

Brexit Announcement: A Test of Market Efficiency

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This study tests market efficiency theory by examining the effect of the Brexit announcement on the risk adjusted stock price returns of a sample of firms with strong economic ties to the EU using the standard event study methodology in the finance literature. How did the market react to UK leaving the European Union? We hypothesize that the June 24, 2016 Brexit announcement would negatively affect the risk adjusted returns of the sample of firms analyzed. The purpose of this study is to test market efficiency by analyzing the effect of Brexit's announcement on the market. Specifically, we analyze the semi-strong market efficiency hypothesis predicting that stock price returns react so fast to all public information that no investor can earn an above normal return by acting on such news. Consistent with market efficiency and behavioral finance theories, we observe an overreaction to the bad news up to 14 days following the announcement followed by a return to equilibrium. Overall, results support semi-strong form market efficiency for the Brexit announcement. Implications of this study suggest that efforts to determine the "right" value of stock are useless since the market is semi-strong form efficient. The "right" price is the market price that instantly impounds all available and relevant information.

INTRODUCTION

When the United Kingdom voted to leave the European Union on June 24, 2016, many investors were concerned that a similar movement would follow in other countries to exit the EU. The European Union consisted of 28 members that create the European Union stock market. The outcome was not anticipated since a majority of capital market participants predicted a 90% chance that the UK would remain in the EU. This decision to exit caused huge losses in the financial market resulting in large share price losses, especially for financial institutions. Compared to the Lehman bankruptcy (Bacon and Pichardo, 2009), Brexit initiated large stock price losses for financial institutions ranking as the most significant economic event in recent years. Similar to the market reaction to Lehman's bankruptcy, we hypothesize that the Brexit announcement would negatively impound stock price returns consistent with the semi-strong form market efficiency hypothesis.

A market is efficient with respect to an information set if and only if security prices act as if everyone knows that information. If this condition holds, prices are said to "fully reflect" all available and relevant information (Beaver, 1981). Likewise, usage of popular valuation methods to determine the "right" price of stocks is rendered useless if the market is efficient. Market efficiency has two implications. First, in any given time period, a security's abnormal return depends on information or news received by the market in

that period. And second, an investor who uses the same information cannot expect to earn abnormal returns (Ross et. al., 2016). For this to hold, the following conditions must be true: investors react rationally, investors have offsetting irrationalities in the marketplace, and arbitrage of professionals dominates the speculation of amateurs in the market. The purpose of this study is to test the semi-strong form market efficiency theory by examining the effect of the June 24, 2016 Brexit announcement on the risk adjusted stock price returns of a sample of firms using the standard risk adjusted event study methodology in the finance literature.

LITERATURE REVIEW

Market Efficiency and Investment Analysis Fees

This study tests the semi-strong market efficiency theory by using the standard event study methodology in the finance literature (Bacon, 2008 and 2017). If the market is semi-strong form efficient, then two popular methods of stock valuation are rendered useless resulting in a significant implication of this study's findings. Investors pay analysts who use these valuation models billions of dollars annually for investment advice and guidance. But if the market is efficient, these investors are wasting billions of dollars on useless investment advice. Efforts to determine the "right" value of stock are useless if the market is semi-strong form efficient since the "right" price is the market price that instantly impounds all available and relevant information.

Technical Stock Analysis

The first popular method in the finance investment literature called into question by the efficient market hypothesis is technical stock analysis. Technical analysis is, in essence, the recording of the actual history of trading for one stock or a group of equities and deducing the future trend from this historical analysis. Technical analysts identify buy and sell points by analyzing past price movement with charts. Often called chartists, they closely examine the effect on stock price of supply and demand, popular opinions, moods, and blind necessities. Using these factors continually, technical analysis disregards the minor fluctuation in the market and identifies how stock prices tend to move in trends in the long run. Finally changes in trends are determined by shifts in supply and demand relationships and can be detected sooner or later in the market (Levy, 1966). Critics contend that the past behavior of the stock market may not be indicative of future behavior and that the market moves in a random pattern. The market reacts to information, and since information arrives randomly, the market responds in a similar fashion. Also, multiple interpretations could be made by looking at the chart of past stock price movements. These critics also argue that if technical analysis were continually successful, an influx of technical traders will neutralize whatever profit potential exists (Levy, 1966).

Fundamental Stock Analysis

The other stock valuation model used by analysts to determine market value is fundamental stock analysis. Fundamental stock analysis assumes that each security has an intrinsic value, which is the present value of expected future cash flows of the firm. Therefore, value and future cash flow depend upon the firm's earning potential, economic variables, and financial factors that cause actual market prices to move toward intrinsic values (Levy, 1966). If the fundamental intrinsic value is below the market value, the analyst recommends a sell signal and the opposite for a buy signal when the intrinsic value is above the market value. Critics of fundamental analysis contend that the market reacts so quickly to information that it is impossible to maximize profit since the investor is forced to wait for information to be publicly available. This information comprises statistics on sales, orders, earnings, and dividend announcements. Not only is this information hard to collect but it is also costly and not always reliable. A fundamental analyst may find himself heavily invested in a security for a considerable length of time before the market support develops (Levy, 1966).

Market Efficiency

If the market is semi-strong form efficient, investors are wasting billions of dollars on technical and fundamental analyst fees for worthless advice. There are three different forms of market efficiency as defined by the efficient market hypothesis (Fama, 1970). These include strong-form, semi-strong form, and weak form efficiency. Strong form efficiency states that the market reacts to all forms of information including past, public, and private so fast that no investor can earn an above normal risk adjusted return by acting on such information. This makes it impossible for someone to earn an above normal return because the stock price reflects all information whether known or not. An above normal return would be a return greater than the expected risk adjusted return of the stock price. Accordingly, an investor can't earn an above normal return by acting on inside information. Research suggests that the market is not strong form efficient because insiders outperform the market. This finding provides enough evidence to refute the strong-form of the efficient market hypothesis (Finnerty, 1976). Next, the weak form efficient market hypothesis states that all past information is imbedded in stock price. This means that the stock price would not reflect other information, such as earnings forecasts, merger announcements, or money supply figures (Ross et. al., 2016). This means that no investor can earn an above normal return by acting on past information rendering technical analysis useless since its basic assumption rests on the ability to use the past stock price movement identified in charts to predict future stock prices. Weak-form efficiency is the weakest type of efficiency since historical price information is the easiest kind of information about a stock to acquire (Ross et. al., 2016). No investor can earn an above normal return by acting on past information.

Semi-strong Form Efficiency

Finally, the form of market efficiency tested in this study is the semi-strong form efficient market hypothesis. This states that all stock prices reflect public information making it impossible to earn an abnormal return by acting or investing on public information, thus rendering fundamental stock analysis useless. This information includes historical stock prices and published accounting statements of a firm (Ross et. al., 2016). This study tested the semi-strong form efficient market hypothesis by examining the risk-adjusted returns of 10 firms' stock prices from thirty trading days before the event to thirty days after. Ross defines an efficient market response as an immediate stock price adjustment to new information. There is no tendency for subsequent increases and decreases (Ross et. al., 2016).

Brexit and Market Efficiency

Finance Research Letters compare the Lehman Brothers bankruptcy on September 15, 2008, to the Brexit announcement. The Brexit vote was not anticipated by a majority of capital market participants since the group placed a 90% chance that the UK would remain in the EU (Schierreck, 2016). The Lehman Brothers bankruptcy posted the largest financial market loss until the announcement of Brexit. After the Lehman Brothers bankruptcy announcement, bank operations and the regulatory environment faced greater uncertainty. In comparison to the Lehman Brothers bankruptcy announcement, the Brexit event caused significantly larger share price declines for the EU financial institutions.

Bouoiyour (2016) explains that soon after the results of Brexit, experts predicted that the UK stocks would crash given the uncertainty of how the UK would manage from this decision to leave the EU. The findings suggest that the British industries are strong when dealing with uncertainty. Sectors with greater challenges from Brexit included; defense and airlines, real estate, technology, and financials.

Similar to Brexit, the 2016 US Presidential Election of Donald Trump was incorrectly predicted. Bacon and Gobran (2017) tested the efficient market theory on the Presidential Election, by examining the effects of the election outcome on stock price returns of samples of firms from republican and democratic leaning industries. Could individual stock industry returns correctly predict the outcome? Results support semi-strong form efficient market theory since it is not possible to achieve above average returns through the use of public information such as polls. Therefore, since all publicly available information immediately impounds stock price when adjusting for risk, it is not possible to outperform the market.

Cazan (2017) analyzed the effect of the announcement of Brexit on England's banking system. Similar to this study, the Cazan event study confirmed the immediate negative reaction of the risk adjusted stock price returns on a sample of 11 banks.

DATA AND METHODOLOGY

This study used the standard risk adjusted event study methodology from the finance literature to test the 10-firm sample's response to the June 24, 2016 Brexit announcement. Table 1 shows the sample of 10 large cap firms that engaged in significant economic activity with the European Union. Table 1 also shows the firms' alpha and beta.

TABLE 1
ALPHAS AND BETAS

| Firm | Stock Ticker | Beta | Alpha |
|-----------------|---------------------|-------------|--------------|
| British Airways | ICAGY | 1.000206 | -0.00123 |
| EasyJet | ESYJY | 0.39582 | -0.00161 |
| Lloyds Bank | LLDTF | 0.681491 | -0.00074 |
| Morgan Stanley | MS | 1.805094 | -0.00175 |
| Citigroup | C | 1.800806 | -0.00142 |
| Goldman Sachs | GS | 1.466588 | -0.0012 |
| Invesco | IVZ | 1.723927 | -0.00091 |
| JPMorgan | JPM | 1.457535 | -0.00041 |
| BorgWarner | BWA | 1.550373 | -0.0018 |
| Delphi Auto. | DLPH | 1.383118 | -0.00105 |

All required historical data of all firms' stock prices and the corresponding S&P 500 index for the event study period, 181 trading days before the event and 30 trading days after, were obtained from Yahoo! Finance. Only trading days when the market was open were analyzed. The analysis was conducted as follows: Historical stock prices for all companies and the S&P 500 were obtained for the event study duration of -180 trading day to +30 trading days, where -30 to +30 is the event period and day 0 is the event day (June 24, 2016). The holding period returns (HPR) for the sample firms (R) and the S&P 500 (R_m) were calculated using the following formula: Current daily stock return= (Current Day Close Price – Previous Day Close Price)/Previous Day Close Price. A regression analysis was performed using the actual

daily returns of each company (dependent variable) and the corresponding S&P 500 daily returns (independent variable) over the course of the pre-event period (day -181 to -31). For this study, in order to get the normal expected returns, the risk-adjusted method (market model) was used. The expected return for each day of the event period from day -30 to day +30, was calculated as: $E(R) = \alpha + \text{Beta} (R_m)$ where R_m is the return on the market (S&P 500 index). Then, the Excess return (ER) will be calculated as: $ER = \text{the Actual Return } (R) - \text{Expected Return } E(R)$. Average Excess Returns (AER) was calculated (for each day from -30 to +30) by averaging the excess returns for all the firms for a given day. $AER = \text{Sum of Excess Return for given day} / n$, where $n = \text{number of firms in sample}$. Cumulative AER (CAER) was calculated by adding the AERs for each day from -30 to +30. Graphs of AER and Cumulative AER are plotted for the event period i.e. day -30 to day +30.

In order to test semi-strong market efficiency of the June 24, 2016 Brexit announcement, this study proposed the following hypotheses:

H1₀: The risk adjusted stock price return of the sample of 10 firms is not significantly affected by information on the announcement date.

H1₁: The risk adjusted stock price return of the sample of 10 firms is significantly negatively affected by information on the announcement date.

H2₀: The risk adjusted return of the stock price of the sample of 10 firms is not significantly affected by this type of information around the event date as defined by the event period.

H2₁: The risk adjusted return of the stock price of the sample of 10 firms is significantly negatively affected around the event date as defined by the event period.

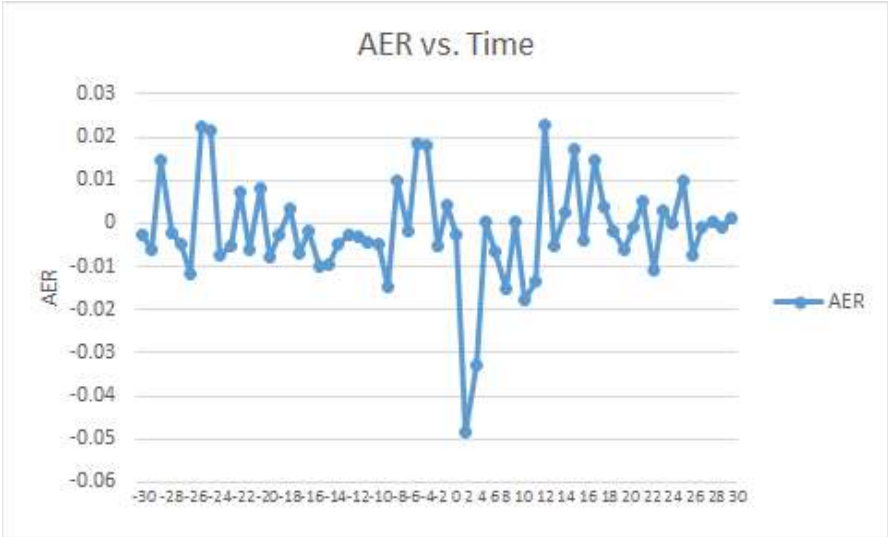
QUANTITATIVE TESTS AND RESULTS

Did the market react to the June 24, 2016 Brexit announcement? Were the risk-adjusted stock price returns of the sample of firms significantly negatively affected? If there were a significant reaction to the event, it would be expected that the difference in the risk adjusted average excess returns and cumulative average excess returns (from day -30 to day +30) would differ significantly. If a significant risk adjusted difference is observed, then the evidence supports the alternative hypotheses that the unexpected Brexit event caused a significant decrease in stock prices returns. To statistically test for a difference in the risk adjusted average excess returns and the cumulative average excess returns (for the firms over the time period day -30 to day +30), a paired sample t-test was performed and found a significant difference at a 5% level between actual and expected risk adjusted returns of the sample of firms. The result of these test supports the alternative hypotheses H1₁ and H2₁ and concludes that the risk adjusted return of the stock price of the sample firms is indeed significantly negatively affected around and on the event date.

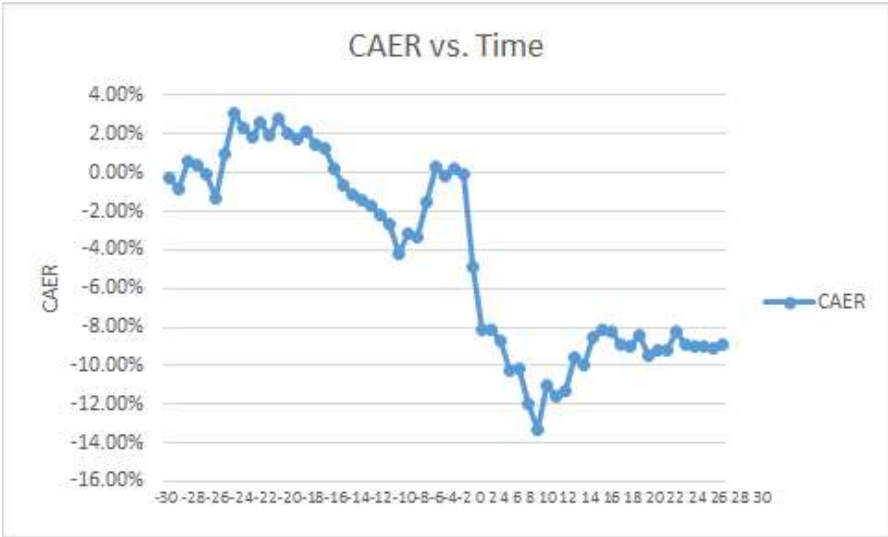
Was the level of efficiency weak, semi-strong, or strong form according efficient market theory? Did the market respond to the information and what are the implications of market efficiency? Exhibit 1 shows the Average Excess Return (AER) graph over the event period. The sample shows significant variation in the AERs around the event (day 0). Results here support the alternate hypotheses that the risk adjusted return of the stock prices of the sample of firms are significantly affected on and around the event. Another purpose of this analysis was to test the semi-strong efficiency of the market in reacting to the unforeseen Brexit outcome. The key in determining this is if the AER and CAER are significantly different from zero or if there is a visible graphical or statistical relationship between time and either AER or CAER. Like the AER, the CAER graph (Exhibit 2) shows significant negative reactions of the risk adjusted returns for the sample of firms on and around the event day 0. Evidence shows that the risk adjusted sample stock price returns fell significantly from day -20 to day -11, then rebounded back to equilibrium by day -8. Possibly the market temporarily predicted the Brexit outcome but was reassured of its failure by day -8 when equilibrium was restored. The significant decline in the risk adjusted return of the stock prices of the sample

of firms on day 0 confirms the semi-strong form efficient market hypothesis. Consistent with market efficiency and behavioral finance theories (Fama, 1997), we observe a negative overreaction from day 0 to day +8, then a return to equilibrium by day +14.

**EXHIBIT 1
TIME VS. AVERAGE EXPECTED RETURN**



**EXHIBIT 2
TIME VS. CUMULATIVE AVERAGE EXCESS RETURNS**



CONCLUSION

This study examines the effect of the Brexit announcement on the stock prices’ risk adjusted rate of return for 10 large cap stock firms with significant economic ties to the European Union. Evidence shows that the risk adjusted sample stock price returns fell significantly from day -20 to day -11, then rebounded back to equilibrium by day -8. Evidence confirms significant negative reactions of the risk adjusted returns for the sample of firms on and around the Brexit announcement or day 0. Likewise, consistent with market

efficiency and behavioral finance theories, a significant negative overreaction to the bad news immediately followed the Brexit announcement with a return to equilibrium by day +14. Overall, results support semi-strong form market efficiency for the Brexit announcement.

Since results support semi-strong form market efficiency, this study adds to the body of finance literature questioning the value of two popular methods of stock valuation, technical and fundamental analysis. Implications of this study suggest that efforts to determine the “right” value of stock are useless since the market is semi-strong form efficient. The “right” price is the market price that instantly impounds all available and relevant information.

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