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Vacillating Behavior of TOM Effect and Adaptive Market Hypothesis: A Firm Level Evidence from Emerging Stock Market of Pakistan

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ABSTRACT

Through the current study we amplify the available literature on AMH (Adaptive Market Hypothesis) and calendar anomalies because this is the first study of its nature which links TOM effect with AMH which allows the behavior of conventional TOM-effect to swing over time. To fulfill the drive, study investigates daily mean return from PSX of Pakistan using data of 107 firms individually over a longer period of time ranging 1996-2015. To discover the time variation in the levels of predictability of TOM returns, study uses four different sub-samples covering identical length of observations of five years each to investigate how TOM effect has performed over time. There are few studies in the literature investigating TOM effect at firm level and very rare studies examining TOM effect through (AMH), so the current study may be of importance and interest to finance researcher, academicians and practitioners alike. To elucidate the volatility and its varying nature, the study applies GARCH (1,1) regression model which enables for time-variation in volatility of security returns. Kruskal-Wallis test-statistic is used to handle non normality in the equity return series. We find that with the passage of time performance of TOM effect evolves, consistent and aligned with the assertion of AMH. Finally, this study exhibits that behavior of TOM effect is well elucidated by Adaptive Market Hypothesis (AMH) than conventional Efficient Market Hypothesis (EMH). The results may be used for better decision making for investors and the article complements studies on market efficiency and TOM effect in developing and developed countries.

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1. Introduction

Through investigation of capricious levels of renowned turn of the month (TOM), the article tries to enhance prevailing literature on Adaptive Market Hypothesis (AMH) proposed by (Lo, 2004). TOM effect/anomaly is referred to a time period "starts from the last trading-day of the current month to the first three trading-days of the next month". The anomaly produces nosily high average returns around the TOM in stock exchanges which cast serious ambiguity on the validation of market efficiency. The notion of market efficiency and Efficient Market Hypothesis (EMH) depicts independence of stock prices under the umbrella of weak form efficiency hence returns are unforeseeable (Fama, 1970). When the prices of stocks are dependent, the investors can use the historical information of past trading to predict and gain abnormal returns. According to (Halari, 2013; Hashmi, 2014; Shahid & Mehmood, 2015), stock returns display serial correlation and profitable opportunities do exist in the market which contradicts EMH. Hence TOM effect prevails in the markets especially in emerging stock markets. Absolute perfect efficiency is not possible for a stock market. If market is perfectly efficient there would be no profitable opportunities exist in the market, threfore, market participants will have no advantage to collect costly information (Grossman & Stiglitz, 1980). By keeping in view the argument of (Grossman & Stiglitz, 1980) of "impossibility of perfectly efficient market", Campbell et al. (1997) proposes the idea of "relative efficiency" rather "perfect efficiency" which encourages the researchers to measure market efficiency from an all-or-nothing stance to measure levels of market efficiency (Shahid & Sattar (2017).

In Pakistan, researchers (Abdul, Hung-Chun, & Fakhar-un-Nisa, 2011; Sania & Rizwan, 2014) in their latest studies render proof about inefficiency of Pakistani stock markets. Whereas other studies elucidate efficiency of Pakistani equity markets. Weak form efficiency of PSX is investigated by (Nisar & Hanif, 2012) where they support weak form efficiency through monthly return data. In similar fashion Rabbani et al. (2013) conclude PSX as weak form efficient during 1999-2001 and 2005-2007. Whereas (Riaz, Hassan, & Nadim, n.d) suggest the market efficiency alters with application of different tests that means efficiency of market may changes occasionally. Therefore, about efficiency and inefficiency of markets conflicting views have been presented. Exploration of efficiency of stock market using AMH is necessary which defines that efficiency (return predictability) alters over time. A new model is proposed by Lo (2004) namely "Adaptive Market Hypothesis (AMH)" to include varying degree of return predictability. It ease market anomalies to coexist with market efficiency. AMH facilitates efficiency of markets to evolve over time. According to AMH model, market efficiency is an "ever changing phenomenon" based upon conditions of environment and players of market. In addition, AMH illustrates market efficiency is not a warranted outcome as arbitrage opportunities for gaining extra ordinary profit is occasionally. According to Urquhart (2013), early studies are evident of market inefficiency and efficiency based on pre-determined time frames while trading environment in the market may variates over time producing fluctuations in efficiency over time which is consistence with AMH (Shahid & Sattar, 2017; Shahid et al., 2018). The paper examines whether AMH is better explanation of behavior of TOM effect comparing to conventional EMH at firm level in Paistan as currently AMH is drawing more attention. Moreover, individual investors and security organizations may be benefitted for even better forecasting and clear understanding of market by the conclusions of the study. From January 1996 to December 2015, individual firms trading on PSX have been chosen. For subsample analysis, a fixed five-year length of sample is used to analyze TOM effect behavior.

The paper will result in enhancement of available literature on AMH and calendar anomaly (TOM). Exploration of changing behavior of TOM effect is leveraged by sub-sample analysis on the whole period of study. However, according to (Urquhart & Hudson, 2013; Shahid & Sattar 2017), selection of sub-samples and range of size are subjective in nature. To study how TOM effect will perform overtime, the data is split into four subsamples with same length of 5 year. Sub-samples render reasonable observations to yield authentic results that allow thorough examination of varying degree of TOM effect. So we enrich literature on AMH by satisfying the broken thread of varying degree of TOM effect by AMH in vide infra ways: Firstly, it is the first study which explores abnormality of TOM effect with AMH that allows behavior of returns regarding the TOM effect to vary over the time. Secondly, this

is the first study that explores the performance of TOM effect at firm level based on AMH. Finally, the paper analyses behavior of TOM effect by applying a GARCH (1,1) regression model which eases the unstable nature of volatility in equity returns. Moreover, Kruskal-Wallis test statistic is used to leverage the non-normal behavior of stock return data. The results of this study depicts that behavior of TOM effect gradually varies with time as performance of this effect changes from time to time and persistent with AMH. The article proposes that AMH is good explanation of behavior of TOM effect comparing to traditional EMH.

2. Literature Review

Based on the strong agreement exists in earlier research (Lakonishok & Smidt, 1988; McConnell & Xu, 2008), TOM (the turn of the month) is defined as "a time period starts from the last trading-day of the current month to the first three trading-days of the next month". At the month end investors start selling of shares therefore, they look for optimistic/positive changes in upcoming month. This anomaly is defined as nosily high average returns around the TOM in the equity exchange markets. According to Camptom et al. (2006) TOM effect is the most popular and important anomaly among other kinds of calendar patterns and different researchers document this effect in national and international equity markets. In NYSE, TOM effect is first documented by Ariel (1987) over the period from 1963 to 1981, where he finds that last day of the current and first nine days of the subsequent month exhibit greater average and statistically significant returns as compared to the rest of days of month. Ariel (1987) finds 0.47% return around the turn of the month (TOM) as compared to 0.061% during any other four days period. Likewise, DJIA index is investigated by Lakonishok and Smidt (1988) over the period of years 1897-1986 and detect eight times greater average returns around TOM trading days as compared with other normal trading days of the month. This analysis of Lakonishok and Smidt (1988) is further extended by (Cadsby & Ratner, 1992) in other countries. It is found that TOM effect is present in UK, Switzerland, Germany, Canada and Australia, while stock markets of Japan, Hong Kong, Italy and France are not evident of TOM effect. Agrawal and Tandon (1994) examine TOM effect in 18 countries from 1970-1987 and find that only 14 countries are evident of TOM-effect including most emerged exchanges of Japan (Nikkei), UK (FT30) and USA (DJIA). Hensel and Ziemba (1996) examine investment in the S&P500-Index on TOM days and in T-bills over the other days. They report that the turn-of-the-month strategy outperformed a baseline strategy by 0.63% per year over the period 1928-1993".

With the application of several tests, Wong at al. (2006) investigate TOM effect and find that it exhibits greater positive returns as compared to other trading-days of the month. By taking daily equity returns calendar anomalies are investigated by Silva (2010) over the period from 1989 to 2008 in Portuguese stock exchange. With the application of OLS, significant positive returns are observed on last and first 5 days of the month. Also, exchange traded funds and S&P 500-index exhibit highest returns around TOM (Chen & Chua, 2011). Ehsan (2012) describes that psychology of the investors directs the calendar anomalies at PSX. She finds positive and statistically significant TOM in daily returns over the period of 2002 to 2004. But the small sample size of the study is the basic limitation of her research work. From 1991 to 1997, Zafar et al. (2012) examine the presence of TOM effect at KSE-100 index of PSX. They find the TOM anomaly in the full as well as in certain sub periods like during 1991-1993 and 2002-2005. The time variation in the behavior of TOM effect is against the assumptions of EMH and supports AMH.

3. Data and Methodology

In this study, we consider the daily stock returns of listed firm on PSX to investigate the effect of TOM and to gauge its influence over the time. The final sample consists of 107 listed firms for which the 20 years data from January 1996 to December 2015 is available and obtained. The individual firm data is more suitable to examine the behavior of TOM effect as compared to stock exchange indices. Thus, the analysis provides a more accurate indication of whether equity returns are useful to investors on TOM and whether this effect has a cyclical nature of efficiency.

Table-1. Full sample period (1996-2015) descriptive of TOM-effect

	Mean	Std. Deviation	t-statistic	W-statistic
TOM	0.1134	0.138	7.185***	53.641***
Non-TOM	0.0127	0.0444		

Where *** show significance level at 1% level.

The regression equation is as under:

$$R_t = c + \beta D_t + \varepsilon_t, \qquad t = 1, \dots, T$$

Where R_t represents the individual stock return, D_t represents indicator of TOM effect as adopted by (Urquhart & McGroarty, 2014; Shahid & Sattar, 2017), while ε_t is the error term.

To investigate the existence of TOM effects on the Pakistan Stock Exchange, instead of using simple least squares regression (OLS), this study uses the GARCH (p, q) model proposed by (Bollerslev, 1986). In our analysis, we use the GARCH (1, 1) regression model because the GARCH (1, 1) model is the suitable and simplest model for the measurement of volatility and is the commonly used and applied in the literature (Engle, 2001). GARCH (1, 1) model "enables researchers to model volatility based on past variance and error, rather than fixed through the series (Urquhart & McGroarty, 2014)". To gauge the time variant behavior of each sample firm, in this study, we use the GARCH (1, 1) model as under:-

$$h_t = \beta_0 + \beta_1 \varepsilon_{t-1}^2 + \theta h_{t-1}$$

For each firm's return at time t, h_t represent the conditional variance, h_(t-1) symbolizes the conditional variance of each firm's stock return at time t-1. β_0,β_1 & θ represent the parameters of GARCH (1,1) regression. The GARCH model is a suitable model and has the potential to capture the desirable characteristics of stock market returns, but it is not suitable to capture the non-normality function of yield regions. Due to this reason, we use a non-parametric Kruskal-Wallis (K.W) test to examine predominant sensitivity of population to difference in mean and whether the population has identical distributions from which the samples are drawn. Thus, we investigate the mean differences in the stock returns around TOM and on non-TOM days so that;

$$H = \left(\frac{12}{N\,(N+1)} \sum_{j=1}^{k} \frac{R_j^2}{n_j} \right) - 3(N+1)$$

Where total number of observations is denoted by N, k represents the number of groups, n_j shows the total observations, R_j^2 denotes the average rank of observations in the jth group. Therefore, to test how the TOM effect actually varied through time, we apply the Kruskl – Wallis test and the GARCH regression model in the full-sample as well as fixed-length subgroups. We divide our data into sub-samples for a period of 5 years, thus generating 4 sub-examples of identical lengths to estimate the

Table-2. Full sample period (1996-2015), Mean Returns on non-TOM days and TOM days for sample firms

TOM Effect	Firms	Mean	Firms	Mean	Firms	Mean	Firms	Mean
TOM	PK:ABB	0.174	PK:DEG	0.258	PK:JIN	0.199	PK:TLM	0.232
Non-TOM		0.024		-0.008		0.039		-0.067
TOM	PK:ADI	0.21	PK:ETU	0.082	PK:KIE	0.28	PK:PTC	0.244
Non-TOM		0.009		0.064		-0.091		0.025
TOM	PK:AGR	0.052	PK:ERO	0.279	PK:KRM	-0.077	PK:PSM	0.064
Non-TOM		0.077		-0.003		0.025		-0.028
TOM	PK:AGT	0.171	PK:FSM	-0.009	PK:KWG	-0.055	PK:LAK	0.155
Non-TOM		0.044		0.056		0.053		0.089

TOM	PK:ACB	0.323	PK:FAU	0.271	PK:KNR	0.26	PK:PCT	0.336
Non-TOM		-0.026		-0.004		-0.01		-0.02
TOM	PK:ATH	0.047	PK:FZM	0.052	PK:LDP	0.109	PK:POC	0.106
Non-TOM		0.113		0.023		-0.026		-0.024
TOM	PK:ATR	0.15	PK:FEC	0.076	PK:MLC	0.32	PK:RMP	0.025
Non-TOM		0.026		0.011		-0.036		0.09
TOM	PK:BKP	0.097	PK:NAK	-0.001	PK:MBK	0.286	PK:RUP	-0.02
Non-TOM		0.012		0.025		0.021		-0.026
TOM	PK:BAP	0.114	PK:GAI	0.067	PK:MIR	-0.066	PK:STM	-0.018
Non-TOM		0.084		0.021		0.056		0.001
TOM	PK:BHA	-0.012	PK:GTR	0.166	PK:MRB	0.064	PK:CCB	0.191
Non-TOM		0.05		0.037		0.094		-0.091
TOM	PK:BOC	0.029	PK:GWC	-0.084	PK:NAR	0.25	PK:SAN	0.099
Non-TOM		0.054		0.021		-0.014		-0.007
TOM	PK:CAL	0.424	PK:GLT	0.201	PK:NPK	0.093	PK:HPN	0.063
Non-TOM		-0.081		0.003		0.092		0.027
TOM	PK:CPB	0	PK:GRY	0.057	PK:NAT	0.11	PK:SPP	0.254
Non-TOM		0.032		0.019		-0.046		0.025
TOM	PK:CTC	0.277	PK:GUL	0.122	PK:NHT	0.183	PK:SAP	0.097
Non-TOM		-0.022		0.021		0.03		0.036
TOM	PK:CSA	0.158	PK:GSM	0.002	PK:NON	-0.139	PK:SEA	0.122
Non-TOM		0.015		-0.026		0.074		0.078
TOM	PK:CTX	0.037	PK:HAB	0.233	PK:ORI	0.082	PK:SER	0.074
Non-TOM		0		-0.005		0.004		0.046
TOM	PK:CYA	0.116	PK:MET	0.164	PK:PAC	0.176	PK:SHA	0.019
Non-TOM		0.049		0.037		0.015		0.034
TOM	PK:DAC	0.178	PK:HSM	0.264	PK:PET	0.172	PK:SCM	-0.208
Non-TOM		-0.072		-0.004		0.025		0.052
TOM	PK:DAE	0.013	PK:HAE	0.206	PK:PSM	0.203	PK:SHJ	0.005
Non-TOM		-0.011		-0.027		0.038		0.026
TOM	PK:DAN	0.165	PK:HPM	0.054	PK:PNC	-0.096	PK:SHK	-0.067
Non-TOM		-0.046		0.064		0.094		0.033
TOM	PK:DDH	0.278	PK:HUB	0.367	PK:PEN	0.014	PK:PBS	0.219
Non-TOM		0.016		-0.047		0.079		-0.011
TOM	PK:DAW	0.204	PK:HUF	0.16	PK:PAL	0.058	PK:SIT	0.051
Non-TOM		0.037		0.029		-0.013		0.037
TOM	PK:DKT	0.06	PK:ICI	0.229	PK:PNS	0.214	PK:SON	0.184
Non-TOM		-0.06		-0.027		0.023		0.009
TOM	PK:DMT	0.094	PK:IMO	0.136	PK:POF	0.33	PK:SNG	0.231
Non-TOM		-0.064		0.066		0.002		-0.037
TOM	PK:DES	0.032	PK:INI	0.092	PK:PRE	0.185	PK:SUI	0.24
Non-TOM		-0.071		0.044		-0.009		-0.023
TOM	PK:DSM	-0.171	PK:ASB	0.051	PK:PSO	0.194	PK:TRP	-0.549
Non-TOM		-0.005		-0.048		-0.004		0.095
TOM	PK:DEW	-0.105	PK:JAV	0.033	PK:PSC	-0.002		
Non-TOM		-0.056		0.018		-0.008		

adaptive nature of equity returns. But, Urquhart and Hudson (2013) claim that the selections, choice, or size range of sub-samples is of a subjective nature. Thus the 5-year sub-sample contains an adequate set of observations to provide reliable and sufficient results to investigate the behavior of the TOM effect on how the abnormal effect behaves / performs over time. The above discussed empirical tests are employed on the 20 years (ranging from January 1996 to December 2015) equity returns of 107 firms (are available and in the possession of author which may be provided on demand.) listed on Pakistan Stock Exchange (PSX). The equity returns are calculated as under:-

$$r_t = [\ln(P_t)/\ln(P_{t-1})] \times 100$$

For each firm's return at time t, ln(P_t), denotes the natural logarithm of price of index at time t, and ln(P_(t-1))

represents the natural logarithm of index price at t-1. There are 5219 number of observations for each of 107 listed firms.

4. Empirical Results

Table 1 shows the results for TOM-effect during the period of full-sample (1996-2015) for all 107 firms. Standard t-test and K.W (non-parametric test) statistics are calculated to measure differences in mean. As compared to the normal days TOM days (Turn of the month) provide higher average returns in Pakistan. Both K.W and t-test support the presence of TOM-effect by demonstrating significant difference between mean returns on TOM and non-TOM days. Thus, we find statistically significant TOM-effect during full-sample period.

The table 2 elucidates average return on TOM anomaly days and non-TOM anomaly days for every firms individually through full sample period. Also, in 76.7% companies the average returns on TOM-days are greater than non TOM-days. Hence, based on average returns we find TOM anomaly in most of the sample firms during full-sample. Table 3 presents the behavior of TOM effect in full sample-period along with during sub samples-period. The findings reveal significant and positive TOM-effect in 34 companies [1] during full-sample period comprising 20 years (1996-2015); representing predictable, significant and positive returns around the turn of the month as the TOM effect claims. Meanwhile, 49 firms [2] generate positive but insignificant coefficient around the turn of the month in the full-sample. Thus, an overwhelming majority of companies under study display higher-positive mean returns around the turn of the month at PSX of Pakistan. While, 19 firms [3] generate negative-insignificant TOM effect and firms PK:DSM, PK:FZM, PK:GSM, PK:NON and PK:PNC produce significant and negative returns around TOM.

As for as sub-samples analysis is concerned TOM effect is insignificant in firms PK;ABB, PK;DAC, PK;DAW, PK;GTR, PK;HAE, PK;HUF, PK;JIN, PK;KWG, PK;PRE, PK;HPN, PK;SPP and PK;PBS in first sample-period (1996-2000), the behavior then reverses and becomes significant in next sub-sample. However the TOM effect again shows insignificant coefficients (market become efficient) in the next two consecutive sub-samples (2006-20010 and 2011-2015), thus supporting AMH (see Table 3, Panel A). Similarly, the firms PK;FSM, PK;GAI, PK;ASB, PK;MBK, PK;MRB, PK;NPK, PK;ORI, PK;SAP and PK;SER show independence of TOM effect in first two sub-samples (1996-2000 and 2001-2005). The behavior of TOM effect reverses in third sub-sample (2006-2010) and becomes dependent which completely reverses and show independent behavior in the last sub-sample thus, consistent with AMH (see Table 3, Panel B).

Table 3: Results of GARCH (1,1) model and k.w (Kruskal-Wallis) for TOM-Effect in sub and full-sample period for listed companies of PSX. Where TOM effect days are represented by"β" while "N" represents number of observations. The level of significance at 10%, 5% & 1% is represented by *, ** & * respectively.**

N	Period	Firms	β	$K.w$	Firms	β	$K.w$	Firms	β	$K.w$
Panel-A										
5219	Full-Sample	PK:ABB	0.1387** (1.982)	2.6442*	PK:HAE	0.2174 (1.237)	2.1224	PK:PRE	0.1426* (1.654)	4.4657**
1305	1996-2000		0.0447 (0.322)	1.427		-0.1763 (-0.022)	0.816		-0.0864 (-0.42)	0.681
1305	2001-2005		0.3537** (1.992)	0.09		-2.06*** (-11.432)	3.695*		0.345** (2.023)	1.559
1304	2006-2010		0.0755 (0.681)	2.8431*		0.1738 (0.285)	3.0118*		0.0833 (0.683)	1.1173
1305	2011-2015		-0.0172 (-0.168)	0.0514		0.1461 (0.523)	0.1662		0.1974* (1.644)	3.2081*
5219	Full-Sample	PK:DAC	0.0022 (0.019)	1.1623	PK:HUF	-0.1405 (-1.265)	0.1503	PK:HPN	0.084 (0.883)	0.3154
1305	1996-2000		0.5712* (1.761)	1.531		0.1125 (0.149)	2.361		-0.0658 (-0.264)	0.012
1305	2001-2005		0.6541** (1.994)	0.004		0.8291** (1.936)	0.386		0.2416** (1.917)	5.819**

1304	2006-2010		0.2611 (0.867)	1.6347		-0.0849 (-0.465)	0.0032		-0.0082 (-0.04)	0.6777
1305	2011-2015		0.009 (0.085)	0.2131		-0.182 (-1.122)	0.0101		-0.0492 (-0.333)	0.0512
5219	Full-Sample	PK:DAW	0.2433** (2.532)	4.7778**	PK:JIN	0.1823* (1.813)	2.4049	PK:SPP	0.0577 (0.799)	4.2749**
1305	1996-2000		0.0835 (0.427)	0.102		-0.0024 (-0.011)	0.004		0.2953 (1.294)	0.001
1305	2001-2005		0.9065*** (3.81)	1.174		0.399** (2.001)	1.844		-1.346*** (-6.534)	3.706*
1304	2006-2010		0.017 (0.118)	2.6305*		0.151 (1.121)	2.7534*		0.0562 (0.389)	0.829
1305	2011-2015		0.1774 (1.165)	0.4084		0.0825 (0.705)	0.0507		-0.0145 (-0.112)	0.0148
5219	Full-Sample	PK:GTR	0.0499 (0.62)	0.6213	PK:KWG	-0.32*** (-3.007)	0.6371	PK:PBS	0.109** (2.129)	11.2532***
1305	1996-2000		-0.1928 (-1.064)	0.152		-0.341 (-1.213)	0.211		-0.0305 (-0.223)	0.027
1305	2001-2005		0.3449** (1.961)	1.732		-0.298** (-2.02)	0.795		0.3069** (2.329)	7.279***
1304	2006-2010		-0.0789 (-0.604)	0.0855		-0.2457 (-1.303)	0.9391		-0.0184 (-0.216)	0.4889
1305	2011-2015		-0.0161 (-0.103)	0.359		-0.2559 (-1.078)	0.5294		0.0667 (0.836)	5.3797**
Panel-B										
5219	Full-Sample	PK:FSM	-0.0318 (-0.237)	3.2075*	PK:MBK	0.1867** (2.416)	7.6248***	PK:ORI	0.0927 (1.095)	1.4244
1305	1996-2000		-0.3876 (-0.684)	1.147		0.0181 (0.088)	0.264		-0.2731 (-1.49)	2.009
1305	2001-2005		-0.3016 (-1.226)	2.173		0.2051 (1.077)	0.666		0.1199 (0.453)	0.085
1304	2006-2010		0.033*** (8.126)	0.2053		0.3238** (1.901)	5.4174**		0.4067*** (2.751)	3.2382*
1305	2011-2015		-0.0113 (-0.086)	0.3568		0.1684* (1.769)	2.0708		0.069 (0.431)	1.5471
5219	Full-Sample	PK:GAI	0.254* (1.931)	0.5372	PK:MRB	-0.0573 (-0.709)	0.1959	PK:SAP	0.2227** (2.472)	0.5838
1305	1996-2000		0.1322 (0.149)	0.018		-0.3395 (-1.53)	5.417**		0.1864 (1.023)	0.367
1305	2001-2005		0.1802 (0.873)	0.425		-0.0219 (-0.118)	0.888		-0.3368* (-1.656)	3.78*
1304	2006-2010		0.3364** (1.915)	4.9792**		0.2939** (1.909)	1.6513		0.6815** (1.903)	8.4408***
1305	2011-2015		-0.0952 (-0.974)	5.5136**		-0.1272 (-0.914)	0.0321		0.0452 (0.439)	0.5781
5219	Full-Sample	PK:ASB	0.2692 (0.974)	0.8388	PK:NPK	0.0209 (0.321)	0.6002	PK:SER	0.0752 (0.602)	0.0321
1305	1996-2000		0.1181 (0.248)	1.381		-0.0028 (-0.023)	1.383		-0.1246 (-0.469)	0.174
1305	2001-2005		0.1504 (0.22)	0.733		0.0343 (0.191)	2.237		-0.1132 (-0.151)	0.253
1304	2006-2010		0.8352** (1.984)	4.3817**		0.2415** (2.098)	0.7123		0.4441** (1.982)	3.8345**
1305	2011-2015		0.3357 (0.931)	0.7846		-0.0671 (-0.605)	0.0107		-0.1422 (-1.09)	0.1798

The TOM effect in firms PK;AGT, PK;ATR, PK;BAP, PK;CTC, PK;DDH, PK;DEG, PK;FEC, PK;MET, PK;HUB, PK;KIE, PK;KNR, PK;MLC, PK;LDP, PK;PSO, PK;PSC, PK;TLM, PK;PTC, PK;PCT, PK;SNG and PK;SUI remain insignificant (independent) in first three subsamples (from years 19996-2010) and revert, predictable and moving towards dependency (market inefficiency) in last sub-sample (2011-2015) supporting AMH (see Table 4). Contrary to this behavior, firms PK;CAL, PK;CSA, PK;GLT, PK;GRY, PK;GUL, PK;GSM, PK;IMO and PK;RMP (see Table 5, Panel A) have significant TOM effect in first sub-sample (1996-2000) and produce insignificant coefficient in three consecutive sub-samples (2001-2015) and consistent with AMH. Also, firms PK;ADI, PK;FZM, PK;PAC and PA:POF support AMH (see Table 5, Panel B).

Table 4: Results of GARCH (1,1) model and k.w (Kruskal-Wallis) for TOM-Effect in sub and full-sample period for listed companies of PSX. Where TOM effect days are represented by"β" while "N" represents number of observations. The level of significance at 10%, 5% & 1% is represented by *, ** & * respectively.**

Period	Firms	β	$K.w$	Firms	β	$K.w$	Firms	β	$K.w$
Full-Sample	PK:AGT	0.0885 (1.241)	1.7902	PK:MET	0.1861*** (2.674)	3.8617**	PK:PCT	0.3605*** (3.442)	11.8177***
1996-2000		0.012 (0.054)	0.914		0.0803 (0.438)	0.172		0.1567 (0.486)	1.03
2001-2005		-0.0186 (-0.121)	0.674		0.185 (1.281)	0		0.1393 (0.489)	1.28
2006-2010		0.017 (0.193)	0.1347		-0.0104 (-0.077)	0.5359		0.1401 (0.857)	2.4228
2011-2015		0.2329** (2.135)	0.171		0.3371*** (3.127)	7.4937***		0.6553*** (4.209)	7.0409***
Full-Sample	PK:ATR	0.1066 (1.359)	6.9514***	PK:KIE	0.4882*** (4.695)	14.711***	PK:SNG	0.1729** (2.081)	10.8337***
1996-2000		-0.1198 (-0.702)	0.045		0.4185* (1.675)	1.27		0.019 (0.101)	1.035
2001-2005		0.2011 (1.036)	1.406		0.8353*** (4.131)	4.516**		0.2715 (1.399)	4.426**
2006-2010		0.101 (0.451)	0.0255		0.1583 (0.736)	3.1587*		-0.0033 (-0.021)	0.0026
2011-2015		0.3169*** (2.815)	5.1029**		0.5562*** (3.173)	3.2147*		0.4*** (3.208)	8.6338***
Full-Sample	PK:BAP	0.0145 (0.187)	1.0839	PK:MLC	0.4528*** (4.467)	10.1752***	PK:SUI	0.174** (2.129)	7.8119***
1996-2000		0.1545 (1.224)	0.856		0.0981 (0.385)	0.002		0.1747 (0.968)	0.726
2001-2005		-0.0838 (-0.525)	0.557		0.4072 (1.591)	1.655		0.056 (0.284)	2.469
2006-2010		-0.0451 (-0.256)	0.1115		0.3795* (1.647)	7.1606***		0.1186 (0.7)	0.3967
2011-2015		-0.001*** (-3.925)	1.2526		0.5853*** (4.473)	1.0816		0.2746** (2.055)	4.7863**
Full-Sample	PK:CTC	0.2265** (2.501)	11.8777***	PK:PSO	0.1795** (2.294)	8.1584***	PK:HUB	0.2831*** (4.196)	24.3059***
1996-2000		0.0185 (0.084)	0.546		-0.0157 (-0.093)	0.147		0.24 (1.36)	5.73**
2001-2005		0.0486 (0.229)	2.463		0.2125 (1.554)	2.236		0.1924 (1.289)	6.563***
2006-2010		0.1069 (0.661)	6.5885***		0.1799 (0.887)	0.4927		0.1135 (0.826)	2.5815*
2011-2015		0.4372*** (2.971)	1.2622		0.277*** (3.269)	5.8868**		0.3176*** (3.358)	4.6044**
Full-Sample	PK:DDH	0.2182** (2.529)	14.1214***	PK:PSC	-0.0388 (-0.341)	0	PK:LDP	0.0924 (1.527)	3.552*
1996-2000		-0.0195 (-0.086)	0.29		0.2506 (0.991)	0.535		-0.0824 (-0.515)	0.003
2001-2005		0.2166 (1.337)	2.578*		-0.142 (-0.667)	0.335		-0.0118 (-0.102)	0.796
2006-2010		0.1574 (1.288)	5.2897**		0.4571 (1.46)	0.1941		0.0937 (0.85)	1.0504
2011-2015		0.3793*** (2.814)	7.086***		-0.2783** (-2.043)	0.1806		0.3065*** (2.772)	4.6954**
Full-Sample	PK:DEG	0.3147*** (3.713)	8.8173***	PK:TLM	0.265*** (3.558)	16.5606***	PK:KNR	0.1849 (1.177)	7.8623***
1996-2000		0.0461 (0.198)	0.54		0.3846* (1.727)	5.749**		-0.8324* (-1.613)	2.256
2001-2005		0.1983 (0.99)	0.248		0.0997 (0.798)	1.561		0.3999 (1.341)	2.338

2006-2010		0.1398 (0.792)	1.8912		0.003 (0.022)	0.4957		0.2846 (1.446)	5.8293**
2011-2015		0.5168*** (4.565)	9.6967***		0.4468*** (3.767)	9.947***		0.5259*** (2.693)	1.4519
Full-Sample	PK:FEC	0.077 (0.74)	1.3354	PK:PTC	0.1644* (1.695)	4.0282**			
1996-2000		-0.2339 (-0.983)	0.231		0.0146 (0.058)	0.089			
2001-2005		0.2473 (1.004)	0.393		0.133 (0.547)	0.21			
2006-2010		0.0657 (0.378)	0.0052		-0.095 (-0.628)	0.1086			
2011-2015		0.5063*** (2.699)	1.6		0.3455** (2.408)	7.2405***			

Table 5: Results of GARCH (1,1) model and k.w (Kruskal-Wallis) for TOM-Effect in sub and full-sample period for listed companies of PSX. Where TOM effect days are represented by"β" while "N" represents number of observations. The level of significance at 10%, 5% & 1% is represented by *, ** & * respectively.**

Period	Firms	β	$K.w$	Firms	β	$K.w$	Firms	β	$K.w$
Panel-A							Panel-B		
Full-Sample	PK:CAL	0.5881** (2.227)	1.2168	PK:GUL	0.0622 (0.797)	1.7375	PK:ADI	0.2023** (2.388)	7.6042***
1996-2000		1.9316*** (11.941)	2.973*		0.1607** (2.42)	0.024		0.0667 (0.318)	1.641
2001-2005		0.5917 (0.622)	0.055		-0.1634 (-0.963)	0.451		0.3686** (2.089)	4.474**
2006-2010		0.2049 (0.469)	0.0006		0.0639 (0.263)	1.0908		0.1629 (0.829)	0.9466
2011-2015		0.9636 (1.482)	0.0826		0.0823 (0.618)	0.3221		0.2298** (2.001)	1.1182
Full-Sample	PK:CSA	0.0598 (0.667)	2.008	PK:GSM	-0.1724* (-1.917)	0.9381	PK:FZM	-0.515*** (-5.431)	0.1053
1996-2000		-0.3362** (-1.98)	1.447		-0.68*** (-4.456)	0.33		-0.995*** (-2.595)	0.013
2001-2005		0.2068 (0.885)	0.786		0.0939 (0.334)	0.646		0.0275 (0.164)	0.154
2006-2010		0.1148 (0.508)	0.1857		0.1595 (0.768)	0.2943		1.269*** (3379.564)	2.3522
2011-2015		0.1439 (1.088)	1.118		0.3913 (1.342)	0.778		0.0426 (0.322)	0.612
Full-Sample	PK:GLT	0.1386** (2.542)	3.0801*	PK:IMO	0.0661 (0.917)	0.0892	PK:PAC	0.1461 (1.577)	3.0257*
1996-2000		0.2451** (2.296)	2.751*		0.4363** (2.009)	5.054**		-0.494*** (-6.798)	0.018
2001-2005		0.0961 (0.783)	1.711		-0.0259 (-0.163)	0.609		0.1347 (1.202)	0.637
2006-2010		0.0163 (0.183)	0.0113		-0.0963 (-0.7)	2.0904		0.0399 (0.23)	0.0469
2011-2015		0.1973* (1.814)	0.6611		0.1951* (1.883)	1.593		0.3999*** (3.571)	7.2322***
Full-Sample	PK:GRY	0.0415 (0.363)	0.0266	PK:RMP	-0.0002 (-0.004)	0.5628	PK:POF	0.2837*** (4.751)	11.6213***
1996-2000		0.219*** (3.106)	0.494		-0.31*** (-173.46)	0.256		0.2647** (2.361)	0.137
2001-2005		-0.0991 (-0.295)	1.318		0.1169 (1.315)	0.968		0.0618 (0.392)	4.701**
2006-2010		0.3308 (0.988)	0.0034		-0.0167 (-0.171)	0.4491		0.1299 (0.848)	0.6314
2011-2015		-0.1394 (-0.723)	1.8486		-0.0081 (-0.057)	1.1083		0.2607*** (3.177)	3.9506**

Contrary to this behavior, firms PK;ACB, PK;ERO, PK;FAU, PK;KIE, PK;NAR and PK;CCB show insignificant TOM effect in the first sub-sample (1996-2000), while the behavior of TOM effect reverses in the next sub-sample and becomes dependent in (2001-2005). The sub-sample 2006-2010 reveals a complete reversal of TOM effect which prevails in sub-period (2001-2005), then again turns to significant TOM effect in the last sub-sample (2011-2015) supporting AMH (see Table 6). Therefore, 59 firms (55 % of the sample size) show behavior of TOM effect consistent with AMH, means TOM effect fluctuate over time. While TOM effect in firms [4] remains independent and does not evolve over time as all the sub-samples produce insignificant coefficient.

Table 6: Results of GARCH (1,1) model and k.w (Kruskal-Wallis) for TOM-Effect in sub and full-sample period for listed companies of PSX. Where TOM effect days are represented by"β" while "N" represents number of observations. The level of significance at 10%, 5% & 1% is represented by *, ** & * respectively.**

Period	Firms	β	$K.w$	Firms	β	$K.w$	Firms	β	$K.w$
Full-Sample	PK:ACB	0.2549*** (3.829)	18.6673***	PK:FAU	0.1725*** (3.794)	17.7898***	PK:CCB	0.1166 (0.855)	3.6365*
1996-2000		0.2417 (1.421)	7.355***		0.155 (1.009)	0.773		-0.2479 (-0.817)	0.523
2001-2005		0.3765*** (2.621)	2.2		0.3547*** (2.665)	8.007***		0.6777** (2.474)	4.688**
2006-2010		0.1534 (1.303)	4.5662**		0.1535* (1.676)	5.718**		0.0465 (0.197)	1.084
2011-2015		0.2709** (2.166)	3.9097**		0.1397** (2.2)	3.8678**		1.248*** (3719.402)	0.0805
Full-Sample	PK:ERO	0.2621*** (3.954)	15.1403***	PK:KIE	0.4882*** (4.695)	14.711***	PK:NAR	0.2606*** (2.955)	9.8936***
1996-2000		0.074 (0.541)	0.44		0.4185* (1.675)	1.27		-0.0471 (-0.326)	0.08
2001-2005		0.3171*** (2.753)	2.516		0.8353*** (4.131)	4.516**		0.4038** (2.346)	2.78*
2006-2010		0.2405* (1.668)	4.3549**		0.1583 (0.736)	3.1587*		0.0917 (0.372)	0.119
2011-2015		0.3907*** (3.233)	7.2605***		0.5562*** (3.173)	3.2147*		0.4663*** (4.51)	6.6453***

5. Conclusion

Although, the modern research favors the fact that TOM effect anomaly is diminished or even reversed with the passage of time. But the capacious published work exhibits the presence and acceptance of TOM effect in all stock exchanges of world. The study explore the time varying nature of TOM-effect to elucidate whether or not TOM-effect is used to capture the excess returns. The study finds 77 % firms' display positive and higher average profits on TOM (turn of month) days, therefore, exhibits the existence of TOM anomaly via application of GARCH model and K.W test over the sample period (1996-2015). Finally, analysis of sub sample reveals TOM-effect (Appendix 1) in 59 companies swings between the eras of market efficiency/predictability and market inefficiency/no-predictability or vice versa, while TOM effect do not swing in 48 companies in sub sample periods. Therefore, it is concluded that behavior TOM effect at firm level is best elucidated by AMH than traditional/classical EMH at PSX.

In summary, it is inferred that firms listed at PSX exhibit time varying behavior with the utilization of sub-sample analysis. This symbol of time variation in the behavior of turn of month effect (TOM) is supporting and consistent with the implications of AMH while contrasting to classical EMH. We recommend further researchers to use a long time period sub-sample to explore the idea of AMH and propose that the method used in this study could be helpful and adapted to inspect other anomalous market effect or calendar effects in emerged and emerging stock markets around the globe.

Notes

[1] PK:ABB, PK:ADI, PK:ACB, PK:BKP, PK:CAL, PK:CTC, PK:DDH, PK:DAW, PK:DEG, PK:ERO, PK:FAU, PK:GLT, PK:HAB, PK:MET, PK:HSM, PK:HUB, PK:ICI, PK:JIN, PK:KIE, PK:KWG, PK:MLC, PK:MBK, PK:NAR, PK:NHT, PK:POF, PK:PRE, PK:PSO, PK:TLM, PK:PTC, PK:PCT, PK:SAP, PK:PBS, PK:SNG and PK:SUI.

[2] PK:AGT, PK:ATR, PK:BAP, PK:CPB, PK:CSA, PK:CTX, PK:CYA, PK:DAC, PK:DAE, PK:DAN, PK:DKT, PK:DMT, PK:DES, PK:FEC, PK:GAI, PK:GTR, PK:GWC, PK:GRY, PK:GUL, PK:HAE, PK:HPM, PK:IMO, PK:INI, PK:ASB, PK:JAV, PK:KNR, PK:LDP, PK:NPK, PK:NAT, PK:ORI, PK:PAC, PK:PET, PK:PSM, PK:PAL, PK:PNS, PK:PSM, PK:LAK, PK:POC, PK:RUP, PK:STM, PK:CCB, PK:SAN, PK:HPN, PK:SPP, PK:SEA, PK:SER, PK:SHJ, PK:SON and PK:TRP.

[3] PK:AGR, PK:ATH, PK:BHA, PK:BOC, PK:DEW, PK:ETU, PK:FSM, PK:NAK, PK:HUF, PK:KRM, PK:MIR, PK:MRB, PK:PEN, PK:PSC, PK:RMP, PK:SHA, K:SCM, PK:SHK and PK:SIT.

[4] PK;AGR, PK;ATR, PK;BKP, PK;BHA, PK;BOC, PK;CPB, PK;CTX, PK;CYA, PK;DAE, PK;DAN, PK;DKT, PK;DMT, PK;DES, PK;DSM, PK;DEW, PK;ETU, PK;NAK, PK;GWC, PK;HAB, PK;HSM, PK;HPM, PK;INI, PK;JAV, PK;KRM, PK;MIR, PK;NAT,PK;NHT, PK;NON, PK;PET, PK;PSM, PK;PNC, PK;PEN, PK;PAL, PK;PNS, PK;PSM, PK;LAK, PK;POC, PK;RUP, PK;STM, PK;SAN, PK;SEA, PK;SHA, PK;SCM, PK;SHJ, PK;SHK, PK;SIT,PK;SON and PK;TRP.

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