MARTA ANASTAZJA WIŚNIEWSKA

PRICE CREATION IN EQUITY MARKET: OVERNIGHT RETURNS

Introduction

Efficient market hypothesis is one of the most paramount concepts in finance and is subject of countless empirical research. As much as there is a consensus that trading on inside information could result in abnormal returns and therefore provide an evidence against strong form of market efficiency, there is no such consensus in case of semi-strong and (especially) weak form of market efficiency. Weak form of efficiency assumes that all past information is already incorporated in prices. If one can identify patterns, the use of which would lead to sustainable abnormal returns, it would be possible to reject the weak form of market efficiency.

Numerous studies have investigated patterns in equity prices while others were attempting to predict returns based on those patterns. Firm characteristics such as: size, market-to-book or earnings-price ratio, were identified as having impact on returns[1]. Time patterns which include both Monday effect and January effect are helpful predicting returns. Monday returns are much lower than returns on other days of the week[2]. Moreover half of these negative returns come from the weekend returns and the other half from the first 45 minutes of Monday trading.[3] Returns in January are substantially higher than returns in other months,[4] with majority of returns coming from the first few days of January. This

---

[1] E. Fama, K.,R. French: *Permanent and Temporary Components of Stock Prices*, "Journal of Political Economy" 1988,, 96, pp. 246–273; R.W. Banz: *The Relationship Between Return and Market Value of Common Stock*, "Journal of Financial Economics" 1981, 9, pp. 3–18; and K.C. Chan, Y. Hamao, J. Lakonishok: F*undamentals and Stock Returns in Japan*, "Journal of Finance" 1991, 46, No. 5, pp. 1739–1764.

[2] M.R. Gibbons, P.J. Hess: *Day of the Week Effects and Asset Returns*, "Journal of Finance" 1981, 54, pp. 579–596.

[3] L. Harris: *A Transaction Data Study of Weekly and Intradaily Patterns in Stock Returns*, "Journal of Financial Economics" 1986, 14, pp. 99–117.

[4] E. Fama: *Efficient Capital Market II*, "Journal of Finance" 1991,26, No. 5, pp. 1575–1617.

inequality of distribution of return through time calls for investigation of the relationship between daily returns and overnight returns.[5]

The aim of this paper is to investigate such relationship. The paper attempts to an-swer the question of: (1) whether the overnight returns have the same sign as daily returns, (2) what is the magnitude of overnight returns as compared to daily returns, (3) whether daily returns can help to predict overnight returns, i.e. is there evidence of Granger causality relationship . The paper uses Polish equity market as a case study.[6] The analysis focuses on the impact of current financial crisis on the efficiency of the Polish market.

The paper is organized as follows: after this brief introduction, a summary statistics of both daily and overnight returns is presented. Next a more in-depth analysis of the relation-ship between the two return types is made. Subsequently, Granger causality test results are presented. Finally conclusions summarize empirical results obtained in the study.

Descriptive statistics: day and overnight returns

Table 1 presents summary statistics for both daily and overnight returns on WIG20 index[7] for years 2002–2013. The average logarithmic returns, for the whole research period, as measured per trading day, are much higher for overnight returns than for daily returns. Moreover in seven out of 12 years: 2006–2010 and 2012–2013 overnight returns turned out to have higher average values. Those years correspond to the financial crisis and (as can be been in Table 1) can also be characterised by higher volatility of returns. These findings in-dicate the importance of overnight returns in the time of uncertainty.[8] Figure 1 also provides evidence for the importance of overnight returns. The magnitude of overnight returns seems to be close to the magnitude of daily returns.

The average correlation for both types of returns in the entire research period was negative and equals –0.102. Once again the particularly strong evidence of correlation is connected to volatile times of the crisis: 2006–2009. In the next section we will investigate in more detail the relationship between the daily and overnight returns, and how this rela-tionship evolved in time.

---

[5] Daily returns can be calculated as returns obtained between the opening and closure of the market at day t, whereas overnight returns are those obtained between the closure of the market on day t and the opening of the market on day following trading day (i.e. t + 1).

[6] The efficiency of Polish market is questionable, see P. Strawinski and R. Ślepaczuk: *Analysis of high frequency data on the Warsaw Stock Exchange in the context of efficient market hypothesis*, "Journal of Applied Economic Sciences" 2008, 5, pp. 306–319.

[7] These are logarithmic return for 1 trading day.

[8] The importance of overnight returns on the Polish market was indicated in earlier studies (M. Sokalska: *Intraday Volatility Modeling: The Example of the Warsaw Stock Exchange*, [in:] *Quantitative methods in Economics*, ed. B. Borkowski, SGGW, Vol. XI, No. 1, Warsaw 2010, pp. 139–145).

Table 1

Summary statistics of WIG20 returns (in %)

	Daily					
	Mean	St.Dev.	Median	Min	Max	Corr.
2002	0.05	1.431	−0.056	−4.403	5.039	−0.112*
2003	0.052	1.214	0.044	−3.647	3.653	0.033
2004	0.095	0.951	0.107	−2.757	3.566	−0.014
2005	0.066	0.897	0.073	−3.493	2.241	−0.036
2006	0.001	1.411	0.028	−4.606	4.11	−0.067
2007	−0.085	1.219	−0.173	−3.057	3.862	−0.106*
2008	−0.16	1.993	−0.383	−9.914	6.485	−0.176***
2009	−0.112	2.033	−0.242	−6.148	6.503	−0.15**
2010	−0.022	1.014	−0.022	−3.714	2.913	0.009
2011	−0.038	1.416	−0.04	−6.938	5.214	−0.108*
2012	0.035	0.885	0.057	−2.812	2.519	0.032
2013	−0.193	0.644	−0.188	−1.693	1.603	−0.182
2002–2013	−0.013	1.366	−0.021	−9.914	6.503	−0.102***
	Overnight					
	Mean	St.Dev.	Median	Min	Max	
2002	−0.046	0.802	−0.06	−4.475	2.539	
2003	0.044	0.651	−0.006	−1.86	1.904	
2004	0.006	0.549	0.04	−2.292	1.833	
2005	0.031	0.57	0.083	−2.098	1.732	
2006	0.056	0.872	0.148	−4.512	2.856	
2007	0.108	0.875	0.129	−3.006	3.007	
2008	−0.098	1.658	−0.058	−6.363	5.573	
2009	0.18	1.182	0.189	−4.147	3.251	
2010	0.085	0.71	0.105	−2.575	3.299	
2011	−0.069	0.709	0.105	−2.575	3.299	
2012	0.04	0.545	0.039	−3.373	2.323	
2013	−0.001	0.336	0.047	−0.904	0.676	
2002–2013	0.031	0.898	0.056	−6.363	5.573	

Asterisks indicate the significance level: *10% level; ** 5% level; *** 1% level.
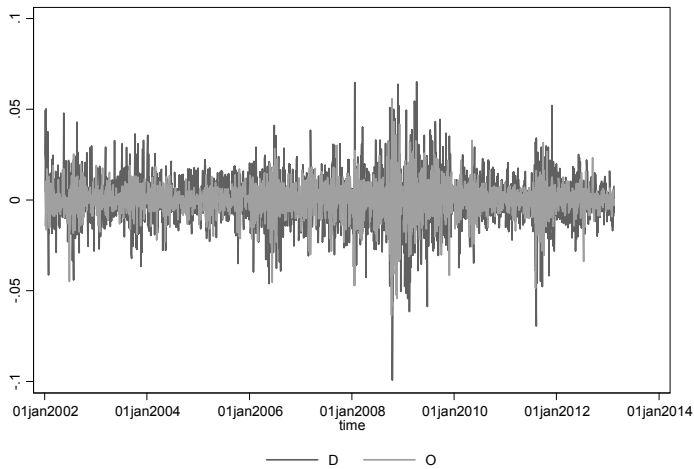
Source: EcoWin and own calculations.

Figure 1. Daily logarithmic returns (D) and overnight logarithmic returns (O)

Source: EcoWin and own calculations.

Relationship between daily and overnight returns: further investigation

The previous section indicated that overnight returns are an important component of total returns. One could ask a question whether overnight returns follow the trend set up by the daily returns, thus is there a sign change between daily and overnight returns. Table 2 illustrates the frequency with which the sign of the returns is the same as the sign of overnight returns. In 47% of cases the sign remained the same, indicating that in over 50% of cases the overnight returns were correction to the daily returns. The correction seems to be more frequent in case of negative daily returns – this was the case in 56.5% of cases, whereas positive daily returns were followed by negative overnight returns in 50% of cases. Years 2005–2007 and 2009 are characterised by over 60% probability of correction following negative daily returns.

Table 2

Frequency of the same sign of daily and overnight returns (as % of the sample)

	Overall	Negative	Positive
1	2	3	4
2002	47.01	51.59	41.67
2003	53.97	54.87	53.17
2004	47.54	43.24	51.13
2005	45.68	36.61	53.44
2006	45.90	36.97	54.40

1	2	3	4
2007	43.98	36.72	52.21
2008	47.52	49.30	45.00
2009	43.5	38.93	48.70
2010	44.72	40.32	49.18
2011	49.38	46.34	52.50
2012	48.96	43.97	53.60
2013	43.75	38.89	50.00
2002–2013	47.05	43.51	50.68

Source: EcoWin and own calculations.

Another measure of the importance of overnight returns is whether in the case of sign differences between returns, the magnitude of overnight returns is big enough to cause the change in the sign of total returns. Table 3 displays results of such comparison of the magnitude of returns. In over 30% of cases overnight returns did overcome daily returns. On average there is slightly higher reaction to the negative daily returns, than there is to positive returns. Moreover in years 2006–2009 and 2011 overnight returns seem to be particularly influential, and affecting the sign in over 38% of cases. It is worthwhile to point out that in those years the high percentage of the change in sign happened as a reaction to positive daily returns. Thus, in more volatile times one can expect that the negative trend will continue overnight with a higher probability than the positive trend.

Table 3

Frequency with which overnight returns change the sign of the daily returns (as % of the sample)

	Overall	Negative	Positive
2002	28.23	34.43	22.22
2003	34.55	31.37	37.29
2004	29.69	33.33	26.15
2005	33.33	35.21	31.15
2006	34.85	32.00	38.60
2007	39.26	37.04	42.59
2008	33.07	40.28	23.64
2009	34.53	31.25	38.98
2010	30.88	31.08	30.65
2011	34.96	31.82	38.6
2012	31.71	36.92	25.86
2013	27.78	36.36	14.29
2002–2013	33.15	34.16	31.96

Overall – all observations; negative – different signs, with daily returns having negative sign; positive – different signs, daily returns having positive sign.

Source: EcoWin and own calculations.

Table 4 presents the ratio of (1) the value of overnight returns to the value of overall returns (measured as a sum of overnight and daily returns) if both daily and overnight returns have the same sign or (2) the ratio of absolute value of overnight returns to the sum of absolute value of daily returns and absolute value of overnight returns. Moreover, each case includes three sub-categories outlines (a) negative, i.e. when daily returns were negative; (b) positive, i.e. when daily returns were positive and (c) overall, where daily returns can be both positive and negative. Overnight returns roughly amounted to, on average, 40% of overall daily returns. These values seem to be relatively insensitive to whether daily returns were positive or negative, on average the overnight reaction is of the same magnitude. Moreover, if the overnight returns are of a different sign than daily returns, then the reaction is still in line with the level of reaction expected if the sign is not changed. The highest overnight reaction was observed in years 2008 and 2010. Yet again indicating that volatile times increase the importance of overnight price change.

Table 4

Overnight returns to overall returns ratio (in %)

	The same sign			Different sign[*]		
	overall	negative	positive	overall	negative	positive
2002	43.9	48.58	37.14	35.39	38.83	32.07
2003	38.00	37.34	38.61	39.54	42.10	37.32
2004	35.12	42.13	30.18	39.77	42.30	37.33
2005	43.21	48.23	40.26	38.27	40.29	35.91
2006	39.73	39.29	40.01	40.92	40.57	41.38
2007	41.18	39.35	42.65	41.23	39.63	43.64
2008	45.69	44.88	46.95	41.19	43.17	38.59
2009	40.78	34.42	46.58	41.20	41.47	40.84
2010	46.68	41.87	50.69	40.30	42.66	37.48
2011	40.79	40.91	40.69	40.34	39.15	41.72
2012	35.69	32.76	37.92	38.92	41.77	35.72
2013	42.94	39.25	46.63	33.61	34.28	32.55
2002–2013	40.91	41.01	40.83	39.69	40.98	38.18

[*] Based on absolute values.

Source: EcoWin and own calculations.

Granger causality

Prior to advancing to Granger causality tests it is necessary to establish the level of integration of the time series in question. The series turned out to be stationary. Table 5 presents the Wald statistics of the VAR-Granger causality test. When looking at the results for the whole sample period causality in both directions can be detected. Looking at the an-

nual results, the causality was detected in years 2007–2009. This yet again indicates that in time of instability there seems to be a connection between daily and overnight returns.

Table 5

VAR-Granger causality test

	Daily		Overnight	
	Chi2	*Prob>Chi2*	Chi2	*Prob>Chi2*
2002	3.84590	*0.146*	1.89070	*0.389*
2003	0.31440	*0.855*	4.92750*	*0.085*
2004	1.65400	*0.437*	2.56870	*0.277*
2005	0.98063	*0.612*	15.78300***	*0.000*
2006	0.02890	*0.986*	4.11590	*0.128*
2007	7.87460**	*0.020*	2.92830	*0.231*
2008	4.02720	*0.134*	10.00700***	*0.007*
2009	13.25400***	*0.001*	4.80930*	*0.090*
2010	2.55640	*0.279*	0.37278	*0.830*
2011	2.57150	*0.276*	1.96100	*0.375*
2012	2.07400	*0.355*	0.72544	*0.696*
2013	2.43320	*0.296*	1.91950	*0.383*
2002–2013	9.34440***	*0.009*	21.11900***	*0.000*

Asterisks indicate the significance level: * 10% level; ** 5% level; *** 1% level.

Source: EcoWin and own calculations.

Conclusions

A weak form of market efficiency calls for identification of patterns in past prices. One of the most profound group patterns are time patterns. This paper looks at daily and overnight returns and tries to investigate the existence of possible relationship between those returns (or existence of possible patterns). An evidence of negative relationship has been found. This relationship seems to be present in times of high volatility. In such times negative daily returns seem to be followed by positive returns with higher than 60% probability. The same is not true for positive daily returns. When daily returns are followed by overnight returns of different sign, there is an over 30% chance that overnight returns will be higher in magnitude, thus overcoming the effect of daily returns. This is related to the relatively high importance of overnight returns, as on average they contributed to 40% of the total returns. The existence of the relationship between daily and overnight returns in time of high volatility was confirmed by Granger-causality test. Further studies could use the filter rule to investigate whether the weak form of market efficiency can be violated using the relationship between daily and overnight returns.

References

Banz, R.W.: T*he Relationship Between Return and Market Value of Common Stock*, "Journal of Financial Economics" 1981, 9.

Chan, K.C., Hamao, Y., Lakonishok, J.: *Fundamentals and Stock Returns in Japan*, "Journal of Finance" 1991, 46, No. 5.

Fama, E.: *Efficient Capital Market II*, "Journal of Finance" 1991, 26, No. 5.

Fama, E., French, K.,R.: *Permanent and Temporary Components of Stock Prices*, "Journal of Political Economy" 1988, 96.

Gibbons, M.R., Hess P.J.: *Day of the Week Effects and Asset Returns*, "Journal of Finance" 1981, 54.

Harris, L.: *A Transaction Data Study of Weekly and Intradaily Patterns in Stock Returns*, "Journal of Financial Economics" 1986, 14.

Sokalska, M: *Intraday Volatility Modeling: The Example of The Warsaw Stock Exchange*, [in:] *Quantitative methods in Economics*, ed. B. Borkowski, SGGW, Vol. XI, No. 1, Warsaw 2010.

Strawinski, P., Ślepaczuk, R.: *Analysis of high frequency data on the Warsaw Stock Exchange in the context of efficient market hypothesis*, "Journal of Applied Economic Sciences" 2008, 5.

PhD Marta Wisniewska
Wyższa Szkoła Bankowa w Gdańsku
University of East Anglia

Summary

The study investigates the relationship between daily and overnight returns on WIG20 for years 2002-2013. The study revealed the importance of the overnight returns in total return creation. Moreover, it presented evidence for the negative relationship between daily and overnight returns, particularly in times of high volatility. The probability of overnight price correction is higher after positive daily returns than after negative. This leads to the conclusion that stock declines are more persistent and could be perceived as 'safer' patterns.

CENY NA RYNKU AKCJI: STOPY ZWROTU MIĘDZY SESJAMI

Streszczenie

Artykuł ma za zadanie zaprezentować związek między stopami zwrotu podczas trwania sesji (dzienne stopy), a tymi uzyskanymi między sesjami (nocne stopy). Badanie wskazało na istotność stóp uzyskanych między sesjami na całkowitą stopę zwrotu. Ponadto wykazana została negatywna zależność między dziennymi i nocnymi stopami zwrotu, która była widoczna zwłaszcza w czasie podwyższonego ryzyka na rynku. Prawdopodobieństwo korekty trendu dziennego po zakończeniu sesji jest znacznie wyższe w przypadku pozytywnych zmian ceny w czasie sesji. Tym samym należy uznać spadkowe trendy za bardziej stabilne.