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MARKET EFFICIENCY IN THE GREEK STOCK EXCHANGE: THE HALLOWEEN EFFECT

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Abstract

This paper examines the robustness of the Greek Halloween puzzle to alternative model specifications and time periods. The Halloween effect disappears after adjustments for the impact of outliers, and other model specifications. This paper argues against the existence of Sell in May effect in the ASE and its sectors. JEL G10, G24.

1. Introduction

According to the Efficient Market Hypothesis (EMH) rational investors gather relevant information fully and correctly, and if immediately incorporate it in stock prices, only new information should cause change in prices. This would imply that stock returns are unpredictable. However, there is growing evidence in the international literature that stock returns are predictable to some degree from historical prices and returns, lagged economic and financial variables, and seasonal (or calendar) dummies.

The concept of EMH predicts that once calendar effects become widely known, then excess risk-adjusted returns are arbitraged away. For instance, the January effect became statistically insignificant since 1982 due to the received publicity in the financial press (Fama 1991). In general, there are particular periods that the investors' behavior changes significantly. To give some examples, we can have a change in the mean, the variance, the skewness, or the kurtosis of the returns' distribution, only for the periods the effect is observed (Aggrawal and Schatzberg 1997 and Mills et al., 2000). There are no universally accepted explanations for calendar anomalies, and a number of factors have been found as potential contributors: measurement errors, differences in settlement time of transactions, taxes, capitalization, riskness of the stock, company-type etc. (Mills et al., 2000).

A particular calendar anomaly is known as Halloween effect. According to Halloween Indicator (HI) the month of May signals the start of a bear market, so that investors are better off their stocks. The Halloween effect is frequently cited in the popular financial press, but attired little attention by the academic literature.

This study provides additional empirical evidence and extends the international literature to the Halloween effect. A data set from a small European capital market, namely the Greek stock market, and more recent sample are considered to circumvent the data snooping problem. Emerging markets provide an interesting "out of sample" test of the existence of calendar anomalies, since many well-known calendar anomalies do not exist in the emerging stock markets (Claessens et al., 1995).

The sample refers to the General Index (GI) and the sectors indices of the Athens Stock Exchange (ASE). In addition, although several calendar effects are examined for the ASE, no previous study refers to the Halloween effect (Mills et al., 2000). The only evidence refers to Bouman and Jacobsen's (2002) data set that contains 128 monthly returns for the Greek stock market with the most recent month being August 1998. Their sample period does not contain the financial crisis of August 1998, the huge price appreciation in 1999 and the fall since 2000. Thus, the lack of these periods increases the probability of rejecting the null hypothesis.

Additionally, the economic significance of this particular calendar anomaly is considerable. Calendar effects affect the decisions made by professional asset managers and investors as well. Following such an anomaly, if it holds and is statistically significant, with low costs transactions an investor may obtain large returns. Especially the Halloween calendar anomaly results in a very simple trading strategy, and of minimum cost. For example, following the Halloween strategy the last 20 years in the ASE one could have return 18.7% with standard deviation 29.73%. The buy and hold strategy gives returns 13% with standard deviation 74.8%. Thus, it is interesting to study the significance of the Halloween effect in the Greek market under different model specifications.

The rest of the paper is organized as follows. Section 2 presents an overview of the financial literature as concerns as the calendar anomalies of the stock markets. Section 3 gives the data set used as well as the preliminary statistics and diagnostics. Section 4 deals with model specification and presents the empirical results, while section 5 concludes the paper along with a route for future research.

2. Previous literature

Empirical studies on financial time series have revealed the so-called calendar effects in the behavior of stock returns. Thaler (1987a, 1987b) provides an early and partial survey, while Mills and Courts (1995), and Mills et.al. (2000), provide more recent references and additional evidence. Calendar studies questioned whether regularities exist in the rates of return during the calendar year. This fact would allow investors to predict returns on stocks. According to the Efficient Market Hypothesis (EMH) such seasonal patterns should not persist since their existence implies the possibility of obtaining abnormal returns by market timing research strategies.

Vast number of studies provides evidence for calendar anomalies in international stock markets. Among the most important calendar effects are the monthly or January effect (relatively higher January returns), the weekend effect, the day-of-the week effect, the trading month effect, and the holiday effect. Day-of-the week effect is first documented by Osborne (1962), and subsequently analysed by Cross (1973) and French (1980). The January effect is one of the most famous calendar effects. January effect is first reported in Wachtel (1942). Rozeff and Kinney (1976) conducted the first rigorous study, which confirmed the January effect, followed by many other researchers. The weekend effect (significantly lower returns over the period between Friday's close and Monday's close) is first documented by French (1980) and Gibbons and Hess (1980). Ariel (1987) studies the month effect, and Lakonishok and Smidt (1988) and Ariel (1990) examine the holiday effect.

Jaffe and Westerfield (1985a,b) test for the weekend effect and find out significant negative mean returns on Mondays in the US, Canada and the UK stock markets, and significant negative Tuesday returns in the Japanese and Australian stock markets. Aggrawal and Rivoli (1989) observe lower mean returns on Mondays and Tuesdays in stock returns of Hong Kong, Singapore, Malaysia and the Philippines from September 1976 to June 1988. Both in Jaffe and Westerfield (1985a, b), and Aggrawal and Rivoli (1989), the strong Tuesday effect is attributable to the +13 hour time difference between New York and these four markets.

Aggrawal and Tandom (1994) provide international evidence for several calendar anomalies in stock markets of eighteen countries (Australia, Belgium, Brazil, Canada, Denmark, France, Germany, Hong Kong, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Singapore, Sweden, Switzerland, and the UK) other than the USA. They find large, positive mean returns on Fridays and Wednesdays in most of the countries. They observe lower or negative mean returns on Mondays and Tuesdays, and higher and positive returns from Wednesday to Friday in almost all the countries. Balaban (1995, 1996) reports that in the Turkish stock market for the period January 1988 to August 1994 the highest returns and the lowest standard deviations on Fridays followed by Wednesdays. He observes the lowest and negative mean returns on Tuesdays, and the highest standard deviations on Mondays. In addition, he notes that the day of the week effects change in direction and magnitude across years. The author claims that observed anomalies could be partly attributed to the settlements rules in the Turkish stock market. Dubois and Louvet (1996), find negative returns on Mondays and Tuesdays and positive returns on Wednesdays for eleven indices in nine countries from 1969 to 1992.

Mills et.al. (2000), analyze calendar effects for each of the constituent stocks of the Athens Stock Exchange, rather than examining only basket indices. They demonstrate that the calendar regularities vary significantly across the constituent shares and that aggregation introduces a considerable bias in unraveling these regularities. Their study refers to the period 1986-1997, and they find substantial evidence of the day-of-the week, monthly and holiday effects. They also report that there is an intensity of these effects for various stocks on the basis of capitalization, beta coefficient and company-type factors. In particular, for the capitalization they report a weakly significant inverse relationship, a statistically significant relationship with aggressive, high-beta stocks, and that company-type is an important factor in the seasonality of returns.

Bayara and Kan (2002) provide further international evidence for the presence of the day of the week effects in local currency terms from a majority of stock markets in nineteen countries. They provide evidence for the presence of the day of the week effects in the mean returns denominated in dollars from most of stock markets of eighteen countries, excluding the USA.

Hansen and Lunde (2003) examine calendar anomalies in ten stock exchanges. They analyze 27 stock indices from 10 countries and find calendar effects to be significant in most return series, and it is particularly end-of-the-year effects that produce the largest anomalies. The most solid evidence in favor of calendar effects is found in small-cap indices. In these series, they find significant calendar effects and their findings are found to be robust in sub-sample analyses.

Aly et. al.'s (2004) result suggest no evidence of day of the week effect in the Egyptian stock market. Their findings indicate that while Monday stock returns are significantly positive, they are not significantly different from returns during the rest of the week. Since they found that the returns on Monday are significantly more volatile than the returns from Tuesday to Thursday, they conclude that the significantly positive returns on Monday are associated with returns that are more risky.

Tang (1997) studies the day-of the-week effect on exchange rate risks. He finds that different days of the week have great impact on the diversification of exchange rate risks, particularly on skewness and kurtosis. Aggrawal and Schatzberg (1997) also indicate differences on each weekday's distribution of equity returns. Mills et.al. (2000), try to explain seasonalities of the Greek stock market on the basis that certain calendar periods show a combination of high returns, kurtosis and skewness. They provide evidence that investors prefer to invest on days with higher kurtosis and positive skewness coefficients, which is consistent with Aggrawal and Schatzberg (1997) result.

For the studies about the holiday effect it is worth to mention Mills and Coutts (1995) about the London Stock Exchange, Hiraki and Maberly (1995) about the Tokyo stock exchange, Mookerjee and Yu (1999) for the two stock exchanges of China, and Mills et. al (2000) for the emerging stock market of Greece. They all conclude that there are anomalies on the time series before the days of holidays, so that the holidays have a certain influence on the time series of returns.

Leontitsis and Siriopoulos (2007) present a forecasting method based on chaos theory taking into account the specific calendar characteristics, and they give empirical results for NASDAQ Composite Index and TSE 300 Composite Index. Their study shows that there is a great deal of improvement on out-of-sample forecasting results, for calendar-corrected time series. On the other hand, if the time series does not show any calendar affection at all, the forecasting is not improved a lot. This fact was clearly shown on the results regarding the TSE 300 Cmp results. In a second paper Leontitsis and Siriopoulos (2006) present a way to incorporate some of the most significant calendar effects on forecasting by neural networks. The main advantage of their method is that it gives no correction to time series that do not show calendar effects. Finally, they indicate that calendar effects may be hidden in indices, which represent low-risk stocks. This result is not consistent with the findings of Aly et.al. (2004) for the emerging market of Egypt.

In a recent issue of the American Economic Review, Bouman and Jacobsen (2002) document yet another calendar time anomaly in stock prices, which they claim many Americans tend to be unfamiliar with. They label this anomaly the Halloween effect, as October 31 marks the end of the "scary period" for investors. In particular, Bouman and Jacobsen conclude that stock returns are significantly lower during the May-October periods versus the November-April periods, and they propose a trading strategy to exploit this anomaly. The Halloween effect amounts to a "Sell in May and go away" strategy. The strategy is described as investing in a value-weighted index like the S&P 500 index during the November-April periods and in a risk-free investment like U.S. Treasury bills during the May-October periods.

Bouman and Jacobsen (2002), report evidence of the Halloween effect in 36 of the 37 studied developed and emerging markets. The effect tends to be particularly strong and highly significant in European countries. Sample evidence shows that in a number of countries it has been noticeable for a very long time, and in the U.K. stock market, for instance, they find evidence of a Sell in May effect as far back as 1694. However, they find no evidence that the effect can be explained by factors like risk, cross correlation between markets, or the January effect.

Marquering (2002) indicates that the Sell in May effect is presented in US, UK, Belgium, Germany and the Netherlands. Maberly and Pierce (2004) do not find evidence of the effect for the US stock and futures markets. However, in a second paper in 2005 they observe significant Halloween effect for the Japanese market, prior to the mid-1980s.

Bouman and Jacobsen (2002) examine the Halloween effect in the Greek stock exchange using 128 monthly returns for the general index, with the most recent month being August 1998. Their sample period does not contain major financial events of the recent period, namely the financial crisis of August 1998, the huge price appreciation in 1999 and the fall since 2000. It might be the lack of these periods that increases the probability of rejecting the null hypothesis.

3. Data and preliminary statistics

Table 1 represents the data set used along with the period covered and the number of total observations, while table 2 reports summary statistics.

TABLE 1
Indices consider in the study

Index	Period	# of Observations
General Index (GI)	10/1986-12/2004	219
Banks	10/1986-12/2004	219
Industrial	5/1987-12/2004	213
Construction	10/1994-12/2004	124
Holdings	10/1994-12/2004	124
Parallel Market	8/1995-12/2004	114
Insurance	1/1993-12/2004	124
Investments	1/1993-12/2004	124

Monthly returns for each index are calculated as follows

$$R_t = \ln\left(\frac{IDX_t}{IDX_{t-1}}\right) \tag{1}$$

where IDX_t is the value of the index in month t.

TABLE 2
Descriptive statistics

	GI	BANKS	INDSTR	CONSTR	HOLD	PARALEL	INSUR	INVEST
MEAN	0.01551	0.01822	0.01102	-0.0007	0.00603	0.0024426	-0.0034	0.00162
VARIANCE	0.10925	0.01492	0.00932	0.01848	0.01245	0.0203835	0.01464	0.01039
STDEV	0.10452	0.12214	0.09652	0.13595	0.11159	0.1427706	0.12099	0.10194
MAX	0.40967	0.51175	0.3704	0.55495	0.26862	0.5371819	0.34765	0.33909
MIN	-0.2865	-0.3113	-0.349	-0.3525	-0.3487	-0.350304	-0.3207	-0.2806
KURTOSIS	2.5536	3.0369	1.87313	1.99014	0.68511	1.7354935	0.6908	0.92492
SKEWNESS	0.00177	1.0926	0.4697	0.59671	0.07985	0.4785982	0.06732	0.22929
JARQUE-BERA	1.81848	43.5851	19.1018	12.6276	27.8184	11.947207	27.6444	23.334

General Index, Banks Index and Industrial Index perform better, while Construction Index and Insurance Index report negative returns. We also observe that indices' returns do not follow the normal distribution, because the Jarque-Bera test was found significant for all indices.

4. Model specifications and empirical results

To test for the existence of a Halloween effect the usual dummy variable method is applied. According to Bouman and Jacobsen (2002) this is represented as

$$R_t = a + \beta_1 D_{1t} + u_t \tag{2}$$

Rt represents continuously compounded monthly returns of the Index and D_{1t} is the dummy variable taking the value 1 if month *t* falls within the November-April periods and 0 if it falls within the May-October periods. The intercept *a* represents the monthly mean return over the May-October periods and $a + \beta_1$ represents the monthly mean return over the November-April periods. β_1 denotes the average monthly returns in the period November-April in excess of the average monthly returns during the other six months of the year. Evidence of a Halloween effect is considered if the regression parameter $\beta\backslash$ is positive and significant.

Because of the high sensitivity of the OLS to outliers Bouman and Jacobson (2002) and Meberly and Pierce (2004) examine their impact on the estimation of equation (2) coefficients including an outlier dummy. The outliers are defined as unusual large returns. The January effect is best-documented calendar anomaly in stock returns, and the Sell in May-effect may be simply the January-effect in disguise. Thus high positive January returns are the driving force behind a significant $\beta\backslash$ coefficient in equation (2). To test this possibility, equation (3) is considered

$$R_t = a + \beta_1 D_{1t}^{adj} + \beta_2 JANUARY + u_t \tag{3}$$

where JANUARY is a January dummy that takes the value 1 whenever month *t* is January and 0 otherwise. In January we now assigned the dummy D_{1t}^{adj} the value zero.

Maberly and Pierce (2004) identify two months that potentially drive the findings of a statistically significant Halloween effect over the period January 1970-August 1998: the Crash of October 1987 and the August 1998, where the Russian government unexpectedly announced a moratorium on debt repayments, and financial markets were into a tailspin. These are verified by a within sample z-score of 1.8893 and 2.6 and corresponding p-values of 0.0021 and 0.0047, respectively.

However, unusual large returns may be observed in other month as well, especially in a small equity market. Therefore, a month is identified as an outlier whenever the absolute value of the within sample z-score is greater than 2.5. Using this criterion, eight outliers are observed over the period October 1986 through December 2004 (six negative and two positive). Including a dummy variable for outliers, equation (3) becomes

$$R_t = a + \beta_1 D_{1t}^{adj} + \beta_2 JANUARY + \beta_3 OUTLIERS + u_t \qquad (4)$$

The outlier dummy variable *OUTLIERS* is set equal to 1 for the ten identified outliers, and 0 otherwise.

Table 3 represents the estimations of equations (2)-(4) for the General Index (GI). The value of the parameter $\beta\backslash$ provides evidence of the Halloween effect since it is positive at 0.0185 and significant at 10% (t-value of 1.282). This result confirms the Bouman and Jacobsen's results (2002) for the case of the Greek stock market (t-statistic 1.77, their table 1) for the period January 1970-August 1998.

Adjusting for the January effect the estimation of equation (4) shows that the Sell in May effect does not survive. Thus, we could not accept the hypothesis that is the January effect in disguise. The same conclusion could be drawn from the Bouman and Jacobsen's results for Greece (t-statistic for β_2 equals 1.53, their table 1). In the next two columns the results of equation (4) are provided, where the dummy variable includes all the outliers (column three) or the outliers for October 1987 and August 1998 only (column four). The Halloween effect is not statistically significant in both cases. The impact of the outliers is represented by β_3 , which is highly significant. Thus, it appears that the Halloween effect in the ASE is being driven by the large negative returns observed during the months of October 1987 and August 1998.

TABLE 3
Halloween effect in the Athens Stock Exchange

	Equation (2)	Equation (3)	Equation (4)	Equation (4)*
Coefficient				
a	0.006138	0.006138	-0.00133	-0.007557
t-statistic	(0.61)	(0.6097)	(-0.14)	(0.7588)
p-value	[0.5425]	[0.542676]	[0.8883]	[0.4487]
β1 (HALLOWEEN)	0.018577	0.014436	0.013137	0.01468
t-statistic	(1.32)	(0.9726)	(0.95)	(1.0016)
p-value	[0.1911]	[0.3318]	[0.3441]	[0.3176]
β2 (JANUARY)		0.039738	0.034074	0.032147
t-statistic	N/A	(1.492)	(1.35)	(1.2010)
p-value		[0.1371]	[0.1778]	[0.2310]
β3 (OUTLIERS)			0.20175	-0.1532
t-statistic	N/A	N/A	(5.72)	(-2.5353)
p-value			[3.47E-08]	[0.01194]

* Only the outliers for October 1987 and August 1998 are considered.

An important finding in the study of Bouman and Jacobsen (2002) is that all sector indices in a country presenting the Halloween effect also exhibit the Sell in May effect. Equation (2) is estimated in all sectors indices to test if the Halloween effect is a sector-specific anomaly. Table 4 represents the results.

TABLE 4
Halloween effect in the Greek Sectors

	Banks*	Industries	Holdings	Parallel Market	Insurance	Investments	Construction
Intercept	0.0043	0.009898	7.4128	0.006398	-0.0065	-0.0084	-0.00231
t-statistic	(0.3655)	(1.05587)	(79.26)	(0.3324)	(-0.4128)	(-0.6361)	(-0.1324)
p-value	[0.7151]	[0.2922]	[0.00]	[0.7402]	[0.6804]	[0.5259]	[0.8947]
Coefficient	0.0277	0.002278	-0.08298	-0.00798	0.006141	0.19876	0.0147
t-statistic	(1.6761)	(0.1702)	(-0.623)	(-0.292)	(0.227)	(1.06855)	(0.5934)
p-value	[0.0951]	[0.8650]	[0.53]	[0.7701]	[0.7823]	[0.2874]	[0.5537]

* For the Banking sector several alternative model specification were tested, as before, and inserting the January dummy reduced the Halloween effect further.

Finally, the predictability of the Halloween Index (HI) is examined. For the bull periods the Halloween strategy predicts correctly 14 markets out of 18, and in the bear periods it predicts correctly 10 markets out of 18. It follows from table 5 that the Halloween strategy appears to have better skills in forecasting bull markets than bear markets.

TABLE 5
The noise-to-signal ratio of the HI in the ASE

	Bull Market: November-April (Correct signal)	**Bear Market: May-October (False signal)**
HI issues a BUY "signal"	14 (cell A)	4 (cell B)
HI does not issue a BUY "signal"	8 (cell C)	10 (cell D)

However, if the HI were a perfect predictor of the market we would only have entries in cells A and D. Consequently, an extremely noisy HI would have many entries in cells B and C. The noise-to-signal ratio (NSR) is given by the ratio of false signals to all possible bad signals divided by the ratio of good signals to all possible good signals (Kaminsky and Reinhart 1999)

$$NSR_{HI} = \frac{B/(B+D)}{A/(A+C)} \quad (5)$$

The NSR of the HI for a Buy signal is 0.572 and for a Sell signal is 3.2, which are considered high (>0.50). Therefore, the HI could not be considered as a good predictor for the period under study on the ASE. Thus, our results differ considerably from those obtained by Bouman and Jacobsen (2002) as concern as the Greek stock market.

5. Conclusion

This study examines the robustness of the Halloween effect to alternative model specifications on the ASE. The paper could not accept the existence of exploitable Sell in May-effect in the Greek stock market during the period October 1986-December 2004. The results of the paper differ from the results present in the study of Bouman and Jacobsen (2002) for he Athens stock exchange. Our results are robust under different model specifications. Robustness is needed because the financial time series show non-normal distributions. Their distribution presents skewnes and leptokurtosis, therefore the robust methods should be preferred.

Every year, in the period of May the financial press refers to that market strategy. Recent years, however, many investors do not sell stocks in May (R. Byrne, 2004). Schwert (2003) observes, that in many cases, following scholarly documentation of apparent predictability in stock return based on some observable patterns, the predictive power of the pattern diminishes. This means, that all market anomalies receiving publicity become insignificant soon or later, as finance theory and the efficient market hypothesis predict.

This paper is inconclusive about the usefulness of the Halloween effect to the traders. One of the fundamental questions with which many financial economists and practitioners are concerned is how can the information about the presence or absence of a calendar market anomaly be translated in improved portfolio performance and financial forecasting. Jensen (1978) highlights the importance of trading profitability when assessing market efficiency: "if a trading rule is not strong enough to outperform a buy and hold strategy on a risk-adjusted basis then it is not economically significant". In a *Wall Street Journal* commentary, Professor Richard Roll says "if calendar time anomalies represent evidence of market inefficiencies, then they ought to represent an exploitable opportunity" (Makiel 2000).

In this line of research it will be interesting and useful both for the practitioners and the financial economists to examine the performance of different forecasting methods and techniques that take into consideration calendar effects (Leontitsis and Siriopoulos 2006, 2007).

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