Article Type: Research Paper

Determinants of short and long-term exchange market pressure in Indonesia

Heru Wahyudi*, Widia Anggi Palupi, and I Wayan Suparta

Abstract: A decrease in a country's export prices and foreign exchange reserves is symptomatic of exchange rate market pressures, which would be described as an oversupply or disequilibrium in the money market. The method used in this study is the Vector Error Correction Model (VECM) to investigate Exchange Market Pressure (EMP) in Indonesia. This study utilizes secondary data obtained from Statistics Indonesia and Bank Indonesia (BI) website since 2008Q1-2021Q4. The findings of this study demonstrate a strong positive long-term relationship between domestic credit growth and the BI rate, a large negative long-term relationship between GDP growth and the BI rate, and no significant relationship between the current account balance and the exchange rate.

Keywords: Exchange Market Pressure; Vector Error Correction Model; Impulse Response Function; Variance Decomposition
JEL Classification: E4; E5

AFFILIATION:
Department of Economics, Faculty of Economics and Business, Universitas Lampung, Lampung, Indonesia

***CORRESPONDENCE:**
heru.wahyudi@feb.unila.ac.id

THIS ARTICLE IS AVALILABLE IN:
http://journal.umy.ac.id/index.php/esp

DOI: 10.18196/jesp.v24i1.16131

CITATION:
Wahyudi, H., Palupi, W. A., & Suparta, I. W. (2023). Determinants of short and long-term exchange market pressure in Indonesia. *Jurnal Ekonomi & Studi Pembangunan, 24*(1), 14-31.

ARTICLE HISTORY
Received:
22 Sep 2022
Revised:
31 Jan 2023
13 Feb 2023
Accepted:
20 Feb 2023

Introduction

Exchange rate pressure, often called market pressure (EMP), has evolved into a topic that has garnered much interest from numerous scholars. EMP is a broad term for market disequilibrium. The Exchange Market Pressure (EMP) index measures the impact of global economic pressure on a country's finances (Sulaeman & Lisna, 2016). Girton and Roper (1976) first proposed Exchange Market Pressure (EMP) by merging variations in exchange rates and changes in foreign exchange reserves, which are scaled with base money. Girton and Roper found from their research that EMP exerts pressure on foreign exchange reserves and exchange rates when there is an excessive demand for foreign exchange. Ozcelebi (2019) defines EMPSas the rate of exchange rate depreciation due to capital.

Figure 1 illustrates the evolution of Indonesia's EMP values between 2008:Q1 and 2021:Q4. According to Sulaeman and Lisna (2016), the Indonesian currency market is pressured to depreciate. In the meantime, a negative EMP number or a value below zero indicates that Indonesia's foreign exchange market appreciated throughout that period. From 2008:Q1 to 2021:Q4, the EMP value in Indonesia fluctuated with a high degree of volatility. 2008:Q4 had the greatest EMP value within this time frame (9.74 percent), while 2010:Q3 had the lowest EMP value (-13.41 percent). In addition, with the exception of the period between 2009 and 2021, the EMP value is frequently negative.

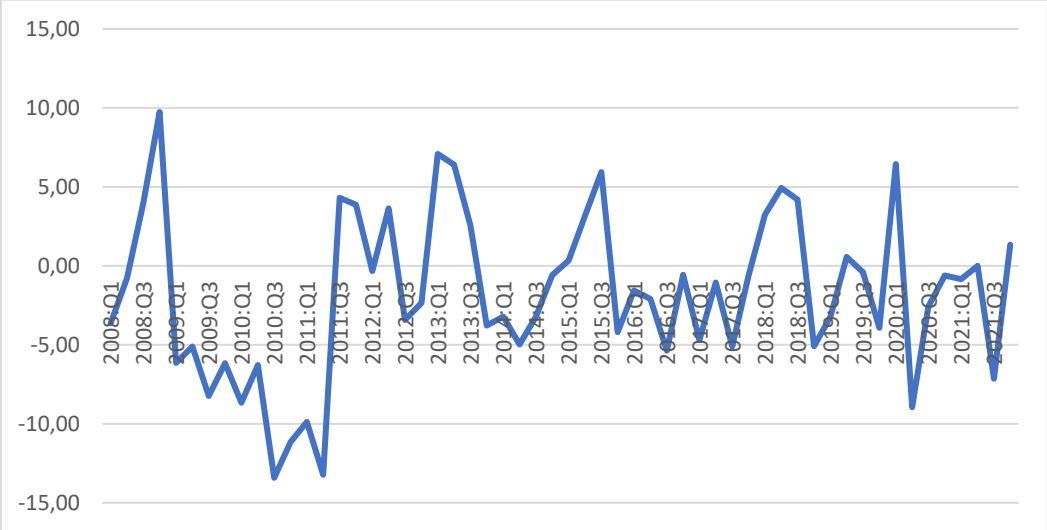

Figure 1 Exchange Market Pressure (EMP) Development from 2008:Q1 to 2021:Q4
Source: Bank Indonesia

The EMP index is essential to Feldkircher et al. (2014) research for two reasons. First, it is straightforward to perform mathematical calculations and economic analysis. Second, the Exchange Market Strain (EMP) index can be used to measure the pressure on a country's foreign exchange market. The factors of the level of change in foreign exchange reserves (official reserves) and the pace of change in currency values explain why the base rate is lowered to alleviate EMP pressure (exchange rate). Global economic instability can exert significant pressure on the foreign exchange markets of developing countries like Indonesia. The real sector was negatively impacted by excessive pressure on the currency rate, which also caused problems in the financial sector. Additionally, pressure on the foreign exchange market can result in an excessive appreciation or depreciation of the exchange rate, which would be detrimental to Indonesia's economy (Falianty & Andhony, 2012).

According to a study conducted by Kyin et al., (2013), domestic credit growth is one of the variables that can explain the quantity of EMP. It is impossible to disregard the significance of domestic credit development for an economy. When domestic credit growth develops, and foreign exchange reserves fall or diminish, the foreign exchange market may become more volatile or the exchange rate may depreciate. Lestano (2010) discovered that the increase in domestic credit distributed by the monetary authority was proportional to the increase in domestic currency in circulation. This will undoubtedly have a detrimental effect on the stability of the local currency, particularly if the monetary authority does not exert control over the distribution of domestic credit growth. García and Malet (2007) demonstrate that domestic credit creation positively affects EMP.

It will be simple for developing countries such as Indonesia, which has a modest open economy and is one of the world's largest, to be impacted by instability in a big country such as the United States. According to the IMF, during the American recession of 2008, a 1% fall in American economic growth would result in a 0.5–1% reduction in Asian

economic growth. The economic forecasts of Asian countries, especially Indonesia, would be impacted by the global recession that resulted from the American recession. As a result, Indonesia's GDP growth could significantly impact the demands on the foreign exchange market. Additionally, the current account balance has a considerable impact on EMP. The current account balance variable is one of the most significant macroeconomic indicators of the economy.

Bank Indonesia (2018) provides this statistic to gauge a country's economic strength based on trade in commodities and services, income from production inputs held, and money transfers such as worker remittances and grants. This indicates that the bigger the proportion of the current account balance to the economy, the greater the indications of domestic and international economic growth, increased investment revenue, and increased income from foreign employees. Government initiatives to boost the domestic currency include increasing interest rates and maintaining foreign exchange reserves. Therefore, the weighted average of the exchange rate and foreign exchange reserves can be utilized to calculate the EMP index (Pontines & Siregar, 2008) found that monetary authorities will loosen by boosting domestic credit growth as the EMP increases, domestic credit growth increases, and interest rates decline. This distinction is a result of a greater EMP value increase.

(Jing, 2015) demonstrates that the banking crisis's beginning influences the currency crisis's beginning and vice versa. Exchange Market Pressure (EMP), a dependent variable, is used in this study to quantify the pressure on the FX market. The factors taken into account for calculating the EMP data for Indonesia from 2008:Q1 to 2021:Q4 include domestic credit growth, domestic credit growth, GDP growth, current account balance, and BI rate. Based on this context, the authors will examine the long- and short-term relationships between domestic credit growth, GDP growth, current account balance, and the BI rate of the EMP in this study. They will then examine how the EMP reacts to shocks from domestic credit growth, GDP growth, current account balance, and BI rate and their relative contributions to the EMP. Few studies on EMP in Indonesia have employed the current account balance and domestic credit growth factors; the novelty of this study is the combination of independent variables employed as well as the study year.

Research Method

The type of data used in this study is quantitative secondary data obtained from Bank Indonesia (BI) and Statistics Indonesia (BPS) since 2008Q1-2021Q4. The analysis in this study used a time series methodology with a Vector Autoregression (VAR) approach. The Unrestricted VAR and the Vector Error Correction Model are two other models for the Vector Autoregression method (VECM). If the data are stationary at the level, the Unrestricted VAR model is employed, if all variables are cointegrated, and the data is stationary at the first difference level but not at the level, the vector error correction model is utilized (Widarjono, 2018) . Research conducted by Sulistiana (2017) suggests that VECM offers an easy work procedure to separate long-run components and short-run components from the data formation process, so VECM is different from VAR where

VECM can be used to model cointegrated and non-stationary time series data. The VECM model was chosen in this study because it is expected to be able to explain behavioral research variables in the long term (Mardiana & Prawoto, 2016).

To determine how shocks brought on by the EMP variable will affect the domestic credit growth variables, GDP growth, current account balance, and BI rate, impulse response function analysis was done. Along with the examination of the impulse response function, variance decomposition analysis is also performed to determine the relative weights of the various variables, including the development of domestic credit, GDP, the current account balance, and the BI rate as a result of EMP shocks. Volatility decomposition is useful for estimating the percentage of each variable's variance that is attributable to changes in other variables. The equation for the study's Vector Error Correction Model (VECM) is as follows:

Long Run Equation

$$\mathrm{EMP_t} = \alpha_0 + \lambda_1 \mathrm{DC_{t-j}} - \lambda_2 \mathrm{PDB_{t-j}} - \lambda_3 \mathrm{CA_{t-j}} - \lambda_4 \mathrm{IR_{t-j}} + \varepsilon_t \qquad (1)$$

Short Run Equation:

$$\triangle \mathrm{EMP_t} = \alpha_0 + \sum_{i=1}^{p} \beta_1 \triangle \mathrm{DC_{1t-j}} - \sum_{i=1}^{p} \beta_2 \triangle \mathrm{PDB_{2t-j}} - \sum_{i=1}^{p} \beta_3 \triangle \mathrm{CA_{3t-j}} - \sum_{i=1}^{p} \beta_4 \triangle \mathrm{IR_{4t-j}} + \varepsilon_t \qquad (2)$$

In order to determine how shocks brought on by the EMP variable would affect the domestic credit growth variables, GDP growth, current account balance, and BI rate, impulse response function analysis was carried out. Where EMP stands for Exchange Market Pressure, DC for domestic credit growth, GDP for GDP growth, CA for current account balance, IR for BI rate, 1, 2 for long-term relationship coefficients, 1 2 for short-term relationship coefficients, 0 for regression constants, and ECT for error correction (lag 1, 2,...).

Result and Discussion

Stationarity Test

Perform a stationarity test utilizing the root test (unit root test) and the Augmented Dickey-Fuller Test (ADF test) method to determine whether one of the assumptions in the time series data test using the VECM model analysis is true. Non-stationary data results in false regression, a regression that describes the relationship between two or more statistically significant visible variables, when it is not (Johari et al., 2022). The results are as follows:

Table 1 Augmented Dickey-Fuller (ADF) Level Unit Root Test

Variable	ADF T-statistic	Critical Value			Conclusion
		1%	5%	10%	
EMP	-4.9285	-3.5550	-2.9155	-2.5955	Stationary
DC	-1.1704	-3.5550	-2.9155	-2.5955	Not Stationary
PDB	-0.9047	-3.5550	-2.9155	-2.5955	Not Stationary
CA	-2.0378	-3.5550	-2.9155	-2.5955	Not Stationary
IR	-3.2376	-3.5550	-2.9155	-2.5955	Stationary

Source: Results of data processing on EViews 10, (2022)

The ADF method at the level is used to calculate the unit root test results in Table 1. The t-count value is compared to the critical values for each variable, which are 1%, 5%, and 10%, respectively. Conclusion: The DC, PDB, and CA variables are not stationary at the level; however, the EMP and IR variables exhibit stationary data. In order to repeat the unit root test on the initial difference for each variable, the outcomes are as follows:

Table 2 Augmented Dickey-Fuller (ADF) First Difference Unit Root Test

Variable	ADF T-statistic	Critical Value			Conclusion
		1%	5%	10%	
EMP	-10.5072	-3.5550	-2.9155	-2.5955	Stationary
DC	-4.9234	-3.5550	-2.9155	-2.5955	Stationary
PDB	-7.3142	-3.5550	-2.9155	-2.5955	Stationary
CA	-8.6203	-3.5550	-2.9155	-2.5955	Stationary
IR	-6.3365	-3.5550	-2.9155	-2.5955	Stationary

Source: Results of data processing on EViews 10, (2022)

For all stationary variables in the results mentioned above, Table 2 displays the outcomes of the unit root at the first difference level. As a result, the information used in this study is organized in chronological order, or I (1). The following data processing stage can be completed now that the stationary requirements have been met.

Optimum Lag Determination

The Akaike Information Criterion (AIC) value, which has a minimum absolute value, is a widely utilized methodology in this study. The Table 3 displays the least Akaike Information Criterion (AIC) value at lag 2 based on the results of the optimal lag test conducted in this study utilizing EViews 10. Based on Table 3, the determination of the optimum lag used in this study is lag 2 for the VAR/VECM equation model in this study, then the lag used in the next test is lag 2.

Table 3 Results of Determination of Optimum Lag

Lag	Akaike Information Criterion (AIC)
0	37.57512
1	33.53573
2	33.49814*
3	33.76744

Source: Results of data processing on EViews 10, (2022)
Information (*) : The smallest Akaike Information Criterion (AIC) value

Stability Test

The stability of the estimated VECM equation system needs to be checked using a predefined lag and the VECM stability condition check, which looks for roots of characteristic polynomials and inverse roots of AR characteristic polynomials for all variables employed. A VECM system is deemed stable based on the test findings if all of its roots have a modulus that is less than one. Based on the results of the VECM stability test in Table 4 for this study, it can be said that the estimated VECM stability that will be utilized to analyze the impulse response function has been stable. This is because the modulus range is less than one. Table 4 indicates that all equation models' modulus values are smaller than 1, supporting the validity of the VECM model.

Table 4 Test Results for the AR Characteristic Polynomial's Roots

Root	Modulus
0.851350 - 0.239838i	0.884488
0.851350 + 0.239838i	0.884488
0.813049	0.813049
-0.662094	0.662094
0.444432	0.444432
0.325669 - 0.250804i	0.411051
0.325669 + 0.250804i	0.411051
-0.184160	0.184160
0.055487 - 0.172849i	0.181537
0.055487 + 0.172849i	0.181537

Source: The results of data processing on EViews 10, (2022)

Cointegration Test

The model employed in this work can be estimated using VECM if cointegration at the level of differentiation exists; otherwise, it can be calculated using VAR. The Johansen cointegration test was employed in this investigation. The Johansen cointegration test's findings are as follows:

Table 5 Cointegration Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.431039	87.25904	69.81889	0.0011
At most 1 *	0.395603	57.37001	47.85613	0.0050
At most 2 *	0.276786	30.68326	29.79707	0.0394
At most 3	0.136580	13.50861	15.49471	0.0974
At most 4 *	0.102395	5.725347	3.841466	0.0167

Source: Results of data processing on EViews 10, (2022)
Information
(*) : The trace statistic value is greater than the critical value (0.05)

Inferred from Table 5, the null hypothesis that there is no cointegration exists is rejected, and the alternative hypothesis—that there is cointegration—is accepted. The trace statistic and maximum eigenvalue at r = 0 are greater than the critical value with a

significant level of 5 percent, which is 87.2590, greater than 69.8188. As a result, the cointegration test results show a relationship between stability or balance and similarity of movements among the movements of the variables EMP, DC, PDB, CA, and IR over the long term. Alternately, all variables tend to adjust to one another during each short-run phase to reach their long-run equilibrium. Therefore, the Vector Error Correction Model (VECM) rather than the Variance Autoregressive (VAR) should be used in this inquiry, as the variables are cointegrated and stationary at the first difference level.

Results of the Vector Error Correction Model Estimation

A vector error correction model is used to estimate the data when it is stationary on the order of first difference, stable, and cointegrated based on the test findings (VECM).

Long-Term Forecast

Based on the finding that the link between these variables is significant if t-count > t-table at a significance levels of 10% (1.6752), 5% (2.0075), and 1% respectively (2.6757).

Table 6 Long-Term VECM Estimation Results

Variable	Coefficient	t-statistics	Information
EMP(-1)	1.000000		
DC(-1)	5.722454	[1.95842]***	Significant
PDB(-1)	-12.01779	[-4.69888]*	Significant
CA(-1)	-0.001048	[-0.84356]	Not Significant
IR(-1)	8.901398	[2.76938]*	Significant
C		-10.14666	

Source: Results of data processing on EViews 10, (202 2)
Information
[ ] : Shows t-count
* : Based on the confidence level 9 0 % (α=1 0 %)
** : Based on 95% confidence level (α=5%)
*** : Based on 99 % confidence level (α=1%)

The results of the long-term VECM estimation (3) are:

$$\mathrm{EMP_t} = -10.1466 + 1.0000\mathrm{EMP_{t-1}} + 5.7224\mathrm{DC_{t-1}} - 12.0178\mathrm{PDB_{t-1}} - 0.0010\mathrm{CA_{t-1}} + 8.9014\mathrm{IR_{t-1}} \quad (3)$$

The dependent variable EMP and the independent factors provide the long-term estimate results (DC, PDB, CA, and IR). While the current account (CA) variable is not significant over the long term, the domestic credit growth variable (DC) is significant at a 90% level of confidence, the GDP growth variable and the BI rate (IR) are significant at a 99% level of confidence. The DC coefficient or domestic credit growth is 5.7224, and the coefficient has a significant positive relationship at the 90% confidence level or (=10%). It can be said that when there is an increase in domestic credit growth of 1 percent, it will cause an increase in EMP by 5.7224 percent, ceteris paribus. The coefficient on GDP growth is 12.0178 percent, and has a significant negative relationship at the 99% confidence level

or (α=1%). It can be said that an increase in GDP growth of 1 percent will cause a decrease in forex market pressure or EMP of 12.0178 percent, assuming other variables are ceteris paribus.

At the 90% confidence level, or (=10%), the DC coefficient, or domestic credit growth, is 5.7224 and exhibits a strong positive association. If all other factors remain constant, it may be claimed that a 1% increase in domestic credit growth will increase EMP by 5.7224 percent. At the 99% confidence level or (α=1%), the GDP growth coefficient, which is 12.0178 percent, shows a significant negative connection. If all other factors remain constant, it may be claimed that an increase in GDP growth of 1% will result in a reduction in the foreign exchange market pressure, or EMP, of 12.0178 percent. The current account balance's coefficient is 0.0010 percent. The results of the long-term estimation of the current account balance are not significant for the EMP, which means that under the ceteris paribus assumption, a rise in the current account balance of 1 percent will only indirectly result in a fall in the EMP of 0.0010 percent. At the 99% confidence level or (α=1%), the results of the long-term estimation of the BI rate or IR have a coefficient value of 8.9014 percent and significantly positively relate to the EMP. This suggests that, assuming ceteris paribus, a one percent increase in the BI rate will increase EMP by 8.9014 percent.

Short Term Estimate

Table 7 Short-Term VECM Estimation

Variable	Coefficient	t-statistics	Information
ECT	-0.103906	[-2.48960]**	Significant
DEMP(-1)	-0.4073	[-2.98967]***	Significant
DEMP(-2)	-0.094986	[-0.63615]	Not Significant
DDC(-1)	1.161172	[2.66862]**	Significant
DDC(-2)	1.209388	[3.04031]***	Significant
DPDB(-1)	-0.868449	[-1.69314]*	Significant
DPDB(-2)	-0.504526	[-0.92928]	Not Significant
DCA(-1)	-4.59E-05	[-0.12110]	Not Significant
DCA(-2)	-0.001041	[-2.45426]**	Significant
DIR(-1)	-3.351686	[-1.87605]*	Significant
DIR(-2)	-3.864726	[-2.70437]***	Significant
C		0.123920	

Source: Results of data processing on EViews 10, (202 2)
Information
[ ] : Shows t-count
* : Based on the level of confidence n 9 0 % (α=1 0 %)
** : Based on 95% confidence level (α=5%)
*** : Based on 9 9 % confidence level (α=1%)

If the t-count is higher than the t-table value with a significance level of 10% (1.6752), 5% (2.0075), and 1%, the estimation results on the collected research variables are considered to have a significant influence (2.6757).

As for short-term VECM estimation results in the equation:

$$\triangle \mathrm{EMP_t} = 0{,}1239 - 0{,}4073\mathrm{DEMP_{t-1}} - 0{,}0949\mathrm{DEMP_{t-2}} + 1{,}1611\mathrm{DDC_{t-1}} + 1{,}2093\mathrm{DDC_{t-2}} - 0{,}8684\mathrm{DPDB_{t-1}} - 0{,}05035\mathrm{DPDB_{t-2}} - 0{,}00004\mathrm{DCA_{t-1}} - 0{,}00104\mathrm{DCA_{t-2}} - 3{,}3516\mathrm{DIR_{t-1}} - 3{,}8647\mathrm{DIR_{t-2}} \quad (4)$$

Based on the short-term VECM estimation outcomes, the estimated error correction parameter (ECT) was statistically significant, with a coefficient of -0.103906 and a significance level of 95%. The coefficient's negative sign implies that quarterly error corrections are made to the equation to test the long-run equilibrium. The purportedly important error correction parameter establishes that there is a method for adjusting from the short to the long term. 10%, or 10 quarterly, should be modified in order to achieve long-term equilibrium. The short-term estimation of the domestic credit growth variable (DC) yielded results with coefficients of 1.16117 in lag 1 and 1.209388 in lag 2. In other words, if domestic credit growth increases by 1% in the most recent quarter, the EMP will increase by 1.161172% during the most recent quarter, and if domestic credit growth increases by 1% during the most recent two quarters, the EMP will increase by 1.20938% in the most past 2 quarters, assuming ceteris paribus.

With a coefficient value of 0.868449, the short-term estimation of the GDP growth variable at lag 1 shows a negative and significant relationship with the EMP at the 90% confidence level. This relationship suggests that, all else being equal, when GDP growth increases by 1% in the preceding quarter, the EMP will decrease by 0.868449% in the preceding period. In contrast, there is no link for lag 2, which means that, under the assumption of ceteris paribus, an increase in GDP growth has no impact on EMP for the two prior quarters. The short-term VECM estimation of the current account variable at lag 1 yielded results that are not statistically significant, indicating that when the current account balance increases, the EMP for the preceding quarter is unaffected. With a coefficient value of 0.001041 percent, lag 2 has a significant negative relationship at the 95% confidence level, which means that under the ceteris paribus assumption, an increase in the current account balance of one percent will result in an increase in the EMP of 0.001041 percent over the preceding two quarters.

According to the short-term VECM estimation of the BI rate variable (IR) at lag 1, the coefficient of 3.351686 reveals a significant negative correlation, meaning that when the BI rate increases by 1 percentage point, the EMP lowers by 3.351686 percentage points in the preceding period. The IR variable has a coefficient value of 3.864726 at lag 2 and a significant negative association at the 99 percent confidence level, indicating that a 1 percent increase in the BI rate will decrease the EMP by 3.864726 percentage points in the preceding two quarters, assuming all other factors remain constant.

Discussion of the Relationships between Variables across the Long and Short Term
Domestic Credit Growth's Impact on Exchange Market Pressure

The findings of this study's long-term and short-term VECM estimations demonstrate that domestic credit expansion has a sizable favorable impact. According to Girton & Roper's (1976) EMP theory, if domestic credit growth picks up, the EMP value will rise or the

currency market will experience depreciation pressure. According to Lestano (2010) study, "A Structural VAR Model of Exchange Rate Market Pressure: The Case of Indonesia," domestic credit growth and exchange market pressure have a sizable positive association. As well as in the Ayuningtyas and Purwono (2020) research entitled " Analisis Exchange Market Pressure di Indonesia Periode Setelah Krisis Moneter" shows the relationship between significant and positive domestic credit growth to EMP in the long and short term. The research results obtained in this study are in accordance with the research hypothesis so that the hypothesis can be accepted.

GDP Growth's Impact on Exchange Market Pressure

Growth GDP has a negative and significant impact, notably lag 1, according to this study's long-term and short-term VECM estimation findings. Countries are trying to boost economic growth by manufacturing and consuming products and services (Ali et al., 2022). This outcome supports the study's prediction that the exchange rate will increase with greater GDP growth, easing the burden on the foreign currency market. This study is also consistent with Panday's (2015) study, "Impact of Monetary Policy on Exchange Market Pressure: The Case of Nepal," demonstrating a strong inverse link between GDP growth and EMP. The findings of a different study by Aziz and Widodo (2017), titled "Exchange Market Pressure: Evidences from ASEAN Inflation Targeting Countries," are consistent with the findings of García & Malet (2007) study, "Exchange Market Pressure, Monetary Policy, and Economic Growth: Argentina" in that Indonesia's GDP growth coefficient is significantly negatively correlated with exchange market pressure. Reduced EMP will result in a gain in foreign exchange reserves, appreciation of the home currency, and a drop in relative interest rates. GDP Growth and EMP have a negative association because when GDP growth increases, the exchange or domestic exchange rates rise, lowering EMP or the pressure on the forex market. EMP or depreciation pressure on the Currency market results if both the GDP growth and depreciation rate slow down.

Current Account's Impact on Exchange Market Pressure

The investigation of the long-term VECM estimation in this study's results revealed that the current account balance has no discernible impact on the EMP, indicating that the pressure on the Indonesian forex market is not affected by changes in the country's current account balance. The findings of this study do not support the research hypothesis, but they are consistent with Hegerty (2018), which claims that due to specific circumstances in the country during the research period, the current account balance, which is affected by exports and imports, is not actually able to have a significant long-term impact on EMP. When the global financial crisis first hit Indonesia in 2008, exports there saw a sharp decrease, which was accompanied by a substantial capital outflow in the capital account sector. Even in 2020, Indonesia's exports' value fell by 2.68 percent from 2019. Additionally, imports significantly dropped, even as high as 17.34% less than in 2019 (Statistics Indonesia, 2020).

The COVID-19 epidemic, which slowed down the world economy, was the primary cause of the reduction in the value of exports and imports. These factors prevent the current

account balance from having a long-term, meaningful impact on Indonesia's EMP. According to the short-term VECM estimation results, the current account balance has a negligible impact on the EMP at lag 2 but is not significant at lag 1 relative to the EMP. According to research by (Ozcelebi, 2019), "Assessment of Asymmetric Effects on Exchange Market Pressure: Empirical Evidence From Emerging Countries," there is a short-term, significant negative correlation between the current account balance and the EMP. The pressure on the foreign exchange market or EMP will decrease as the current account balance rises. The current account balance is also utilized internally to calculate the EMP and indicate the necessity for borrowing foreign money.

BI Rate's impact on the pressure on the exchange market

The VECM BI rate estimation results have a considerable favorable impact on EMP over time. The research hypothesis does not match the findings of the study. However, the estimation findings in this study are consistent with Amiruddin (2014) article, "*Tekanan Nilai Tukar dan Intervensi Bank Sentral di Tiga Negara ASEAN*". Rising interest rates may have an impact on excessive demand in the FX market. Since depreciation also causes inflation, the monetary authority must raise interest rates to control inflation, according to research by Khawaja and Din (2007) titled "Instrument of Managing Exchange Market Pressure: Money Supply or Interest Rate," which found a positive relationship between interest rates and exchange market pressure.

The short-term VECM estimation's findings about the BI rate have a very detrimental impact on the EMP. The findings of the study support the research hypothesis. The estimation findings in this study are consistent with Ratnasari and Widodo's (2007) paper, "Exchange Market Pressure and Monetary Policies in ASEAN 5," which asserts that a rise in interest rates will lessen exchange market pressure during times of crisis. The value of the EMP declines in response to an increase in interest rates. This is because the pressure on the foreign exchange market will lessen when interest rates rise since capital inflows will lead the rupiah/USD exchange rate to gain (Ratnasari & Widodo, 2007). Both the short-term and long-term findings of the VECM estimation indicate valid results. The change in the dependent variable, EMP, can be explained by the independent variables, which include domestic credit growth, GDP growth, current account balance, and the BI rate of 62.10%, as shown by the coefficient of determination R-squares value, which is worth 0.621084. The impulse response function and variance decomposition tests will be the following ones run as part of this investigation.

Impulse Response Function (IRF) Results

The outcomes of the influence of a shock on one variable on another variable are explained by the impulse response function analysis, which in this analysis is not only in a short period but can analyze for numerous horizons to future as long-term information. It is used in this study to examine the Exchange Market Pressure (EMP) reaction to shocks in domestic credit growth (DC), GDP growth (GDP), current account balance (CA), and BI rate (IR).

Table 8 Results of Impulse Response Function

Period	EMP	DC	PDB	CA	IR
1	5.052703	0.000000	0.000000	0.000000	0.000000
2	2.745133	0.746012	0.304915	0.032416	-1.79632
3	2.666316	0.207653	0.367707	2.138370	-0.60631
4	2.835382	0.360451	1.635837	1.267833	-0.81906
5	2.551915	0.869658	1.862027	0.511398	-1.12682
6	2.978707	0.621433	1.728209	0.636174	-1.18667
7	2.861030	0.768610	1.344660	0.793525	-1.41044
8	2.781673	0.620712	1.169199	0.909043	-1.28966
9	2.788567	0.640054	1.044093	0.969115	-1.22174
10	2.779176	0.586108	1.061511	0.889952	-1.19001

Source: Results of data processing on EViews 10, (2022)

Exchange Market Pressure Response to Domestic Credit Growth Shock

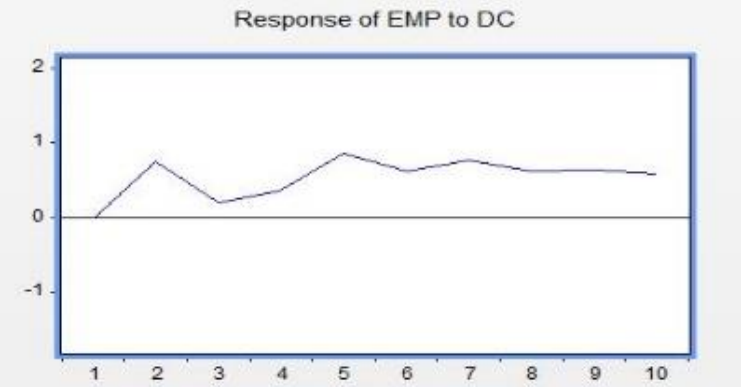

Figure 1 IRF EMP Test Results against DC shock
Source: Results of data processing on EViews 10, (2022)

Table 8 shows the positive response of the EMP to DC shocks or domestic credit growth in periods 2 to 10 at one standard deviation. This positive response indicates a decline in the value of the EMP below zero from shocks to domestic credit growth. The EMP reaction fluctuated from the second to the tenth period, with the second period's response size being 0.7460 percent rising to 0.8696 percent in the fifth period. The sixth to tenth period also displayed oscillations, with the tenth period's response size being 0.5861 percent. The findings of this study show that the EMP responded favorably to the shock of credit growth. Accordingly, if there is an increase in domestic credit growth as indicated by an excess demand for money, foreign exchange reserves will rise, the exchange rate will appreciate, and EMP, or pressures on the forex market, will be reduced.

Lestano (2010) study, "A Structural VAR Model of Exchange Rate Market Pressure: The Case of Indonesia," found that the EMP responded favorably to shocks to domestic credit growth in Indonesia. These findings are consistent with the results of the EMP. According to Lestano (2010), increasing capital inflows can positively affect the economy. The existence of capital inflows can lead to an appreciation of the domestic currency and will trigger an explosion in asset prices which in turn will encourage domestic credit

expansion. The domestic currency will strengthen, or in other words, the EMP will decline due to the rise in capital flows combined with the rise in domestic credit growth that is being directed by the monetary authority to increase liquidity.

Exchange Market Pressure Response to GDP Growth Shock

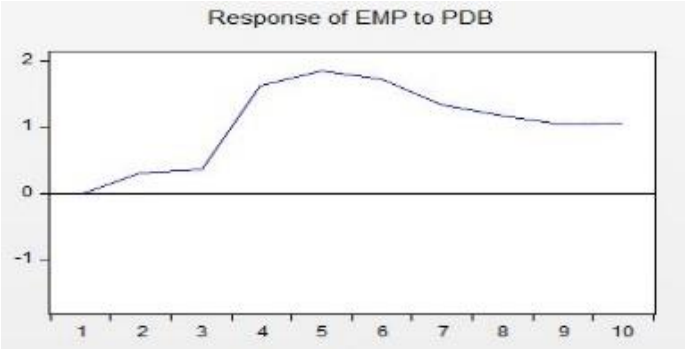

Figure 2 IRF EMP Test Results on GDP growth shock
Source: Results of data processing on EViews 10, (2022)

The EMP responded positively to GDP growth shocks from 2 to 10 at one standard deviation. When the EMP responds positively to a GDP growth shock, the EMP has fallen below zero in the second to tenth period. The EMP's response to GDP growth was 0.3049 percent in the second period, 1.6358 percent in the fourth period, and increased from the fifth to the tenth quarter. The results of the EMP responded positively to the GDP growth shock in line with Lestano's (2010) research, entitled "A Structural VAR Model of Exchange Rate Market Pressure: The Case of Indonesia" Thus, when there is a shock to GDP growth, the EMP reacts favorably. When the GDP growth rate declines, as it did from 2020:Q2 to 2021:Q1, there is a positive EMP response to the GDP growth shocks. In reaction to the number of foreign exchange pressures that have decreased in value below zero, indicating a reduction in pressure on the forex market, GDP growth illustrates that considerable societal constraints affect the economy.

Exchange Market Pressure Response to Shock Current Account

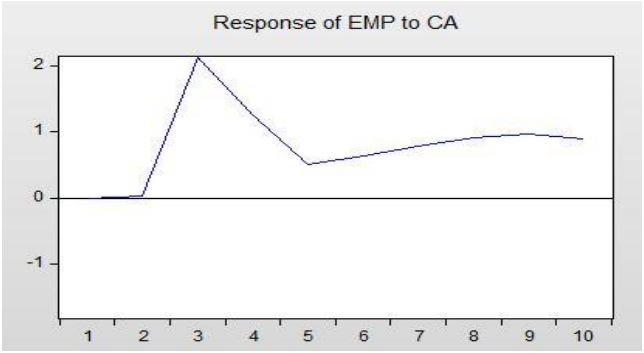

Figure 3 IRF EMP Test Results against CA. shock
Source: Results of data processing on EViews 10, (2022)

In periods 2 to 10, EMP responded favorably to shocks to the current account (CA) by one standard deviation. This indicates that a shock to the current account balance or a current account deficit will lessen the pressure on the currency market, or EMP has a value below zero. The EMP response to the EMP shock had results of 0.3049 in the second period, 1.6358 in the fourth period, and until the tenth period, when the fluctuating values tended to increase by 1.0615. These findings are consistent with the study by Ozcelebi (2019), "Assessment of Asymmetric Effects on Exchange Market Pressure: Empirical Evidence From Emerging Countries," which found that changes in the current account balance have a positive impact on the exchange market pressure (EMP), as they can lessen forex market pressures. A country's economic power is measured by its ability to trade goods and services, generate income from its production assets, and receive grants and remittances from its citizens (Bank Indonesia, 2018). Therefore, the higher the ratio of the current account balance to the economy, the local economy will develop better, including international trade, an increase in revenue from investment, and an increase in income from foreign employees.

Exchange Market Pressure Response to Shock BI Rate

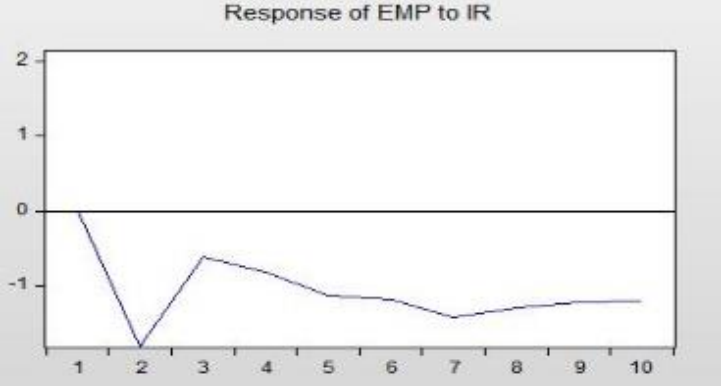

Figure 4 IRF EMP Test Results against IR shock
Source: Results of data processing on EViews 10, (2022)

According to Ozcelebi (2019), in "Assessment of Asymmetric Effects on Exchange Market Pressure: Empirical Evidence From Emerging Countries," these findings support the theory that the EMP reacts favorably to shocks in the current account balance because the current account balance can IR shocks cause the EMP to react negatively in periods 2 to 10 at one standard deviation. This indicates that the EMP will react negatively by increasing FX market pressure in response to a shock to the BI rate. When the EMP reacts negatively, it indicates that the currency market is under more pressure or that the EMP's value has increased above zero. The response value was -1.7963 percent in the second period and -1.1268 percent in the fifth period. According to Aziz and Widodo's (2017) research titled "Exchange Market Pressure: Evidences from ASEAN Inflation Targeting Countries," if interest rates rise, the domestic currency will weaken, and/or foreign exchange reserves will be lost, which will increase EMP. The BI rate manages market liquidity to help monetary policy accomplish its operational goals. The BI rate's other goals are maintaining economic stability and reducing inflation. In most cases, BI will raise the

BI rate if inflation is anticipated to be higher than the objective, and vice versa if inflation is anticipated to be lower than the target.

Results of Variance Decomposition (VD)

To determine the relative impact of research factors on other variables, variance decomposition is used to assemble the forecast error variance of a variable, that is, how much the variance before and after the shock differs from other variables. The decomposition variable on the EMP variable during 10 quarters is summarized in the Table 9.

Table 9 Results of Variance Decomposition

Period	EMP	DC	PDB	CA	IR
1	100.0000	0.000000	0.000000	0.000000	0.000000
2	89.50455	1.506470	0.251667	0.002844	8.734466
3	81.70478	1.219534	0.464059	9.301636	7.309988
4	77.39753	1.171181	4.661979	9.922394	6.846918
5	73.39804	1.992837	8.545047	8.640695	7.423379
6	71.76639	2.112468	10.55973	7.726640	7.834771
7	70.49938	2.418728	10.96618	7.343135	8.772570
8	69.87739	2.502671	11.01304	7.296282	9.310617
9	69.55475	2.595622	10.85429	7.363969	9.631372
10	69.40355	2.630361	10.77334	7.329168	9.863582

Source: Results of data processing on EViews 10, (2022)

Variance decomposition seeks to quantify the relative importance of the DC, PDB, CA, and IR factors in influencing the EMP variable. From Table 9, it can be inferred that the EMP variability period began as a result of the EMP shock itself, which was 100%, and was caused by the variance decomposition results in the equation model where the contribution of the independent variables to the forex market pressure or the EMP from period 1 to period 10 fluctuated. Other factors started to have an impact on the fluctuation of currency market pressures or EMP in the second period. EMP plays a significant role in the second session with an 89.50% dominance. Then, with a period 8 contribution of 11.01 percent, GDP growth is the independent variable contributing the most to EMP, illustrating the significance of GDP growth in the foreign currency market dynamics. In addition, the current account balance variable's contribution of 9.92 percent to the fourth period was the second greatest. The third contribution of the BI rate variable in the tenth period was 9.86 percent, while the contribution of the domestic credit growth variable (DC) was the least at 2.63 percent.

Conclusion

This study aims to analyze Exchange Market Pressure (EMP) in Indonesia using the Vector Error Correction Model (VECM) method. The data used are EMP, credit growth, gross domestic product growth, current account balance ratio, and the BI rate. Based on the results of the long-term VECM estimation, domestic credit growth has a significant

positive relationship to Exchange Market Pressure (EMP), GDP growth has a significant negative relationship to EMP, the current account balance is not significant to Exchange Market Pressure (EMP), and BI rate has a significant positive relationship to EMP. According to the short-term VECM estimation findings, domestic credit growth has a significant positive relationship to EMP, GDP growth has a significant negative relationship to EMP, the current account balance has a significant negative relationship to EMP, and the BI rate has a significant negative relationship to EMP. According to the Impulse Response Function results, Exchange Market Pressure (EMP) responded successfully to shocks to domestic credit growth, GDP growth, and the current account balance (IRF). In the interim, EMP responded badly to BI rate shocks. The positive response indicated a decrease in the value of the Exchange Market Pressure (EMP) below zero or a decrease in foreign exchange market pressure, whereas the negative response indicated an increase in the Exchange Market Pressure (EMP) above zero or an increase in foreign exchange market pressure.

Based on the conclusions, the role of the government in controlling EMP is very necessary. Governments and stakeholders can advance international trade through international economic cooperation by increasing exports and controlling imports. The closer the cooperation with many countries, the more opportunities the country has to conduct international trade. In addition, the government should also improve the quality of human resources and technology so that the quality of export products is improving. The government, through Bank Indonesia, can also maintain economic growth through infrastructure development to realize price stability and inclusive and quality economic growth.

Moreover, the government must reduce domestic credit growth by limiting new loans, increasing taxes, and synergy between State-Owned Enterprises (SOEs). The limitation of this study is that it has not compared crisis and non-crisis conditions. As occurred in 2008 and 2021, with the 2008 financial crisis and the 2021 COVID-19 pandemic, respectively. Subsequent research combines independent variables that influence EMP and examines the effects of the independent variables on EMP under crisis and non-crisis settings.

References

Ali, W., Gohar, R., Chang, B. H., & Wong, W. K. (2022). Revisiting the impacts of globalization, renewable energy consumption, and economic growth on environmental quality in South Asia. *Advances in Decision Sciences, 26*(3), 75–98. https://doi.org/10.47654/v26y2022i3p75-98

Amiruddin, A. R. R. (2014). Tekanan Nilai Tukar dan Intervensi Bank Sentral di Tiga Negara ASEAN. *Thesis*. Institut Pertanian Bogor.

Ayuningtyas, M., & Purwono, R. (2020). Analisis Exchange Market Pressure di Indonesia Periode Setelah Krisis Moneter. *Media Trend, 15*(2), 333–344. https://doi.org/10.21107/mediatrend.v15i2.7437

Aziz, M. A., & Widodo, T. (2017). Exchange Market Pressure: Evidences from ASEAN Inflation Targeting Countries. *Munich Personal RePEc Archive*.

Bank Indonesia. (2018). *Laporan Kebijakan Moneter*. Retrieved from https://www.bi.go.id/id/publikasi/laporan/Documents/Laporan-Kebijakan-Moneter-Triwulan-III2018.pdf

Falianty, T. A., & Andhony, M. (2012). Exchange Market Pressure dan Intervensi Bank Indonesia. *Jurnal Keuangan dan Perbankan, 14*(1), 1–15. Retrieved from https://journal.perbanas.id/index.php/jkp/article/view/165

Feldkircher, M., Horvath, R., & Rusnak, M. (2014). Exchange market pressures during the financial crisis: A Bayesian model averaging evidence. *Journal of International Money and Finance, 40*, 21–41. https://doi.org/10.1016/j.jimonfin.2013.08.021

García, C., & Malet, N. (2007). Exchange Market Pressure, Monetary Policy, and Economic Growth: Argentina, 1993-2004. *The Developing Economies, 45*(3), 253–282. https://doi.org/10.1111/j.1746-1049.2007.00043.x

Girton, L., & Roper, D. E. (1976). A Monetary Model of Exchange Market Pressure Applied to the Post-War Canadian Experience. *International Finance Discussion Paper, 1976*(92), 1–32. https://doi.org/10.17016/ifdp.1976.92

Hegerty, S. W. (2018). Exchange market pressure, stock prices,and commodity prices east of the Euro. *Journal of Economics and Management, 31*, 74–94. https://doi.org/10.22367/jem.2018.31.04

Jing, Z. (2015). On the relation between currency and banking crises in developing countries, 1980–2010. *The North American Journal of Economics and Finance, 34*, 267–291. https://doi.org/10.1016/j.najef.2015.09.016

Johari, S. M., Wong, W. K., Anjasari, I. P., Ha, N. T. T., & Thuong, T. T. H. (2022). The Effect of Monetary Instrument of Islamic Banking Financing Channel Towards The Economic Growth in Indonesia. *Jurnal Ekonomi & Studi Pembangunan, 23*(1), 124–139. https://doi.org/10.18196/jesp.v23i1.13198

Khawaja, M. I., & Din, M.-U. (2007). Instrument of Managing Exchange Market Pressure: Money Supply or Interest Rate. *The Pakistan Development Review, 46*(4II), 381–394. https://doi.org/10.30541/v46i4iipp.381-394

Kyin, T. S., Chin, L., & Habibullah, M. S. (2013). Monetary Policy and Exchange Market Pressure in Malaysia. *Pertanika Journal of Social Science and Humanities, 21*(S), 29-46. Retrieved from http://www.pertanika.upm.edu.my/pjssh/browse/special-issue?article=JSSH-0933-2013

Lestano. (2010). A Structural VAR Model of Exchange Rate Market Pressure : The Case of Indonesia. Majalah Ekonomi, 62(1), 36–49.

Mardiana, L., & Prawoto, N. (2016). Analisis Penerimaan Pajak Reklame Kabupaten Magelang Dengan Pendekatan VECM Periode 2010 - 2014. *Jurnal Ekonomi & Studi Pembangunan, 17*(2), 193-202. https://doi.org/10.18196/jesp.17.2.3984

Ozcelebi, O. (2019). Assessment of asymmetric effects on exchange market pressure: Empirical evidence from emerging countries. *The North American Journal of Economics and Finance, 48*, 498–513. https://doi.org/10.1016/j.najef.2019.03.016

Panday, A. (2015). Impact of monetary policy on exchange market pressure: The case of Nepal. *Journal of Asian Economics, 37*, 59–71. https://doi.org/10.1016/j.asieco.2015.02.001

Pontines, V., & Siregar, R. (2008). Fundamental pitfalls of exchange market pressure-based approaches to identification of currency crises. *International Review of Economics & Finance, 17*(3), 345–365. https://doi.org/10.1016/j.iref.2006.10.001

Ratnasari, A., & Widodo, T. (2007). Exchange Market Pressure and Monetary Policies in ASEAN5. *Munich Personal RePEc Archive*.

Statistics Indonesia. (2020). *Foreign Trade Statistics Import 2020 Volume I*. Retrieved from https://www.bps.go.id/publication/2021/06/10/2f4516969cc6fa220892f170/statistik-perdagangan-luar-negeri-impor-2020-jilid-i.html

Sulaeman, C. S. R., & Lisna, V. (2016). Analisis EMP Indonesia dan Empat Negara ASEAN pada Masa Krisis. *Jurnal Ekonomi dan Pembangunan Indonesia, 16*(2), 105–122. https://doi.org/10.21002/jepi.v16i2.592

Sulistiana, I. (2017). Model Vector Auto Regression (VAR) and Vector Error Correction Model (VECM) Approach for Inflation Relations Analysis, Gross Regional Domestic Product (GDP), World Tin Price, BI Rate, and Rupiah Exchange Rate. *Integrated Journal of Business and Economics, 1*, 17-32. Retrieved from https://ojs.ijbe-research.com/index.php/IJBE/article/view/46

Widarjono, A. (2018). *Ekonometrika Pengantar dan Aplikasinya Disertasi Panduan EViews (5th Ed.)*. UPP STIM YKPN.