International Journal of Economics and Financial Issues

ISSN: 2146-4138

available at http: www.econjournals.com

International Journal of Economics and Financial Issues, 2018, 8(2), 148-153.

Does MAX Anomaly Exist in Emerging Market: Evidence from the Turkish Stock Market?

Ozkan Haykir*

Faculty of Economics and Administrative Science, Nigde Omer Halisdemir University, Turkey. *Email: ohaykir@ohu.edu.tr.

ABSTRACT

In this paper, I investigate a recent asset pricing anomaly proposed by Bali et al. (2011) in the Turkish stock markets during the period between January 2011 and December 2017 using univariate and bivariate sorting methodologies. Bali et al. (2011) suggest that there is a negative link between maximum daily return and future expected a return. If an investor constructs a hedge portfolio buying stocks which are in the highest maximum daily return portfolio and shorting stocks which are in the lowest maximum daily return portfolio, they get the negative payoff at the end of the next month. Results of this study suggest that the MAX anomaly does not exist in Turkish stock markets.

Keywords: MAX Effect, Extreme Return, Turkish Stock Market
JEL Classifications: G11, G12, G17

1. INTRODUCTION

Finding the determinants of the cross-section of expected stock return has been in the Centre of the Finance Literature over the last few decades. During this period, researchers have reported hundreds of cross-sectional anomalies. A recent paper was written by Bali et al. (2011) report that the maximum daily return over the past 1 month is negatively related to the subsequent stock returns in the U.S. equity market, known as “the MAX effect.” To be specific, they show that firms with the high maximum daily return over the past 1 month have associated with economically and significantly lower subsequent return compare to firms with the low maximum daily return.

There are two types of research have been conducted after the MAX anomaly is documented. A set of studies try to answer whether the MAX anomaly occurs worldwide. These studies have shown that “the MAX effect” is not only uncovered in the U.S. stock markets but also seen in the European and other stock markets. A separate strand of the literature tries to answer the question why the MAX anomaly exists. Kumar (2009) suggests that the MAX anomaly occurs due to investor preference. Maximum daily return can be used as a measure for lottery-like stocks which may lead an increase in the price of the stocks and reduced the expected future return. Filippou et al. (2017) also examine the effect of lottery-like stocks. They show that there is a link between the availability of options and lottery-like stocks which is defined as the MAX anomaly. Another paper examines the link between sentiment index and the MAX anomaly (Fong and Toh, 2014). They show that sentiment index is strongly related to MAX anomaly.

In this paper, I extend the literature and investigate the MAX anomaly in the Turkish stock market over the sample period between 2011 and 2017. As a methodology, I follow earlier studies and employ single and double sorting analyses to examine the pricing ability of the maximum daily return on subsequent stock return in the Turkish stock market. I find that the MAX anomaly does not have pricing ability in the Turkish stock market.

The contribution of this paper is to analyse the MAX anomaly in the emerging market. So far, numerous papers have studied the MAX effect around the world such as the U.S. equity market, Canadian stock market as well as European exchange markets. The importance of this study to see whether MAX effect exists in emerging market. As we know, emerging market have generally high volatility, so that the MAX effect might not be seen in the volatile markets due to its relation with idiosyncratic volatility.

There might be two reasons why we do not see a significant result of MAX anomaly in the Turkish market. The first reason might be the relaxation of short-selling constraint: The uptick rule is removed in the Turkish stock market at the beginning of 2013. Prior papers show that relaxation of short-selling constraint reduces the anomaly returns (Chu et al., 2016). The second reason might be that the MAX anomaly may not have pricing ability in the emerging markets due to the high volatility in the emerging markets.

The importance of the Bali et al. (2011) study does not only reveal a new anomaly but also its explanatory power of idiosyncratic volatility puzzle. Under the capital asset pricing model (CAPM) introduced by Sharpe (1964) and Lintner (1965), the only systematic risk is priced, since idiosyncratic risk is diversifiable and so investors should not be compensated for bearing this risk. However, Merton (1987) presents evidence that investors may be willing to hold undiversified portfolios to gain a higher expected return. Ang et al. (2006), very influential paper, claim that there is a negative link between idiosyncratic volatility and future expected return which is the opposite of what the theory says. After Ang et al. (2006) the link between idiosyncratic volatility and future expected return which is called as idiosyncratic volatility puzzle is examined a lot. Numerous papers try to solve this phenomenon and Bali et al. (2011) explain the link by the MAX anomaly. Double sorting analysis of my study shows that the MAX anomaly exists after we control for idiosyncratic volatility in the Turkish stock market. This is an evidence of the link between idiosyncratic volatility and maximum daily return.

The remainder of this paper is organised as follows. Section 2 summarises the prior related literature. Section 3 describes the data. Section 4 reports the empirical results. Section 5 summarises the chapter and offers some concluding comments.

2. PRIOR RELATED LITERATURE

Asset pricing anomalies are considered an inefficiency of the stock market. When investors do not react as they should to new information, the price of the stocks does not fully adjust itself immediately, thus financial anomalies occur. There have been plenty of studies that try to determine what should be considered financial market anomalies, since some of the anomalies disappear after a short time period or when controlling for other factors. One of the most prominent asset pricing anomalies is momentum anomaly. Jegadeesh and Titman (1993) claim that high-return recent-past stocks outperform the low-return recent-past stocks, and this holds in different market conditions and asset classes (e.g., Asness et al., 2013).

Not only historical stock data but also corporate finance information is used to predict subsequent stock returns. Sloan (1996) shows that low-accrual firms earn higher returns. Hirshleifer et al. (2004) document that stocks with low net operating assets outperform stocks with high net operating assets. Titman et al. (2004) show that increasing capital investment brings negative returns. Fama and French (2006) find that earnings can be used to estimate stock returns. Cooper et al. (2008) document that asset growth is one of the important components in predicting cross-sectional stock returns. Contrary to the capital asset pricing model (CAPM), Ang et al. (2006) document that low idiosyncratic volatility firms earn higher returns than high idiosyncratic volatility firms.

The scope of this paper is to investigate recent financial anomaly which is proposed by Bali et al. (2011), the MAX anomaly. They show that there is a negative link between maximum daily return and future expected a return. MAX strategy suggests buy (long) with highest past maximum daily return performance stocks and sell (short) with lowest past maximum daily return performance stocks. Because of this trading strategy, the long-minus-short portfolio should earn negative profits in the subsequent month for the investor.

Following Bali et al. (2011) study, other researchers examine this new anomaly around the world. Annaert et al. (2013) and Walkshausl (2014) investigate the pricing ability of MAX anomaly in the European stock markets. Nartea et al. (2014) investigate the MAX anomaly in the South Korean market and Aboulamer and Kryzanowski (2016) extend the research using Canadian stock market. Zhong and Gray (2016) investigate the MAX anomaly in the Australian stock markets and found a statistically significant negative relation between maximum daily return and future expected a return. In addition to these researchers, Aziz and Ansari (2017) paper uses the opposite of the MAX anomaly and examine whether the minimum daily return has a pricing ability to explain future expected return using Indian stock market. As mentioned earlier, other sets of studies investigate why there is MAX anomaly and find that the MAX anomaly is related to lottery-like characteristics, sentiment index and options market.

3. DATA

My data covers the period from January 2011 to December 2017. My main sample comprises the stocks which are listed on the BIST 100 index in the period of 2017. The choice of the sample period is designed to avoid the effect of financial crises prior to 2010.

I use two sources of data in this analysis. Daily and monthly price, return, volume, the return of BIST 100 and risk free rate (10 years Treasury bond is used as a proxy for risk free rate) data are taken from the investing.com. Isyatirim is used to download the book value and share outstanding of the companies to construct book-to-market ratio and market capitalisation.

The variable definitions are as follows:
MAX is defined as the maximum daily return and constructed by using 1-5 days average of the highest maximum daily returns for each stock i on month $t-1$.

Market Capitalisation (MC) is calculated by the share outstanding multiply by the stock price in month $t-1$.

The book-to-market ratio is defined as the book value of equity divided by market value of equity in month $t-1$.

Amihud (2002) measure is constructed to capture the illiquidity of stocks. It is defined as the monthly average of the ratio of the absolute return of a stock divided by its volume traded in dollars and interpreted as the price change per dollar of trading volume.

Momentum defined as the cumulative return on stock *i* from month *t*-12 to *t*-2.

Reversal is defined as the lagged return for stock *i*.
Idiosyncratic volatility is measure using capital asset pricing model (CAPM).

$$R_{it}-rf_t = \beta_0+\beta_1*Mrktprem_t+\varepsilon_{it} \quad (1)$$

Where $R_{it}-rf_t$ is the daily excess return on stock *i* in time *t*, $Mrktprem_t$ is the daily market risk premium in time *t*. I estimate the CAPM model by OLS and use the standard deviation of the residuals as my estimate of IVOL within a month: $IVOL_{it} = \sqrt{Var(\varepsilon_{it})}$.

After I define the variables that are used in this analysis, I report the summary statistics for each MAX portfolios. Stocks are divided in to decile portfolios in month *t* based on the highest daily maximum return over the previous month *t-1*. I then calculate the average of the median values of each variable; namely market capitalisation, price, book-to-market, Amihud, momentum, reversal and IVOL for each portfolio.

Table 1 reports the summary statistics of the decile portfolios. The sample includes stocks which are listed on the BIST 100 in 2017 from January 2011 to December 2017. We can see that high MAX portfolio consists smaller market capitalisation, lower market-to-book ratio, higher price, higher IVOL, liquid, high momentum and reversal stocks. We could expect to see that high MAX portfolio consists smaller market capitalisation and higher momentum, reversal and IVOL stocks; however, it is surprising that stocks in the high MAX portfolio are liquid and have a lower book-to-market ratio. Smaller market capitalisation means high MAX portfolio form by smaller companies.

4. EMPIRICAL RESULTS

I follow earlier studies and implement univariate and bivariate sorting analyses to analyse whether MAX anomaly have pricing ability in the Turkish stock market.

4.1. Univariate Analysis

First of all, I conduct the single sorting analysis. Stocks are divided into decile (in Panel A) and quintile (in Panel B) portfolios based on the maximum daily return (MAX) over the previous 1 month. After dividing stocks into decile and quintile portfolios equal and value-weighted average monthly portfolio returns are calculated. The low max group consists the lowest maximum daily return stocks and high max group consists the highest maximum daily return stocks during the previous 1 month. The last row of each panel represents the average raw return difference between high and low MAX return portfolios. I use Newey and West (1987) robust t-statistics.

Table 2 reports the univariate portfolio sorting analysis results. Panel A shows the results of the decile portfolios and Panel B present the results of the quintile portfolios. In both panels, the surprising result can be seen in the last row of each panel that the buying high MAX stocks and shorting low MAX stocks is positive but it is not statistically significant in both equal and value-weighted portfolio returns. We also see that when I use decile portfolios, the low MAX portfolio earn insignificant subsequent returns but the high MAX portfolio exhibits significant result at 10% level of significance.

I follow the prior literature and construct maximum daily return based on multiple days. I define MAX as an average of *N* (n = 1, 2, 3, 4 and 5) highest daily return over the previous 1 month. For example, MAX (n = 3) refers to the average of the three highest daily return of a stock *i* on month *t-1*. I sort stocks in to decile portfolios based on the average of MAX variables. I then calculate the equal and value-weighted average of each portfolio. Each column represents the different construction of MAX return (n = 1-5).

Table 3 presents the results of the univariate sorting analysis with a different construction of maximum daily return. We could see that in both panels the high-low portfolio returns are positive and statistically insignificant.

Overall, the univariate portfolio sorting analysis shows that MAX anomaly does not price in the Turkish stock market. Constructing portfolios by buying a highest maximum daily return and shorting a lowest maximum daily return over the previous 1 month is not associated with a negative return in the subsequent month as Bali et al. (2011) suggested. One of the reason might be that the regulation change at the beginning of 2013 which coincides with my sample periods.

4.2. Bivariate Sorting Analysis

In this section, the link between future expected returns and the maximum daily returns is investigated after controlling for market

Table 1: Summary statistics

Decile	MAX	MC (in millions)	Price	Book-to-market	Amihud	Momentum	Reversal	IVOL
1	1.69	847.50	3.64	0.99	0.28	7.38	−3.07	1.27
2	2.34	1128.75	4.37	0.92	0.19	7.25	−1.75	1.28
3	2.73	1229.83	4.57	0.92	0.20	11.24	−0.93	1.32
4	3.14	1736.86	4.84	0.93	0.18	10.65	−0.97	1.32
5	3.52	1759.14	5.47	0.87	0.16	13.24	0.35	1.33
6	3.93	1497.25	5.05	0.94	0.16	11.29	1.17	1.39
7	4.50	1851.61	5.53	0.85	0.16	15.21	1.51	1.45
8	5.26	1184.92	5.45	0.89	0.17	18.61	3.76	1.52
9	6.78	842.60	5.00	0.79	0.21	21.35	4.82	1.73
10	11.20	649.32	4.01	0.66	0.18	23.77	9.41	2.16

Table 2: Returns on Max Decile and Quintile

Decile	EW portfolios: Average return	EW portfolios: T-statistics	VW portfolios: Average return	VW portfolios: T-statistics	Average max
Panel A: Decile portfolios					
Low MAX	0.650	0.97	0.992	1.59	1.75
2	1.638**	2.64	1.304*	1.80	2.41
3	1.493***	2.83	1.242**	2.32	2.83
4	1.435**	2.59	1.265	1.86	3.22
5	1.551**	2.48	1.433**	2.06	3.62
6	1.922***	2.67	0.867	1.23	4.07
7	1.618**	2.36	0.935	1.27	4.69
8	1.882**	2.60	1.567*	1.92	5.50
9	1.927***	2.91	1.719***	2.85	7.14
High Max	1.689*	1.87	1.688*	1.84	12.99
High - Low	1.039	1.26	0.695	0.76	
Panel B: Quintile Portfolios					
Quintile					
Low MAX	1.193*	1.96	1.068	1.65	2.09
2	1.483***	2.96	1.368**	2.29	3.03
3	1.764***	2.73	0.938	1.42	3.85
4	1.771***	2.68	1.110	1.49	5.09
High max	1.801***	2.69	1.923***	3.14	9.93
High - low	0.608	1.35	0.855	1.23	

*I use Newey and West (1987) robust t-statistics which are reported. *,**,***Present the statistical significance at 10, 5, and 1%, respectively

Table 3: Returns on multi-day Max Decile and Quintile

Decile	n=1	n=2	n=3	n=4	n=5
Panel A: Equal-weighted portfolio return					
Low MAX (N)	0.650	0.725	1.043	0.954	0.744
2	1.638	1.556	1.131	1.330	1.397
3	1.493	1.762	1.799	1.461	1.395
4	1.435	1.741	1.729	2.060	1.995
5	1.551	1.387	1.784	1.684	1.793
6	1.922	1.762	1.701	2.039	2.010
7	1.618	1.835	1.725	1.576	1.605
8	1.882	1.507	1.662	1.480	2.017
9	1.927	2.054	1.972	1.845	1.542
High MAX (N)	1.689	1.647	1.574	1.595	1.561
High - low	1.039 (1.26)	0.922 (1.11)	0.532 (0.69)	0.641 (0.80)	0.818 (1.10)
Panel B: Value-weighted portfolio return					
Low MAX (N)	0.992	0.647	0.818	0.933	0.613
2	1.304	1.404	1.460	1.031	1.126
3	1.242	1.360	1.056	1.331	1.278
4	1.265	1.533	1.540	1.540	1.704
5	1.433	0.812	1.220	1.082	1.403
6	0.867	1.005	1.118	1.346	1.387
7	0.935	1.395	0.991	0.822	0.641
8	1.567	1.226	1.152	0.940	1.355
9	1.719	1.828	1.834	1.671	1.429
High MAX (N)	1.688	1.212	1.048	1.389	1.507
High - low	0.695 (0.76)	0.565 (0.71)	0.230 (0.29)	0.456 (0.54)	0.894 (1.04)

*I use Newey and West (1987) robust t-statistics which are reported in parenthesis. *,**,***Present the statistical significance at 10, 5, and 1%, respectively

capitalisation (MC), the book-to-market ratio (BM), momentum return (MOM), short-term reversal return (REV), illiquidity (ILLIQ) and idiosyncratic volatility (IVOL). Stocks are divided in to two portfolios based on the control variables.[1] Then in each portfolio, I sort stocks in to quintile based on the maximum daily return. So, in total, I have 10 portfolios (2*5). To be consistent with Bali et al. (2011), I report the equal and value-weighted average of portfolio returns average across the control variable portfolios to present the average raw return in MAX portfolios. In other words, I have lowest maximum daily return from two control variables portfolios in the low MAX portfolio. By doing this, I control for variation in control variables and get the effect of MAX on future expected returns.

Table 4 reports the results of the double sorting analysis. Equal and value-weighted average quintile portfolio returns are presented in Panels A and B, respectively. Each column represents different control variables. The last row in each panel represents the

1 I do not have sufficient stocks in each portfolio if I use decile, therefore I decide to use quintile to have enough observation to complete my analysis in each portfolio.

Table 4: Double sorting analysis

Quintile	MC	BM	MOM	REV	ILLIQ	IVOL
Panel A: Equal-weighted portfolios						
Low MAX	1.542	1.378	1.139	1.551	1.556	1.553
2	1.180	1.302	1.578	1.440	1.359	1.779
3	1.832	1.774	1.711	1.382	1.391	2.095
4	1.952	1.669	2.122	1.732	1.855	1.694
High MAX	1.400	1.812	1.363	1.847	1.794	0.654
High - low	-0.146 (−0.30)	0.434 (0.89)	0.223 (0.51)	0.296 (0.55)	0.238 (0.44)	−0.899** (−2.22)
Panel B: Value-weighted portfolios						
Low MAX	1.463	1.436	1.109	1.483	1.152	2.398
2	0.799	1.286	1.330	0.918	1.151	2.091
3	1.477	1.507	1.367	1.729	0.414	2.901
4	1.787	0.978	1.378	1.300	1.288	2.574
High MAX	1.267	1.607	1.215	1.590	1.420	1.284
High - low	−0.196 (−0.41)	0.171 (0.34)	0.106 (0.19)	0.106 (0.21)	0.268 (0.46)	−1.114* (−1.89)

*I use Newey and West (1987) robust t-statistics which are reported in parenthesis. *,**,***Present the statistical significance at 10, 5, and 1%, respectively

difference between the average raw returns of portfolios high to low. Double sorting analysis does not affect much of my results. I still have insignificant results of high-low hedge portfolios in both panels. But the high-low portfolio return becomes negative when I control for market capitalisation which may tell us there is a link between the size of the stocks and maximum daily returns, but it is still statistically insignificant. On the other hand, in the last column (controlling by IVOL), I have a statistically significant high-low portfolio returns at 5 and 10 per cent level of significance in Panels A and B, respectively. The coefficient is negative which means there is a negative relation between maximum daily return and future expected a return after controlling idiosyncratic volatility.

5. CONCLUSION

Stock market anomalies are one of the most popular topics in the finance literature. There are numerous of stock markets anomalies are reported over the last decades. In the recent paper, Bali et al. (2011) suggest that there is a link between maximum daily return in month *t-1* and subsequent expected return in month *t* which is known as "the MAX effect" Specifically, they show that the maximum daily return in month *t-1* is negatively associated with returns in month *t* in the U.S. equity markets. If an investor constructs a hedge portfolio by buying a highest maximum daily return portfolio stocks and shorting a lowest maximum daily return portfolio stocks in month *t-1*, an investor should bear a loss around 1% in the month *t*. This relation also consistent in other markets such as European and Canadian markets.

In this study, I examine the MAX effect in the Turkish stock market. Unlike earlier research, I do not find any significant results in my analysis. I first conduct univariate portfolio sorting analysis. Stocks are sorted in to decile and quintile and an equal and value-weighted average of raw return of each portfolio is calculated. The results of single portfolio sorting analysis indicate that "the MAX anomaly" does not have pricing ability in the Turkish market. I then change my strategy to construct maximum daily return based on the average of multiple-days in the month *t-1*. To be specific, I use 1-5 days average maximum daily return to construct MAX anomaly. However, results do not change. Finally, I conduct double sorting analysis by controlling the variables that may have an impact on the MAX anomaly such variables are market capitalisation, book-to-market, momentum return, short-term reversal, Amihud illiquidity measure and idiosyncratic volatility. The results of double sorting analysis also support the single portfolio sorting analysis and confirm that MAX anomaly does not exist in the Turkish stock market.

The reason why the MAX anomaly does not exist in the Turkish market may depend on the change in the regulation at the beginning of 2013. Uptick rule is removed by the Turkish government. This change allows the investor to do short selling in the stock markets which may eliminate the pricing ability of the MAX anomaly.

REFERENCES

Aboulamer, A., Kryzanowski, L. (2016), Are idiosyncratic volatility and MAX priced in the Canadian market? Journal of Empirical Finance, 37, 20-36.

Amihud, Y. (2002), Illiquidity and stock returns: Cross-section and time-series effects. Journal of Financial Markets, 5(1), 31-56.

Ang, A., Hodrick, R., Xing, Y., Zhang, X. (2006), The cross-section of volatility and expected returns. The Journal of Finance, 61(1), 259-299.

Annaert, J., De Ceuster, M., Verstegen, K. (2013), Are extreme returns priced in the stock market? European evidence. Journal of Banking and Finance, 37(9), 3401-3411.

Asness, C.S., Moskowitz, T.J., Pedersen, L.H. (2013), Value and momentum everywhere. The Journal of Finance, 68(3), 929-985.

Aziz, T., Ansari, V.A. (2017), Are extreme negative returns priced in the Indian stock market? Borsa Istanbul Review, Forthcoming, 12(45), 1-14.

Bali, T.G., Cakici, N., Whitelaw, R.F. (2011), Maxing out: Stocks as lotteries and the cross-section of expected returns. Journal of Financial Economics, 99(2), 427-446.

Chu, Y., Hirshleifer, D., Ma, L. (2016), The causal effect of limits to arbitrage on asset pricing anomalies. Available from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2696672

Cooper, M., Gulen, H., Schill, M. (2008), Asset growth and the cross-section of stock returns. The Journal of Finance, 63(4), 1609-1651.

Fama, E., French, K. (2006), Profitability, investment and average returns. Journal of Financial Economics, 82(3), 491-518.

Filippou, I., Garcia-Ares, P.A., Zapatero, F. (2017), Demand for lotteries: The choice between stocks and options. Available from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3016462.

Fong, W.M., Toh, B. (2014), Investor sentiment and the MAX effect. Journal of Banking and Finance, 46, 190-201.

Hirshleifer, D., Kewei, H., Teoh, S., Zhang, Y. (2004), Do investors overvalue firms with bloated balance sheets? Journal of Accounting and Economics, 38, 297-331.

Jegadeesh, N., Titman, S. (1993), Returns to buying winners and selling losers: Implications for stock market efficiency. The Journal of Finance, 48(1), 65-91.

Kumar, A. (2009), Who gambles in the stock market? The Journal of Finance, 64(4), 1889-1933.

Lintner, J. (1965), The valuation of risky assets and the selection of risky investments in stock portfolios and capital budgets. Review of Economics and Statistics, 47, 13-37.

Merton, R. (1987), A simple model of capital market equilibrium with incomplete information. The Journal of Finance, 42(3), 483-510.

Nartea, G.V., Wu, J., Liu, H.T. (2014), Extreme returns in emerging stock markets: Evidence of a MAX effect in South Korea. Applied Financial Economics, 24(6), 425-435.

Newey, W.K., West, K.D. (1987), Hypothesis testing with efficient method of moments estimation. International Economic Review, 28(3), 777-787.

Sharpe, W.F. (1964), Capital asset prices: A theory of market equilibrium under conditions of risk. The Journal of Finance, 19, 425-442.

Sloan, R.G. (1996), Do stock prices fully reflect information in accruals and cash flows about future earnings? The Accounting Review, 71(3), 289-315.

Titman, S., Wei, J., Xie, F. (2004), Capital investments and stock returns. The Journal of Financial and Quantitative Analysis, 39(4), 677-700.

Walkshausl, C. (2014), The MAX effect: European evidence. Journal of Banking and Finance, 42(1), 1-10.

Zhong, A., Gray, P. (2016), The MAX effect: An exploration of risk and mispricing explanations. Journal of Banking and Finance, 65, 76-90.