reports to explore the impacts made the changes of the Fed rate, e.g., the impact of federal funds rate on an investor's returns [3]. Deviations from Purchasing Power Parity and report of Inflation, Money Demand, and Purchasing Power Parity in South Africa, etc. [4,5].

As much relative research like Jonsson's mentioned above, U.S. dollar fluctuations will have a great impact on developing countries with poor economic foundations. Especially, when the U.S. dollar is in a strong cycle, emerging market countries will undergo a crisis. For instance, Mexico's financial crisis, Southeast Asia's financial crisis, Brazil's economic crisis, and the Argentine debt crisis all broke out during the period of USD appreciation from 1993 to 2001 [6].

Investigating the alteration in the Federal Reserve rate is essential for foreseeing the changes in the interest rates, mortgage rates, and foreign exchange rates, etc. [2]. The most principal effect is the prime rate, which includes the deposit rates, loans, and mortgages [7]. Taking the impacts on real estate as an example, when Fed decreases the interest rate, the consumers will be willing to borrow more money from the bank. On this basis, homeowners can not only release some pressure to repay the loan but also have home equity loans easily [7]. As a result, they will have a stronger sense to cost, which can improve the interest rate and housing market. On the other hand, if Fed increases the interest rate, consumers will buy less with the expansive loan, which can slow down the development of real estate and relieve economic overheating [7]. It can be seen that changes in the Fed Rate will have a great impact on the real estate industry. The purpose of this paper is to discuss the impact of the federal funds rate in Asian emerging markets and the real estate industry.

1.2 The Federal Reserve

It is almost irrefutable that the US dollar has the strongest power nowadays that the Federal Reserve has more power to impact other economies by its endogenous changes than any other central bank. According to Beckworth and Crowe, many countries "delegated their monetary policy to the Federal Reserve as they moved towards open capital markets over the past few decades" and hence has been "exposed to the machinations of US monetary policy" [8].

The data from the IMF WEO database (as shown in Fig.1), representing World GDP under the three largest currency blocs in purchasing power parity (PPP) gives evidence to the view above. As shown in Fig. 1, the dollar bloc has always been the largest currency bloc in the world, indicating a large number of economies pegging their currency with the US dollar. Till 2015, compared to only 16% of world GDP made by the US itself, the US dollar blocs comprised 41%, which is approximately a 2.5-fold increase in the reach of Federal Reserve policy [8].

Given the dominant status of the US dollar in the world, the data of the US Taylor rule gap (Taylor rule federal funds rate minus actual federal funds rate) against the year-on-year growth of nominal spending for the countries of the OECD less the United States (from 1995:Q1 to 2015:Q4) as shown in Fig. 2 provided strong evidence that even most advanced economies could not avoid being influenced by US monetary policy [8].
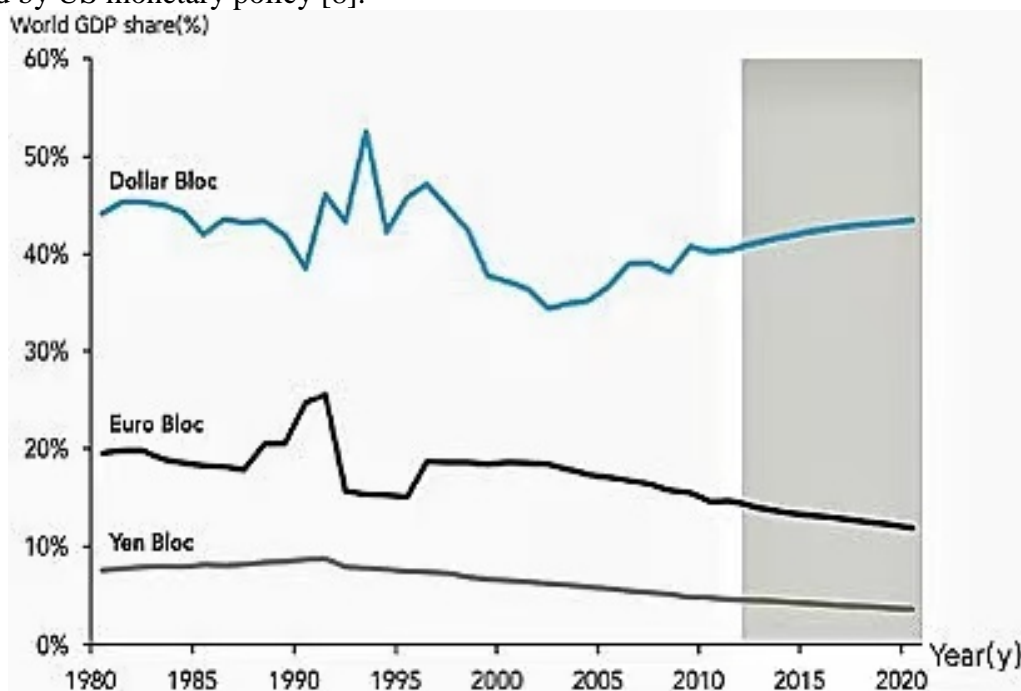

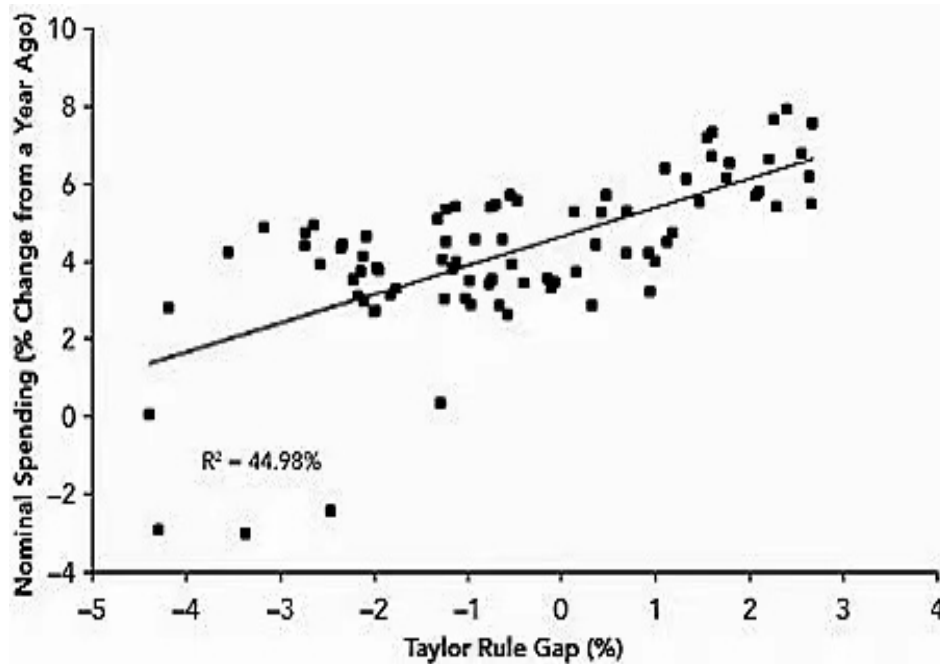Figure 1. Share of World GDP at PPP for Currency Blocs [5].

Figure 2. Fed Policy & OECD less USA Nominal Spending Growth (1995:Q1 – 2015:Q4) [5].

1.3 Asian Emerging Market Economies (Asian EMEs)

The monetary policies in the past two decades of Asian EMEs provided themselves resistance against an internal crisis. After the Asian financial crisis in 1997, the Asian policymakers have been more focused on the stabilization of inflation, evolving towards the standard "New Keynesian" prescription [9]. Their approach mainly included the use of short-term interest rate, which is similar to the federal funds rate, being the primary monetary policy tool to ensure their expected future inflation [9].

However, the opened bond market of Asian EMEs exposing them to international monetary transmission generated their vulnerability facing the US monetary policy. With the development of the domestic corporate bond market and rapid growth of foreign investment in the local currency bond market in many Asian countries, the capital flows to Asian EMEs have increased sharply [9]. Furthermore, till 2015, data from International Monetary Fund (IMF) implied that half of the total external liabilities of EMEs is made up of loans, and Bräuning and Ivashina documented that "over 80 percent of the cross-border loans to EMEs are denominated in U.S. dollars" [10].

Considering the argument of Beckworth and Crowe, the open bond market of Asian EMEs as well as the high percentage accounted by US dollar in their capital inflow, it is reasonable to assume that the Asian EMEs' monetary policy could be highly influenced by the Federal Reserve.

In the following content, a review on past studies to perceive the channels of interest rate influencing house prices in Literature review. In Data source and Method, the source for the statistical study and the methodology of examining the relationship between the federal funds rate and house prices in Asian EMEs will be explained, with the outcome illustrated in Result. In Discussion, the findings involved in this paper and limitations of our method design as well as the possible future investigation.

2. Literature Review

The discussion about the impact of the federal funds rate on the Asian emerging market has been fierce. The federal funds rate is the interest rate at which the Federal Reserve charges commercial banks; in 2015, Iklaas Gurrib found that a higher federal funds rate could increase the normal interest rate [3]. Over the past few years, researchers generally paid attention to how the interest rate, stock market, and inflation influenced the house prices index in an emerging market. The decline of the

federal funds rate, decreasing the interest rate, stimulates individuals to invest more in real estate due to cheap credits for housing and the desire for higher returns. Nevertheless, irrational expectations made by speculators have the potential to cause a bubble. The analysis below takes purchasing power, stock market, and investors' expectations, these three factors, into account.

2.1 Interest Rate and Purchase Power

Fung and Lo in 1992 posed the univariate test and failed to reject the random walk model, but the multivariate test indicated that part of the real exchange rates was predictable, a result supporting purchasing power parity [4]. Further analysis of the random walk component in real exchange rates indicated that it is quite persistent. In detail for all currencies, it takes about five to eight years for this shock to diminish to half its size. In 1999, Benjamin S. Cheng conducted the While causality from interest rates to exchange rates and found that in the short run, there was no causality between prices and exchange rates [11]. However, causality is found running from relative prices to exchange rates along with interest rates between the U.S. and Japan in the long run. In 2001, Gunnar Jonsson reported that in the short run, shocks to the nominal exchange rate affected domestic prices but had virtually no impact on real output, while shocks to broad money had a temporary impact on the real output before becoming inflationary [5]. Eric O'N. Fisher in 2002 analyzed purchasing power parity and uncovered interest parity in the laboratory. It found strong evidence that purchasing power parity, covered interest parity, and uncovered interest parity hold [12]. In 2014, John Smithin demonstrated that logically the counterpart to the rejection of any domestic natural rate of interest must also be the rejection of the idea that the real exchange rate is primarily determined by nonmonetary factors such as the supposedly immutable barter terms of trade [13].

2.2 Interest Rate and Stock Market

To determine the effect of interest rate on stock price, in 1981, Fama argued that expected inflation was negatively correlated with anticipated real activity, which in turn was positively related to returns on the stock market. Therefore, stock market returns should be negatively correlated with expected inflation, which was often proxied by the short-term interest rate [14]. In 1987, Campbell analyzed the relationship between the yield spread and stock market returns. Such analyses formed the basis for building a negative relationship between interest rate and stock price. After several years, in 2008, M'd. Konan Leon analyzed the data from Korean Stock Price Index 200, which found that stock prices have a negative and significant relationship with the interest rates [15]. When stock prices increase as interest rates fall, the house prices will fluctuate. Several models have been developed to understand viewers' tuning behavior. In 1991, Takala and Pere examined a long-run relationship between house prices and stock prices in Finland. The results gave information that there was a long-run relationship between the two prices and there was a Granger causality that ran from stock prices to house prices [16]. In 2002, Sutton posed a variable vector autoregression that explained the positive responses of house prices to stock price changes [17]. In 2010, Oikarinen also supported a long relationship between house prices and stock prices [18]. After a few years, in 2013, Bjornland and Jacobsen used a structural vector autoregressive model to analyze the role of two asset prices, which showed the positive relationship between them [19].

2.3 Interest Rate and Speculators' Expectation

Prior researchers have done numerous studies on the correlation between the interest rate and investors' expectations. Ling T et al. in 2003 suggested that the sensibility to real estate investment trusts (REITs) was the main factor to be considered [20]. In 2001, He, who was one of the coauthors, suggested that the long-term interest rate was a major risk factor for investors due to the sensibility of stock markets and the interactivity between factors of security markets(real estate, financial institutions, utilities, and commerce and industry) [20]. Hu et al. claimed in 2006 that speculation existed only when there was an expectation about the future fluctuation in real estate prices [21]. They found that positive feedback of previous price changes gives speculators indications. Combining studies on psychology and economics, in 2014, Sarah Farese further pointed out the reason for

irrational expectations [22]. He proposed that investors are largely affected by the most accessible information, meaning that investors may be overconfident, make decisions based on irrational expectations and cause fluctuation in prices. A few years later, in 2014, Paola Gelain and Kevin J. Lansing demonstrated how speculators caused house bubbling through irrational anticipation [23]. A decrease in interest rate stimulates people to invest more in real estate for the sake of higher returns, increasing the demand for and prices of houses. Paying attention to short-term benefits, investors' expectation about sustained growth in prices elevates the demand for houses. In 2014, Gubau et al. pointed out the impact of irrational speculation [24]. In 2000, they draw a conclusion from Shiller's book, Irrational Exuberance, that there would be a circle of continuously increasing prices to compensate the prior one by increasing investors' demand [24].

Together, these studies outline three different ways that can affect the house prices after the federal fund rates have been declined. The previous reviews provided the measurements for how the house price changed when the declining interest rates affected the purchasing powers, stock prices, and investor expectancy directly. Therefore, because of the cost of borrowing, the increased stock prices, and unreasonable expectations, i.e., the house prices will rise rapidly. However, as technology rapidly increases and the information age expands, this paper ought to think about the changes of other factors following the interest rates that could be acted in the house prices.

3. Method

3.1 Research Design

This paper investigates the relationship between the federal funds rate and three Asian EME house prices respectively. Practically, time-series data of federal funds rate and house prices are inserted into the Granger causality model to test the correlation between the two-time series of each federal funds rate (house price data group). Ideally, the data is ranged from 2004 to 2019 to ensure the sample size is large enough to derive significant results. However, this study avoided other events that drastically impacted federal funds rate such as QE1 and COVID-19 to reduce the impact of the sudden drop of federal funds rate and possible low responsiveness of Asian EME house prices on federal funds rate. Therefore, this paper selected period series data from 2010 to 2018 for both federal funds rate and house prices. Considering the probably low or intermediate responsiveness of the house price index in Asian emerging economies towards the federal funds rate, the interest rate on the first day of December was taken as the representative of the federal funds rate in each year.

3.2 Data Collection

The house price index of Korea of all kinds of houses from 2004 to 2021 is obtained via the ECOS screening system in the Bank of Korea. The same type of CPI data (2016-2021) in the Philippines is gained from the Philippine Central Bank, whose period is limited due to reasons of the government statistics. The consumer price index (CPI) of housing, water, electricity, gas, and fuel in Indonesia from Bank Indonesia is available from 1966 to 2021, as a representative of housing prices in this country. This combined CPI of housing and other resource and energy use is considered as a limitation, as a specific house price index in Indonesia was missing in the bank statistics. The numerical data of federal funds rate from 1954 to 2021 is obtained from the Economic Research section of Federal Reserve Bank of St. Louis, searching with keywords "federal funds rate". As illustrated in Fig. 3, the data set includes the interest rate set by the Federal Reserve on the first day of each month in each year, which has twelve single interest rate data within one year, associating with each month.
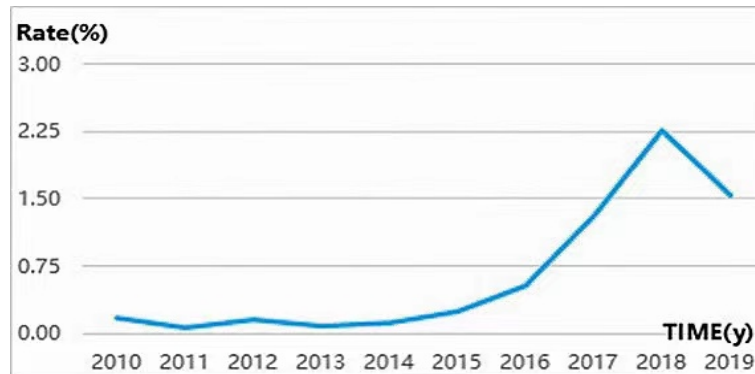
Figure 3. Federal funds rate from 2010 to 2019.

3.3 Data Analysis

Granger causality model was applied respectively to the three combinations of housing price and federal funds rate, associating to three Asian developing countries. The application was completed based on the use of Statsmodels, which is a package for Python3 that can automatically process the data with a set of commands within the package. Apparently, the housing prices of the three countries have certain trends, all of the data in the data sets were converted into percentage change according to the last lag to ensure the stationarity of the time series. Otherwise, the result of the autocorrelation model involved as a component of the Granger causality model would be unreliable.

PACF (Partial Auto-Correlation Function) tests were applied to all the time series data involved in the study, including federal funds rate and housing price of three countries. The test was designed to represent the extent of contribution of a certain lag (or a point of time) to the present value. It was used in the Granger causality model to select the effectively contributing lags in the whole time series, to ensure that the prediction of the autocorrelation model and hence Granger causality model was not negatively influenced by disturbing lags. One example of the PACF test implemented in the process is shown in Fig. 4 and the result of lag selection is listed in Table 1. The length of continuous lags selected for the Granger causality model is 99 lags, and they were decided by matching significant lags of Federal Funds Rate and the subject country.
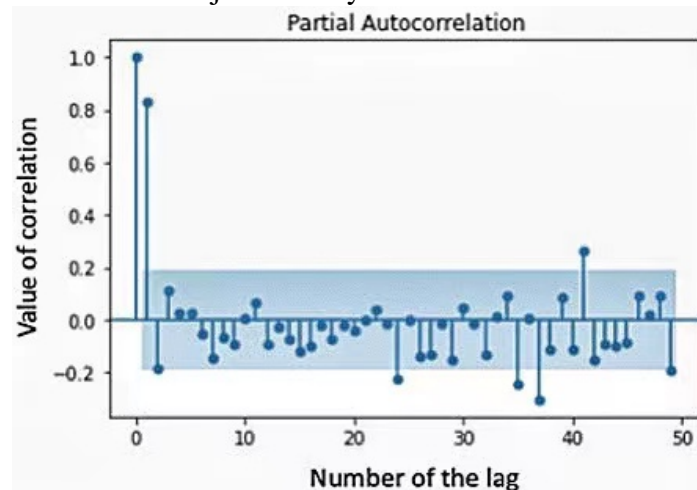

Figure 4. Partial Autocorrelation Function (PACF) involved in the data processing.

Table 1. Significant lags obtained from PACF.

Data set name	Significant Lag(s)
Federal Funds Rate	12, 35
Philippines	39, 45
Korea	35
Indonesia	12

4. Result

A P-value lower than the significance level means the null hypothesis is rejected. In this case, if the p-value is less than 0.05 (the significance level), the house price index is a granger caused by the federal funds rate, which also means that we can use the house price index to predict the federal funds rate. In data processing, this study chooses the data with 12 lags. The following are the results after model fitting. The first one is South Korea where all the p-value is less than 0.05. It can be predicted that Korea's house price index through the federal funds rate. The second one is Indonesia, and none of the p-values is less than 0.05, i.e., it can't be observed that the house price index in Indonesia is a granger caused by the federal funds rate. When it comes to the Philippines, only two of the p-values are less than 0.05, the house price index in the Philippines is partially a granger caused by the federal funds rate. It is not as obvious as Korea's. The data of the Philippines and Indonesia did not meet the expectations. Since Korea receives more money from the U.S. than the other two countries, there should be a more obvious relationship between the house price index in Korea and the federal funds rate.

5. Discussion

The theory of monetary transmission can be described briefly as follows. When the Fed rate decreases, the amount of money borrowed by people will go up, and they will be willing to invest more, while when the Fed rate increase, people will invest less. After exploring the impacts made by Feb on three Asian emerging markets, Korea is affected a lot by the variety of the Fed rate, while the other two countries do not show a direct relationship. In addition, Korea is a country in Asian emerging economies that have the largest capital flows from the United States, which remains bilateral economic relations with America for several decades. On this basis, the outcome is clear that the countries that are closely connected with the U.S. will be affected more by the changes in the Fed rate.

This paper examines the impact exerted by declining federal funds rate on house prices in the emerging market from three aspects: purchase power, stock market, and investors' speculation. Reviewing previous studies, this research concludes that there is a negative relationship between the federal funds rate and house prices in general. Similar to the prior paper, this study finds out that declining interest rates decrease the cost of borrowing and increase the purchasing power, which finally elevates house prices. This article tried to illustrate how the interest rate influences purchase power directly and then affects house prices. Nevertheless, in the prior paper, the exchange rate was mentioned to be one of the factors, which interacts with interest rate and then affects purchase power.

Stock prices influence house prices by receiving the effect from interest rates. The previous studies investigated the short-term and long-term stock market performance and found that rate decrease was followed by significantly greater short-term and long-term stock returns. Measuring the stock market performance is a wide range of means to test how the fluctuation in the stock market affects house prices. Therefore, it cannot focus precisely on the impact on house prices. Previous researchers studied how the decrease in interest rate influences stock prices and then affects house prices without neglecting other factors completely. Nonetheless, in this study, the only factor that was considered is the stock price.

Investors' speculation is elevated by declining interest rates. Prior studies about how the declining interest rate affects investors' expectations generally claim that if investors are overconfident about the future tendency, they will cause the housing bubble, the over increase in house prices. Their conclusion is consistent with this paper's result as long as no other factors exist. However, prior researches took other factors like government policies into accounts, which influence investors' decisions and which is not considered by this paper.

6. Conclusion

Based on the researches and data related to the housing price in Asian countries made before and the theory of Granger causality mode, the Fed's impact on housing prices in emerging Asian countries

is discussed in this paper. In general, the direction of the federal funds rate and the normal interest rate's fluctuation are similar. A declining interest rate elevates people's purchasing power due to the low cost of borrowing and increases stock prices as well as investors' speculation because of desire towards higher returns, which increases the demand for houses and decreases house prices. Based on the analysis, the data is related to the house price index in three different countries which are Korea, the Philippines, and Indonesia, and the federal funds rate.

A Granger causality model is involved to prove that if the federal funds rate could be used to predict the house price index. According to the PACF test, effectively contributing lags could be selected in the whole time series. The result from the model denotes that only Korea performed a relatively strong dependence on the federal funds rate, while the other two countries (Philippines and Indonesia) show statistical insignificance. It is noticeable that the extent of Asian EMEs house prices being granger caused by federal funds rate fits in the percentage of the portfolio investment of these countries from the US, indicating that the influence of federal funds rate to other countries might depend on their investment inflow from the US.

Based on the principle of cheap house credits, this paper concentrates mainly on how the federal funds rate directly influences house prices. Different from previous studies, this research achieves its conclusion by using a regression line and considering the direct influence. Combining methods and prior researches, this study reveals that the federal funds rate cannot be considered as the foremost factor to predict house prices. Since the correlation between the federal funds rate and house prices in emerging markets is weakly negative, individuals have better take other factors, e.g., policies and exchange rates, into account when speculating house prices.

It is also necessary to address that this study has certain strong limitations, e.g., the selection of data in this study was not capable of deriving the statistically significant result. Possibly, a determining factor could be the time gap set between two-time series which is Federal funds rate and house prices. As the Federal funds rate is a short-term interest rate, its effect is transmitted to Asian EMEs' house prices through other factors as mentioned in the literature review. Such a process of transmission creates a delay for the federal funds rate to influence Asian EMEs of a certain period, and a gap between the two time series should be set to complement this sort of delay. However, the proper amount of time gap should be further investigated. Overall, these results offer a guideline for the study about the interaction between different economies.

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