BRICI STATE MONETARY TRANSMISSION: HOW STRONG IS THE ARDL PANEL MODEL PREDICTING THE FINAL GOAL?

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Abstract

This study aims to analyze the ability of the ARDL panel to detect the monetary transmission of BRICI countries. This research problem includes the transmission that is difficult to detect until the final target. The emerging market countries chosen were India, Brazil, China, Russia, Indonesia. Data analysis uses the ARDL Panel's long-term analysis. The ARDL Panel results conclude that the ability of monetary transmission in the inflation expectation path of the BRICi country can be explained by the money supply, investment, interest rates, consumption, while GDP and the exchange rate are less able to detect monetary transmission due to exchange rate coverage and GDP is only short-term. Brazil's monetary transmission determines the final target, GDP, Russian monetary transmission, the final target, namely interest, money supply, and investment. Monetary transmission in China and India determines the ultimate goal of interest and consumption. Indonesia's monetary transmission determines the ultimate goal of interest and exchange rates.

Keywords: BRICI, Monetary Transmission, ARDL Panel, Inflation Expectations

INTRODUCTION

Monetary transmission is often hampered in achieving Bittencourt's final goal (2016). The delay effect (lag) as one of the causes, then encourages the need for real economic activity, which mechanism can be traversed by various channels or channels of Natsir (2011). Interest is also a tool for influencing the ultimate goal (Wróbel, 2013). Wimanda (2015) the exchange rate of the dollar and lending rates affect exports, (Rusiadi; Novalina, 2018) states that monetary transmission is very important in controlling stability. Onyeiwu (2012) concluded that exports have a positive and significant effect on foreign exchange reserves. Alfian (2011) asset paths affect economic growth and inflation. Natsir (2015) which shows that labor and net exports influence economic growth. Silvia (2013) states that economic growth is influenced by consumption, net exports, and investment. Indonesia rose to fifth place because of the increased growth of chemical products, as well as industrial manufacturing and financial services (Watson, 2018).

Emerging economies "E11," consisting of Argentina, Brazil, China, India, Indonesia, Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, and Turkey. The scale of emerging market economic growth will be the key to creating the momentum of world economic growth where 70% of global economic growth in the 2013-2030 period will come from this developing country. While trade among emerging market countries has the potential to contribute 40% of world trade in 2030, up from the current 18% (Sugandhi, 2018). Very dominant emerging market countries continue to be reviewed by BBVA Research (2017) to introduce the concept of "EAGLEs" or an abbreviation of Emerging and Growth-Leading Economies. EAGLEs is a concept that contains ten economic forces including China, India, Brazil, and Indonesia. Alicia Garcia-Herrero (2017) Indonesia as an important economic power on the EAGLEs list. Stephen Spiegel (2017) the importance of the contribution of emerging market countries (Rusiadi; Novalina, 2017c) to the world economy makes EAGLEs will enable investors to have up-to-date perspectives on emerging markets, especially related to several countries that play an important role for the global economy. International Monetary Fund (IMF) report, 2016, the world economy is controlled by 10 countries, namely China, the United States, India, Japan, Germany, Russia, Brazil, Indonesia, Britain, and France where these ten countries accounted for 61.21 percent of world GDP. Of the ten countries, five of them are included in the emerging market category, namely Brazil, Russia, China, India, and Indonesia (BRICI).
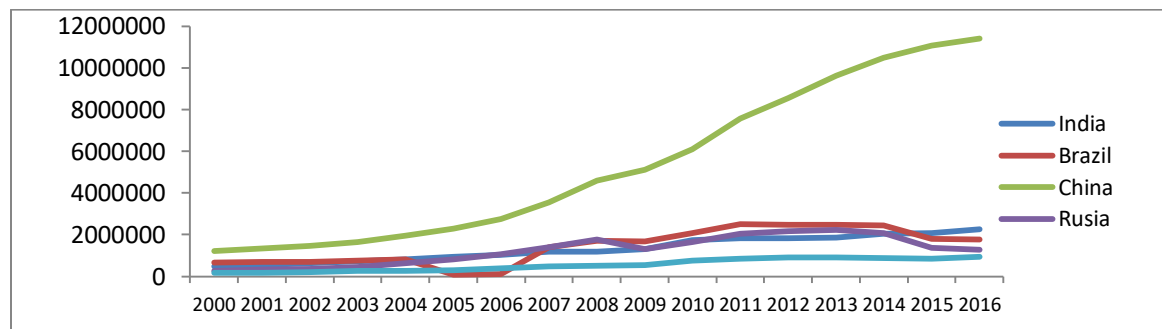

Figure 1. Developments in GDP of emerging market countries in 2000 to 2016

Based on the table and graph above it is known that the GDP growth of emerging market countries in 2009 decreased from the previous year, India decreased 6.06%, Brazil by 7.19%, China decreased -0.6%, Russia decreased 2%, and Indonesia decreased 8.27% due to global financial shocks and ambiguity. The value of Indonesia's exports also played a role as a savior in the 2008 global crisis. The small proportion of exports to GDP (Gross Domestic Product) is quite a savior in facing the financial crisis at the end of 2008. In the Asian region itself, Indonesia is a country that experienced the mildest negative impact of the crisis compared to other countries. Some say that Indonesia's "survival" from the onslaught of the financial crisis originating from America is due to the minimal proportion of exports to GDP. Countries that have a high ratio of exports to GDP experienced negative economic growth.
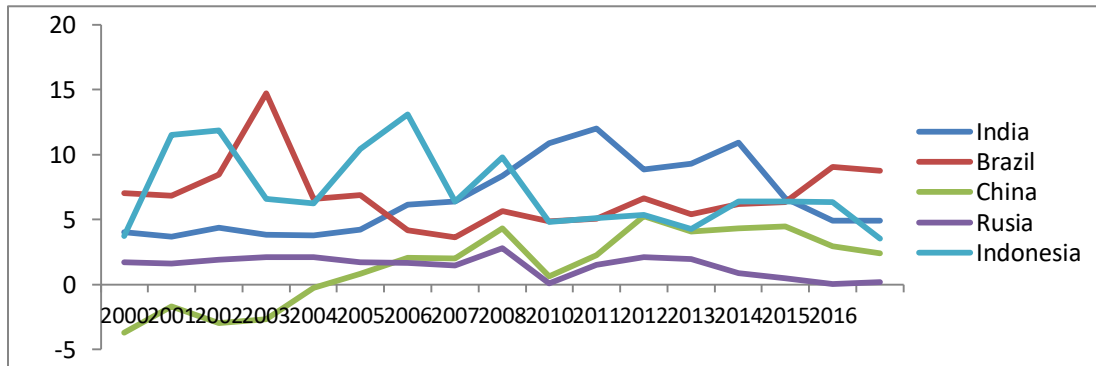
Figure 2. Inflation rates of emerging market countries in 2000 to 2016

Based on the table and graph above, it is known that there was an increase in inflation in 2008, India rose 8.35%, Brazil rose 5.66%, China rose 6.46%, Russia rose 14.10%, Indonesia 9.77%. this is due to the impact of rising world oil prices and rising fuel prices due to the effects of the global economic crisis which increases the prices of goods. However, the price of oil during 2008 continued to creep up and in May had passed the price above the US $ 130. Without the price increase, fuel subsidies would balloon to Rp. 190 trillion. As a result, there will be a very large budget deficit which is feared to disrupt the realization of the 2008 state budget. Whereas according to Law No. 16/2008 on the 2008 APBN approved by the DPR, the fuel budget subsidy limit is only set at Rp 135.1 trillion.
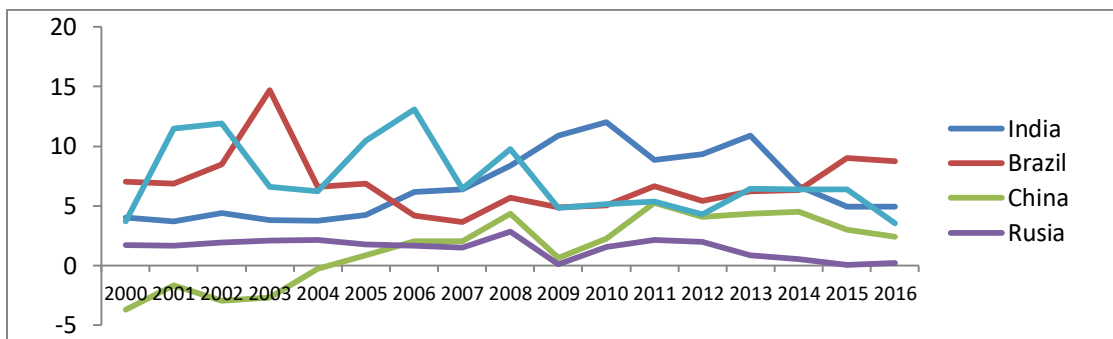

Figure 3. Development of the rupiah - dollar (%) exchange rate from 2000 to 2016

Based on the table and graph above it is known that an increase in inflation in emerging market countries in 2008, Indian inflation rose 8.35% from 6.36% a year earlier, Brazil rose 5.66% from 3.66% a year earlier, China rose 6.46% from 2.87% a year earlier, Russia rose 14.10% from 9.00% a year earlier, Indonesia 9.77% from 6.41% a year earlier (Rusiadi; Ade Novalina, 2018). Westermeier (2010) states the negative impact of rising interest rates will increase prices and the economy in general. Natsir (2011) states that interest rates function effectively as operational targets. Sitaresmi (2005) which states the reliability of the use of the interest rate channel in pursuit of policy targets in the form of inflation. Tightening of the interest

rate can also protect Hussain (2014), Hsing (2015) and Hasibuan (2016) price fluctuations. Monetary policy must facilitate a favorable investment climate through appropriate interest rates, exchange rate, and liquidity management mechanisms and money markets. (Onyeiwu, 2012). Interest rates are largely related to price increases. These results provide evidence of the existence of functional interest rates in the Zambian economy (Sheefeni, 2013).

1. THEORIES

Increasing business and consumer spending will ultimately increase aggregate demand. The flow rate transmission mechanism is formulated in two forms, such as:

$$m \uparrow \to r \downarrow \to \pi \uparrow \to y \uparrow$$

$$m \uparrow \to p \uparrow \to r \downarrow \to \pi \uparrow \to y \uparrow$$

Where:

m   =   nominal money stock,

r   =   real interest rate,

p   =   price level expectation,

π =   real investment, and

y   =   aggregate real output

The Cagan adaptive expectation model starts with the money demand model in the form of exponential functions, such as:

$$\frac{M_t}{P_t} = e^{\alpha_0 + \alpha_2 R_t} y_t^{\alpha_1} \text{ atau } \ln \frac{M_t}{P_t} = \alpha_0 + \alpha_1 \ln(y_t) + \alpha_2 R_t + \mu_t$$

It is known that the value of nilai $R_t = r_t + \pi_t$ where rt is the real interest rate, and substitution of the nominal interest rate [R] with $r + \pi$ will change the money demand model to:

$$\ln \frac{M_t}{P_t} = \alpha_0 + \alpha_1 \ln(y_t) + \alpha_2\, r_t + \alpha_2\, \pi_t + \mu_t \qquad\qquad \ln \frac{M_t}{P_t} = \lambda + \alpha\, \pi_t + \mu_t$$

$$(1)$$

where π_t = inflation expectations, $\lambda = \alpha_0 + \alpha_1 \ln(y_t) + \alpha_2 \; r_t$ dan $\alpha = \alpha_2$. For example $\ln(M_t) = m_t$ and $\ln(P_t) = p_t$ so the equation (1) transformed into:

$$m_t - p_t = \lambda + \alpha \; \pi_t + \mu_t$$

The Cagan model explains that inflation expectations are expectations of changes in the price level in the future, such as: $\Delta p_{t+1} = p_{t+1} - p_t$. The Cagan inflation expectation model is the basis of Milton Friedman's work, and then Friedman called it the adaptive expectation model, such as:

$$\pi_t - \pi_{t-1} = \rho(\Delta p_t - \pi_{t-1}) \quad 0 \le \rho \le 1 \tag{1.4}$$

Δp_t as a measure of the actual inflation rate can be smaller or greater than the value of inflation expectations of the previous period. If $\Delta p_t \prec \pi_{t-1}$ then value $\pi_t \prec \pi_{t-1}$, vice versa if $\Delta p_t \succ \pi_{t-1}$ then value $\pi_t \succ \pi_{t-1}$. Equation (1.4) can be changed to:

$$\pi_t = \rho\Delta p_t + (1-\rho)\pi_{t-1}$$

$$\pi_{t-1} = \rho\Delta p_{t-1} + (1-\rho)\pi_{t-2}$$

$$\pi_{t-2} = \rho\Delta p_{t-2} + (1-\rho)\pi_{t-3}$$

The iterative process is substituting the second equation to the first equation and the third equation to the second equation from (1.15), so that the actual inflation rate for period [t] is

$$\pi_t = \rho\Delta p_t + (1-\rho)\{\rho\Delta p_{t-1} + (1-\rho)[\rho\Delta p_{t-2} + \rho(1-\rho)\pi_{t-3}]\}$$

$$\pi_t = \rho\Delta p_t + (1-\rho)\rho\Delta p_{t-1} + (1-\rho)^2[\rho\Delta p_{t-2} + \rho(1-\rho)\pi_{t-3}]$$

$$\pi_t = \rho\Delta p_t + \rho(1-\rho)\Delta p_{t-1} + \rho(1-\rho)^2\Delta p_{t-2} + \rho(1-\rho)^3\pi_{t-3} + ...$$

If equation (1.6) continues for an infinite period, the inflation value for period [t] is the weighted average of current inflation and inflation for the previous period, such as:

$$\pi_t = \rho \; \Delta p_t + (1-\rho)\pi_{t-1}$$

Equation substitution (1.7) to (1.3) and the result of substitution reversing one period or [t - 1] yields a money demand model for periods [t] and [t - 1], such as:

$$m_t - p_t = \lambda + \alpha \ [\rho \Delta p_t + (1-\rho)\pi_{t-1}] + \mu_t$$

$$m_{t-1} - p_{t-1} = \lambda + \alpha \pi_{t-1} + \mu_{t-1}$$

$$\pi_{t-1} = \frac{m_{t-1} - p_{t-1} - \lambda - \mu_{t-1}}{\alpha}$$

Substitution equation (1.8B) to (1.8A) will produce the following money demand model:

$$m_t - p_t = \lambda + \alpha \left(\rho \Delta p_t + (1-\rho)\frac{m_{t-1} - p_{t-1} - \lambda - \mu_{t-1}}{\alpha} \right) + \mu_t$$

$$m_t - p_t = \lambda + \alpha \rho \ \Delta p_t + (1-\rho)m_{t-1} - (1-\rho)p_{t-1}$$

$$- (1-\rho)\lambda - (1-\rho)\mu_{t-1} + \mu_t$$

$$m_t - p_t = \rho \ \lambda + \alpha \rho \ \Delta p_t + (1-\rho)[m_{t-1} - p_{t-1}] + \varepsilon_t$$

where $\varepsilon_t = -(1-\rho)\mu_{t-1} + \mu_t$. The Cagan model in equation (1.9) can be estimated by the OLS method. If the results of the assessment produce $0 \le \rho \le 1$ and value $\alpha < 0$ then this is in accordance with the theory. Fluctuations in the value of [mt - pt] are shown by the coefficient of determination of the OLS regression equation (1.9). If the coefficient of determination [R2] is high then there is an indication of high inflation or high real money demand fluctuations, conversely if the coefficient of determination [R2] is low then there is an indication of low inflation or low real money demand fluctuations.

METHODOLOGY

Based on the above opinion the authors use the ARDL Panel with the reason of ease in answering and empirically proving and more complex reciprocal relationships in the long run economic variables are used as endogenous variables (Rusiadi, Subiantoro, & Hidayat, 2014).

RESULT AND DISCUSSION

Analysis of the Auto Regressive Distribution Lag (ARDL) panel tests the pooled data, which is a combination of cross-section data (country) with time-series data (annual), the ARDL panel results are better compared to ordinary panels, because they are able to be co-integrated long term and have the most appropriate lag distribution with theory, using Eviews 10 software, the following results are obtained:

Output Panel ARDL

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
BUNGA	0.104816	0.027281	3.842102	0.0003
LNKURS	-0.138120	0.551388	-0.250495	0.8029
LNEINF	-1.825815	1.005963	-1.814993	0.0736
LNJUB	3.962382	0.406662	9.743664	0.0000
LNKON	-0.836950	0.246736	-3.392088	0.0011
LNINV	-1.050280	0.168304	-6.240386	0.0000
LNPDB	1.724768	0.922561	1.869544	0.0656
Short Run Equation				
COINTEQ01	-0.400710	0.119024	-3.366622	0.0012
D(BUNGA)	-0.015506	0.118189	-0.131195	0.8960
D(LNKURS)	1.941651	3.162000	0.614058	0.5411
D(LNEINF)	-43.26576	38.47072	-1.124641	0.2644
D(LNJUB)	1.184032	1.460983	0.810435	0.4203
D(LNKON)	3.398029	5.098214	0.666514	0.5072
D(LNINV)	0.084171	0.203962	0.412680	0.6811
D(LNPDB)	35.15027	36.54419	0.961857	0.3393
C	-4.360453	1.275852	-3.417678	0.0010

The accepted ARDL Panel Model is a cointegrated lag model, where the main assumption is that the coefficient has a negative slope of 5%. ARDL Panel Model Requirements: the value is

negative (-0.40) and significant (0.00 < 0.05), then the model is accepted. Based on the acceptance of the model, the data analysis is done by panel per country.

Panel Analysis in Brazil

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	-0.842867	0.040207	-20.96321	0.0002
D(BUNGA)	-0.034145	0.018782	-1.818009	0.1667
D(LNKURS)	-5.619420	105.2375	-0.053398	0.9608
D(LNEINF)	-9.444644	51.82109	-0.182255	0.8670
D(LNJUB)	2.972560	1.915932	1.551496	0.2186
D(LNKON)	-11.16770	66.91762	-0.166887	0.8781
D(LNINV)	-0.756379	0.940189	-0.804497	0.4800
D(LNPDB)	-1.152264	0.391135	-2.945948	0.0602
C	-8.446534	29.53611	-0.285973	0.7935

ARDL panel test results show: Interest does not significantly affect inflation. Exchange rates, money supply, inflation expectations, consumption, and GDP do not significantly affect inflation.

Panel Analysis in Russia

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	0.034347	0.002237	15.35187	0.0006
D(BUNGA)	-0.056677	0.000392	-144.5835	0.0000
D(LNKURS)	-5.998229	4.345575	-1.380307	0.2614
D(LNEINF)	-0.101883	0.066883	-1.523295	0.2251
D(LNJUB)	-0.907278	0.111494	-8.137428	0.0039
D(LNKON)	-3.453210	8.388155	-0.411677	0.7082
D(LNINV)	0.092847	0.034131	2.720348	0.0725
D(LNPDB)	2.317271	10.93265	0.211959	0.8457
C	0.384326	0.740151	0.519253	0.6395

Interest, money supply, and investment significantly influence inflation. While the exchange rate, inflation expectations, GDP and consumption did not significantly affect inflation.

Panel Analysis in India

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	-0.088498	0.005702	-15.51944	0.0006
D(BUNGA)	-0.188461	0.014654	-12.86052	0.0010
D(LNKURS)	-8.853141	75.32125	-0.117538	0.9139
D(LNEINF)	-0.993570	33.09877	-0.030018	0.9779
D(LNJUB)	2.192933	2.616786	0.838025	0.4635
D(LNKON)	-0.893420	0.163976	-5.448479	0.0121
D(LNINV)	0.026040	0.127496	0.204240	0.8512
D(LNPDB)	-5.154180	53.01423	-0.097223	0.9287
C	0.020029	1.751021	0.011439	0.9916

The ARDL panel test results show interest and consumption as recommendations in controlling the economic stability of the Indian state.

Panel Analysis in China

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	0.073005	0.008320	8.774247	0.0031
D(BUNGA)	-0.177621	0.012095	-14.68493	0.0007
D(LNKURS)	3.179790	175.9370	0.018073	0.9867
D(LNEINF)	5.342011	5.356019	0.997385	0.3921
D(LNJUB)	0.663903	1.945085	0.341323	0.7554
D(LNKON)	-0.679790	0.070802	-9.601298	0.0024
D(LNINV)	-0.133441	0.091339	-1.460944	0.2402
D(LNPDB)	3.201193	124.5256	0.025707	0.9811
C	0.883667	5.537085	0.159591	0.8833

The ARDL panel test results show interest and consumption as recommendations in controlling the economic stability of the country of China.

Panel Analysis in Indonesia

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	-0.872181	0.090208	-9.668605	0.0023
D(BUNGA)	0.026333	0.074582	2.353078	0.0474
D(LNKURS)	16.52492	132.0353	2.125155	0.0083
D(LNEINF)	-334.8606	10140.16	-0.033023	0.9757
D(LNJUB)	9.667886	16.41997	2.588788	0.0974
D(LNKON)	-2.678970	3.618180	-0.740419	0.5127
D(LNINV)	0.262135	0.132417	1.979619	0.1421
D(LNPDB)	324.2636	9574.029	0.033869	0.9751
C	-9.909772	21.52328	-0.460421	0.6765

The ARDL panel test results show the exchange rate and the money supply as recommendations in controlling Indonesia's economic stability.

The conventional monetary transmission has a continuity with inflation that starts from interest (Magdalena, 2014). The monetary policy transmission mechanism consists of interest, credit, exchange rates, asset prices, inflation expectations. This study uses the interest rate channel, asset prices and the exchange rate channel (Rusiadi; Novalina, 2017a). Other studies have nothing in common using these three pathways. For example, those using a single channel such as Bittencourt (2016) credit lines, Hussain (2014), Soares (2015), interest lines. Using two channels such as Senbet (2016) lines of credit and exchange rates, Sekhposyan (2011), Abubakar (2013), Nijkamp (2011), (Rusiadi; Novalina, 2018). Rosoiu (2012), Tien (2013), Wollmershäuser (2005), interest and credit lines, Rusnák (2012), Vymyatnina (2005), Shenglin (2016), Togatorop (2014), Zega (2009), interest and exchange rates. Using three channels such as Ashiddiiqi (2013), interest, credit and exchange rates, Qurotulaina (2014), Odo (2016), interest, credit and asset prices, Qori'ah (2013) credit lines, asset prices and exchange rates (Rusiadi; Novalina, 2017c). Using four channels such as Oguanobi (2013) interest, credit, asset prices, exchange rates and expectations, Trang

(2015), Nwaobi (2014), interest lines, credit, asset prices. Although using the three paths but not the same path of interest, asset prices and exchange rates, and using the four paths Ndou (2013), Trang (2015) and Oliner (2014), but only one country. The reason for using the three asset lines is by setting aside credit lines and expectations, where credit lines in some studies have very perfect interactions with interest interactions so that the mechanisms are both equal and representative (Maski, 2005), Disyatat and Forhad (2017). The application pathway also has characteristics with asset prices and inflation itself. Kusmiarso (2000), (Rusiadi; Novalina, 2017c), Maski (2005), Disyatat and Forhad (2017), (Nuryakin and Warjiyo, 2006), Natsir (2015) concluded that the interest rate channel was an effective path in realizing the ultimate goal of monetary policy. Tjahyono et al (2002) state that the exchange rate other than interest is the main transmission line and effectively realizes the ultimate goal of monetary policy. Asset prices as transmission can represent the demand and expectations (Jusoh; & Rusiadi;, 2014), (Rusiadi; Novalina, 2017b), (Waheed, 2006), Mgadmi (1978). Minea (2004) chose to emphasize the concept of the mechanism of transmission of the continuation of the exchange rate policy. VAR models (Rusiadi, 2016), (2015), Zhang (2015), Wollmershäuser (2005), Estrella (2015), Rooiu (2015), Yusuf (2016), Fauziyah (2015), (Rusiadi; Novalina, 2018), Daniar (2016).

CONCLUSION

The ARDL Panel results conclude that the ability of monetary transmission in the inflation expectation path of the BRICi country can be explained by the money supply, investment, interest rates, consumption, while GDP and the exchange rate are less able to detect monetary transmission due to exchange rate coverage and GDP is only short-term. Brazil's monetary transmission determines the final target, GDP, Russian monetary transmission, the final target, namely interest, money supply, and investment. Monetary transmission in China and India determines the ultimate goal of interest and consumption. Indonesia's monetary transmission determines the ultimate goal of interest and exchange rates.

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