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Monetary Policy and Herding Behavior: Empirical Evidence From Indonesia Stock Market

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Monetary Policy and Herding Behavior: Empirical Evidence From Indonesia Stock Market

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This study aims to analyze the role of monetary policy, including the spillover of the US Federal Reserve (Fed) monetary policy, in the existence of herding behavior in the Indonesian stock market. We used beta herding to measure the level of herding behavior and analyze the relationship between monetary policy and beta herding using the VECM model, as well as IRF and FEVD. This study shows that monetary policy plays a role in the existence of herding behavior in the Indonesian stock market. Although the effect of monetary policy on herding behavior is relatively small, Fed monetary policy shocks have a greater effect on the existence of herding behavior in the Indonesian stock market. The credibility of Bank Indonesia (BI) and the Fed may play a role in shaping investors' expectations. Therefore, policymakers have to take into account the volatility of asset prices in formulating monetary policy.

Keywords: Monetary Policy; Investor Sentiment; Credibility; Beta Herding; VECM

JEL Classification: E52, E58, G41

Introduction

Investor behavior is an important element that reflects the decision taken by investors. Different behavior among investors, caused by the psychology and cognitive bias of investors, can cause investors to make different investment decisions, leading to uncertainty in the stock market. These biases can also lead investors to mimic the investment decisions of other investors, known as herding behavior. When investors herd, they suppress their own beliefs and trade in the same direction with others or converge to the consensus. This behavior can lead to an inefficnt market and mispricing, which can lead to stock price instability (Dasgupta et al., 2011), even bubbles and a crisis in the long run (Hwang et al., 2018).

Although many studies defined herding behavior as irrational behavior, it is believed that herding behavior requires some sort of coordination mechanism, and monetary policy may play this role (Devenow & Welch, 1996). Monetary policy sends strong signals that may coordinate similar investor behavior through two channels (Krokida et al., 2020): (1) monetary policy announcements can affect economic expectations and investor sentiment in the short and long run, which then can lead investors to react simultaneously to the same direction or similar investment decision; (2) monetary policy can lead herd behavior via risk measurement/ management models which then encourage investors to trade towards the similar direction.

The investor response to the central bank's

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policy can also be two-fold. First, the central bank's monetary policy announcement can influence investor sentiment and expectations, which then trigger herd behavior (Chiang & Lin, 2019; Gagnon & Gimet, 2020; Galariotis et al., 2018; Hwang et al., 2018; Krokida et al., 2020; Lutz, 2015). When the central bank announces its policy position, it can lead to investor overconfidence, increase investor sentiment and could potentially destabilize prices and affect asset markets (Bikchandani & Sharma, 2000; Krokida et al., 2020). In addition, public information announcements can result in increased uncertainty as investors learn from market prices. Second, a timely implemented monetary policy can prevent the risk of the market bubble due to herding behavior (Loisel et al., 2009). However, the central bank needs to have such credibility to maintain investor sentiment and expectations in accordance with the central bank's target.

In recent years, the Indonesian stock market has become an attractive investment destination for global investors, that is more than 50 percent of investors in Indonesia are foreign investors (KSEI, 2020). Furthermore, foreign investors play a dominant role in the movement of Indonesian stock prices. Therefore, it is possible that any changes in the monetary policy stance of central banks in advanced countries, especially the US Federal Reserve (Fed), can coordinate the herding behavior of investors. For instance, global investors reacted to the announcement of the Fed's Zero Lower Bound (ZLB) and Quantitative Easing (QE) policy, which resulted in large capital outflows from the US to Indonesia (Anaya et al., 2017; Punzi & Chantapacdepong, 2017). The condition was similar when Fed announced the implementation of the tapering policy, that capital flow was largely out from Indonesia to the US, thus putting the Indonesian economy in vulnerability (Basri, 2016). During Fed's normalization policy by increasing their policy rate, some capital were out from Indonesia although it didn't give impact to the stock prices as much as during the tapering. The excessive capital inflow to Indonesia—as well as capital outflow from Indonesia—due to the dynamic of the Fed's monetary policy could cause the herding behavior, thus posing potential risks to the Indonesian economy.

In their recent study, Rahman & Ermawati (2020) found that both BI and Fed policy rates play a role in the existence of herding behavior in Indonesia's stock price and result in large capital flows. However, they did not study the dynamic relationship between herding and the monetary policies, as well as the other macroeconomic variables. They also had not taken into account the effect of unconventional monetary policy on herding behavior, as it can affect the capital flow and trigger herding behavior in the stock market. Krokida et al. (2020) specifically studied that conventional and unconventional monetary policy had an impact on herding behavior in the US and EU stock markets, especially during the GFC. However, it is also important to study the role of monetary policy in herding behavior in Indonesia as an emerging country given the fact that Indonesia becomes an attractive investment destination for global investors, especially after the GFC. Therefore, this study will further discuss the research gap.

This study aims to analyze the role of monetary policy in the existence of herding behavior in the Indonesian stock market. Our study also examines the spillover effect of the Fed's monetary policy on herding behavior in the Indonesian stock market. Our study contributes to allowing policymakers to understand further the role of monetary policy in the existence of herding behavior and to mitigate the potential risk related to the behavior. This paper is the first to focus on analyzing the effect of conventional and unconventional monetary policy on herding behavior in the Indonesian stock market.

We employed beta herding developed by Hwang et al. (2018) to measure the level of herding behavior in the Indonesian stock market. Then, we analyze and simulate the dynamic relationship of the monetary policy and beta herding using the VECM model, as well as Impulse Response Function (IRF) and Forecast-Error Variance Decomposition (FEVD) analysis, with monthly data from February 2002 to July 2020. To test the robustness of our results, we also estimated the same model with monthly

data from July 2007 period to July 2020 based on Wolff (2013) which argues that in the GFC period, investors tend to have stronger sentiments towards macroeconomics announcements and have an impact on investors' confidence and forward-looking preferences. This argument is strengthened by the descriptive analysis we conducted, which describes that the level of herding behavior in Indonesia tends to strengthen during and after the GFC period.

Our result suggests that monetary policy plays a role in the existence of herding behavior in the Indonesian stock market although the effect is relatively small. Compared to BI monetary policy shock, The Fed monetary policy shock has a greater effect on the existence of herding behavior in the Indonesian stock market. The credibility of the BI and the Fed may play a role in shaping the expectations of financial actors. Therefore, the central bank has to take into account the volatility of asset prices, especially stock prices, in formulating its monetary policy since it can represent the investors' behavior in the stock market.

The rest of the article is organized as follows. Section II presents the previous literature. Section III explains the data and research methodologies used in this study. Section IV reports the descriptive analysis, the empirical results, and the discussion. Section V concludes the results of the study.

Literature Review

Herding behavior is described as a collective behavior in suppressing their own belief and choosing to imitate others' investment decisions. In psychology studies, herding behavior is described as irrational and unconscious behavior, where people tend to choose simpler solutions, presume that 'the majority is always right' or 'consensus is good', and decide to mimic others' actions (Rook, 2006). Hwang et al. (2018) describe herding behavior as investors trading in the same direction with others or converging to the consensus.

Many studies of herding behavior try to understand the impact of herding behavior in the financial market in imposing financial stability risks, not limited to during the GFC but also other crises (Choijil et al., 2022). Dasgupta (2011) argues that herding behavior among trader managers can cause price instability. In the long run, herding behavior can lead to bubbles and crises (Hwang et al., 2018). Other previous studies also discussed how herding behavior occurs. Lux (1995) explains that irrational behavior, as an attempt to get information, and reputation are several explanations for the herding behavior of speculative traders. Bikchandani & Sharma (2000) argue that herding behavior occurs due to asymmetric information among the investors. Herding behavior also occurs when investors lack investment analysis skills (Rahayu et al., 2021). Chang et al. (2000) find that macroeconomic information gives more impact on herding behavior.

However, investor sentiment and expectation also play an important role in herding behavior in the stock market. Hwang et al. (2018) find that herding behavior occurs when investors feel overconfident in the outlook of the market, yet it is weaker when a crisis appears. They also find that investors' expectation towards the market tends to be homogenous, regardless of whether it is a bull or bear market. Investor sentiment can also occur due to the recommendation of an investment analyst, which then leads to herd among them (Chiang & Lin, 2019).

The important change of macroeconomic information can lead to herding behavior in the stock market. The change of macroeconomic indicators—for instance, stock price index, policy rate, exchange rates, oil price, and global risk (VIX)—can affect investors' behavior through their belief and forward-looking preference (Balcilar et al., 2014; Chang et al., 2000; Galariotis et al., 2015; Phan et al., 2019; Rahman & Ermawati, 2020). Moreover, monetary policy can also affect investors' herding behavior through expectation channels (Gong & Dai, 2017; Krokida et al., 2020). Both conventional and unconventional monetary easing can increase the investors' sentiment through the central bank's signal channel which can change investors' long-run expectations (Anaya et al., 2017; Gagnon & Gimet, 2020; Galariotis et al., 2018; Kurov, 2010; Lutz, 2015). Mon-

Table 1. Variables Description

Variable	Description	Previous Study
BI Rate	BI monthly policy rate	Rahman & Ermawati (2020)
BI Balance Sheet	The total asset of BI	Anaya et al. (2017), Punzi & Chantapacdepong (2017)
Fed Fund Rate (FFR)	Fed monthly policy rate	Rahman & Ermawati (2020), Krokida et al. (2020)
Fed Balance Sheet	The total asset of the Fed	Anaya et al. (2017), Punzi & Chantapacdepong (2017)
VIX	The average value of the monthly CBOE Volatility Index	Balcilar et al. (2014), Chiang et al. (2013)
Oil Price	The average value of monthly WTI oil price	Balcilar et al. (2014), Chiang et al. (2013)
Stock Price	The average value of the monthly stock price	Phan et al. (2019)
Exchange Rate	The average value of the monthly exchange rate (IDR/USD)	Gong & Dai (2017), Phan et al. (2019)

etary policy can trigger the increase in asset prices higher (lower) than their fundamentals due to positive (negative) sentiment and investor expectations and lead to an asset bubble in the long run (Acharya & Naqvi, 2019; Kurov, 2010; Lutz, 2015). The spillover of US macroeconomic indicators, as well as US monetary policy, can also affect the capital inflow and investors' behavior in emerging markets (Belgacem et al., 2013; Punzi & Chantapacdepong, 2017).

Empirical studies of herding behavior in Indonesia have been conducted with various approaches, yet very few have discussed herding behavior in a macroeconomic approach. According to previous literature, herding behavior occurs in the Indonesian stock market during market stress, especially during the financial crisis (Bui et al., 2015). Herding behavior happened due to information asymmetry among investors, especially between foreign and domestic investors, that made domestic investors tend to mimic the decision of foreign investors (Ramli et al., 2016; Setiyono et al., 2013; Setyawan & Ramli, 2016). Furthermore, Rahman & Ermawati (2020) found that the Fed and BI policy rate caused the existence of herding behavior in the Indonesian stock market. They also argued that the Fed policy rate has a greater effect on the existence of herding behavior compared to the BI policy rate.

Research Methods

Data

This study uses monthly data from February 2002 to July 2020. We obtain the stock price and its fundamental financial data from the Eikon database. We use LQ45 as the initial sampling, as it lists high-liquidity stocks in the Indonesian stock market. This study uses monthly data and proceeds 24-month rolling-window regression as the first step to obtain herding data; hence this study uses stocks that have been listed since 2000. This data sampling method follows Hwang et al. (2018) to obtain a more representative herding measurement.

Furthermore, we follow Punzi & Chantapacdepong (2017) and Anaya et al. (2017) in using the policy rate and the central bank's asset balance sheet as a proxy for conventional and unconventional monetary policy (UMP), respectively. Data were obtained from SEKI and Federal Reserve Economic Data. Moreover, other macroeconomic indicators were used as the control variables which also affect the existence of herding behavior. Detailed variables used in this study are presented in Table 1. The data were obtained from Yahoo Finance and Federal Reserve Economic Data. All variables, except rates, are transformed into logarithmic levels. Quarterly data, such as financial fundamental data, have been disaggregated into monthly data by using cubic spline interpolation (Abbate et al., 2016; Krokida et al., 2020).

Beta Herding Measurement

This study follows the beta herding measurement introduced by Hwang et al. (2018) with an important feature of being able to capture herding behavior as a time-varying phenomenon and control systemic risk factors caused by overconfident and sentiment behavior of investors. The concept of beta herding measurement is how herding behavior results in a biased relationship between risk and return. Beta herding is also reflected in individual stock betas that converge toward market beta. When investors

are herding towards the market portfolio, the beta value will be biased from its equilibrium value, which will make the cross-sectional beta dispersion of each stock have a value that is smaller than its equilibrium value. If all returns for each stock are expected to be equal to market returns, then the beta value is equal to one, and the standard error will be zero. Herding behavior can be described from the following equation:

$$\frac{E_t^b(r_{it})}{E_t^b(r_{mt})} = \beta_{imt}^b = \beta_{imt} - h_{mt}(\beta_{imt} - 1) \tag{1}$$

where $E_t^b(r_{it})$ is short-run stock bias expectation on excess stock return I in period t; $E_t^b(r_{mt})$ is short-run market bias expectation on market excess return in period t; β_{imt}^b is beta of a market that bias in period t; and hh_{mt} is the level of herding due to mispricing in stocks.

Moreover, Hwang et al. (2018) suggest that the distortion in betas consists of herding, market sentiment, and individual sentiment, which is expressed as follows:

$$\beta_{imt}^s = 1 + \frac{1}{1 + s_{mt}}[(1 - h_{mt})(\beta_{imt} - 1) + \omega_{it}] \tag{2}$$

where β_{imt}^s is the systematic risk bias caused by sentiment; s_{mt} is the level of market confidence; and ω_{it} is idiosyncratic sentiment. The non-parametric beta herding measure suggested by Hwang et al. (2018) is written as follows:

$$H_{mt} = \frac{1}{N_t}\Sigma_{i=1}^{N}(\widehat{\beta}_{imt}^s - 1)^2 \tag{3}$$

where H_{mt}, or later called beta herding, shows the level of herding towards the market portfolio; N_t shows the number of stocks in period t. To control the heteroskedastic problem due to idiosyncratic variations or market variations, equation (3) is transformed into the standardized form as follows:

$$H_{mt} = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{\widehat{\beta}_{imt}^s - 1}{\widehat{\sigma}_{\varepsilon it}/\widehat{\sigma}_{mt}}\right)^2 \tag{4}$$

where $\widehat{\sigma}_{\varepsilon it}$ is the variance between stock returns and market returns and $\widehat{\sigma}_{mt}$ is the variance of market returns. The advantage of standardized beta measurement is that it can compare the dy-namics of beta herding from time to time without being influenced by heteroskedastic problems in error estimation. Beta herding can be interpreted as: the smaller the value of H_{mt}, the greater the level of herding in the stock market the smaller the beta deviation; while the greater the value of H_{mt}, the smaller the level of herding the greater beta deviation.

We use rolling-window regression with multi-factor asset pricing model set-up introduced by Fama & French (1993) to get the value of beta herding. This model can control the value of market return with fundamental factors, such as SMB and HML. SMB represents stocks that have a small market capitalization but provide a greater return than the market, while HML represents a stock value with a high book-to-market but provides a greater return than the market return. The model is expressed as follows:

$$R_{it} = \beta_0 + \beta_1 R_{mt} + \beta_2 SMB_{mt} + \beta_3 HML_{mt} + \varepsilon_t \tag{5}$$

where R_{it} and R_{mt} are the excess return of stock i in period t and market excess return in period t, respectively. The value of β_1 then used in calculating the herding level according to formula (4).

This study follows Hwang et al. (2018) to employ a rolling sample of 24 observations with one-month constant rolling using Newey-West standard error OLS estimation. The sample was estimated from March 2000 to February 2002 to obtain the beta for February 2002 and roll everything by one month until we get data for July 2020.

Vector-Error Correction Model (VECM)

We use Vector-Error Correction Model (VECM) to analyze the effect of monetary policy on the existence of herding behavior in the Indonesian stock market. We assume that there is a cointegrating relationship between herding level and monetary policy variables, as well as the control variables (Duasa & Kassim, 2009; Krokida et al., 2020). VECM restricts the long-run behavior of the endogenous variables to converge to their co-integrating relation-ships while allowing for short-run adjustment

to gradually correct the deviation from long-run equilibrium. The VECM model can be expressed as follows:

$$\Delta Y_t = \Sigma_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} - \gamma \beta Y_{t-1} + \varepsilon_t \qquad (6)$$

where is the first difference condition; Y_t is the set of variables used on the model; Γ is the short-run coefficient; β is the long-run coefficient; γ shows the speed adjustment of the correction term; k-1 shows the VECM order from VAR; dan ε_t is the disturbance of the reduced form.

This study also adopts Impulse Response Function (IRF) and Forecast-Error Variance Decomposition (FEVD) analysis to simulate the dynamic interactions and strength of relations among variables in the model. FEVD shows the percentage of a random shock to the endogenous variables; thus the strength and weakness of each variable in affecting other variables can be analyzed. Meanwhile, the IRF determines the response of endogenous variables of one standard deviation shock given by another variable. By using both tools, the magnitude and persistence of herding level to the variation of monetary policies can be assessed.

To evaluate whether the variables are valid to use the VECM model, we employ several pre-estimation tests, such as stationarity test by using augmented Dickey-Fuller (ADF); cointegration test by using Johansen test; and optimal lag test by using Akaike Information Criterion (AIC) indicator.

Results and Discussions

Herding Behavior in Indonesia

The result of the beta herding measurement indicates that herding behavior occurs in several periods in the Indonesian capital market. The trend of herding behavior can be seen in Figure 1, while Figure 2 to Figure 4 provide the comparison of herding behavior with each type of monetary policy trend to see the occurrence of herding behavior through the implementation of BI and the Fed's monetary policy.

Based on Figure 1, a higher level of beta herding, or the decreasing of beta herding value, occurred in the post-GFC period. Beta herding starts to strengthen in late-2008 and was followed by the decreased stock price. The highest level of beta herding occurred in 2011, while the stock price is increasing. A higher level of beta herding is also seen in 2016, also followed by the decreased stock price. This indicates that investors herd not only when the market is bullish, but when the market is bearish. It means that investors have views or expectations of the homogeneous market and that they tend to move in the direction of consensus.

Surprisingly, herding behavior weakened, or the increasing of beta herding value, during the GFC in 2008 and the early period of the Covid-19 pandemic. This phenomenon is similar to Hwang & Salmon's (2018) finding, that herding behavior tends to occur in stable market conditions. During the crisis, herding behavior does not appear, as investors tend to follow the information they have and do not take a risk by following the consensus.

The effect of the implementation of conventional monetary policy on the herding level is seen in certain periods (Figure 2). The highest level of herding behavior occurred when both BI and Fed ease their monetary policy rate during the recovery period of GFC. The level of herding also strengthened when the BI and the Fed tightened their monetary policy rate between the end of 2017 and 2019. It indicates that investors' sentiment occurs when BI and the Fed change their policy stance, that they tend to enter the stock market when BI and the Fed ease their policy rate and go out when both tightened their policy rate, which then encourages other investors to move to follow consensus. It also indicates that herding behavior in the Indonesian stock market reacts not only to expansionary monetary policy but also to contractionary monetary policy.

The relation between BI UMP, proxied by BI's balance sheet, and herding level in Figure 3 shows no certain correlation. It might be due to BI having just implemented its QE in early 2020 in response to the economic turmoil during the pandemic. When BI announced the implementation of QE during the early period of

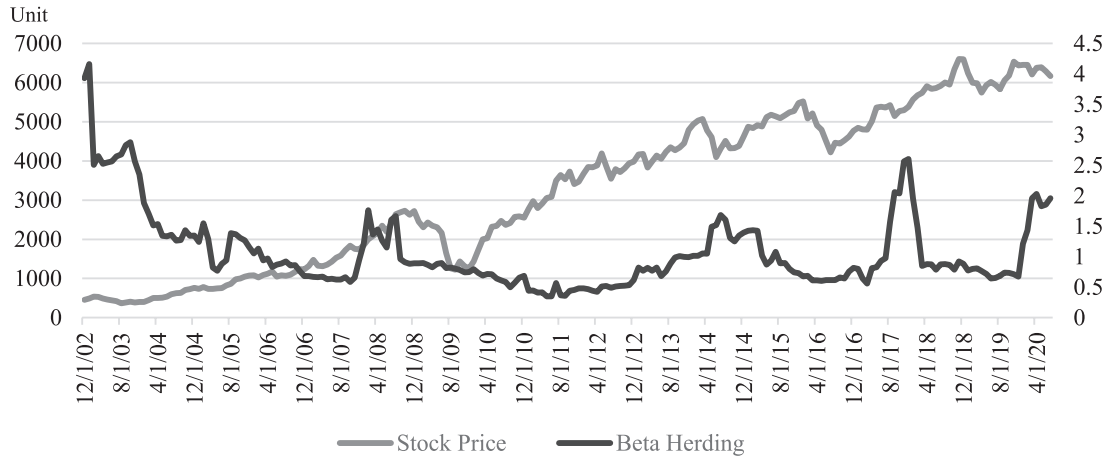Figure 1. Beta herding and Indonesia stock price

Figure 2. Beta herding and conventional monetary policy
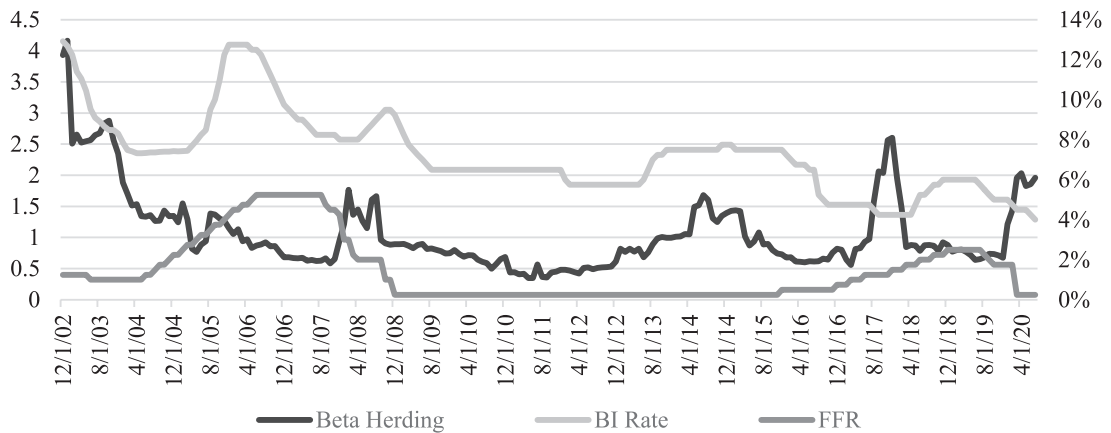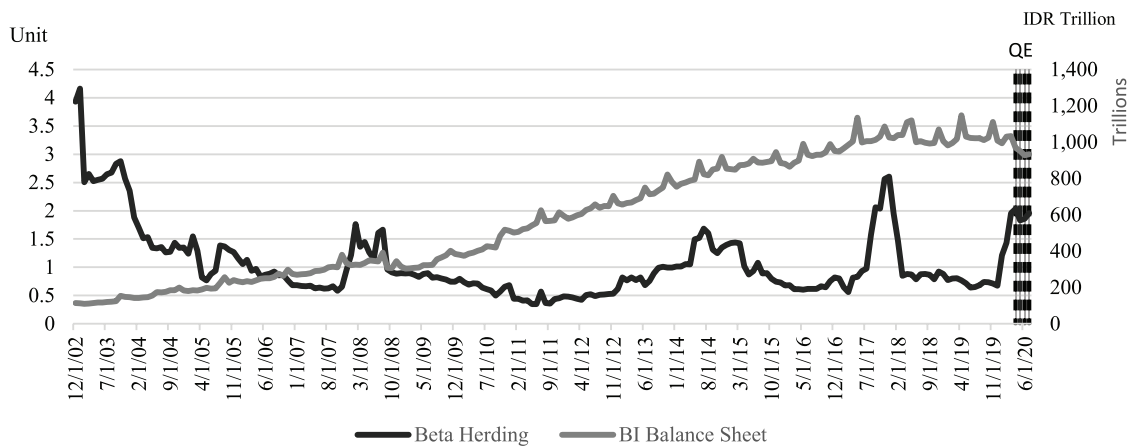

Figure 3. Beta herding and BI unconventional monetary policy

the pandemic in March 2020, investors tend to be more cautious due to the uncertain economic situation that occurred throughout the world.

Meanwhile, for Fed UMP (Figure 4), proxied by Fed's balance sheet, beta herding is started to strengthen when Fed implemented QE 1 in 2008. The highest level of beta herding is seen after Fed implemented QE 2. When Fed implemented the Tapering Policy, the level of beta herding tend to decrease, although in the early periods of implementation the level of beta herding is a little bit increased. While in pandemic periods, the implementation of QE 4 doesn't increase the level of beta herding. This indicates that during the uncertain period, investors tend to make a more rational investment

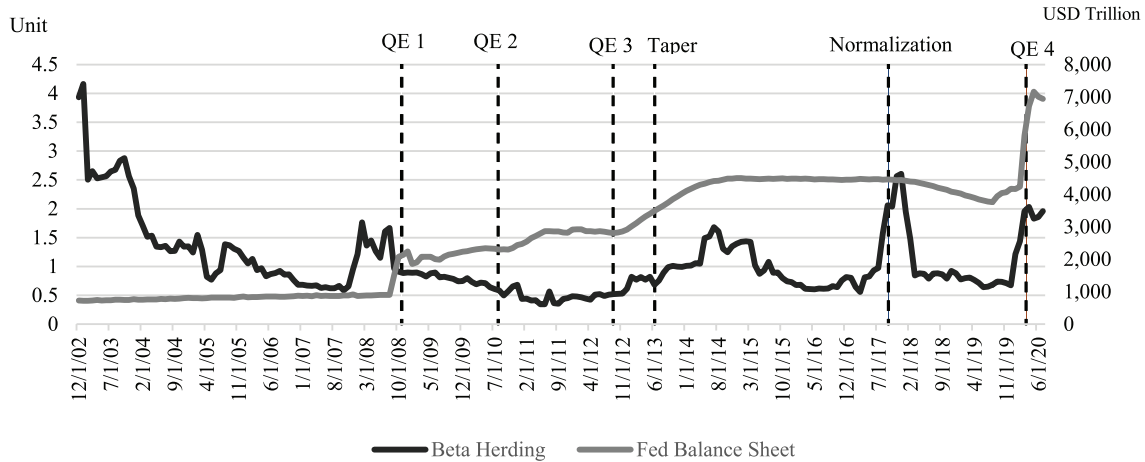Figure 4. Beta herding and Fed unconventional monetary policy

Table 2. Vector Error Correction Model Estimates

| Variable	Johansen Normalization Restriction Imposed	
	Coef	Std. Error
Beta Herding	1.000	.
FFR	**-0.410***	0.148
Fed Balance Sheet	**-5.171***	0.874
VIX	**3.019***	0.336
Oil Price	**-1.250**	0.499
BI Rate	**0.193**	0.069
BI Balance Sheet	1.698	1.460
Exchange Rate	0.202	1.512
Stock Price	**4.203***	0.990
Variable	Error Correction	
	Coef	Std. Error
_ce1	**-0.035**	0.014
Beta Herding	**0.161**	0.070
FFR	**-0.244***	0.092
Fed Balance Sheet	-0.325	0.335
VIX	0.107	0.080
Oil Price	0.192	0.140
BI Rate	-0.024	0.053
BI Balance Sheet	-0.110	0.276
Exchange Rate	0.033	0.482
Stock Price	-0.339	0.304
Cons	**-0.0003**	0.016

Notes: ***statistically significant at 1% level; **at 5% level; *at 10% level

decision than to take a risk to follow the consensus. Likewise, the level of herding tends to strengthen when Fed announces the implementation of QE in response to the GFC. When the Fed announced QE during the GFC, it also followed the implementation of zero lower bound (ZLB) policy, which resulted in large capital outflow from advanced markets to emerging markets, including Indonesia. It also resulted in the increasing stock prices in domestic and positive sentiment in the domestic stock market, as well as strengthening the level of herding.

Estimation result

As a preliminary step, we employ several pre-estimation tests, such as stationarity test, cointegration test, and optimal lag test. Due to some variables do not satisfy the stationarity test, we transform all variables into the first-difference form and the results show that all variables are stationary in the first difference form. Meanwhile, the results of the cointegration test using the Johansen test show that there is a cointegration relationship in the model because

Figure 5. Impulse Response Function
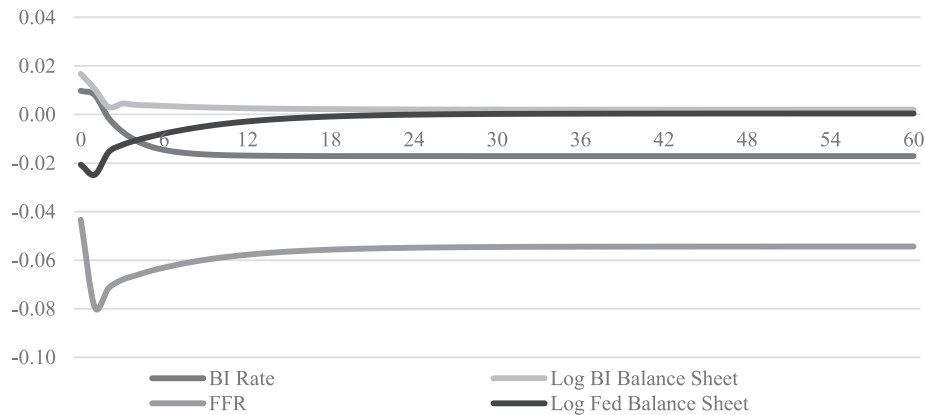
the rank is greater than zero. This result confirms that the model used is further estimated using the VECM. Next, we use the optimal lag test to determine the optimal lag for the model, and this study uses lag 2 on the model as its results in the test.

Table 2 presents the empirical result of the effect of monetary policies and control variables on the herding level. It shows that there is a long-run relationship between herding behavior and monetary policy and other control variables since is the value of the error correction term (_ce1) is negative and significant.

Based on Table 2, FFR has both short and long-run negative effects on herding levels, which means tightening of the FFR can strengthen the level of herding. Meanwhile, Fed's UMP has a long-run negative effect on the herding levels. On the other hand, only BI Rate has a long-run positive effect on the herding levels while BI's UMP doesn't statistically significant both in the short and long run. However, the Fed's FFR has the greatest effect compared to the other policies.

The result indicates that when BI eases its policy rate, it increases the investors' sentiment and increases the level of beta herding in the long run. This result is in line with Kurov (2010), that expansionary monetary policy will increase the investors' sentiment, and the positive sentiment could trigger herding behavior in the stock market (Hwang & Salmon, 2007). The positive sentiment also occurs when Fed implemented QE, that large capital enters Indonesian capital markets and increases the stock price. While for FFR, the tightening of FFR can

result in capital outflow from Indonesia to the US and decrease the stock price, which causes fears in the market and investors to tend to herd to sell their stocks. This result is supported by Ono(2020), which suggest that the contractionary monetary policy of the Fed can cause a large capital outflow from emerging countries, which can decrease investors' sentiment in the stock market.

The IRF analysis was conducted to see the shocks caused by each monetary policy on herding behavior in the Indonesian capital market. The result is presented in Figure 5.

Each monetary policy has a similar pattern in the short run, that one standard deviation increase in each monetary policy gives a negative shock to herding behavior. However, the level of herding has a different response to each monetary policy. The shocks from BI Rate and FFR results in a negative effect on the herding level in the short run. However, the shocks given from FFR have a deeper negative effect. It implies that the tightening of FFR encourages investors to herd in the Indonesian capital market compared to BI Rate. Moreover, the shocks from both BI's and Fed's UMP also result in a negative effect in the short-run, which means that the easing of BI's and Fed's UMP also encourage investors to herd in the short-run. Meanwhile, in the long run, the effect of BI's UMP shock tends to stabilize and Fed's UMP shocks tend to give a positive shock.

Table 3 presents the contribution of each monetary policy to the variance of the herding level. The FEVD suggests that the variation of herding behavior that can be explained by each

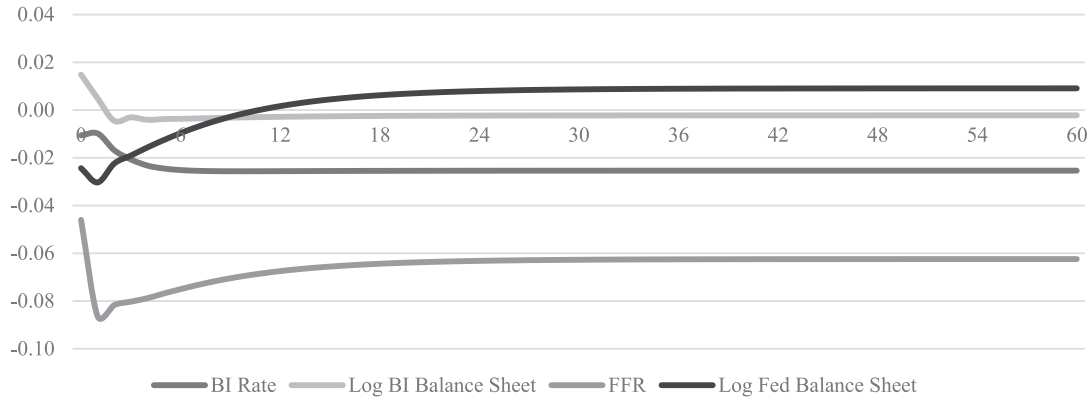Figure 6. Impulse Response Function (Robustness Check)

Table 3. Forecast-Error Variance Decomposition

Step	Beta Herding	FFR	Fed BS	Oil Price	VIX	BI Rate	BI BS	ER	SP
3	87.37%	8.09%	0.78%	0.66%	1.01%	0.10%	0.24%	0.04%	1.69%
6	86.79%	7.85%	0.49%	0.37%	1.62%	0.15%	0.13%	0.05%	2.56%
12	85.92%	7.28%	0.28%	0.22%	2.57%	0.31%	0.08%	0.06%	3.29%
18	85.32%	6.88%	0.19%	0.17%	3.22%	0.38%	0.05%	0.06%	3.72%
24	84.91%	6.61%	0.14%	0.15%	3.65%	0.43%	0.04%	0.07%	3.99%
30	84.63%	6.43%	0.11%	0.13%	3.95%	0.45%	0.04%	0.07%	4.17%
36	84.43%	6.31%	0.10%	0.12%	4.16%	0.47%	0.03%	0.08%	4.30%
42	84.29%	6.21%	0.08%	0.11%	4.31%	0.48%	0.03%	0.08%	4.40%
48	84.18%	6.14%	0.07%	0.11%	4.43%	0.49%	0.03%	0.08%	4.47%
54	84.09%	6.09%	0.06%	0.10%	4.52%	0.50%	0.02%	0.08%	4.53%
60	84.02%	6.04%	0.06%	0.10%	4.60%	0.51%	0.02%	0.09%	4.57%

monetary policy is relatively small. However, Fed's conventional monetary policy explains the biggest fraction of variation of herding behavior, which is about 8 percent in the short term and 6 percent in the medium to long term. The BI Rate and all the UMP can only explain very small fractions of variation of herding behavior by less than 1 percent.

Robustness check

We conduct a robustness check to test the robustness of our results. The robustness check uses a sample between July 2007 to July 2020 based on an argument from Wolff (2013), that in the GFC period investors tend to have stronger sentiments towards macroeconomics announcements and have an impact on investors' confidence and forward-looking preferences. In addition, based on the previous descriptive analysis, herding behavior in the Indonesian capital market tends to strengthen during the GFC period. Pre-estimation tests were carried out and the results of the stationarity test, cointegration test, and the optimal lag test were the

same as in the previous model.

Based on the empirical results of the VECM model, there is a long-run relationship between herding behavior and monetary policy and other control variables which is indicated by the negative and significant value of the error correction term (_ce1). The empirical result is presented in Table 3.

The short-run estimation result in Table 4 suggests that the FFR lag has a negative short-run effect on herding behavior. The Fed's UMP, BI rate, and BI's UMP have no significant effect on herding behavior in the short run. Meanwhile, in the long run, only Fed's UMP has a negative effect on herding behavior in the Indonesian capital market. Both FFR and BI Rate do not have long-run impact on herding behavior, presumably because, in the GFC period, the implementation of UMP will cause investors to tend to have higher risk appetites and have an impact on higher sentiment, then encourages herding behavior (Fassas et al., 2019).

Meanwhile, the IRF analysis in Figure 6 suggests that the shock given by each monetary policy has a negative impact on herding behav-

Table 4. Vector Error Correction Model Estimates (Robustness Check)

Variable	Johansen Normalization Restriction Imposed	
	Coef	Std. Error
Beta Herding	1.000	.
FFR	-0.139	0.201
Fed Balance Sheet	**-3.441**	0.955
VIX	**2.566**	0.481
Oil Price	-0.444	(0.677)
BI Rate	0.180	(14.452)
BI Balance Sheet	-0.342	(0.638)
Exchange Rate	0.295	(0.430)
Stock Price	**4.450**	(0.447)
Variable	Error Correction	
	Coef	Std. Error
_ce1	**-0.041**	0.014
Beta Herding	**0.269**	0.083
FFR	**-0.254**	0.084
Fed Balance Sheet	-0.383	0.288
VIX	**0.185**	0.075
Oil Price	**0.313**	0.133
BI Rate	0.010	0.076
BI Balance Sheet	-0.247	0.269
Exchange Rate	-0.169	0.425
Stock Price	-0.355	0.310
Cons	0.014	0.015

Notes: ***statistically significant at 1% level; **at 5% level; *at 10% level

Table 5. Forecast-Error Variance Decomposition (Robustnest Check)

Step	Beta Herding	FFR	Fed BS	Oil Price	VIX	BI Rate	BI BS	ER	SP
3	82.59%	12.82%	1.59%	0.68%	0.84%	0.39%	0.21%	0.15%	0.75%
6	81.41%	12.61%	1.01%	0.34%	1.86%	0.75%	0.11%	0.12%	1.80%
12	79.12%	11.75%	0.53%	0.17%	3.79%	1.07%	0.07%	0.08%	3.41%
18	77.32%	11.06%	0.37%	0.12%	5.25%	1.20%	0.05%	0.06%	4.58%
24	76.03%	10.58%	0.31%	0.09%	6.26%	1.26%	0.04%	0.05%	5.39%
30	75.13%	10.24%	0.28%	0.07%	6.96%	1.29%	0.04%	0.04%	5.95%
36	74.49%	10.01%	0.26%	0.06%	7.46%	1.32%	0.03%	0.03%	6.34%
42	74.01%	9.83%	0.25%	0.05%	7.83%	1.34%	0.03%	0.03%	6.63%
48	73.64%	9.70%	0.24%	0.05%	8.11%	1.35%	0.03%	0.03%	6.86%
54	73.36%	9.60%	0.23%	0.04%	8.33%	1.36%	0.02%	0.02%	7.03%
60	73.13%	9.51%	0.23%	0.04%	8.50%	1.37%	0.02%	0.02%	7.17%

ior in the short term, which means that herding behavior strengthens during the initial period of changes in the monetary policy. A slight difference is seen in the response of herding behavior to shocks given by BI Rate, that it slightly shows a positive response, but the immediate response was negative in the next period. FFR also still has the largest negative response among all other monetary policy variables.

The contribution of each monetary policy to the variance of the herding level in this model is also relatively small (Table 5). However, the contribution of FFR still has a bigger fraction than the previous model as it values more than 10 percent. Similar to FFR, Fed's UMP also has a slightly larger fraction of contribution to explaining the variation in herding behavior in the short term than in the previous model. On the other hand, the BI rate has a very small contribution to explaining herding behavior in the Indonesian capital market in the short term, but the fraction is getting bigger in the long term. Meanwhile, BI's UMP has a relatively small fraction of variation.

Discussion

The empirical results above suggest that monetary policy plays a role in encouraging the existence of herding behavior in the Indonesian

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stock market, although the impact is relatively small. This finding is different from the magnitude of the effect of monetary policy on herding behavior in advance markets (Krokida et al., 2020). This study also finds that the existence of herding behavior is driven by the different directions of each kind of monetary policy imposed by central banks. In addition, different central banks also have different strengths in moving investor sentiment, as well as their decision to follow the consensus.

Herding behavior tends to occur when BI eases its policy rate instead of when they announce the implementation of QE. As the easing policy rate can trigger positive sentiment (Kurov, 2010), the investors tend to ignore the information they have and follow the consensus, although the impact is relatively small. On the other hand, BI's UMP does not have a significant influence on herding behavior due to its relatively new implementation. The QE policy was announced in early 2020 as a response to economic turmoil due to the Covid-19 pandemic. In this period, herding behavior tends to weaken because investors tend to behave rationally and rather do not take a risk (risk-averse).

Furthermore, herding behavior in the Indonesian stock market is more influenced by the Fed's monetary policy in this study. This finding corresponds to Rahman & Ermawati (2020), that the Fed monetary policy has a larger effect on herding behavior compared to BI monetary policy. However, each Fed monetary policy has a different direction of impact. Unlike the conventional monetary policy of BI, herding behavior in the Indonesian stock market is more influenced by the tightening of conventional Fed monetary policy, which explains the strengthening level of herding during normalization policy. According to Ono (2020), the tightening of the Fed's policy rate has a considerable influence on financial markets in emerging markets compared to its expansionary policy. The normalization policy encourages large capital outflows from Indonesia, thus may also lead to negative sentiment and cause stock prices to fall and motivate investors to follow the consensus. This may pose the risk of a negative bubble or a decline in asset prices below

their fundamentals in the long run (Acharya & Naqvi, 2019). Meanwhile, Fed's UMP shows a negative direction, explaining the strengthening of herding level in the post-GFC period. The implementation of this UMP will also encourage capital inflows to Indonesia (Anaya et al., 2017; Ono, 2020; Punzi & Chantapacdepong, 2017), thus making stock prices rise and motivating investors to herd.

As the spillover of the Fed's monetary policy has a larger effect on the herding behavior in the Indonesian stock market than the BI's monetary policy, this indicates that investors tend to react more to the Fed's policy announcement than to BI's. It may be related to the credibility of BI and the Fed in transmitting investors' expectations and sentiments in the Indonesian stock market. According to Krokida et al. (2020), herding behavior is influenced by how the central bank communicates its policies so that it can shape investors' long-run expectations. The Fed tries to shape the expectations of financial market participants by conveying the direction of monetary policy that will be taken every quarter, while the BI communicates the direction of its monetary policy every month. Although Fed tends to communicate its policies less frequently, the announcement of the direction of the Fed's monetary policy tends to be very strong in influencing financial actors to determine their investment decision making. For instance, the announcement of the tapering policy plan triggered a high negative sentiment, known as the taper tantrum, which then led to capital outflow from emerging countries, including Indonesia. On the other hand, according to Tanuwidjaja & Choy (2020), BI's credibility in shaping the expectations of economic actors can push the inflation target to be achieved more quickly, but its credibility still has little effect on exchange rate movements.

Conclusions

This study analyzes the role of monetary policy on herding behavior, both BI monetary policy and the spillover of Fed's monetary policy. Using the VECM model, as well as the IRF and FEVD analysis, this study demonstrated

that monetary policy plays a role in encouraging the existence of herding behavior in the Indonesian stock market. However, the existence of herding behavior is driven by different directions of each kind of monetary policy imposed by central banks. In addition, different central banks also have different strengths in moving investor sentiment, as well as their decision to follow the consensus. Although the effect of monetary policy on herding behavior is relatively small, the Fed monetary policy shock, both conventional and unconventional monetary policy, has more effect on the existence of herding behavior in the Indonesian stock market. Meanwhile, only BI conventional monetary policy shocks affect herding behavior although the effect is still smaller than the Fed monetary policy shock. The credibility of the BI and the Fed may play a role in shaping the expectations of financial actors. The announcement of monetary policy stance by the Fed can encourage investors to make less rational decisions or to follow the consensus instead.

Although the effect of monetary policy on the existence of herding behavior in Indonesia is relatively small, policymakers still need to anticipate the extreme impact caused by herding behavior, which could have an impact on financial instability in the future. Therefore, the central bank has to take into account the volatility of asset prices, especially stock prices, when formulating its monetary policy. The volatility of asset prices can represent the investors' behavior in the stock market, especially under monetary policy announcements. For further research, it is necessary to conduct comprehensive research on how investors respond in a more microstructure manner due to changes in monetary policy, as well as other macroeconomic announcements.

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