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Max-Effect in the Indonesian Market

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Abstract: Research Question: Following the well-documented MAX-effect anomaly in different markets, we inquire whether the MAX-effect occurs in the Indonesian market. **Motivation:** The MAX-effect is the following month negative return when investors long the highest decile portfolio and short the lowest decile portfolio. The decile portfolios are sorted and created based on the stocks highest previous month daily return (Alkan and Guner, 2018; Bali, *et al.*, 2011; Seif *et al.*, 2018). The anomaly has been documented in different countries and regions, such as Australia (Zhong and Gray, 2016), Turkey (Alkan and Guner, 2018), and European countries (Walkshäusl, 2014). We conduct this study because the Indonesian market has different features from other markets, namely the relatively low proportion of the retail investors in comparison to the whole population and the limit to short-sell stocks. **Idea:** Based on the extant literature, if the MAX-effect is robust, we deduce that the MAX-effect will exist in the Indonesian market. **Data:** We create ten portfolios sorted on the maximum previous month's daily return (MAX) using the Indonesian market data from July 2013 till June 2018. **Method/Tools:** Our study utilizes descriptive statistics, Fama French Three-Factor Model, and Fama-Macbeth regressions. **Findings:** Our portfolio analysis suggests that a combination of long (short) position in high (low) MAX decile stocks will generate a raw return and a risk-adjusted (Fama-French Three-Factor) return of -1.6% per month. Also, our stock level analysis shows that MAX and market capitalization (SIZE) are negatively associated with the subsequent monthly stock return. In contrast, stock market beta (BETA) and book-to-market ratio (BM) do not significantly influence the subsequent monthly return. **Contributions:** Although the Indonesian market has different features, our study corroborates the existence of MAX-effects in different markets. We also find that the previous month MAX positively affects the current month MAX, indicating some investors' preference for lottery-type stocks.

Keywords: Market efficiency, MAX-effect, Irrational behaviour
JEL classification: G11, G12, G15

1. Introduction

A market can be categorized as efficient only when no pre-planned trading strategy can generate abnormal returns (Campos Dias de Sousa and Howden, 2015). Since the discovery of the January anomaly effect by Rozeff and Kinney (1976), various researchers have discovered several anomalies. Rozeff and Kinney (1976) studied the comparison of returns among months within a year in NYSE for more than seven decades. The study finds that

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returns in January consistently exceed other months' returns in one year. Basu (1977) found the value effect whereby stocks with a low P/E ratio tend to generate higher returns than high P/E stocks. French (1980) finds the weekend effect whereby returns on Monday tend to be negative. Banz (1981) discovers that small-capitalization stocks tend to generate higher returns than large-capitalization stocks. De Bondt and Thaler (1985) uncover the contrarian effect due to market participants' tendency to overreact against a piece of new information. Jegadeesh and Titman (1993) discover the momentum effect referring to rising asset prices tends to increase further, for investors tend to underreact to new information. Saunders (1993) also finds that weather factors affect the return on NYSE significantly.

One of the most recent anomalies that are consistent in generating an abnormal return is the MAX-effect. If we sort stocks based on their highest previous month daily return and create deciles portfolios, the MAX-effect is the negative next month return when investors long the highest decile and short the lowest decile (Alkan and Guner, 2018; Bali *et al.*, 2011; Seif *et al.*, 2018). Bali *et al.* (2011) investigate the significance of extreme positive return on the cross-sectional pricing of stocks and find the MAX-effect. If investors form portfolios of US stocks based on the maximum daily return in the past month (MAX) and long the highest MAX decile and short lowest MAX decile, they will generate an abnormal return of -0.65% per month.

Previous literature links MAX-effect's existence on the individual investors' tendency to invest in lottery-type stocks (Kumar, 2009). Lottery stocks are low-priced stocks with high idiosyncratic skewness and volatility (Brunnermeier *et al.*, 2007; Kumar, 2009). Moreover, individual investors are attracted to extreme returns, although they are rarely repeated (Barberis and Huang, 2008), and they tend to be overconfident and choose not to diversify their portfolios (Brunnermeier *et al.*, 2007). Motivated by the discovery of lottery stock's preference, Bali *et al.* (2011) try to study the effect of the previous month's MAX daily return on the subsequent return in NYSE, AMEX, and NASDAQ during January 1926-December 2005. Bali *et al.* (2011) use portfolio-level and firm-level statistical analysis. The portfolio-level statistical analysis shows that if investors hold a long position in the highest MAX decile group and short position in the lowest MAX decile group, they will get an abnormal return of -0.65% per month. The firm-level statistical analysis concludes that the MAX and market capitalization (SIZE) negatively affect subsequent monthly returns, while market beta (BETA) and book-to-market ratio (BM) positively affect the subsequent monthly return.

There have been several studies on the negative MAX-effect using portfolio-level and firm-level statistical tests in the last decade. Nartea *et al.* (2017) find a significant abnormal return of -1.03% per month using a portfolio-level test in the Chinese market. They find that MAX and SIZE show significant negative effects on subsequent return at the firm-level. The BM variable had a significant positive effect on subsequent return, and BETA does not have a significant negative effect on subsequent return. Alkan and Guner (2018) found a significant abnormal return of -0.3% per month using a portfolio-level test in the Turkish market. At the firm-level, they find that MAX and SIZE negatively affect subsequent return, while BM positively affects subsequent return, and BETA does not show a significant negative effect on subsequent return. Walkshäusl (2014) only used a firm-level statistical test in the European market. In his study, he finds that the MAX has a significant negative effect on subsequent return, while BM shows a significant positive effect on subsequent return. In contrast, BETA and SIZE do not have a significant effect on subsequent return.

Unlike the negative MAX-effect literature, Ali *et al.* (2020) find a positive MAX-effect in the Singapore market. Stocks with the highest previous month returns will generate positive returns in the current month. However, the idiosyncratic volatility effect is more dominant in the Singapore market.

It is relevant to test the MAX-effect in the Indonesian market due to several reasons. Firstly, foreign investors own about 52% of Indonesian listed stocks as of October 2018 (Kunjana, 2018). Secondly, the amount of domestic individual investors is around 1.79 million or 0.66% of the total population as of April 2019. The domestic individual investors' proportion is smaller compared to Malaysia (7.6%), Thailand (2.3%), and the Philippines (0.83%) (Jayani, 2019; SK, 2018). Finally, the short-sell transactions in the Indonesian market are allowable only for investors with a minimum initial deposit of IDR200 million and only for stocks included in the permitted list of the *Otoritas Jasa Keuangan* (OJK). Different from previous studies in other markets, our study will contribute to the MAX-effect literature in the emerging markets with small retail traders and limited arbitrage opportunity.

Based on portfolio level analysis, we find that a long position in high MAX decile and a short position in low MAX decile will generate raw and a risk-adjusted return of -1.6% per month. Our results corroborate the negative MAX-effect (Alkan and Guner, 2018; Nartea *et al.*, 2017; Walkshäusl, 2014) and do not support the positive MAX-effect (Ali *et al.*, 2020). Based on the stock level analysis, we learn that MAX and market capitalization (SIZE) are negatively associated with the subsequent monthly stock return. In contrast, stock market beta (BETA) and book-to-market ratio (BM) do not significantly influence the subsequent monthly return. Additionally, we find that the previous month MAX positively affects current month MAX significantly.

2. Research Methodology

This study utilizes all listed companies in the Indonesia Stock Exchange (IDX) during 2013-2018 as the sample. We collect daily and monthly closing prices, the number of shares, quarterly financial reports, Jakarta Composite Index (JCI) closing prices, and risk-free (SBI) rates from Bloomberg and Datastream.

We calculate portfolio returns based on equal-weighted methods. Following Fama and French (1993), this study starts in July instead of January to give each stock six months to release their financial reports. Following Bali *et al.* (2011) and Walkshäusl (2014), we use two-level analysis: portfolio-level and firm-level statistical analysis to validate MAX-effect. The portfolio-level analysis uses the t-test and Fama French Three-Factor Model. The firm-level analysis uses Fama-Macbeth regression with modified standard errors.

2.1. Fama French Three-Factor Model

The discovery of several variables besides market beta that can explain return urge Fama and French (1992) to study the explanatory power of BETA, E/P ratio, BE/ME ratio, and leverage on the return of a stock or portfolio. They find that SIZE and BE/ME could explain cross-sectional stock returns and formulate the Fama French Three-Factor Model (FF3F hereafter) as presented in Eq. (1).

$$R_i(t) - R_f(t) = a_i + b_i\left[R_m(t) - R_f(t)\right] + s_i SMB(t) + h_i HML(t) + e_i(t) \quad (1)$$

whereby $R_i(t)$ and $R_f(t)$ are return of stock i and risk-free rate at time t. $\left[R_m(t) - R_f(t)\right]$ is the market risk premium. a_i is constant; $SMB(t)$ is the difference between small and big size portfolio at time t; $HML(t)$ is the difference between high and low book to market ratio portfolio at time t; and (b_i, s_i, h_i) are independent variables' slopes.

The first step is to calculate all daily and monthly returns from all listed companies during the study period. After that, we estimate SMB and HML every month during the study period through several steps. Firstly, every June each year, all listed companies are sorted based on their market capitalization and divided into two groups, namely BIG (B) and SMALL (S).

Secondly, we classify all listed companies based on the book to market ratio and form three groups, namely HIGH (H) for the highest 30%, LOW (L) for the lowest 30%, and MEDIUM (M) for the 40% remaining companies. Thirdly, we construct six portfolios based on the intersections of two market capitalization groups and three book-to-market groups. The six portfolios formed are SL, SM, SH, BL, BM, and BH. Fourthly, we calculate all the six groups' monthly return with equal weight method. Finally, we estimate the monthly return of SMB and HML using Eq. (2) and (3).

$$SMB = \frac{SL + SM + SH}{3} - \frac{BL + BM + BH}{3} \tag{2}$$

$$HML = \frac{SH + BH}{2} - \frac{SL + BL}{2} \tag{3}$$

2.2 Portfolio-Level and Firm-Level Statistical Tests

The next step is to sort all listed companies based on their previous month's daily maximum return and divide them into ten groups. We repeat the portfolio formation every month during the observation period and calculate the MAX decile groups' monthly return. For each decile, we calculate the average monthly return and perform a t-test. We also calculate the risk-adjusted return based on FF3F for each MAX decile portfolio and the monthly return difference between high MAX decile and low MAX decile.

For the firm-level analysis, we follow Walkshäusl (2014) to conduct firm-level statistical analysis based on Eq. (4).

$$R_{i,t+1} = \alpha_0 + \alpha_{1,t}MAX_{i,t} + \alpha_{2,t}BETA_{i,t} + \alpha_{3,t}SIZE_{i,t} + \alpha_{4,t}BM_{i,t} + e_{i,t} \tag{4}$$

where $R_{i,t+1}$ is the return of each listed company on month t+1; α_0 is the constant; $\alpha_{i,t}$ represents slopes of variable i in month t. $MAX_{i,t}$ is the maximum daily return for stock i on month t. $BETA_{i,t}$ is the beta value of stock i on month t. $SIZE_{i,t}$ is the natural logarithm of the market capitalization for stock i on month t and $BM_{i,t}$ is the book to market ratio data for stock i on month t. $BETA_{i,t}$ is calculated with the same method as Walkshäusl (2014) by using time series regression between market risk premium and equity risk premium using up to sixty months of past return data (20 months minimum).

To investigate the relations between MAX, BETA, SIZE, and BM with the subsequent return, we utilize Fama-Macbeth regression with modified standard error (Eq. (5)) following Rhee and Wang (2009).

$$S.error = \frac{St.Dev.(\beta)}{\sqrt{T}}\left(\frac{1+\rho(1)}{1-\rho(1)}\right) \tag{5}$$

where $St.Dev.(\beta)$ is the standard deviation of the cross-sectional regression' slopes, T is the number of periods, and $\rho(1)$ is the first-order autocorrelation of the βs.

3. Results and Analysis

3.1. Main Results

Table 1 reports the descriptive statistics to show the characteristics of each MAX decile. The market capitalization (SIZE) tends to increase from low MAX decile to the fifth decile, then decrease until high MAX decile. Stock prices decrease almost steadily from low MAX decile

to high MAX decile. These results support the previous findings by Kumar (2009), where investors with high gambling preferences prefer to buy low priced stocks.

Table 1: Descriptive statistic – characteristics across MAX portfolios

	Low Max	2	3	4	5	6	7	8	9	High Max
Ln (size)	28.27	28.25	28.49	28.62	28.68	28.61	28.40	28.22	27.78	27.28
Stock price	737	592	567	618	594	558	508	438	354	272
B/M ratio	0.56	0.83	0.65	0.69	0.66	0.74	0.75	0.78	0.90	0.82
Max(%)	0.57	1.54	2.27	2.99	3.67	4.67	5.81	7.40	10.24	18.98
Beta	0.36	0.62	0.76	0.81	0.83	0.80	0.80	0.73	0.71	0.67

Notes: Every month, we sort all listed companies from July 2013-June 2018 based on the highest daily return in the previous month and sort them into ten portfolios (deciles). The table reports the averages natural log of market capitalization, stock prices, book to market ratio, maximum daily return, and market beta of each decile.

Book to market ratio tends to increase from low MAX decile to high MAX decile even though it is not constant increases. The market capitalization of high MAX decile, which is smaller compared to low MAX decile while the book market ratio increases from low MAX to high MAX. Fong and Toh (2014) find that book to market ratio of high MAX decile is smaller than low MAX decile while Zhong and Gray (2016) find the opposite. MAX return tends to increase gradually from low MAX decile, which is 0.57%, to the seventh decile, which is 5.81%. From the seventh decile, the growth of MAX returns suddenly jumps for each decile. The MAX returns for eighth, ninth, and tenth deciles are 7.40%, 10.24%, and 18.98%, respectively. The results are consistent with previous literature where MAX returns start to increase significantly from the seventh decile to the tenth decile.

The market BETA tends to increase from low MAX decile to the fifth decile, and then it decreases until high MAX decile. Market BETA on high MAX decile, which is 0.67, is more significant than low MAX decile, which is 0.36. This result is consistent with the previous study by Fong and Toh (2014).

Table 2: Raw returns and risk-adjusted returns (Fama-French Three-Factor alphas) of MAX portfolios.

Decile	Average Return	Three-Factor Alpha
Low MAX	0.8558%	0.4400%
2	0.8671%	0.3559%
3	0.6058%	0.0117%
4	0.8221%	0.4714%
5	0.9550%	0.3985%
6	0.9103%	0.1899%
7	0.8730%	0.3066%
8	0.9415%	0.4788%
9	1.1166%	0.7527%
High MAX	-0.7393%	-1.1736%
High – Low	-1.5950% ***	-1.6136% ***
t-test value	-3.5670	-3.1438
P-Value	0.0007	0.0027

Notes: Each month, all listed companies are formed into ten portfolios (deciles) based on the previous month's highest daily return. The lowest (highest) decile contains stocks with the lowest (highest) maximum daily return in the last month. The table shows equal-weighted monthly raw return and Fama-French Three Factor (FF3F) alphas for each decile. The last three rows report the raw return, FF3F alphas, t-test value, and p-value of the difference in raw returns and FF-3F alphas between the highest decile and the lowest decile. Significance level at 10%, 5%, and 1% are represented as *, **, and *** respectively.

Table 2 shows the raw return and risk-adjusted return for each MAX decile and the difference between high MAX and low MAX with a one-month holding period based on equal weighting portfolio formation. The raw return (risk-adjusted return) tends to slightly increase

from low MAX decile, which is 0.86% (0.44%) per month, to the ninth decile, which is 1.12% (0.75%) per month. For the tenth (High MAX) decile, the raw return (risk-adjusted return) suddenly reverse significantly to -0.7% (-1.17%) per month. The results slightly differ from previous literature, where the returns usually reverse in the ninth decile. The relatively small number of listed companies in IDX may have caused the differing results. We also find that the raw (risk-adjusted) return difference between high MAX decile and low MAX decile is -1.6% (-1.61%) per month, statistically significant at 1% level. The results prove that MAX-effect exists in the Indonesian market. Compared to previous MAX-effect literature studies, the MAX-effect that occurs in Indonesia is quite large and significant. The MAX-effect in Indonesia (-1.6% per month) is larger than the MAX-effect found in United States (-0.65%) (Bali *et al.*, 2011), China (-1.1%) (Nartea *et al.*, 2017), and South Korean (-1.37%) (Cheon and Lee, 2018).

Table 3 shows the time-series average of cross-sectional regressions' slopes and their t-stat value. We learn that MAX tends to affect subsequent return negatively and significantly, which supports the existence of MAX-effect in Indonesia. BETA tends to be negatively associated with subsequent returns but not statistically significant. Insignificant BETA to explain subsequent return is in line with the findings of Fama and French (1992), Bali *et al.* (2011), and Walkshäusl (2014).

Table 3: Firm-level Fama-Macbeth regressions of subsequent monthly return on lagged firm characteristics

Regression	MAX	BETA	SIZE	BM	R^2
1	-0.1188***				
	(-3.2559)				0.0092
2		-0.0033			
		(-0.6343)			0.0066
3			-0.0042***		
			(-2.4997)		0.0068
4				0.0003	
				(0.9957)	0.0048
5	-0.1281***	-0.0017	-0.0039***	0.0003	
	(-3.8113)	(-0.4141)	(-2.5764)	(1.1136)	0.0281

Notes: $R_{i,t+1} = \alpha_0 + \alpha_{1,t}MAX_{i,t} + \alpha_{2,t}BETA_{i,t} + \alpha_{3,t}SIZE_{i,t} + \alpha_{4,t}BM_{i,t} + e_{i,t}$

*The t statistics are calculated using the modified Fama-Macbeth standard error as explained in Rhee and Wang (2009). Significance level at 10%, 5%, and 1% are represented by asterisks of *, **, and *** respectively.*

SIZE consistently affects subsequent return negatively and significantly. The results support that the SIZE effect (Banz, 1981) occurs in the Indonesian market. BM tends to affect subsequent return positively but not statistically significant. This result does not support FF3FM, where BM should affect subsequent return positively and significantly. The relatively small average monthly HML premium (0.3%) compared to the average monthly SMB premium (1.2%) might cause differing results. It may also mean that investors in the Indonesian market pay more attention to stock market capitalization than the book to market ratio.

The results from descriptive statistics, portfolio level tests, and firm-level tests conclude that the MAX-effect exists in the Indonesian market. Although Bali *et al.* (2011) have discovered the MAX-effect and many other researchers have published this anomaly, the MAX-effect remains substantial and significant in various markets. Based on the extant literature, the MAX-effect still exists due to several reasons. First, some investors prefer lottery-type stocks with low prices, high idiosyncratic skewness, and high idiosyncratic volatility (Kumar, 2009). Second, in line with Kumar (2009), some investors prefer stocks

exhibiting extreme returns with tiny probabilities (Barberis and Huang, 2008). Third, investors who try to maximize their existing utility tend to focus too much on one stock with attention-grabbing features and not diversify their portfolios (Brunnermeier *et al.*, 2007). Fourth, the inability and unwillingness of investors to conduct short-sell transactions cause the MAX-effect to persist (Shiller, 2003).

3.2. Additional Analysis

Table 4 shows our additional analysis results based on Fama-Macbeth regressions of lagged MAX, lagged BETA, lagged SIZE, and lagged BM on MAX. The results show that lagged MAX affects MAX positively and significantly. The lagged SIZE only affects MAX significantly when tested with other independent variables simultaneously. Among all independent variables, lagged MAX has the most explanation power on the MAX (R^2 of 10.8%). The fact that the previous month's extreme daily return leads to current month extreme daily return may mean that MAX stocks attract some investors to buy the stocks. Intense buying may then lead to another stock price jump in the following month. These findings are in line with the previous studies such as Cheon and Lee (2018) and Bali *et al.* (2011) and may indicate that some investors prefer lottery-type stocks. Investors of stocks with extreme price jump will ultimately receive negative returns.

Table 4. Firm-level Fama-Macbeth regressions of MAX in the current month on lagged firm characteristics

Regression	Lagged MAX	Lagged Beta	Lagged Size	Lagged BM	R^2
1	0.3266*** (7.2548)				0.1078
2		0.0031 (0.2736)			0.0080
3			-0.0038 (-0.8754)		0.0231
4				-0.0001 (-0.1543)	0.0036
5	0.3099*** (7.1045)	0.0036 (1.0739)	-0.0032** (-1.9031)	-0.0002 (-0.4444)	0.1309

Notes: $MAX_{i,t+1} = \alpha_0 + \alpha_{1,t}MAX_{i,t} + \alpha_{2,t}BETA_{i,t} + \alpha_{3,t}SIZE_{i,t} + \alpha_{4,t}BM_{i,t} + e_{i,t}$

*The t statistics are calculated using the modified Fama-Macbeth standard error, as explained in Rhee and Wang (2009). Significance level at 10%, 5%, and 1% are represented as *, **, and *** respectively.*

4. Conclusions

Motivated by extant literature documenting MAX-effect in different markets, this study examines the MAX-effect in the Indonesian market. Following Bali *et al.* (2011) and Walkshäusl (2014), we employ portfolio-level and firm-level tests and use all listed companies in the Indonesia Stock Exchange during July 2013-June 2018. Based on both raw and risk-adjusted returns, we uncover MAX-effect in the Indonesian market that generates about -1.6% per month. Based on firm-level tests, we learn that MAX and market capitalization (SIZE) affect subsequent return variables negatively and significantly. In contrast, BETA and book-to-market ratio (BM) variables do not affect the subsequent return. Additionally, we also find that previous month MAX leads to current month MAX that may indicate some investors' preference for lottery-type stocks.

The Indonesian Stock Exchange (IDX) has implemented the Unusual Market Activity (UMA) monitoring system. When the UMA system identifies a stock with extreme price movements, IDX normally halts the stock trade to gather and distribute more management information. The existence of MAX-effect in IDX supports UMA policy implementation. However, it shows that the system must be able to differentiate between extreme stock price

movements due to manipulation or trading behaviour of investors who like lottery-type stocks.

One limitation of this study is that we only investigate MAX-effect in the Indonesian market as an aggregate. Future studies should look into the type of investors such as domestic vs. foreign, individual vs. institutional investors, and investigate who drive MAX-effect and who prefer MAX or lottery-type stocks. Moreover, we should investigate whether any type of investors will benefit from MAX or lottery-type stocks.

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