Student ID: 100249635

Advent anomaly or festive fallacy? An investigation of January and December calendar effects in US markets

1. Introduction

Burton Malkiel's book, *A Random Walk Down Wall Street,* presents a staunch defence of the efficient market hypothesis (EMH) by emphasising the random nature of price changes and suggesting that any anomalies are quickly negated by new information (Malkiel, 2003). The EMH proposed by Fama (1970) in turn objects to the existence of market anomalies, concluding that markets are a "fair game"; price changes reflect available information and profitable opportunities are quickly lost thanks to this information. However, calendar effects remain a popular heuristic used by traders, particularly for effects relating to particular months of the year and seasonal variations (Forbes et. al, 2015). This heuristic appears contradictory to the EMH. This report seeks to verify the existence of and calendar effects for the months of January and December for a selection of 20 US firms using econometric techniques. Additionally, the determinants of firm age and market capitalisation will be examined to confirm any influence on these calendar effects.

2. Methodology

The data used in this paper comprises historic stock returns and market capitalisation figures for 20 US firms listed on the SP500 index, with the SP500 also being included to act as a benchmark. Assembly of the dataset is performed in Python 3.8.8. The primary source for returns is the Yahoo! Finance API, accessed via the yfinance library, providing returns for the decade spanning January 2010 to December 2019. The secondary source for market capitalisation is finviz.com, with figures scraped using the BeautifulSoup library. Returns and capitalisation are merged and grouped by the firm's ticker code in a long data structure using the pandas library, before being exported as a dataset for econometric analysis in STATA. Regression analysis is performed using panel data with fixed effects and robust standard errors. Visualisations are generated plotting monthly returns against months.

The report investigates the existence of calendar effects by creating variables to represent daily and monthly returns for the 20 firms, with dummy variables created to represent firm age and size in terms of capitalisation. The analysis focuses on January and December, and if the generation of abnormal returns is more probable compared to the rest of the year considering the different qualitative variations of firms.

3. Visualisations

Visualisations of the data suggests the presence of month-based variations in average returns for the selected firms, however a notable decline is observed for December whilst the peak positive variations in returns occurs in February and November.

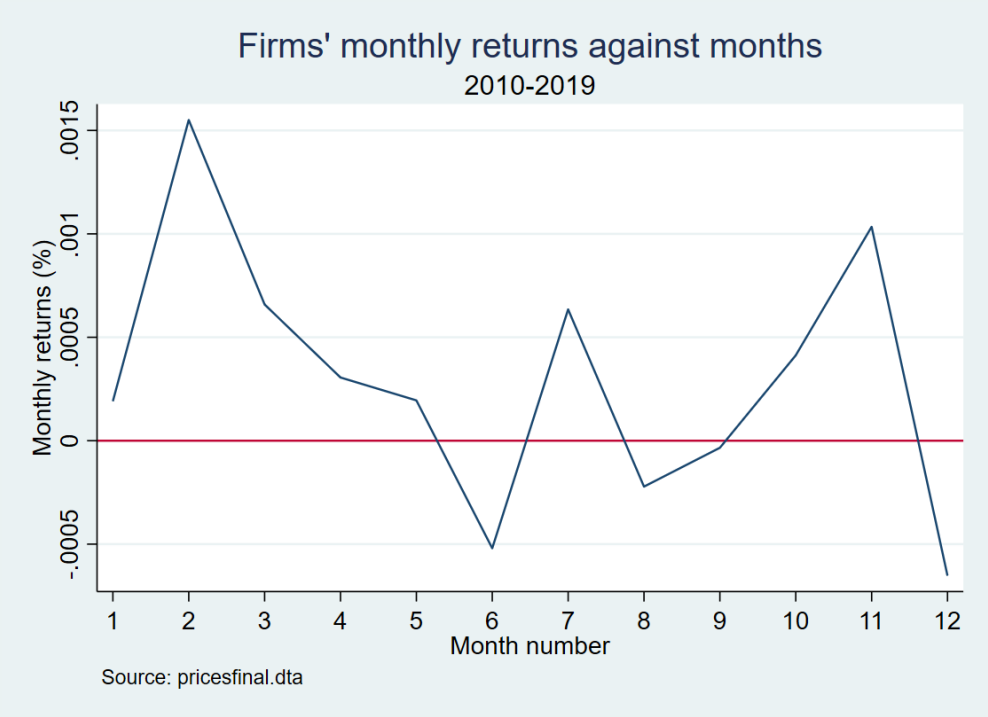

Figure 1 - Graph showing firm's monthly returns against months

When segregated by age, average returns follow a similar pattern of peaking in February and November for both categories. Younger firms appear to be more volatile, experiencing greater deviations from the benchmark than mature firms.

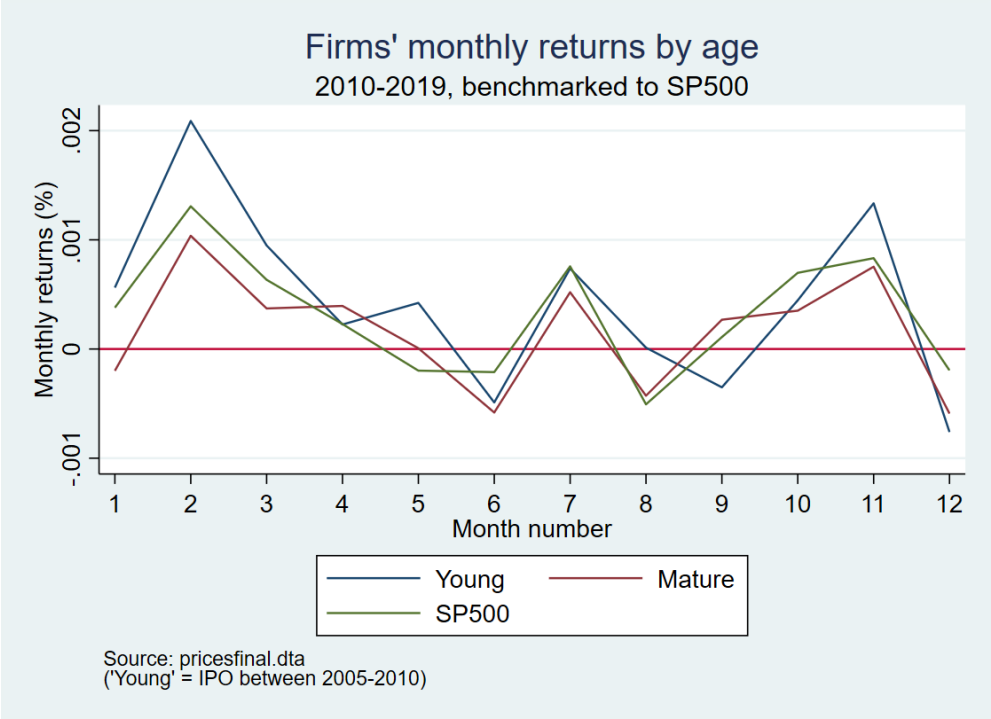

Figure 2 - Graph showing firm's monthly returns by firm age with benchmark

When split by size, large firms broadly follow the benchmark, retaining the February and November peaks in average returns. Small firms' returns drastically decrease during summer months before rallying in October.

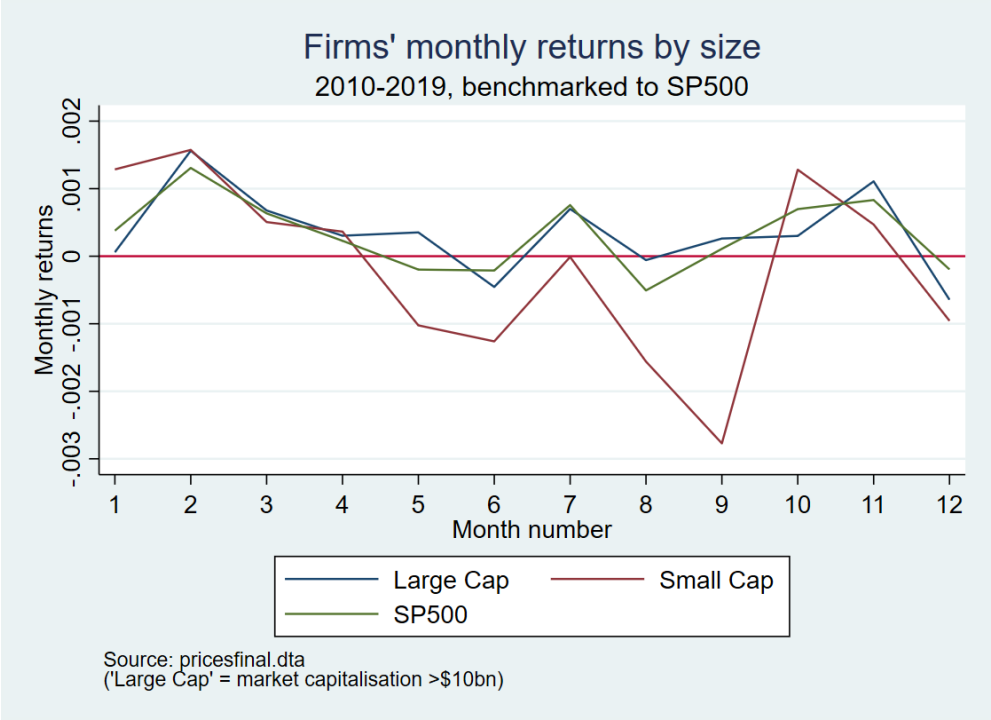

Figure 3 - Graph showing firms' monthly returns by size with benchmark

4. Presence of month effects for January and December

The dataset is examined to establish the presence of abnormal returns in January and December. The fixed effects regression model used is:

$$Y_{it} = \beta_1 + \beta_2 D_{2,it} + \beta_3 D_{3,it} + \alpha_i + u_{it}$$

Where,

Y_{it} = average daily returns

$\beta_2 D_{2,it}$ = 1 if weekday is Monday, 0 otherwise

$\beta_3 D_{3,it}$ = 1 if month is January, 0 otherwise

Table 1. Month effects for January and December

	Daily Returns	
February	0.00138**	(0.002)
March	0.000492	(0.073)
April	0.000143	(0.653)
May	0.0000355	(0.918)
June	-0.000702*	(0.036)
July	0.000462	(0.202)
August	-0.000374	(0.287)
September	-0.000218	(0.589)
October	0.000231	(0.483)
November	0.000879**	(0.004)
December	-0.000840*	(0.022)
Constant	-0.0000810	(0.796)
p_diff	8.00e-08	
Observations	50300	

p-values in parentheses
Source: pricesfinal.dta
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The results do not appear to show the presence of any significant effects for January (illustrated by "constant"). A negative effect for December is observed at 5% level of significance, suggesting that in December returns for the 20 firms decrease by 0.08% *ceteris paribus*. Apparent positive effects significant at the 1% level are observed for months February and November, with a *ceteris paribus* returns increase of 0.138% detected for February. The p-value resulting from the F-test is 0.0000, indicating that the model is a good fit for the data.

5. Presence of month effects considering firm age

To determine if the firm's age influences month effects, the regression model is amended to:

$$Y_{it} = \beta_1 + \beta_2 D_{2,it} + \beta_3 D_{3,it} + \beta_4 D_{4,it} + \alpha_i + u_{it}$$

Where $\beta_4 D_{4,it}$ = 1 if firm IPO was between 2005-2010, 0 otherwise

Table 2. Month effects for qualitative variable young (firms with IPO 2005-2010)

	Daily Returns - Young		Daily Returns - Mature	
February	0.00153*	(0.039)	0.00123*	(0.018)
March	0.000432	(0.274)	0.000552	(0.183)
April	-0.000273	(0.542)	0.000558	(0.229)
May	-0.000134	(0.801)	0.000205	(0.672)
June	-0.00101*	(0.034)	-0.000396	(0.423)
July	0.000226	(0.678)	0.000698	(0.174)
August	-0.000507	(0.325)	-0.000242	(0.642)
September	-0.000905	(0.186)	0.000469	(0.273)
October	-0.0000692	(0.871)	0.000531	(0.313)
November	0.000830	(0.055)	0.000929*	(0.043)
December	-0.00127**	(0.005)	-0.000406	(0.492)
Constant	-0.000315	(0.464)	0.000153	(0.740)
p_diff	0.000000810		0.0000293	
Observations	25150		25150	

p-values in parentheses
Source: pricesfinal.dta
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Again, the results in Table 2 do not appear to show a significant effect for January. For young firms, another negative effect significant at the 1% level is observed, with returns appearing to decrease by 0.127 *ceteris paribus.* Mature firms show no significant effect. February once again appears to show returns increases significant at 5% level for both young and mature firms. 0.0000 p-values from F-tests undertaken illustrate that the models are again a good fit.

6. Presence of month effects considering market capitalisation

To discover the impact of firm's size on month effects, the regression model becomes:

$$Y_{it} = \beta_1 + \beta_2 D_{2,it} + \beta_3 D_{3,it} + \beta_5 D_{5,it} + \alpha_i + u_{it}$$

Where $\beta_5 D_{5,it}$ = 1 if firm capitalisation is >$10bn, 0 otherwise.

Table 3. Month effects for qualitative variable large (capitalisation >$10bn firms)

	Daily Returns - Large		Daily Returns - Small	
February	0.00150***	(0.000)	0.000299	(0.945)
March	0.000626*	(0.027)	-0.000717	(0.595)
April	0.000250	(0.444)	-0.000824	(0.655)
May	0.000295	(0.373)	-0.00230	(0.059)
June	-0.000504	(0.112)	-0.00249	(0.241)
July	0.000650*	(0.047)	-0.00123	(0.700)
August	-0.000106	(0.744)	-0.00279	(0.068)
September	0.000208	(0.468)	-0.00405	(0.199)
October	0.000250	(0.458)	0.0000613	(0.978)
November	0.00106***	(0.001)	-0.000742	(0.326)
December	-0.000690	(0.069)	-0.00218	(0.105)
Constant	-0.000103	(0.746)	0.000115	(0.955)
p_diff	0.000000767		0.945	
Observations	45270		5030	

p-values in parentheses
Source: pricesfinal.dta
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3 shows no significant effects observed for January or December. A highly significant (0.1% level) positive effect is apparent for large firms' returns in February and November, with returns appearing to increase by 0.15% and 0.106% respectively *ceteris paribus.* No significant effects are observed for small firms, perhaps due to the small number of observations and high p-value illustrating that the model may not be a good fit.

7. Discussion and conclusion

The results appear to substantiate the existence of calendar effects for the data, particularly statistically significant and consistent increases in average returns during January to reach peaks in February and decreases during November to troughs in December. Effects appear present for both young and mature firms and firms with large capitalisation. These results potentially confirm calendar effects' significance as more than a simple heuristic, alluding to a persistent market anomaly in the winter months, potentially rendering markets inefficient and prime for market timing trading strategies. However, the EMH may not be disproved by this; investors may be causing the anomaly by following each other's behaviour in a predictable fashion. This may precipitate a change in strategy by investors and conceivably reverse the effects of the anomaly.

Student ID: 100249635

References:

Fama, E., (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, 25(2), p.383. DOI: https://doi.org/10.2307/2325486

Forbes, W., Hudson, R., Skerratt, L. and Soufian, M., (2015). Which heuristics can aid financial-decision-making?. *International Review of Financial Analysis*, 42, pp.199-210. DOI: https://doi.org/10.1016/j.irfa.2015.07.002

Malkiel, B., (2003). The Efficient Market Hypothesis and Its Critics. *Journal of Economic Perspectives*, 17(1), pp.59-82. DOI: https://doi.org/10.1257/089533003321164958