Investor sentiment and local bias in extreme circumstances: The case of the Blitz

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Abstract

This paper treats the Blitz, the bombing of Britain during World War Two, as a natural experiment which can provide insights into the effects of investor sentiment on stock returns. The period of the Blitz is very interesting in that one of the world's major financial centres was under regular and severe air attack, as were many other industrial and commercial centres. These conditions provide a unique opportunity to study both investor sentiment and local bias effects in extreme circumstances. We show that negative investor sentiment during the Blitz as a whole was not evident. However major bombings in London generate negative investor sentiment on stock returns while major bombings outside of London generate no negative investor sentiment on stock returns, which is consistent with local bias effects.

Keywords: Stock returns; Sentiment; World War Two; Local bias

JEL Classification: G10; G11; G12; G14

1. Introduction

This paper examines an interesting period that, to the best of our knowledge, has not been investigated in the finance literature. The Blitz, from 7th September 1940 to 12th May 1941, was a period of almost continual air attack by German forces on Britain during World War Two (WW2 hereafter) with well over 30,000 tons of bombs dropped on the country (Ellis, 1990, Table 28). The bombings of the Blitz caused great numbers of causalities and damage, with over 40,000 civilians killed and 46,000 injured and more than one million houses destroyed or severely damaged. This was accomplished with the loss of about 600 German aircrafts (Richards 1952). A substantial proportion of the bombings and many of the heaviest raids were on London[1], with other major cities also frequently and heavily bombed due to their significance in the war effort. The period of the Blitz is very interesting in terms of finance theory in that one of the world's major financial centres was under prolonged and serious attack. Since London is the hugely pre-eminent finance centre in Britain, it is no exaggeration to say that most market participants were directly exposed to serious danger for a substantial period of time. Given the extensive recent literature on the effect of sentiment and particularly anxiety and fear on stock returns, the conditions of the Blitz generate a unique opportunity to contribute to the literature by examining investor sentiment in extreme circumstances. The Blitz period also provides an excellent natural experiment to explore the local bias hypothesis by investigating whether the Blitz bombings in London had a stronger adverse effect on stock returns than bombings outside of London.

This paper contributes to the literature in several ways. First, we examine a period of the British stock market that has not been studied in great detail. Second, we investigate investor sentiment in the extreme circumstances of the Blitz taking account of the real economic and strategic conditions at the time. Third, we explore the possibility of local bias on the stock market. The results show that stock market returns were not negative during the Blitz as a whole, despite the massive damage and loss of life, but that the days after major London bombings had negative average stock market returns while non-London bombings were associated with positive returns. This suggests that local bias is evident in that investors placed more emphasis on the London bombings than bombings outside of London.

[1] London was bombed every night bar one, for eleven weeks during the Blitz period.

The remainder of the paper is organized as follows. The next section explains the historical background of the Blitz while Section 3 provides a literature review. Section 4 presents the methodology while Section 5 presents the data and empirical results. Section 6 summarises the findings and provides conclusions.

2. Historical Background

The Blitz occurred in a period of the war after the fall of France where the only major participants were Germany, Britain and Italy, although Italy took very little part in the Blitz itself. The Blitz was immediately after the Battle of Britain, which was the attempt by Germany to establish daylight air superiority over Britain after the fall of France in the summer of 1940. The object of the Battle of Britain was to prepare for a cross channel invasion and operations largely pitted one air force against another and much of the fighting took place around airfields. The Battle of Britain was a British victory in that Germany suffered heavy losses and did not achieve the air superiority they hoped before the bad weather of autumn came which led to the invasion of Britain being postponed. The German forces then switched their attack to night bombings of major British cities and this period is now known as the Blitz. They conducted their operations at night as the German bombers were hard to see and engage so German casualties would be relatively low. London was a very major objective of the bombers, although many cities that were important to the war effort were also attacked. At the time the potential effect on moral of the bombings on civilians was largely unknown and probably overestimated. It was thought by some that mass panic was possible which could serious dent Britain's war effort (Beevor 2012).

The London Stock Exchange (LSE hereafter) stayed open during the Blitz, although fear of destruction caused 514 of its 784 members to establish an emergency address (Michie 1999). Damage only closed the LSE from 16th to 24th September 1940, although trading was switched to the settlement room on the 17th September, so only one day's business was lost. Consequently, the LSE stayed open virtually throughout the war although with slightly reduced hours. Nevertheless, the LSE turnover was affected with it falling to half its pre-war level by 1941. By 1942 however, business began to increase and the LSE was recovering back to its pre-war state (Michie 1999).

London was not the only major city to be bombed by German forces. For example, one of the biggest and most damaging attacks during the Blitz was on the manufacturing city of

Coventry on the 14th November 1940. Some 437 German aircrafts dropped bombs repeatedly for 10 hours, with twelve important aircraft plants and nine other major industrial works being targeted. There was a loss of some 500 retail shops, as well as the blocking of railway lines, causing great disruption to the war effort (Richards, 1952). Other major cities were also targeted due to their importance in the war effort, including Birmingham, Bristol, Clydebank[2], Hull, Manchester, Merseyside[3], Portsmouth, Plymouth, Southampton and Sheffield. For example Merseyside suffered over sixty raids and was Hitler's number one target outside of London due to its granaries, power stations, dry docks, gasworks and its port which brought food and materiel across the Atlantic (Gardiner 2011). Other easily located coastal cities of strategic importance, such as Hull, Portsmouth, Plymouth and Southampton were attacked very frequently (Hull approaching 50 times and Plymouth over 30, Gardiner, 2011).

3. Literature Review

Investor sentiment on stock returns has been well documented in the economic and finance literature in recent years (see Hirshleifer, 2001). Many routine and seemingly economically unimportant factors have been shown to affect returns including the amount of daylight (Kamstra et al 2000), sunshine (Hirshleifer and Shumway 2003), and even sports results (Edmans et al 2007). An obvious question is how more extreme events may affect investor sentiment. There has been very little research conducted in this area. Kaplanski and Levy (2010) investigate the effect of aviation disasters and find that they cause stock market drops that are disproportionately larger than their economic effects and ascribe these to bad moods and anxiety being induced among investors. Yet, aviation disasters can only affect the mood of investors in a very indirect way by causing them to think about the risk they may encounter on future flights. One study that examines the sentiment of stock returns in the case of extreme circumstances is Shan and Gong (2012) who investigate the effect of the Wenchuan Earthquake on stock returns. They find that during the 12 months following the earthquake, stock returns are significantly lower for firms near the epicentre of the earthquake and that these results cannot be explained by actual economic losses or by systematic risk. Also, Ramiah (2013) examine the effects of the Boxing Day tsunami in 2004 on world equity markets and show that equity markets were virtually insensitive to this event despite the negative sentiment that prevailed following the event.

[2] The conurbation around Glasgow.
[3] The conurbation around Liverpool.

The literature on financial markets and wars is growing. Brown and Burdekin (2002) study two series of German bonds which were traded on the London Stock Exchange from 1924 to 1930 and find major turning points follow Hitler's reintroduction of conscription in 1935, the outbreak of war in 1939 and the D-Day invasion of June 1944. They also show that the bonds sustained a downward trend after 1935 suggesting a reflection of the risk posed by Hitler. However the bond prices recovered during the war but appear to anticipate the overthrow of Hitler and post-war settlement of foreign bondholders' claims. Frey and Waldenstrom (2004) compare sovereign debt prices on the Zurich and Stockholm stock exchanges and find considerate symmetry in the price responses across the two markets in relation to turning points in the war, suggesting that the markets worked efficiently. Occhino et al (2008) employ a neoclassical growth model that incorporates essential features of the occupied economy to assess the welfare costs of the policies that managed payments to Germany during their occupation of France. They find that the occupation payments required a severe cut in consumption, while a draft of labour to Germany and a reduction of real wages added to this burden. Oosterlinck (2003) studies the information content of French bond prices during World War II (WWII) and show that agents ascribed different deault risks to pre-war and to occupation bonds, while also documenting that fluctuations in the price differential is a pure measure of the relative credit risk, reflecting key political and military events. Oosterlinck (2010) analyses the motivations of the legal changes imposed on the French exchanges during World War II and show that the most efficient tools for stimualating the demand for French state bonds were forced registration and the cap on maximum prices. Choudhry (2010) shows that many major wartime events labelled important by historians resulted in structural breaks in stock price movements and volatility, while Frey and Kucher (2000) find that the loss and gain of national sovereignty during WW2 influenced the bond prices of the European countries involved. Snyder (1990) outlines a rational theoretical framework connecting stock prices and war events. This states that if stock prices are determined by flows of expected returns from some real assets and war events have a significant effect on these expected returns, then these events will be recorded in prices. Le Bris (2012) studies the effects of wars upon the French stock market and shows that World War II led to a significant destruction of market values in real terms, and that there was strong financial repression which led to a surprisingly short-lived rise of prices until 1943. Recently, Hudson and Urquhart (2015) study the major events of WWII on the British stock market and find stock returns reacted more strongly to negative events than positive events, although there is a limited link between war events and market returns.

Given the framework of Snyder we can initially estimate the effect of the Blitz from a rational viewpoint without taking account of sentiment. A huge amount of casualties were inflicted and property damaged during the Blitz and attacks were intended to disrupt industry and infrastructure and this was substantially achieved. For example, the major attack on the city of Coventry caused a 20% reduction in aircraft manufacture output (Richards 1954). Quantifying these effects is a very difficult task and is not the purpose of this paper but it is clear that the direct effects on the economy and asset returns must have been large and negative.

These negative direct economic effects may have been mediated by strategic and macroeconomic factors. From a strategic viewpoint, historians tend not to view this period as a major turning point in WW2. The greatest threat to Britain in 1940 was undoubtedly from a successful cross channel German invasion over the summer. It was clear to all informed parties that a possible invasion of Britain could only take place if the Germans achieved air superiority before the bad weather of Autumn set in. The Blitz period broadly started at about the time that invasion became impractical due to weather considerations. Indeed Hitler did indefinitely postpone invasion plans on 17 September 1940 (Gilbert, p125). Thus the 'Battle of Britain' which took place over the summer is generally regarded as the decisive event in this period and this could be perceived at the time. Whilst not privy to the intentions of the German High Command, it would be increasingly evident to the British public that an invasion was rapidly becoming more or more unlikely as the Blitz period progressed. During the Blitz period there was perhaps some possibility of heavy bombing resulting in the complete collapse of civilian moral and/or catastrophic economic destruction leading to defeat. To some extent the effect of such attacks were unknown and unprecedented before the bombing started and surely many people must have felt a good deal of uncertainty over its strategic effect. It seems reasonable, however, to suppose that in the light of the resilience shown to the initial major raids fears of a total collapse would soon reduce. In no account of the period does it seem that the bombings brought Britain close to defeat. The British Official Historian's judgment on the Blitz was that 'it never brought the enemy within sight of inflicting a decisive stroke' (Collier,1957, p. xvii). Of course this does not imply that all individuals were continually optimistic and these feelings will be captured in the discussion of sentiment below.

Stock market performance will be affected by macro-economic conditions and these can be quite unusual in wartime so it is worthwhile investigating the likely effects of these. Le Bris (2012) points out that monetary policy in WWII was very expansive in France leading to rises in real assets including stocks. There were, however, very contrasting monetary policies in the UK and France at this time. The UK financed the war largely through borrowing so monetary expansion was very modest compared to that in France. In France the share of war spending financed by money was 34% (Le Bris, 2012, p344), in the UK only about 6% of the current deficit during the war years was financed by monetary expansion (figures derived from Table 4, Broadberry and Howlett, 2005). Thus it seems unlikely that the stock market was unduly boosted by monetary policy in the UK.

If we consider the role of sentiment one would certainly expect the Blitz to have induced severe anxiety as the recent literature on terrorism suggests. Carter and Simkins (2004) examine the effect of the September 11th attacks on New York in 2001 and find large significant negative abnormal returns for airfreight firms and international airlines. Chen and Siems (2004) examine the US capital markets response to various terrorism attacks dating back to 1915 and up to the September 11th attacks in 2001. They show that these attacks had a significant negative impact on the US capital markets although they are more resilient than in the past and recover sooner from terrorist attacks than other global markets. Further, Nikkinen and Vahamaa (2010) examine the behaviour of the FTSE 100 index around the terrorist attacks of September 11th 2001, the 2004 attacks in Madrid and the July 7th attacks in London in 2005. They show that terrorism had a strong adverse effect on stock market sentiment with a pronounced downward shift in the expected value of the FTSE 100 and that these attacks caused 3 of the 5 largest daily increases in implied volatility from January 2000 through to December 2005. Drakos (2010) explore whether terrorism exerts a significant negative impact on daily stock market returns from a sample of 22 countries and show that terrorist activity leads to significantly lower returns on the day of a terrorist attack occurs. Also, the negative effect of terrorist activity is substantially amplified as the level of psychosocial effects increases. Further Kollias et al (2011) examine the effect of the bomb attacks in Madrid on 11th March 2004 and in London on 7th July 2005 on equity sectors. They find significant negative abnormal returns across the majority of sectors in the Spanish markets but not so in the case of London. They also find that the market rebound was much quicker in London compared to the Spanish markets and that the bombings had only a transitory impact on returns and volatility that did not last for a long period. Chesney et al

(2011) examine the impact of terrorism on the behaviour of stock, bond and commodity markets over an 11-year time period. They find that two-thirds of the terrorist attacks considered lead to significant negative impact on at least one stock market and that the Swiss stock market is affected by the highest number of attacks, and the American stock market by the lowest. Kollias et al (2013) study the effects war and terrorism have on the covariance of oil prices and the indices of four major stock markets using the nonlinear BEKK-GARCH model. They find that the covariance between stock and oil returns are affected by war, however terrorist incidents that are one-off unanticipated security shocks cause only co-movement between the CAC40, DAX and oil returns is affected and no significant impact is observed in the relationship between the S&P500, FTSE100 and oil returns. Essaddam and Karagianis (2014) examine the effect of terrorist attacks on the stock return volatility of American firms and find volatility increases on the day of the attack and remain significant for at least fifteen days following the day of the attack. Also, Essaddam and Mnasri (2014) investigate the impact of terrorism on the volatility of stock returns of 17 market indices between 1994 and 2005 and find that terrorism has a significant impact on stock market volatility.

In summary, during the Blitz period stock prices would be subject to a variety of influences. The attacks would clearly have a direct negative economic effect due to the destruction caused. In strategic terms it seems likely that this period was likely to be one of increasing optimism in that outright defeat would be evidently becoming increasingly unlikely. Macroeconomic policy does not seem to have been such as to have a very major distorting influence on the stock market. It seems clear that the Blitz would have caused some extreme negative investor sentiment which, on the basis of the past literature, should also depress stock prices. The question of interest is whether inferences about sentiment drawn from fairly routine events and terrorist attacks hold in extreme circumstances where the stock exchange and its participants were under regular heavy attack. We investigate this issue empirically in the sections below.

4. Methodology

In this section, we provide details of the methodology used in this study to examine the effect of the Blitz on British stock returns during WWII.

4.1. Event Study

Initially, we examine the next day return on days following major Blitz bombings on London and non-London to determine the impact of these bombings on the FT30, a good measure of the British stock market at the time. To further examine the impact of these bombings on the FT30, we utilise an event study to calculate the abnormal returns on subsequent days after the Blitz bombings. Since we are examining an index, we utilise the mean-adjusted-returns approach of Brown and Warner (1985). This approach computes daily excess returns of the FT30 by;

$$AR_t = R_t - \bar{R} \tag{1}$$

Where AR_t is the abnormal return for the stock index at time *t*, R_t is the actual observed rate of return for this index, and $\bar{R}$ is the mean return of the index daily returns in the (-61; -11) estimation period so that;

$$\bar{R} = \frac{1}{50}\sum_{t=-61}^{-11} R_t \tag{2}$$

Initially, the event day abnormal returns are calculated. Given that the event date is at t = 0, and following Kollias et al (2011), longer event windows are examined by computing the cumulative average abnormal returns (CARs) ten (*t* = 10), five (*t* = 5), two (*t* = 2) and one (*t* = 1) days following the event. The CARs are estimated using the following equation;

$$CAR_t = \sum_{t=T_1}^{T_2} AR_t \tag{3}$$

Where T_1 is the event day and T_2 is consequently 5 or 10 days after the event. We report the cumulative average abnormal returns (CAARs), which are the average of the CARs for each event studied. We study the parametric t-statistic as well as the Sign test. The sign test (Cowan 1992) studies the ratio of positive cumulative abnormal returns during the event window to number over the estimation window such that;

$$t_s = \frac{p_0^+ + p_{est}^+}{\sqrt{p_{est}^+(1 - p_{est}^+)/N}} \tag{4}$$

where p_0^+ is the ratio of positive cumulative average abnormal returns during the event window and p_{est}^+ is the ratio of positive cumulative average abnormal returns during the estimation window. We also utilise the non-parametric Corrado test (1989), where the basic principle involves the conversion of abnormal returns into a sequential rank. As ranks are generally not substantially distant from another, ranked distributions are less prone to non-normality, which is found in Table 1 for the FT30 data.

4.2. Binomial test

The second stage of the assessment involves testing whether the return on the next trading day differs from the unconditional mean return on all trading days. The non-parametric binomial test is chosen as it is robust to the underlying data distribution and so is appropriate given the non-normal behaviour of the data. The binomial test examines whether the expected return on the next trading day is less than the unconditional mean return after a major bombing of the Blitz by considering the proportion of returns after a bombing that are less than the unconditional mean return.

4.3. Regression analysis

To further our analysis, we conduct regression analysis on the FT30 returns to study how the market reacted following the bombings of the Blitz. However is well known that seasonal anomalies[4] are found in stock market data and could skew the results, as evidenced by Zhang and Jacobsen (2013) in the UK. To account for these seasonal effects in the data, we include dummy variables in the mean equation of our regression, however unlike previous studies, we do not assume all of the seasonal effects exist in our data. We pre-test the data to determine which seasonal effects are evident and only include the significant seasonal effects found in the data before the regression analysis. The seasonal effects examined are the well-known Monday effect, January effect, turn-of-the-month effect, as well as serial correlation in the returns. It is also well known that stock market data is volatile and has time dependence variance. The time dependency of the error variance violates one of the basic Gauss-Markov assumptions for linear regression, therefore making the estimation of OLS regressions invalid. Therefore we use GARCH modelling (Bollerslev 1986) which allows for time-varying volatility and adds robustness to the results.

[4] For a thorough literature review of seasonal anomalies, see Urquhart and McGroarty (2014).

Firstly, we examine whether the seasonal effects are present in our data through a GARCH(1,1) regression such that;

$$r_t = \gamma_0 + \beta . D_{1it} + \varepsilon_t$$
$$h_t = c + \alpha_1 . \varepsilon_{t-1}^2 + \alpha_2 . h_{t-1} \quad (5)$$

Where r_t is the return on the FT30 on day t, γ_0 is the regression intercept, D_{1it} is a dummy variable for the seasonal effect examined, h_t and h_{t-1} are the conditional variance of stock returns at time *t* and *t-1 and εt* and ε_{t-1} are the error terms at time *t* and *t-1* . If the seasonalities are found to be statistically significant, they are included in the proceeding regression analysis. However if the seasonalities are found to be insignificant, we exclude them from our analysis. Therefore, in order to study whether the returns of the British stock market was affected by the major positive and negative events, we estimate the following equation[5];

$$r_{it} = \alpha + \sum_{i=1}^{5} \gamma_{1i}\, r_{t-i} + \vartheta_i Mon_{it} + \rho_i J_{it} + \mu TOTM_{it} + \sum_{i=3}^{3} \sigma London_{i,t} + \sum_{i=3}^{3} \tau Non\_London_{i,t} + \varepsilon_t \quad (6)$$
$$h_t = c + \delta \varepsilon_{t-1}^2 + \beta h_{t-1}$$

Where r_t is the return on the FT30 on day *t*, γ_0 is the regression intercept, r_{t-i} is the return on day *t-i*. Mon_{it} is a dummy variable for the Monday effect. J_{it} is the dummy variable for the January effect where i = 1 for the first 15 days in January. $TOTM_{it}$ is a dummy variable for the turn-of-the-month days and T_{it} is a dummy variable for the first five days of the tax year. $London_{it}$ is the dummy variable for a London bombing while Non_$London_{it}$ is the dummy variable for a non-London bombing. In the conditional variance equation, ε_t is the error term with conditional mean zero and conditional variance h_t. However, if any of the seasonal effects are not found to be significant, they are excluded from the subsequent regression analysis.

Nevertheless, many other alternative GARCH models have been proposed and need to be considered since Charles (2010) notes that the choice of model plays an important role because results differ depending on the model used. Therefore we also examine the GARCH-M model of Engle et al (1987) which considers the possibility of a trade-off

[5] If all the seasonal effects are found. If some are not found, they are not included in the final regression.

between returns and risk by including the conditional standard deviation h_t in the mean equation. Thus our mean equation takes the following form;

$$r_t = \gamma_0 + \beta . D_{1it} + \kappa h_t + \varepsilon_t \tag{7}$$

If $\kappa > 0$, then there is a positive trade-off between risk and return, as suggested by portfolio theory. The significance of κ then determines whether the extended model is appropriate. We also consider two more commonly used alternative GARCH models, namely the TGARCH model. The TGARCH model of Glosten et al (1993) considers that shocks with opposite signs may impact volatility to a different extent and so product terms are added to the variance equation such that;

$$h_t = c + \alpha . \varepsilon_{t-1}^2 + \beta . h_{t-1} + \sum_{v=1}^{r} \lambda_v T_{t-v} \varepsilon_{t-v}^2 + \tag{8}$$

where T_{t-v} is a dummy that takes the value 1 if $\varepsilon_{t-v}^2 < 0$ and 0 if $\varepsilon_{t-v}^2 \geq 0$. If $\lambda_v > 0 (\lambda_v < 0)$, negative (positive) shocks have a larger impact on the conditional variance than positive (negative) shocks of the same magnitude. This model is appropriate if the asymmetry parameter is statistically significant.

5. Data and Empirical Results

This section reports the data used in this study, the major bombings of the Blitz that are analysed, as well as the empirical results of the previously described testing procedure.

5.1. Data

The data used in this study is from the Financial Times Industrial Ordinary (FT30) Index, the standard market index used during the war period, from 1st July 1935 to 31st December 2009 for the full sample, from 1st January 1939 to 31st December 1945 for WW2 in Europe and from 7th September 1940 to 12th May 1941 for the Blitz. The FT30 was devised by Maurice Green and Otto Clarke from the Financial News in 1935 and was called the Financial News 30 until the paper merged with the Financial Times in 1945. The FT30 is based on the share prices of 30 British companies and is made up of those in the industrial and commercial sectors and exclude the financial sector and government stocks. The index is based on the

equal weighting of the 30 constituents and the constituents only change when a company needs to be removed for reasons such as mergers and failures. A new company is selected based on a number of considerations, such as the constituents must reflect the breadth of the UK economy, the shares must be actively traded and not in the hands of a small number of holders, the company is a leaders in its field and is UK-based, and that the shares trade without any undue influence on the price from overseas, although this consideration is less relevant today. Only two original constituents remain in the index from 1935, namely GKN and Tate and Lyle[6].

Figures 1 and 2 show the index and the daily returns on the index. Descriptive statistics shown in Table 1 reveal the mean return during the Blitz is positive and higher than the mean during both the rest of the war and the full sample. The standard deviation of returns during the Blitz is lower than during the rest of war and during the whole sample period. It appears that there is no evidence of the Blitz period being negative for stock prices. It seems that, in broad terms, the greater grounds for optimism about the ultimate outcome of the war exhibited in this period might have outweighed the physical damage caused and any sentiment effects.

To examine in detail the effect of individual Blitz bombings on the British stock market, we examine the 8 heaviest air raids that caused the most deaths in London and outside of London. We select these raids for investigation because they are relatively very large and well documented. The bombings selected along with notes about the magnitude of the bombings are documented in Table 2[7].

Most of the bombings during the Blitz were of quite small scale compared to the ones we have used in our study and very frequently do not have reliable data. Often several cities were attacked on the same night. Needless to say there was a lot of confusion at the time and also quite a lot of disinformation. A lot of the information about the bombings was suppressed or manipulated in the mass media to keep up civilian moral and to confuse the Germans. For example, except for the largest cities like London and Liverpool, the media was not allowed to mention the name of a town that was bombed until 28 days after the attack and even then the precise date of an attack could not be given (Gardiner, 2011, p163).

[6] http://www.ft.com/cms/s/0/2a796c32-a0bd-11e0-b14e-00144feabdc0.html#axzz3YgshomAP
[7] For further details of the bombings, see Gardiner (2011).

Regional Information Officers were permitted to release lists of casualties but without addresses (Gardiner, 2011, p162). There seem to be reasonably reliable figures on the total casualties in different regions over the whole period but not for individual raids apart from the major ones we have already covered in detail.

Overall a reasonable model of the period is of very frequent, mainly small raids, almost every night, causing some casualties across the country, about half of them in London, punctuated by the much more damaging raids we have covered. The effect of the extremely numerous small raids is probably best captured by the overall movement of the index across the whole period whereas it is useful to consider the effects of the largest raids individually.

Comparing attacks outside London with those in London gives a reasonable proxy for the sentiment effect. Both types of bombings would have military and civil (economic) consequences but the ones in London would have a much greater effect on the sentiment of market operators (due to the fact they were under personal threat and also because the attacks were extremely apparent whereas news about the ones at a distance was often concealed). In terms of the military and economic effects the Germans would presumably be choosing targets exogenously to maximize these effects so one would not expect a systematic difference between attacks on different regions in respect of these elements even given some clear differences between regions such as the fact the human capital was probably greater on average in London and some cities were better defended or more inacessible than others. London was probably the most defended city although considerable resources were devoted to defending other targets. During the Battle of Britain anti-aircraft artillery had been mainly deployed to defend factories and airfields so at the start of the Blitz there was only a small force of 264 guns defending London (Gardiner, 2005, p340). Moreover, for technical reasons, defenses against night attacks were generally very ineffective at this stage of the war which is indeed why the Luftwaffe had switched from daylight raids. The RAF had very few specialized night fighters and their main day fighters, the Spitfire and Hurricane, were unsuitable for night fighting. Anti-aircraft artillery was quite ineffective against German bombers even in large concentrations and in practice was mainly useful as a means of raising civilian morale by giving the impression that a fight back was in progress (Gardiner, 2011, p35) . To some extent London was actually a relatively easy target given its size and the fact it was fairly close to the German airfields as night navigation and bomber range were very significant constraints at this stage in the war.

5.2. Empirical Results

Table 3 presents the next day return and reveals that the returns on the day after a major air raid in London are all negative, indicating that the bombings had a negative effect on the British stock market. However, the returns after the major air raids outside of London are all positive. The mean return the day following a major London bombings is -0.00264 while the return the day following a major non-London bombing is 0.00286. The t-test comparing the means of the two samples is highly significant at 1%, indicating there is a significant difference in the return the day after a London and a non-London bombing, supporting the local bias hypothesis. The positive average return following a major non-London bombing may be explained by the fact that news of these raids was largely suppressed in the media with the implication that these bombings were little recognized by London based investors and so were not reflected in the market. In addition, as large numbers of German bombers were used in these raids presumably bombings in and near London would have relatively light which might have been taken as quite a positive development by London based investors

The event study results are presented in Table 4 where the CAARs and significance levels are reported for 0, 1, 2 and 5 days following the major bombings in London and outside of London. The results show that the CAARs are all negative for days following bombings in London, although insignificant, while the CAARs for bombings outside of London are positive for the day of the bombings and the day following a bombing. However when the event window is stretched to 2-days and 5-days after a non-London bombing, the CAARs are positive and insignificant. Therefore the results for the event study suggest that bombings in London had a subsequent negative impact on the FT30 while non-London bombings had little impact on the FT30, again supporting the local bias hypothesis.

The binomial statistics in Table 5 indicate that the average return on the FT30 after a major London bombing are statistically significantly less than the unconditional mean return throughout the period. Further, the average returns after major non-London bombings are statistically significantly more than the unconditional mean return. These results confirm the

earlier findings that returns after a London bombing caused negative sentiment in stock returns and non-London bombings caused no negative sentiment.

Table 7 reports the regression analysis, but initially we investigate the existence of anomalies in our data. Table 6 shows significant evidence of serial correlation up to lag 4 but no significant evidence at the 5% level of any of the other anomalies, therefore only serial correlation is included in our analysis. The GARCH(1,1) regression results in Table 7 show that the London bombings generate a negative effect on the FT30, with the coefficient statistically significant at the 10% level. However the bombings outside of London generate a positive coefficient, indicating no negative sentiment on the FT30. For robustness purposes, we also run two other GARCH models, namely the TGARCH(1,1) and GARCH-M(1,1) models. We show that the asymmetric parameter is statistically significant and the GARCH-M parameter is insignificant, indicating that the TGARCH model is appropriate, but not the GARCH-M model. The TGARCH model shows that London bombings generate a significant negative coefficient, indicating the negative effect these bombings had on the FT30. The non-London bombings generate a positive coefficient, again suggesting no sentiment was attached to bombings outside of London.

6. Conclusions

The attacks during the Blitz period would clearly have a direct negative economic effect due to the destruction caused. In strategic terms it seems likely that this period is likely to be of increasing optimism in that outright defeat would be evidently becoming increasingly unlikely. Macroeconomic policy does not seem to have been such as to have a very major distorting influence on the stock market.

This paper has examined investor sentiment during extreme circumstances when the lives of investors were at risk. We find that the Blitz period as a whole did not experience negative stock returns. This is puzzling in the light of the recent literature on investor sentiment which indicates that bad moods and anxiety can be expected to have a substantial negative influence on stock prices as this surely was a period of great anxiety. The explanation perhaps lies in examining the full range of influences on stock prices during the period. Whilst the attacks would clearly have a direct negative economic effect due to the destruction caused and macroeconomic policy was not overly positive it seems likely that, in overall

strategic terms, this period was one of increasing optimism in that outright defeat was evidently becoming increasingly unlikely.

When we look at individual major bombings, we find that major London bombings have a negative impact on the FT30, while major non-London bombings have a positive impact on the FT30. These findings are in accordance with the idea that the major bombings in London had a strong but short-term impact creating negative sentiment amongst the main stock market investors. In contrast, there is no evidence that non-London bombings created a similar negative sentiment amongst investors . Although the eLondon bombings did have a short-term impact on the stock market, but they weren't strong enough to overcome the generally positive trends in the Blitz period as a whole. Overall, this paper supports the existence of a sentiment effect and the local bias hypothesis, with results strong and robust to a number of testing procedures.

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Tables and Figures

Table 1: Descriptive statistics for daily returns. The value in parentheses is the t-test two sample to investigate whether the mean during the blitz was significant different to the mean over the full sample period.

Data	Obs	Max	Min	Mean	Standard Deviation	Skewness	Kurtosis
Blitz	174	0.0138506	-0.0138506	0.0003225	0.0042991	0.20164	1.12256
Rest of War	1610	0.0590633	-0.0484122	0.0002139	0.0062050	-0.63744	18.10595
Full Sample	19155	0.1078119	-0.1240017	0.0001538	0.0105848	-0.19631	9.69967

Table 2: The cities in which the air raids took place, including the date and some information on the size and impact of the raids. The bombings dates and information is taken from Gardiner (2011).

City	Date	Notes
London	7th Sep	First real raid of the Blitz, with 300 bombers and more than 600 fighter planes over the city. 430 were killed, with 1600 seriously injured.
London	8th Sep	200 German planes pounded the City, with every railway line out of London to the south out of action. 412 Londoners were killed, and 747 seriously injured.
London	9th Sep	The raid lasted nearly 10 hours, killing 370 people and injuring 1400.
Coventry	14th Nov	500 tons of high-explosive bombs and 30,000 incendiaries fell, with 568 people killed and 1256 injured.
Birmingham	22nd +23rd Nov	682 dead, 1057 injured and 2000 houses damaged.
Bristol	25th Nov	1540 tons of high explosives, 47 tons of oil bombs and 12500 incendiaries dropped, 207 dead and 187 seriously injured and 703 slightly hurt.
Sheffield	12th Dec	300 bombers, 750 dead and 500 injured.
Merseyside	22nd Dec	119 fatalities and the town of Wallasey suffered badly. The previous 3 nights caused 702 deaths and the same again injured.
Manchester	22nd + 23rd Dec	On the first night, 272 tons of high explosive bombs and 100 incendiaries, while on the second 195 tons of high explosive bombs dropped and 900 incendiaries. In total, 684 died 2364 wounded and 8000 houses uninhabitable.
London	27th Dec	48 German aircraft bombed the city from Chelsea to Dalston. Parachute mines caused many fires, killings 141 people and injuring 455.
London	29th Dec	120 tons of high explosives and 22000 incendiaries were dropped on the city, with 160 dead and 500 injured.
Clydebank	14th Mar	268 tons of bombs and 1630 incendiaries were dropped on the day before and 227 tons of high explosive bombs and 781 incendiaries dropped on the 14th, with a total of 1083 dead.
London	16th Apr	66 of the 101 London boroughs reported bomb damage and over 2250 fires burning, killing 1180 and seriously injuring 2230.
London	19th Apr	More than 1000 tons of high explosives were dropped plus 153,096 incendiaries, the most ever in a single night raid. 146 people died, with 46 missing. This was the biggest single raid on London during the war.
Plymouth	21st Apr	10,000 incendiary dropped killing 750 civilians.
London	10th May	1436 people killed, 1800 seriously injured with 11,000 houses damaged beyond repair.

Table 3: The major bombings on London and outside of London next day's return, along with the t-test for the returns the day after a major bombing in London against the returns the day after a major bombing outside of London. ***, **, * indicate significance at 1%, 5% and 10% respectively.

City	Date	Next Day Return	City	Date	Next Day Return
	7th Sep	-0.00313	Coventry	14th Nov	0.00700
	8th Sep	-0.00313	Bristol	25th Nov	0.00428
	9th Sep	-0.00471	Birmingham	22nd+23rd Nov	0.00430
London	27th Dec	-0.00285	Sheffield	12th Dec	0.00
	29th Dec	-0.00285	Merseyside	22nd Dec	0.00143
	16th Apr	0.00	Manchester	22nd +23rd Dec	0.00143
	19th Apr	-0.00150	Clydebank	13th+14th Mar	0.00446
	10th May	-0.00294	Plymouth	21st Apr	0.00
	Mean return	-0.00264		Mean return	0.00286
t-test for two sample = 5.43***					

Table 4: Cumulative average abnormal returns of the FT30 from London and non-London bombings. Parametric t-test p-values, as well as non-parametric Corrado and Sign test p-values also reported. ***, **, * indicate significance at 1%, 5% and 10% respectively with respect to the parametric t-statistic.

	Pos:Neg	CAAR	Prob	Corrado Rank	Prob	Sign Test	Prob
London Bombings							
[0; 0]	02:06	-0,0409	0,8505	-0,9305	0,3521	-0,6767	0,4986
[0; 1]	02:06	-0,0576	0,8512	-0,5944	0,5522	-0,6767	0,4986
[0; 2]	04:04	-0,0778	0,8580	-0,3722	0,7097	0,7919	0,4284
[0; 5]	04:04	-0,1359	0,7985	-0,4323	0,6655	0,7919	0,4284
Non-London Bombings							
[0; 0]	05:04	0,3304	0,1783	17,442	0,0811	15,129	0,1303
[0; 1]	04:05	0,2245	0,5178	0,1612	0,8719	0,7985	0,4246
[0; 2]	05:04	-0,4711	0,3373	-0,3698	0,7115	15,129	0,1303
[0; 5]	04:05	-0,6256	0,2982	-0,3573	0,7209	0,7985	0,4246

Table 5: Test results from the binomial statistics. Conditional mean = 0.00032. ***, **, * indicating significance at 1%, 5% and 10% respectively.

	No. of Bombings	No. of returns < conditional mean
London Bombings	8	8***
Non-London Bombings	8	2***

Table 6: Regression results for calendar anomalies. ***, **, * indicate significance at 1%, 5% and 10% respectively.

Monday Effect	January Effect	TOTM Effect	Returns^{-1}	Returns^{-2}	Returns^{-3}	Returns^{-4}	Returns^{-5}
-0.001494*	0.002438*	0.000706	0.257662***	0.819366***	0.196247***	-0.217735***	0.001303
(-1.94)	(1.69)	(1.07)	(5.46)	(167.83)	(3.15)	(-3.79)	(0.02)

Table 7: Regression results for the London and non-London raids. The value in parentheses is the corresponding t-statistic. ***, **, * indicate significance at 1%, 5% and 10% respectively.

	GARCH(1,1)	TGARCH(1,1)	GARCH-M(1,1)
Blitz Major Bombings			
α	0.000102	0.000453	-0.000995
	(0.29)	(1.37)	(-0.67)
γ_1	0.197187**	0.147968	0.198953**
	(2.01)	(1.61)	(2.02)
γ_2	0.736667***	0.733677***	0.747112***
	(18.38)	(17.42)	(17.79)
γ_3	0.018377	0.054919	-0.020363
	(0.17)	(0.52)	(-0.19)
γ_4	-0.289185***	-0.280718***	-0.304036***
	(-3.75)	(-3.83)	(-3.96)
σ	-0.004208*	-0.004753**	-0.003838
	(-1.87)	(-2.32)	(-1.51)
τ	0.002340	0.000454	0.002062
	(1.17)	(0.20)	(0.93)
κ	-	-	62.44969
			(0.75)
c	0.000007	0.000004	0.000008
	(1.45)	(1.31)	(1.23)
δ	0.247815	0.349187*	0.184945
	(1.53)	(1.92)	(1.25)
β	0.434992	0.648025***	0.425973
	(1.37)	(3.01)	(1.06)
λ	-	-0.353039**	-
		(-1.99)	

Figure 1: FT30 index during the Blitz

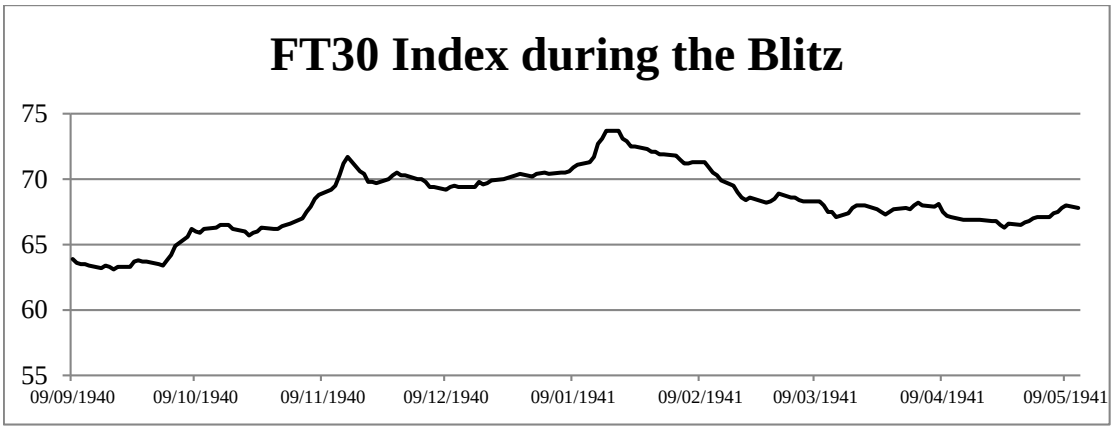

Figure 2: FT30 returns during the Blitz