Do not Fear the Fear Index: Evidence from US, UK and European Markets

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Abstract

The VIX index is popularly known as “the fear index” both in the business media and in academic literature. Following the popularity of the VIX, similar indices were introduced in the UK and European stock markets as an indication of investor uncertainty. In this article, we investigate this popular idea by examining whether these indices indeed reflect investor fear. The results of long horizon predictive regressions show that these fear indices as well as extreme jumps in them fail to predict statistically significant negative market returns up to next five years. Moreover, response of valuation ratios and leading business cycle indicators to shocks in the fear indices are statistically insignificant. However, monetary policy in US, UK and Europe appear to respond significantly to fear indices. Collectively, the results imply that long-term investors do not need to fear these fear indices.

Keywords: VIX index, VSTOXX index, returns, investor fear, monetary policy.

JEL Classification: C22, G17, E44, E47

EFM Classification: 310, 330, 560, 570

1. Introduction

The Chicago Board of Exchange's VIX index is ubiquitously considered as the "Investor Fear Gauge" for asset markets (Whaley, 2000). Whaley (2009) argue that the VIX index serves two purposes. First, VIX index provides ex-ante or the expected measure of stock market volatility for the next 30 calendar days. Thus, it is a forward-looking measure of investor's anxiety or fear for a short-term period. Second, futures and options contracts are designed with VIX index as the underlying instrument, thus helping to mitigate the expected investor fear. In addition to this, financial media, often, consider VIX index as expected investor fear gauge and use it report "calm" or "fear" in the market. For example, on 8th September 2015, Bloomberg published an article, which points to a renewed interest in market's most popular measure of volatility, the Chicago Board's option implied volatility index (VIX), which is a measure of "fear" in the market [1] following the devaluation of Yuan in August 2015.

Besides the interest shown by financial media and practitioners, academic research has also relied on VIX as a measure of expected volatility or the fear. For example, Bloom, (2009) shows that uncertainty shocks, measured using the VIX index, have significant negative impact on business cycle indicators. Drechsler and Yaron (2011) show that the variance risk premium, the difference between squared VIX index and conditionally expected realised variance is linked to underlying economic volatility. Sarwar, (2012) studies the intertemporal relationship between the VIX index and equity markets in Brazil, Russia, India and China (BRIC) to investigate whether VIX serves as investor fear gauge in these countries. His results suggest that VIX indeed, serves as an investor's fear gauge in these markets as well as in the US. Bekaert, Hoerova and Lo Duca (2013), decompose VIX index in two components indicating risk aversion in financial markets and stock market uncertainty. They show that the proxy for risk aversion, derived from VIX index, co-moves with monetary policy. Finally, Lubnau and Todorova (2015), assess the predictive ability of investor sentiment, measured using implied volatility indices such as VIX, in predicting future returns of five stock market indices. The VIX index is also considered as an indication of market participant's "risk-neutral" expectation of future market volatility [Bollerslev, Tauchen and Zhou, (2009), Drechsler and Yaron, (2011)]. Following the popularity of the VIX index, similar indices have been developed across the world such as the VFTSE index in the UK, VSTOXX index in Europe, which indicate the investor fear, and anxiety in the respective markets.

[1] http://www.bloomberg.com/news/articles/2015-09-08/market-volatility-has-changed-immensely

Given the interest shown by both financial media and the academic research, we nevertheless, question to what extent investors should be fearful of the fear index. Alternatively, do these volatility indices exaggerate fear in the market? The aim of this article is to answer these questions and investigate these, rather controversial, issues. The inspiration for asking this question comes from Schwert, (2011) who show that the rise in the VIX index during the 2008 Financial Crisis did not lead to persistent increase in the expected volatility and the VIX index quickly returned to normal levels. He argues that comparisons made (based on rising VIX index) with the Great Depression of 1929 during the Financial Crisis of 2008 were exaggerated and misguided. Furthermore, Chow, Jiang and Li, (2014) show that the VIX is not a true measure of expected volatility and consist of information regarding the skewness of returns. This indicates that VIX may not capture the true expected volatility of market returns and considerably understates the true market volatility when the market participants expect the market returns to be negatively skewed. If the VIX index indicate the risk-neutral expected fear in the short term, then rising fear should lead to significant negative future realised market returns. In addition to this, rising expected fear should lead to a significant negative impact on leading economic conditions and consumer confidence. This is because stock market returns are usually considered as a forward-looking measure of economic outlook. We examine these hypotheses in three different markets the US, UK and European Monetary Union (EMU) from the perspective of traditional buy and hold investor and monetary policy makers.

From the perspective of buy and hold investor (long-term investor), we assess whether the fear indices in these three markets predict significant negative holding period returns starting from next one month up to next five years. We also investigate whether volatility spikes (above – average increases in fear) predict significant negative market returns in these three markets. Furthermore, we also examine the response of four popular valuation metrics to shocks in the fear indices. In this respect, the novelty of our paper is two-fold. First, since we examine the predictive ability of the fear indices and the jumps in the fear indices in forecasting long-horizon market returns, we will be able to uncover whether a long-term investor need to be fearful about the spikes in the fear indices. Second, since we regress the implied volatility indices on future realised market returns and since future market returns represents the future investment opportunity set, we will be able to examine whether innovations to the implied volatility indices can predict the first moment of future investment opportunity set. This is particularly useful within the multi-factor cross-sectional asset-pricing framework, which uses Merton's (1973) Inter-Temporal Capital Asset Pricing Model (ICAPM) as theoretical underpinning. As shown by Maio and Santa-Clara (2012) one of the conditions that a particular state-variable needs to fulfil in order for it to be considered as asset-pricing factor and in order to prevent ICAPM from being labelled as “fishing licence” (Fama, 1991) is that state-variable should predict first or second moment of future investment opportunity set.

From the perspective of policy makers, we examine the impulse response of leading economic indicator and the consumer confidence to innovation in the three fear indices in these markets. Such an investigation seems useful, as it will help to examine whether positive innovations to fear indices lead to decline in economic and consumer sentiments. Furthermore, we study the response of monetary policy and other financial market-related variables to positive innovations in the fear index. Bekaert et al., (2013) show that higher risk aversion and uncertainty, measured by decomposing the VIX index, leads to looser monetary policy, albeit insignificantly. Overall, their result clearly reveals a dynamic relation between VIX and monetary policy stance. More recently, Mallick et al., (2017) show that innovations to VIX index are more prominent than innovations to Bond market volatility. In particular, they show that innovations to VIX index have asymmetric impact on term premium and economic activity, before and after Financial Crisis of 2008. Besides the insights offered by academic research, Central Banks also regularly monitor fear indices in their official publications. For example, Bank of England monitors the VFTSE in their quarterly Inflation Reports as an indicator of future market uncertainty[2].

The result of our analysis using monthly data from January 1990 until June 2017[3] shows following interesting findings. First, using long horizon predictive regressions we find the fear indices in the three markets do not predict statistically significant negative future realised market returns. On the contrary, the results for UK and EMU suggests that the VFTSE and VSTOXX indices can predict statistically significant positive returns on the FTSE 100 and EURO Stoxx 50 indices respectively. Furthermore, jumps in the fear indices also fail to predict significant negative future realised market return in these three markets. On the contrary, extreme jumps in the VIX index (measured as two and three standard deviation spikes above mean) can significantly predict positive long horizon returns (9 to 24 months buy-and hold returns) in the US. Similar moves in the VFTSE and VSTOXX indices predict significantly positive future market returns (one to next five years holding period returns) in the UK and in

[2] http://www.bankofengland.co.uk/publications/Documents/inflationreport/2016/may.pdf

[3] The sample for UK and Euro zone markets starts from January 2000 and January 1999 respectively.

the EMU. This is presumably because, as we show later, monetary policy makers are more "nervous" about positive shocks in these implied volatility indices. That is, a positive shock in these volatility indices leads to decrease in the main policy rates in these three markets, which then further leads to positive realised returns in the future.

Second, the response of valuation metrics in the three markets to one standard deviation shocks in the corresponding fear indices is heterogeneous. The results for the US market suggest a positive standard deviation shock in the VIX index significantly affects the valuation metrics, especially the PE ratio over period of four to 12 months after the initial shock. However, we do not find such a significant response in the valuation metrics in the UK and EMU.

Third, the leading economic indicators and the consumer confidence in these three markets do not seem to respond negatively and significantly to one standard deviation shocks in the corresponding fear indices. We also investigate whether shocks in the fear indices from one market are transmitted significantly to these indicators in the other market. To this end, we find interesting evidence. We find that the shocks in the fear indices in one market are not significantly transmitted to the leading economic indicators. Whereas, the shocks in the fear indices have significant negative impact on the consumer confidence in other markets, contemporaneously. However, the significance of this response dies down from second month after the initial impulse to the fear indices.

Finally, and interestingly, we find that the main monetary policy rates in the three economies react negatively and significantly to one standard deviation shocks in the respective fear indices. This response is significant at least until four months from the initial origin of the shock. We find similar evidence in the behaviour of the interbank markets in these three markets. However, changes in the yields of generic 10-year government bonds and changes in the exchange rates do not seem to respond significantly to shocks in the corresponding fear indices.

Collectively, these results imply that long-term investors need not fear not only the fear indices and but also extreme jumps in the fear indices. However, monetary policy makers in these three economies seem to be "nervous" about the fear indices. In fact, the negative response of the monetary policy makers to shocks in the fear indices could be the reason why the long-term investors need not fear the fear indices. We view are results as supporting the argument in (Dhaene *et al.*, 2012) and Da, Engelberg and Gao (2015) that a better indicator is needed to measure investor fear.

The remainder of the paper is organised as follows; section 2 presents the methodology and is divided into four subsections. Section 3 discuss the data used. In section 4 we report the results, which is again divided in for subsections, and finally, section 5 concludes.

2. Methodology

In this section, we discuss the empirical framework to test how fearful one should be about the fear indices. We divide this section in four sub-sections. In sub- section 2.1 we discuss the methodology to assess the impact of fear indices and the spikes in the fear indices on the future realised returns on the corresponding market indices. In sub-section 2.2 we present the methodology to investigate the response of valuation metrics to innovations in the fear indices. In subsection 2.3 we outline the methodology to examine the response various monetary policy indicators to innovations in the fear indices. Finally, in subsection 2.4 we outlay the methodology to examine the response of leading economic indicator and changes in the consumer confidence to innovations in the fear indices.

2.1 Market returns and fear indices

To test how fearful investors should be of the fear index, we estimate long-horizon predictive regressions of buy-and-hold market returns on the corresponding fear index. We examine the sign and the significance of the regression coefficients on the corresponding fear index to deduce how fearful one should be of these fear indices. We estimate the following long-horizon predictive regression, which is commonly used in the future market return-predictability literature (Keim and Stambaugh 1986; Campbell 1987; Fama and French 1989; Maio and Santa-Clara 2012).

$$r_{t,t+h}^{i} = \alpha_h^i + \beta_h^i . V_t^i + \varepsilon_{t,t+h}^i \qquad (1)$$

where, $r_{t,t+h}^{i} \equiv r_{t+1}^{i} + \cdots + r_{t+h}^{i}$ is the continuously compounded return on i^{th} market index over h-periods (from t+1 to $t+h$), V_t^i is the i^{th} implied volatility index (fear index) in month t and $\varepsilon_{t,t+h}^i$ denotes the forecasting error with an assumption that its expected conditional mean is zero [$E_t(\varepsilon_{t,t+h}) = 0$]. It is clear from (1) that the conditionally expected return on the i^{th} market index is $E_t(r_{t,t+h}^i) = \alpha_h^i + \beta_h^i . V_t^i$ at month t. The sign and the significance of the slope coefficient β_h^i will indicate whether a particular fear index predicts future realised market returns thus indicating whether one should be fearful of the fear index. That is if $\beta_h^i < 0$ and significant, then an investor with investment horizon of h should be fearful about the corresponding i^{th} fear index. We use buy-and hold forecasting horizons of $h = 1,3, 6, 9, 12, 24, 36, 48$ and 60 months ahead i.e. from next one month till next five-year buy and hold returns.

Furthermore, to investigate whether spikes or above-average rise in the fear indices can/should induce fear, we run the following three separate long-horizon predictive regressions, similar to (1):

$$r_{t,t+h}^{i} = \alpha_{h}^{i} + \theta_{1,h}^{i}.D_1V_t^i + \varepsilon_{t,t+h}^{i} \tag{2}$$

$$r_{t,t+h}^{i} = \alpha_{h}^{i} + \theta_{2,h}^{i}.D_2V_t^i + \varepsilon_{t,t+h}^{i} \tag{3}$$

$$r_{t,t+h}^{i} = \alpha_{h}^{i} + \theta_{3,h}^{i}.D_3V_t^i + \varepsilon_{t,t+h}^{i} \tag{4}$$

where, D_1 is a binary dummy variable that takes value of 1 if the respective fear index is between one and two standard deviations above its respective mean and 0 otherwise. D_2 is a binary dummy variable that takes value 1 if the respective fear index is between two and three standard deviations above its respective mean and 0 otherwise. Finally, D_3 is a binary dummy variable that takes value 1 if the respective fear index rises three standard deviations above mean and 0 otherwise. $\theta_{1,h}^{i}$, $\theta_{2,h}^{i}$ and $\theta_{3,h}^{i}$ captures the effect of one, two and three standard deviation volatility jumps above the mean respectively on the h-period holding returns. The sign and the significance of the respective interaction slope coefficients $\theta_{1,h}^{i}$, $\theta_{2,h}^{i}$ and $\theta_{3,h}^{i}$ will then indicate whether an investor of horizon h, should be fearful about a move of one, two and three standard deviations above mean in the i^{th} fear index respectively. This is in spirit of Bloom, (2009) who also analyse the impact of volatility shocks. He defines volatility shocks around 17 unforeseeable events. The measure of uncertainty takes the value of 1, around the 17 events, when stock market volatility is more than 1.65 standard deviation above the Hodrick-Prescott detrended mean of the volatility series and 0 otherwise. We refrain from measuring spikes in the fear indices around any particular events because ex-ante such events are unforeseeable and such a measure of spike in the fear seems to be biased around these events.

In addition to estimating and analysing the results of forecasting regressions, we also examine the response of transmission of fear originating in one market to the returns in the other market. That is, we investigate whether positive one standard deviation shock in the VIX index has significant impact on the market returns in the UK and EU. Similarly, we investigate whether a positive one standard deviation shock in the VFTSE index is transmitted significantly to the market returns in the US and the EU. This is particularly helpful since our sample size contains significant idiosyncratic events related to UK such as the result of UK's referendum to exit the

European Union on the 23rd June 2016. For this, we estimate the following simple Vector Autoregression model (VAR):

$$Z_t = A + \sum_{i=1}^{p} B_i . Z_{t-p} + \varepsilon_t \tag{5}$$

where the vector $Z_t \equiv [r_{US}, VIX, r_{uk}, VFTSE, r_{EU}, VSTOX]$. r_{US} is continuously compounded return on the S&P 500 index. VIX is the CBOE's VIX index, r_{uk} is the continuously compounded return on the FTSE 100 index, $VFTSE$, similar to VIX, is the volatility index derived using options on FTSE 100 and is considered to be "fear indicators" in the UK market, r_{EU} is the continuously compounded return on the EURO STOXX 50 index and $VSTOX$, similar to VIX, is the is the volatility index derived using options on EURO STOXX 50 index and is considered to be "fear indicators" in the EU market. p is the optimal lag order, decided using the AIC criterion and ε_t is the vector of innovations which we maybe contemporaneously correlated to each other but uncorrelated with their own lagged values and independent of the elements in the vector Z_t.

The standard practice in VAR-based methodology is to orthogonalise the impulse response of the variables either by imposing recursive structure i.e. decomposing the variance-covariance matrix of innovations using standard Cholesky decomposition or by imposing theoretically motivated structural restrictions on the contemporaneous coefficient matrix. However, since, the orthogonalised impulse response, generated by standard Cholesky decomposition of residual covariance matrix, is not invariant to ordering of the variables and require rigorous theoretical foundation for ordering the variables in the above VAR, we follow Koop et al., (1996) and Pesaran and Shin, (1998) and construct generalised impulse responses. In particular, we examine the generalised impulse response of market returns in the US, UK and EU to one standard deviation shock to all the three fear indices, over the period of next 12 months. If the market participants are truly fearful of the fear indices and if the fear from one market is transmitted to other, then we should expect a statistically significant negative response to positive one standard deviation impulse in the fear indices.

2.2 Valuation metrics and Fear Indices

In this subsection, we present the VAR framework to analyse the response of the valuation metrics to shocks in the fear indices in the three markets. In addition to analysing the response of market returns to shocks in the fear indices, we also investigate whether shocks to various fear indices induces significant response in the various valuation metrics in the three markets respectively. In particular, we examine the generalised impulse response of four popular valuation metrics, namely price to earnings ratio (PE), net dividend yield (DY), Enterprise value to trailing 12-month sales ratio (EVS) and enterprise value to trailing 12 months EBIT (EVEBIT) in the three markets to one standard deviation positive shocks to VIX, VFTSE and VSTOXX indices. This will enable us to identify whether rise in the fear in the market has significant negative effects on market valuation measures. For this we estimate following three separate VARs for the three individual markets

$$Z_t^{US} = A^{US} + \sum_{i=1}^{p} B_i^{US}.Z_{t-i}^{US} + \varepsilon_t^{US} \tag{6}$$

$$Z_t^{UK} = A^{UK} + \sum_{i=1}^{p} B_i^{UK}.Z_{t-i}^{UK} + \varepsilon_t^{UK} \tag{7}$$

$$Z_t^{EU} = A^{EU} + \sum_{i=1}^{p} B_i^{EU}.Z_{t-i}^{EU} + \varepsilon_t^{EU} \tag{8}$$

Where for i^{th} country/economic zone, the elements of vector Z_t^i are $Z_t^i \equiv [r^i, V^i, PE^i, DY^i, EVS^i, EVEBIT^i]$. r^i is the continuously compounded market return, V^i is the corresponding volatility index (fear index), PE^i is the price-to-earnings ratio of companies in the corresponding market index, DY is the corresponding net dividend yield of the market index, EVS^i is the Enterprise value to trailing 12-month sales ratio for the corresponding market index and finally, $EVEBIT$ is the enterprise value to trailing 12-months earnings before interest and tax of the companies in the corresponding index.

2.3 Monetary policy indicators and Fear indices

We now present the VAR framework to examine the response of the monetary policy stance to shocks in the fear indices in the respective countries/economic zone.

We estimate three separate VAR models for each country/economic zone, similar to (6), (7) and (8) with following elements in the Z_t^i vector $Z_t^i \equiv [r^i, V^i, \Delta br^i, \Delta r3m^i, \Delta r10y^i, \Delta x^i]$, where r^i and V^i are same as in VAR (3). Δbr^i are the changes in the base interest rates or the main policy rate. In case of the US Δbr^i is changes in FED Fund target rate (upper bound), in case of UK, it is changes in the Bank of England's Base Rate and in case of EU, it is the change in the main refinancing rate of the European Central Bank. $\Delta r3m^i$ are the changes in the 3-month LIBOR rates in the respective currencies. $\Delta r10y^i$ denotes changes in the 10-year government bond yields in the respective currencies and finally, Δx^i denotes the changes in the respective effective exchange rate indices. We then study the generalised impulse response of these variables to one standard deviation positive innovation in the respective fear indices over the period of next 12 months. If Central Banks in these three countries/economic zones are fearful of expected market volatility, they should respond negatively and significantly i.e. the base rates should fall, to positive innovation in the fear indices.

2.4. Leading economic indicators and fear indices

Finally, in this section we present the VAR framework to examine the response of future economic activity represented by leading economic indicator and changes in consumer confidence to innovations in the fear indices. Similar to subsection 2.3, we estimate three separate VAR models for i^{th} country/economic zone with following elements in the Z_t^i vector $Z_t^i \equiv [r^i, V^i, LI^i, \Delta CCI^i]$. In the vector, LI denotes the respective leading economic indicator and ΔCCI^i denotes the changes in the respective consumer confidence. To account for the possibility of spillover of fear from one market to other, we also examine the cross-country impulse response of leading economic and consumer confidence to innovations in the fear indices. That is, we examine the generalised impulse response of leading economic indicator and consumer confidence indicators in the UK to one standard deviation positive innovation in VIX, VFTSE and VSTOXX indices. For this, we estimate the following VAR model,

$$Z_t = A + \sum_{i=1}^{p} B_i . Z_{t-p} + \varepsilon_t \tag{9}$$

where the vector Z_t consists of following elements

$$Z_t \equiv [r_{US}, VIX, r_{EU}, VSTOXX, r_{UK}, VFTSE, LI_{US}, LI_{UK}, LI_{EU}, \Delta CCI_{US}, \Delta CCI_{UK}, \Delta CCI_{EU}].$$

3. Data

We use monthly data from Bloomberg for US, UK and the EU. For the US, we use the VIX index as the proxy market's fear Index. The continuously compounded return on S&P 500 index is used as proxy of market return and is calculated as $r_t^{US} = \ln\left(\frac{P_t}{P_{t-1}}\right) \times 100$ for the month t . We use month-on-month changes (in percentage) in Conference Board Leading Economic Indicator of US as a proxy for leading Economic indicator. Changes in the consumer confidence is measured using log-changes (in percentage) in seasonally adjusted Conference Board Consumer Confidence Index. Changes in monetary policy stance in the US are measured using changes in the upper bound of Federal Funds Target interest rate. Changes in the money market interest rate are measured using changes in the 3-month US dollar LIBOR rates. We also use changes in the yields on generic 10-year US government Bond, as a proxy of long term interest rate and changes in US dollar trade-weighted index as a proxy of US dollar exchange rate. The sample size is January 1990 to June 2017.

**** Please insert table 1 about here****

For the UK, we use the VFTSE index as a proxy of fear in the UK market. The continuously compounded return on the FTSE 100 index is used as a proxy of market returns in the UK. The month-on-month change in the Conference Board Leading Economic Indicator for the UK is used as proxy of leading economic indicator. Changes in the consumer confidence in the UK are measured as log changes in GFK consumer confidence indicator. To measure the changes in the monetary policy stance in the UK, we use changes in the Bank of England's Base Interest rate. Changes in the money market interest rate are measured using changes in the 3-month UK Sterling LIBOR rates. Changes in the long-term interest rate are measured using changes in the yields on generic 10-year UK government bond. Changes in the Sterling's exchange rate is measured as log-changes in the trade-weighted Sterling Effective Exchange Rate Index. The sample size is January 2000 to June 2017.

For the EU, we use the VSTOXX index as a proxy of fear index in the European stock market and the continuously compounded return on the corresponding Euro Stoxx 50 index as a proxy of returns on the market. The month-on month change in the Deutsche Bank Eurozone Leading Economic indicator is used as a proxy of changes in the leading economic indicator in the EU. To measure the changes in the consumer confidence, we use monthly percentage changes in the seasonally adjusted European Commission's consumer confidence indicator. The changes in the monetary policy stance is measured using changes in the European Central Bank's main refinancing operations rate. The changes in the 3-month EURIBOR is used as proxy of changes in the money market interest rates. Changes in the long-term interest rates are measured using the changes in the generic 10-year Euro denominated Government Bond. Finally, the log changes in the trade-weighted EURO effective exchange rate index is used a proxy of changes in the exchange rate of EURO against the basket of the EU's trading partners. The sample size is January 1999 to June 2017.

The start of the sample size is different for each country/economic zone because the different start dates of the fear indices. Table 1 presents brief descriptive statistics of the data. Panels A, B and C shows the summary for the US, UK and EU data respectively. For the US, the average monthly return on the S&P 500 index is 0.61% with a standard deviation of 4.15%. The average level of VIX is 19.56% i.e. on average market participants in the US expected next 30-days annualised volatility of returns of S&P 500 index to be 19.56% with standard deviation of 7.49%. The average monthly change in the Fed's target rate is -0.02 indicating that, on an average, the Fed Fund target rate has reduced over the sample size. Similar argument can be made about the 3-month USD LIBOR, the yields on 10-year US Government bonds and the trade-weighted effective exchange rate of US dollar. Furthermore, a similar inference can be drawn about the UK and EU from Panels B and C respectively. Overall, there are four interesting points to note, notwithstanding the unequal sample size. First, the average monthly return on EURO Stoxx 50 is negative and least compared to other two market indices with higher standard deviation. Second, the level of fear index in the EU is highest. Third, interest rates and exchange rates, on average, have been falling over the sample period. Finally, valuation metrics are relatively higher in the UK and the EU compared to their US counterparts with higher volatility.

**** Please insert figure 1 about here****

Figure 1 shows the three fear indices. Panel A of figure 1 shows the VIX index along with three types of jumps viz, a jump of one, two and three standard deviations above mean. Panels B and C shows similar data for VFTSE and VSTOXX indices in the UK and the EMU.

4. Results

4.1 Market Returns and fear indices

**** please insert table 2 about here****

We begin our analysis by examining the results of long-horizon predictive regressions of fear indices on market returns. As mentioned earlier, if the market participants are reasonably fearful about the market's most popular measure of "fear" then a rise in expected fear indices should lead to significantly decreased realised future returns on market. That is, the sign of slope coefficient β_h^i in (1) should be negative and statistically non-zero. Furthermore, if the signs of the coefficients $\theta_{1,h}^i$, $\theta_{2,h}^i$ and $\theta_{3,h}^i$ in (2), (3) and (4) are respectively negative and are significantly non-zero, then an investor of investment horizon *h* should be significantly fearful of one, two and three standard deviation jump above mean in the fear index in the three markets respectively.

In table 2, panels A, B, C and D present the results of models (1), (2), (3) and (4) respectively for the US market. Similarly, tables 2 and 3 presents the results for UK and EU markets respectively. The t-statistics associated with the slope coefficients are computed using Newey and West, (1987) heteroscedasticity and autocorrelation corrected standard errors . From panel A of table 2 , we can see that although there is negative contemporaneous relation between the VIX and the returns on the S&P 500 index ($\beta_{h=1}^i$ =-0.001) , a result which is qualitatively similar to Giot, (2005), yet the coefficient is not significant. Furthermore, R-squared associated with the regression is low. The three, four and five year holding period returns on S&P 500 index are also negatively related to VIX but not statistically significant. Panel A, thus, suggests that market participants might be exaggerating the fear in the market's most popular measure of fear.

In panel B, we study the impact of one standard jump in the VIX index above its mean on the various holding period returns of S&P 500 index. A one standard deviation positive spike above mean does not seem to predict significant negative realised returns at any horizon. On the contrary, such as spike in the VIX index significantly predicts positive realised returns over six-month holding period return ($\beta_{h=6}^i = 0.15$) with R-squared of 1.51%. A jump of two standard deviation above mean in the VIX index is able to predict statistically significant positive realised holding period returns of S&P500 index over a horizon of nine and 12 months ($\beta_{h=9}^i = 0.25$, and $\beta_{h=12}^i = 0.28$) with an R-squared of 1.15% and 0.99% respectively. Similar results can be seen from panel D.

**** Please insert table 3 about here****

Panels A, B, C and D of table 3, present the results of the predictive regressions (1), (2), (3) and (4) in the UK market respectively. Specifically, they show whether VFTSE and the jumps in the VFTSE can predict significant returns of the FTSE 100 index over long horizons. Similar to results in Table 2, we can see from Panel A that although VFTSE is contemporaneously negatively correlated with the FTSE 100 index over one-month period, yet the slope coefficient ($\beta_{h=1}^i$ = -0.003) is insignificant. However, unlike the results in Panel A of table 2, the VFTSE index seems to predict the four and the five-year realised holding period return significantly and positively ($\beta_{h=48}^{i}$ = 1.10 and $\beta_{h=60}^{i}$ = 1.46) with relatively higher R-squared. Furthermore, similar to the results for the US, it can be seen from Panel B that one standard deviation jump above mean in the VFTSE index seems to predict positive realised returns over six-month holding period ($\beta_{h=6}^{i}$ = 0.17) with R-squared of 1.02%. However, unlike the results for the US, a two standard deviation jump above it mean in the VFTSE index seems to predict, significantly and positively, longer horizon returns of FTSE 100 index. For example, ($\beta_{h=24}^{i}$ = 0.44, $\beta_{h=36}^{i}$ = 0.59, $\beta_{h=48}^{i}$ = 0.73 and $\beta_{h=60}^{i}$ = 0.87) with relatively higher R-Squared. Similar inference can be drawn from Panel D regarding a three standard deviation jump in the VFTSE index above its mean.

**** Please insert table 4 about here****

In table 4, we present the results for the EU market. Unlike the results for US and UK, it can be seen from Panel A that the returns on the EURO STOXX 50 index are not negatively correlated, contemporaneously. However, similar to the results in the UK, the VSTOXX seems to predict longer horizon holding period returns positively and significantly ($\beta_{h=48}^{i}$ = 1.55 and $\beta_{h=60}^{i}$ = 2.17) with relatively higher R-Squared.

Furthermore, unlike the results for UK and US, a one standard deviation jump above its mean in the VSTOXX index seems to predict longer horizon returns in on the EURO Stoxx 50 index, positively and significantly. For example, ($\beta_{h=48}^{i}$ = 0.65 and $\beta_{h=60}^{i}$ = 0.84) with relatively higher R-Squared.

We now turn out attention and investigate whether shocks to the fear indices from country are transmitted to market returns in other country/economic zone. We do this by examining the generalised impulse response of the market returns over the next twelve months to one standard deviation innovation in three fear indices. The results are reported in table 5. The impulse response functions are generated by estimating the VAR model (5). We do not present these impulse responses in the form of graphs, as is usually done in the VAR literature, but in tabular format. This is because when the impulse responses are presented as graphs, it is hard to judge the statistical significance of response for each time period. Panel A of Table 5 reports the response of S&P 500 returns to a shock in the VIX, VFTSE and VSTOXX index over the next 12 months. Similarly, panels B and C report the repose of returns of FTSE 100 and Euro Stoxx 50 indices to shocks in VIX, VFTSE and VSTOXX indices over the next 12 months respectively. The standard errors that are required to compute the t-statistics are estimated using

Monte-Carlo simulation with 5000 repetitions. If the fear from one market is significantly transmitted to other, then we should see significantly negative response to a shock in the fear indices. However, observing the results in table 5, it can be seen that, the response of the three market returns is negative to the shocks in three fear indices, albeit none of the response is statistically significant.

**** Please insert table 5 about here****

Collectively, the results from table 2, 3, 4 and 5 indicate that, (i) the volatility indices do not predict statistically significant negative market returns, thereby indicating that investors need not be fearful about the market's most popular measure of fear. (ii) In addition to the level of the volatility indices, large spikes in these fear indices do not predict significant future negative returns. On the contrary, larger spike in the volatility indices leads to statistically significant positive returns over the longer horizon. (iii) The fear of one standard deviation shock from one market does not seem to induce statistically significant negative response of the three market returns. In section 4.4, where we analysed the response of monetary policy to one standard innovations in the fear indices, we provide a possible explanation of these results.

4.2 Response of valuation metrics to fear indices

In the previous section, we examined the impact of the fear indices on buy and hold returns of the corresponding stock market indices for various horizons. One of the interesting conclusion from the analysis was that jumps in the fear indices seem to predict positive long horizon returns. This invariably leads to the question; how does different valuation metrics respond to shocks in the fear indices? Earlier research suggests that there is a dynamic interaction between realised or conditional volatility stock returns and corporate profitability[4]. If higher expected volatility, reflected by the different fear indices, results in higher realised volatility, then there should significant dynamic relation between the different fear indices and the corresponding measures of valuation. We analyse the response of four valuation measures; dividend yields (DY), Price-to-(trailing 12 months) earnings ratio (PE), Enterprise to trailing 12-month Sales ratio (EVS) and Enterprise to trailing 12-months EBIT (EVEBIT). We use enterprise value-based valuation ratios because they incorporate both forms of capital, debt and equity. This is in sprit of the financial leverage-volatility relation of Black, (1976) and Christie, (1982).

[4] (Fama and Fama, (1988); Fama and French, (1989); Keim and Stambaugh, (1986); Schwert, (1989a); Schwert, (1989b)

**** Please insert table 6 about here****

In table 6, we report the generalised impulse responses of the four valuation measures to one standard deviation shocks in the fear indices. Panel A shows the response of the valuation ratios of the S&P500 index to shocks in the VIX index over the next 12 months. VAR model (6) is used to generate these impulse responses. Panel B shows the responses of the valuation metrics of the FTSE 100 index to one standard deviation positive shocks to the VFTSE index in the UK over the period of next 12 months. Model (7) is used to generate these responses. Finally, panel C reports the generalised impulse response of the valuation metrics of the EURO STOXX 50 index to one standard deviation shocks to the VSTOXX index in the EU over the period of next 12 months.

Observing panel A, we can see that a one standard deviation shock in the VIX index induces a statistically significant negative impact on the EVS ratio immediately after one and two months from the origination of shocks. A similar result can be seen for EVEBIT ratio. This is intuitive as rise in expected fear could push down the total market capitalisation of the index companies and thereby of the index. This could lead to increase in the financial leverage and hence reducing the enterprise value relative to sales or EBIT. However, this effect dies down after three months. Dividend yield of the S&P 500 index shows a significant positive response to one standard deviation positive shock to the VIX index after two months from the origination of the shock. However, dividend yield does not respond significantly from third month onwards. Observing the response of the PE ratio of the S&P 500 index to one standard deviation shock in the VIX, we find that, unlike other valuation ratios, PE reacts significantly to a shock in the VIX index. The initial response of the PE ratio is not statistically significant, however, after four months from the original shock in the VIX, the response of PE seems statistically significant, especially after eight months till 12 months. This suggests that the an initial one standard deviation shock in the VIX makes S&P 500 significantly “expensive” after eight months onwards. However, unlike the response of the valuation ratios in the US, the response of the valuation metrics in the UK and EU to one standard deviation shock in the respective fear indices does not seem to induce statistically significant impact. Overall, we can see from table 6 that, except for the response of EVS and EVEBIT in the US, the fear indices in the three markets does not seem have to statistically significant negative impact on the corresponding valuation ratios.

4.3 Response of Leading Indicators to fear indices

In the previous two sub-sections, we examined the response of stock market-variables to innovations in corresponding the fear indices in that market. We also examined whether fear from one market is transmitted significantly to stock market-related variables of other. We now broaden the scope of our investigation by examining the response of leading economic and policy-related variables to innovations in the fear indices in the respective countries/economic zone. In this sub-section, we study the response of leading economic indicators, such as conference board leading economic indicator and the consumer confidence indicator to one standard innovation in the fear indices. We also examine whether of shocks in the fear indices from one market can significantly affect these leading economic indicators in different countries/economic zone.

**** Please insert table 7 about here****

In panel A of table 7, we report the response of Conference Board leading indicator and changes in the consumer confidence in the US to one standard deviation positive innovation to VIX Index over a period of next 12 months. Similarly, in panels B and C we report the responses of the same indicators to one standard deviation innovation in the VFTSE and the VSTOX index in the UK and the EMU respectively. The VAR models used to generate these generalised impulse responses are similar to models (6), (7) and (8) with the vector $Z_t^i \equiv \left[r^i, V^i, LI^i, \Delta CCI^i\right]$. From the all the three panels we can see that none of the forward-looking indicators in the three countries/economic zone respond negatively and significantly to one standard deviation shock in the fear indices in the respective markets.

**** Please insert table 8 about here****

We also test whether shocks to the fear index originated from one country has a significant impact on the leading economic indicator and the changes in the consumer confidence in other country/economic zone. In table 8, we study the generalised response of leading economic indicator to innovations in three fear indices. Panel A reports the response of leading economic indicator in the US to one standard deviation shocks in the VIX, VFTSE and the VSTOXX index. Similarly, panels B and C report the generalised response of leading economic indicator in the UK and the EMU to the one standard deviation shocks in the three fear indices respectively. Model (9) is used to generate these responses. We can see that the conference board leading economic indicator in the all the three countries/economic zone does not respond negatively and significantly to one standard deviation shocks in the fear indices. This not only reinforces the results from table 7, but also goes a step ahead in showing that a shock in the fear index from one market is not significantly and negatively transmitted to leading economic indicator in other country/economic zone.

**** Please insert table 9 about here****

Table 9 reports the generalised impulse response of the changes in the consumer confidence to transmission of shocks in domestic and foreign fear indices. Panel A of table 9 shows the response of the changes in the US consumer confidence indicator to one standard deviation shocks in VIX, VSTOXX and VFTSE indices. Similarly, Panels B and C report the response of changes in the consumer confidence in the UK and the EMU to shocks in these three fear indices respectively. We can see that the consumer confidence in the US responds negatively and significantly to shocks in the three fear indices one month after the shock is originated. Nevertheless, this response reduces and becomes insignificant from second month onwards. On the contrary, observing Panel B we can see the consumer confidence in the UK responds positively and significantly to shocks in the VFTSE and VSTOXX indices respectively.

4.4 Response of monetary policy indicators to fear indices

In this subsection, we study the response of monetary policy indicators to one standard deviation positive innovation in the fear indices in the three economies. In particular, we examine the response of changes in monetary policy rates, changes in the 3-month interbank rates, changes in the yields of generic 10-year government bonds and changes in the trade-weighted exchange rates in the respective countries/economic zones. Such an investigation seems useful, as it will uncover how policy makers respond to the innovations in the corresponding fear indices and whether there is heterogeneity in the response of the three policy makers in these three countries /economic zone. Moreover, the response of monetary policy may also provide an explanation as to why buy-and hold market returns, analysed in section 4.1, do not respond negatively to levels and extreme jumps in the fear indices.

**** Please insert table 10 about here****

Table 10 reports the generalised impulse responses of the monetary policy indicators to one standard deviation positive shocks to the fear indices. In particular, Panel A reports the response of US monetary policy indicators to innovation in the VIX, panel B reports the response of UK monetary policy indicators to VFTSE and finally, panel C reports the response of the EMU monetary policy indicators to VSYOXX. The t-statistics are reported in parentheses and the standard errors required to compute the t-statistics are estimated using Monte Carlo simulation using 5000 repetitions.

Observing panel A, we can see that the Federal Reserve reacts negatively and significantly to a positive one standard deviation shock in the VIX index. That is, a shock in the VIX by one standard, makes the Federal Reserve nervous enough to relax the monetary policy and reduce the Fed Funds target rate. The response is significantly negative until four months after the shock to the VIX index is observed initially. This is qualitatively consistent with results of Bekaert et al., (2013). The interbank market in the US seems to take about three to four months to respond significantly to a one standard deviation shock in the VIX. The 3-month US dollar LIBOR respond negatively and significantly after three and four months. On the contrary, the yield on the 10-year US government seems to react immediately one month after the shock in the VIX is observed. The response of 10-year yield is significantly negative (-0.05). Unlike the response of these indicators, the response of the trade-weighted US Dollar index does not seem to be significant to a one standard innovation in the VIX index.

Observing Panel B, we can see a similar reaction by the Monetary Policy Committee of the Bank of England. The official bank rate responds significantly and negatively to a one standard deviation positive shock in the VFTSE index after two months and until four months after the shock is initially observed. A similar response can be observed in the UK interbank market. The 3-month Sterling LIBOR rates responds negatively and significantly to a one standard innovation in the VFTSE index after 2 months until 4 months. Similar to the response of the US dollar trade-weighted index, the Sterling trade-weighted exchange rate index also does not respond significantly to the one standard deviation shock in the corresponding fear index. However, unlike the response of the US 10-year government bond yield, the yield on the UK 10-year government seems to be immune from the shocks in the VFTSE index. The 10-year government bond yield does not react significantly to the shocks in the VFTSE until next 12-months.

From panel C, we can see a similar response of the European Central Bank (ECB) to a one standard deviation innovation to the VSTOXX index. ECB's main refinancing rate responds negatively and significantly to one standard deviation shocks in the VSTOXX index. However, unlike the response of the policy rates in the US and the UK, the response of the ECB's policy rate is significant until next seven months. Similarly, the interbank market in the EMU also respond significantly negative to one standard deviation shock in the VSTOXX. The 3-month

EURIBOR responds negatively and significantly to a shock in the VSTOXX after 3 months until next 7 months. Unlike to the response of the trade-weighted exchange rates in the US and the UK, the trade-weighted exchange rate of EURO reacts significantly and negatively to one standard innovation in the VSTOXX immediately after one month.

Overall, from table 10 it can be inferred that the monetary policy makers are more fearful and nervous about the fear indices in their respective stock market. The negative response of the policy rates to positive one standard deviation shock in the fear indices found here are indirectly consistent with results Rigobon and Sack, (2003) who find that changes in the stock market returns influence short term interest rates in the same direction. This “nervous” reaction from the policy makers could be a plausible explanation for the results in section 4.1. A positive one standard deviation shock in the fear indices has a significant negative impact on main policy rates and the inter-bank rates in these three economies. This is could lead push up the prices of risky assets thereby leading to higher realised returns in the future.

5. Conclusion

The VIX index is colloquially referred to as “investor fear gauge” in asset markets. Financial media unanimously relies on it to report market “fear” or “calm”. Besides this, academic research has also relied on VIX index to develop measures for economic uncertainty and risk aversion in the stock market. Following the popularity of VIX index, similar indices have been designed across the world, for example the VFTSE and the VSTOXX indices in the UK and EMU. In this paper, we question the notion of “fear”, as reflected and perceived in these indices, and investigate to what extent traditional long-term investors need to fear these indices. We test this from the perspective of buy-and hold investors, which constitutes majority of the investors in stock market. For this, we employ long-horizon predictive regressions and test the predictive ability of the fear indices and extreme jumps in the fear indices in predicting long-horizon market returns. Furthermore, we also examine the response of valuation metrics to shocks in the fear indices and also consider the possibility of the transmission of shocks in the fear indices from one market to valuation metrics in the other. In addition to this, we also test our central hypothesis from the perspective of monetary policy makers. To this end, we examine the response the leading economic indicator and consumer confidence indicator to shocks in the fear indices. We also examine how money policy makers and the interbank market respond to the shocks in the fear indices.

The results from long-horizon predictive regressions of market returns on the corresponding fear indices suggests that long-term investors not only need not fear the fear indices but also the need not fear extreme jumps in these indices. This is because the results show that fear indices do not predict significant negative realised returns in the future. Furthermore, the valuation ratios also seems to be significantly immune from the shocks in the fear indices. The examination of response of the leading indicators and the consumer confidence to the shocks in the fear indices also seems to reveal that these indicators are immune from the shocks in the corresponding as well as the shocks to fear indices from other markets.

The response of monetary policy makers in the US, the UK and the EMU to the shocks in the corresponding fear indices, however, appear to be significantly negative. That is, main monetary policy rates respond negatively (falls down) to shocks in the fear indices. Similar response is observed in the interbank market in these economies. This suggest that monetary policy makers are relatively more nervous about the shocks in the fear indices. This is could be a plausible explanation why long-term investors do not need to fear these fear indices.

References

Bekaert, G., Hoerova, M. and Lo Duca, M. (2013) 'Risk, uncertainty and monetary policy', *Journal of Monetary Economics*. Elsevier, 60(7), pp. 771–788. doi: 10.1016/j.jmoneco.2013.06.003.

Black, F. (1976) 'Studies of Stock Price Volatility Changes', in *Proceedings of the Meetings of the American Statistical Association Business and Economics Statistics Division*, pp. 177–181.

Bloom, N. (2009) 'The Impact of Uncertainty Shock', *Econometrica*, 77(3), pp. 623–685.

Bollerslev, T., Tauchen, G. and Zhou, H. (2009) 'Expected Stock Returns and Variance Risk Premia', *Review of Financial Studies*, 22(11), pp. 4463–4492. doi: 10.1093/rfs/hhp008.

Campbell, J. (1987) 'Stock returns and the Term Structure', *Journal of Financial Economics*, 18(2), pp. 373–399.

Chow, V., Jiang, W. and Li, J. (2014) 'Does VIX Truly Measure Return Volatility?', *Available at SSRN 2489345*, pp. 1–26. doi: 10.2139/ssrn.2489345.

Christie, A. A. (1982) 'The Stochastic Behavior of Common Stock Variances: Value, Leverage and Interest Rate Effects', *Journal of Financial Economics*, 10(4), pp. 407–432.

Da, Z., Engelberg, J. and Gao, P. (2015) 'The sum of all FEARS investor sentiment and asset prices', *Review of Financial Studies*, 28(1), pp. 1–32. doi: https://doi.org/10.1093/rfs/hhu072.

Dhaene, J., Dony, J., Forys, M. B., Linders, D. and Schoutens, W. (2012) 'FIX: The Fear Index—Measuring Market Fear', in Cummins, M., Murphy, F., and Miller, J. (eds) *Topics in Numerical Methods for Finance*. Proceeding. Boston, MA: Springer, pp. 37–55. doi: https://doi.org/10.1007.

Drechsler, I. and Yaron, A. (2011) 'What's Vol Got to Do with It', *Review of Financial Studies*, 24(1), pp. 1–45. doi: 10.1093/rfs/hhq085.

Fama, E. F. (1991) 'Efficient Capital Markets: II', *The Journal of Finance*, 46(5), pp. 1575–1617.

Fama, E. F. and Fama, E. F. (1988) 'Dividend Yields and Expected Stock Returns', *Journal of Financial Economics*, 22(1), pp. 3–25.

Fama, E. F. and French, K. R. (1989) 'Business Conditions and Expected Returns on Stocks and Bonds', *Journal of Financial Economics*, 25(1), pp. 23–49.

Giot, P. (2005) 'Relationships Between Implied Volatility Indices and Stock Index Returns', *Journal of Portfolio Management*, 31(3), pp. 92–100. doi: 10.3905/jpm.2005.500363.

Keim, D. and Stambaugh, R. (1986) 'Predicting returns in the stock and bond markets', *Journal of Financial Economics*, 17(2), pp. 357–390.

Koop, G., Pesaran, M. . and Potter, S. . (1996) 'Impulse Response Analysis in Nonlinear Multivariate Models', *Journal of Econometrics*, 74(1), pp. 119–147. doi: 10.1016/0304-4076(95)01753-4.

Lubnau, T. M. and Todorova, N. (2015) 'The Calm After the Storm: Implied Volatility and Future Stock Index Returns', *European Journal of Finance*, 21(15), pp. 1282–1296. doi: 10.1080/1351847X.2014.935872.

Maio, P. and Santa-Clara, P. (2012) 'Multifactor Models and their Consistency with the ICAPM', *Journal of Financial Economics*, 106(3), pp. 586–613. doi: 10.1016/j.jfineco.2012.07.001.

Mallick, S. K., Mohanty, M. S. and Zampolli, F. (2017) *Market Volatility , Monetary Policy and the Term Premium*. 606.

Merton, R. (1973) 'An Intertemporal Capital Asset Pricing Model', *Econometrica*, 41(5), pp. 867–887.

Newey, W. and West, K. (1987) 'A Simple Positive Semi Definite Hetroskedasticity and Autocorrelation Consistent Covariance Matrix', *Econometrica*, 55(3), pp. 703–708.

Pesaran, H. H. and Shin, Y. (1998) 'Generalized impulse response analysis in linear multivariate models', *Economics Letters*, 58(1), pp. 17–29. doi: https://doi.org/10.1016/S0165-1765(97)00214-0.

Rigobon, R. and Sack, B. (2003) 'Measuring The Reaction of Monetary Policy to the Stock Market', *The Quarterly Journal of Economics*, 118(2), pp. 639–669.

Sarwar, G. (2012) 'Is VIX an Investor Fear Gauge in BRIC Equity Markets?', *Journal of Multinational Financial Management*. Elsevier B.V., 22(3), pp. 55–65. doi: 10.1016/j.mulfin.2012.01.003.

Schwert, G. W. (1989) 'Business Cycles, Financial Crises, and Stock Volatility.', in *Carnegie-*

Rochester Conference Series on Public Policy. Elsevier B.V., pp. 83–125. doi: doi:10.1016/0167-2231(89)90006-7.

Schwert, G. W. (1989) 'Why Does Stock Market Volatility Change Over Time?', *Journal of Finance*, 44(5), pp. 1115–1153. doi: 10.2307/2328636.

Schwert, G. W. (2011) 'Stock Volatility During the Recent Financial Crisis', *European Financial Management*, 17(5), pp. 789–805. doi: 10.1111/j.1468-036X.2011.00620.x.

Whaley, R. E. (2000) 'The Investor Fear Gauge', *The Journal of Portfolio Management*, 26(3), pp. 12–17. doi: 10.3905/jpm.2000.319728.

Whaley, R. E. (2009) 'Understanding the VIX', *The Journal of Portfolio Management*, 35(3), pp. 98–105. doi: 10.3905/JPM.2009.35.3.098.

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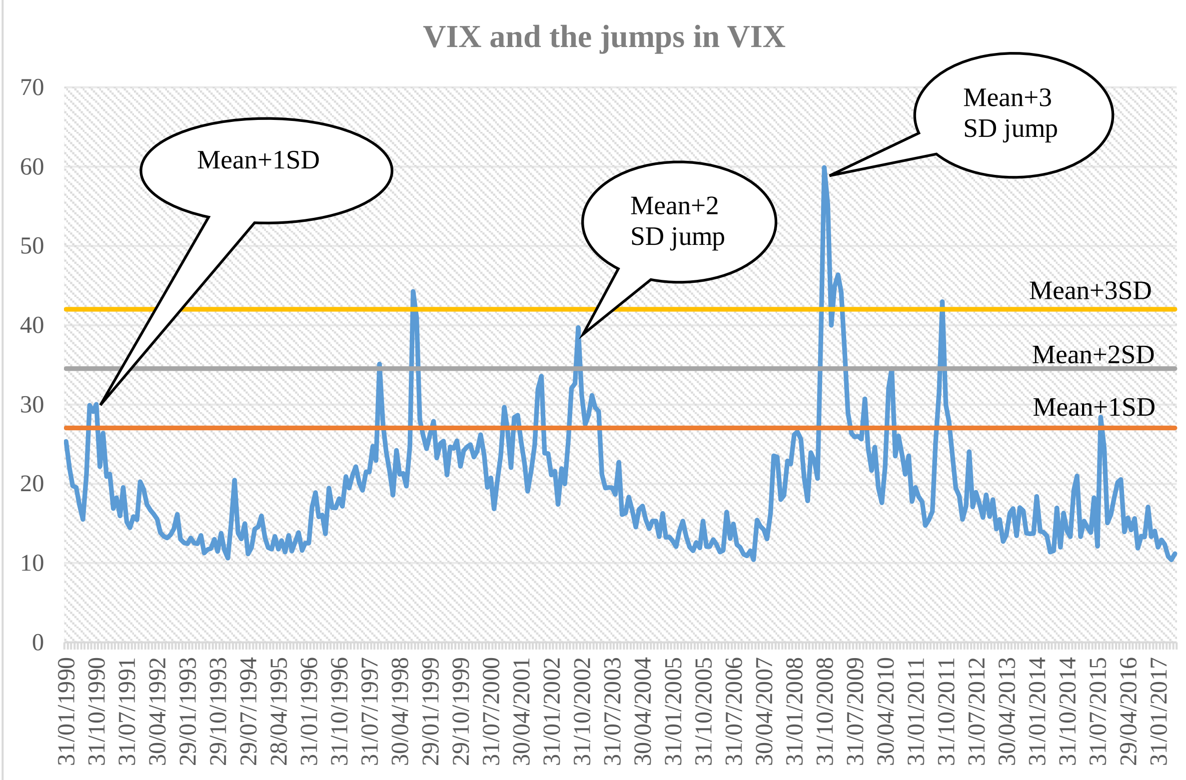
Fig 1: The Fear Indices and the jumps in the fear indices
Panel A



Panel B

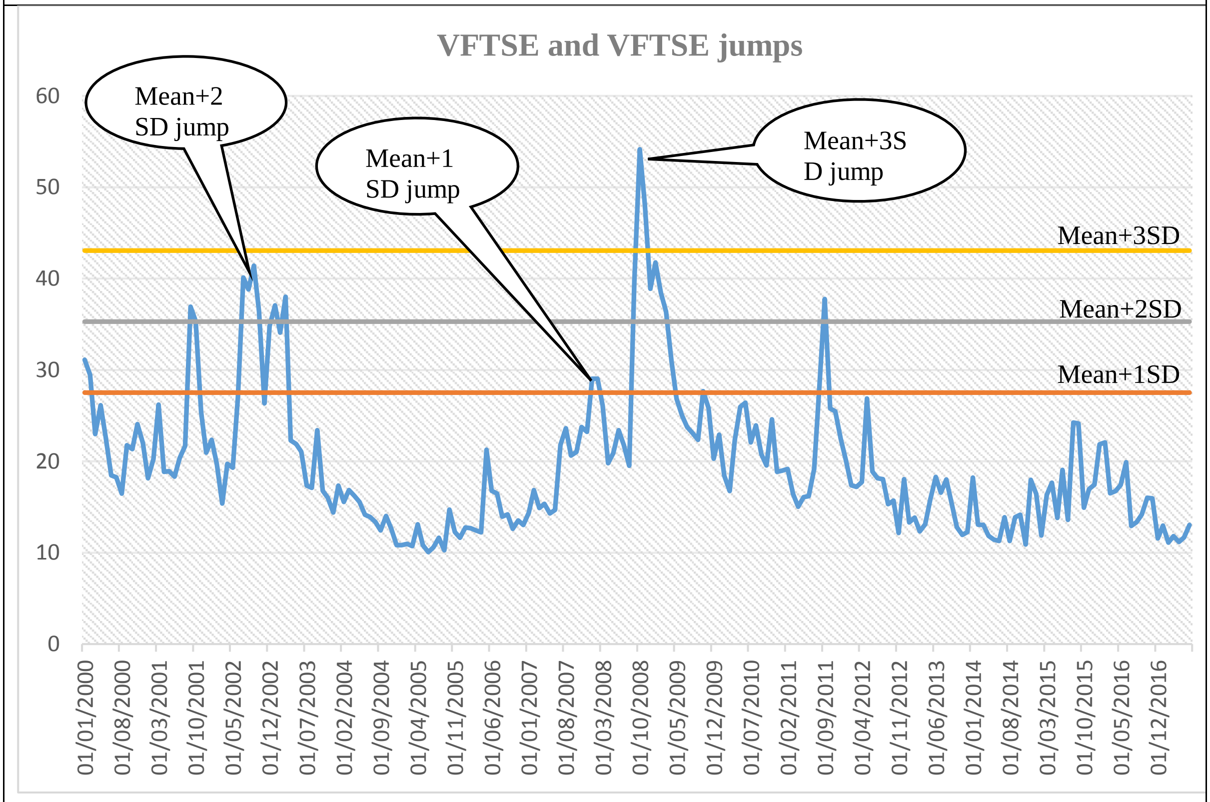


Fig 1 continued … Panel C

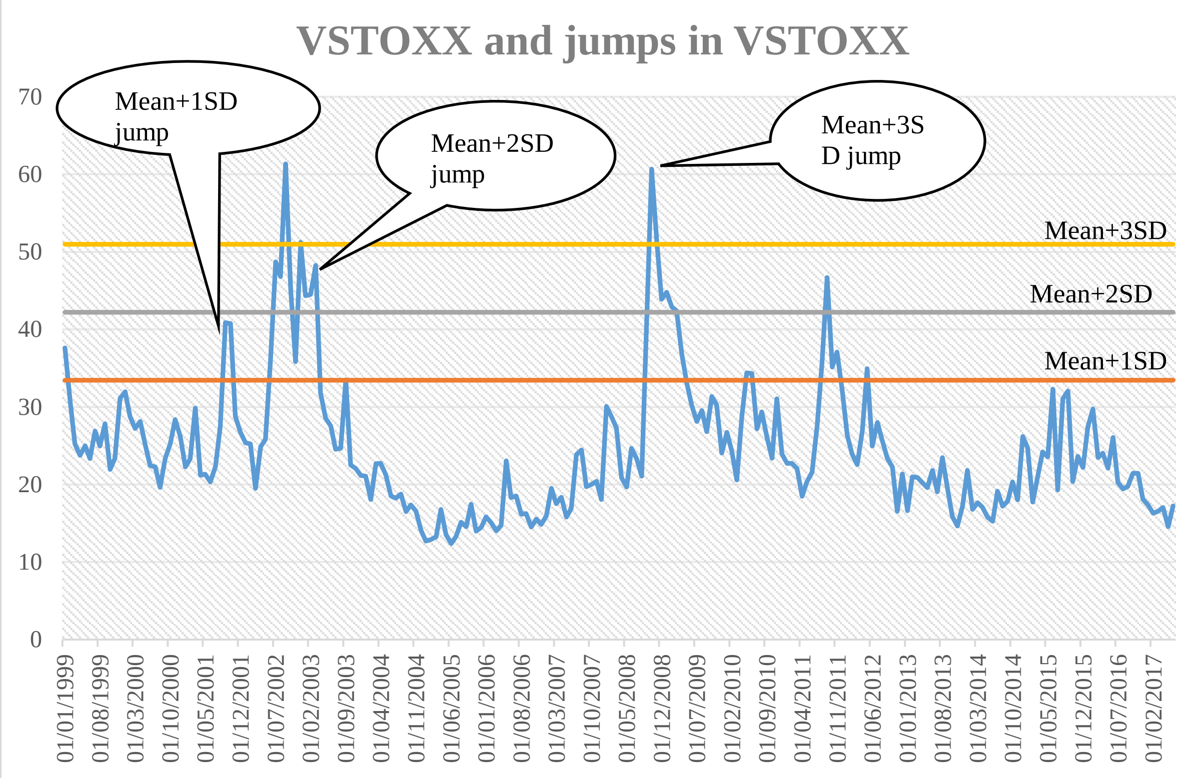


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Table 1: Descriptive Statistics

Note: This table reports the summary statistics of the data. Panel A reports the statistics for US markets. Sample size January 1990-June 2017. Panel B reports the summary statistics for the UK market. Sample size January 2000 - June 2017. Panel C reports the summary statistics for European Monetary Union (EMU). Sample size January 1999- June 2017. JB is Jarque-Berra statistics and the a associated p-value is represented by P(JB).

Panel A

	VIX	r_{US}	LI_{US}	ΔCCI_{US}	Δbr	$\Delta r3m$	$\Delta r10y$	Δx	DY	PE	EVS	$EVEBIT$
Mean	19.56	0.61	0.14	0.03	-0.02	-0.02	-0.018	-0.002	2.09	19.59	1.99	16.82
Median	17.75	1.04	0.20	-0.14	0.00	0.00	-0.01	0.06	1.97	18.52	2.05	16.64
Max	59.89	10.58	1.80	21.68	0.75	1.24	0.89	6.47	3.91	29.83	3.01	25.23
Min	10.41	-18.56	-3.30	-23.01	-1.25	-1.59	-1.03	-4.78	1.05	12.04	1.00	10.19
S.Dev.	7.49	4.15	0.73	6.19	0.20	0.23	0.26	1.66	0.62	4.06	0.52	3.41
Skew	1.72	-0.79	-1.44	-0.17	-1.88	-1.41	0.04	0.06	0.73	0.66	-0.05	0.24
Kurt	7.53	4.84	6.59	4.32	12.79	14.04	3.80	3.54	3.11	2.56	1.74	2.30
JB	443.91	80.91	291.33	25.29	1506.30	1778.71	8.91	4.25	29.47	26.41	21.94	9.91
P(JB)	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.12	0.00	0.00	0.00	0.01
No. Obs	330	329	330	329	329	329	329	329	330	330	330	330

Panel B

	$VFTSE$	r_{UK}	LI_{UK}	ΔCCI_{UK}	Δbr	$\Delta r3m$	$\Delta r10y$	Δx	DY	PE	EVS	$EVEBIT$
Mean	19.75	0.07	0.04	-0.09	-0.03	-0.03	-0.02	-0.13	3.50	27.29	1.86	18.40
Median	18.03	0.71	0.10	0.00	0.00	0.00	-0.03	0.02	3.54	19.51	1.64	17.36
Max	54.15	8.30	0.80	10.00	0.25	0.65	0.68	5.95	6.47	142.08	4.92	39.87
Min	10.07	-13.95	-1.20	-11.00	-1.50	-1.93	-0.76	-12.25	0.18	7.89	0.28	8.30
S.Dev.	7.79	3.96	0.36	3.16	0.17	0.21	0.22	2.03	0.99	21.25	0.70	5.64
Skew	1.49	-0.70	-0.71	0.14	-4.58	-4.56	-0.12	-1.38	-1.40	2.74	0.73	1.22
Kurt	5.49	3.85	4.03	3.63	35.78	40.82	3.87	9.57	7.07	12.22	4.91	4.97
JB	132.09	23.41	27.16	4.17	10135.71	13239.83	7.16	443.93	735.08	5731.41	389.68	3864.65
P(JB)	0.00	0.00	0.00	0.12	0.00	0.00	0.03	0.00	205.80	94346.02	102.22	6640.24
No. Obs	210	209	210	209	210	210	210	210	210	210	210	210

Panel C

	$VSTOX$	r_{EU}	LI_{EU}	ΔCCI_{EU}	Δbr	$\Delta r3m$	$\Delta r10y$	Δx	DY	PE	EVS	$EVEBIT$
Mean	24.68	-0.01	0.02	0.00	-0.01	-0.02	-0.02	-0.004	3.60	29.65	1.38	13.52
Median	22.73	0.72	0.08	0.20	0.00	-0.004	-0.04	0.09	3.44	16.27	1.38	12.84
Max	61.34	13.70	1.14	3.80	0.50	0.48	0.44	8.09	7.69	423.85	1.98	27.85
Min	12.38	-20.62	-1.98	-5.30	-0.75	-0.96	-0.64	-6.52	2.06	7.98	0.88	7.90
S.Dev.	8.79	5.43	0.41	1.51	0.15	0.17	0.20	1.82	0.91	57.13	0.25	4.24
Skew	1.48	-0.57	-0.93	-0.42	-1.37	-2.04	-0.06	-0.16	1.49	5.19	0.04	1.56
Kurt	5.64	4.10	5.53	3.84	9.59	13.47	2.95	5.54	6.71	31.08	2.09	5.48
JB	145.98	23.35	91.56	12.91	471.99	1168.06	0.16	60.80	176.06	6871.04	6.47	123.27
P(JB)	0.00	0.00	0.00	0.00	0.00	0.00	0.92	0.00	0.00	0.00	0.04	0.00
No. Obs	222	221	222	221	222	222	222	222	186	184	186	186

Table 2: Predicting the future S&P500 Returns using VIX index

Note: This table reports the results for single long-horizon regressions for the monthly continuously compounded returns on S&P 500 index at horizons h=1, 3, 6, 9, 12, 24, 36, 48 and 60 months ahead. In Panel A the forecasting variable is the VIX index. In Panels B, C and D, the forecasting variables are mean plus one standard deviation (MP1SD), mean plus two standard deviation (MP2SD) and mean plus 3 standard deviation (MP3SD) moves in the VIX index respectively. The original sample size is January 1990 – June 2017 and *h* observations are lost in each *h*-horizon regressions of *h*= 1, 3, 6, 9, 12, 24, 36, 48 and 60. For each regression in the Panels A, B, C and D , the slope estimates are reported in row 1, the t-statistics are reported in parentheses in row 2, the R-squared and the F-statistics are reported in rows 3 and 4 respectively. The t-statistics are computed using Newey and West (1987) heteroscedasticity and autocorrelation adjusted standard errors with AIC maximum lags = 6 and pre-whitening with lag = 1. * denotes significant at 10%, ** at 5% and *** at 1% significant levels.

h=	1m	3m	6m	9m	12m	24m	36m	48m	60m
PANEL A									
VIX	-0.001	0.03	0.07	0.10	0.07	0.08	-0.13	-0.37	-0.25
	(-0.01)	(0.35)	(0.46)	(0.60)	(0.29)	(0.19)	(-0.17)	(-0.26)	(-0.16)
R-Squared	0.00%	0.14%	0.30%	0.33%	0.10%	0.07%	0.11%	0.65%	0.25%
F-stat	0.0004	0.44	0.98	1.06	0.33	0.20	0.31	1.83	0.67
PANEL B									
MP1SD	-0.02	0.06	0.15***	0.14	0.15	0.13	0.19	0.09	0.21
	(-0.61)	(1.00)	(2.47)	(1.37)	(0.98)	(0.48)	(0.46)	(0.17)	(0.36)
R-Squared	0.12%	0.76%	1.51%	0.75%	0.60%	0.18%	0.27%	0.04%	0.20%
F-stat	0.39	2.49	4.95	2.43	1.90	0.56	0.78	0.12	0.55
PANEL C									
MP2SD	-0.003	-0.06	0.02	0.25**	0.28**	0.35	0.30	0.14	0.23
	(-0.03)	(-0.37)	(0.11)	(2.02)	(2.14)	(1.33)	(0.71)	(0.32)	(0.51)
R-Squared	0.00%	0.33%	0.01%	1.15%	0.99%	0.65%	0.31%	0.06%	0.12%
F-stat	0.01	1.08	0.04	3.71	3.16	1.98	0.92	0.16	0.32
PANEL D									
MP3SD	0.02	0.06	0.17	0.30***	0.37***	0.50**	0.39	0.40	0.62
	(0.49)	(0.97)	(1.46)	(3.40)	(5.25)	(2.38)	(1.15)	(0.98)	(1.37)
R-Squared	0.12%	0.53%	1.41%	2.66%	2.89%	2.16%	0.87%	0.69%	1.45%
F-stat	0.40	1.74	4.62	8.75	9.44	6.73	2.56	1.96	3.96

Table 3: Predicting the future FTSE 100 Returns using VFTSE Index

Note: Note: This table reports the results for single long-horizon regressions for the monthly continuously compounded returns on FTSE 100 index at horizons h=1, 3, 6, 9, 12, 24, 36, 48 and 60 months ahead. In Panel A the forecasting variable is the VFTSE index. In Panels B, C and D, the forecasting variables are mean plus one standard deviation (MP1SD), mean plus two standard deviation (MP2SD) and mean plus three standard deviation (MP3SD) moves in the VFTSE index respectively. The original sample size is January 2000 – June 2017 and h observations are lost in each h-horizon regressions of $h=$ 1, 3, 6, 9, 12, 24, 36, 48 and 60. For each regression in the Panels A, B, C and D , the slope estimates are reported in row 1, the t-statistics are reported in parentheses in row 2, the R-squared and the F-statistics are reported in rows 3 and 4 respectively. The t-statistics are computed using Newey and West (1987) heteroscedasticity and autocorrelation adjusted standard errors with AIC maximum lags = 6 and pre-whitening with lag = 1. * denotes significant at 10%, ** at 5% and *** at 1% significant levels.

h=	1m	3m	6m	9m	12m	24m	36m	48m	60m
					PANEL A				
VFTSE	-0.003	-0.005	-0.02	-0.01	0.06	0.35	0.60	1.10***	1.46***
	(-0.07)	(-0.07)	(-0.18)	(-0.04)	(0.14)	(0.66)	(1.28)	(3.00)	(5.04)
R-Squared	0.00%	0.00%	0.03%	0.01%	0.08%	1.60%	4.00%	15.16%	34.27%
F-stat	0.01	0.01	0.07	0.02	0.16	3.01	7.21	28.76	77.69
					PANEL B				
MP1SD	-0.04	0.05	0.17**	0.02	0.03	0.14	0.05	0.16	0.20
	(-0.76)	(1.59)	(2.20)	(0.11)	(0.10)	(0.58)	(0.17)	(0.55)	(0.83)
R-Squared	0.37%	0.31%	1.02%	0.01%	0.02%	0.18%	0.02%	0.25%	0.52%
F-stat	0.77	0.64	2.07	0.03	0.04	0.33	0.03	0.40	0.77
					PANEL C				
MP2SD	0.01	0.01	0.08	0.17*	0.23	0.44**	0.59***	0.73***	0.87***
	(0.17)	(0.17)	(0.94)	(1.77)	(1.19)	(2.21)	(2.90)	(3.95)	(5.81)
R-Squared	0.04%	0.02%	0.50%	1.83%	2.24%	4.11%	6.40%	11.74%	22.30%
F-stat	0.08	0.05	1.02	3.72	4.51	7.94	11.84	21.42	42.76
					PANEL D				
MP3SD	0.01	-0.02	-0.01	0.03	0.30***	0.48***	0.32**	0.40***	0.60***
	(1.16)	(-1.08)	(-0.40)	(0.55)	(4.16)	(3.05)	(2.10)	(2.65)	(5.29)
R-Squared	0.01%	0.03%	0.00%	0.01%	1.08%	1.33%	0.52%	0.97%	2.97%
F-stat	0.02	0.07	0.01	0.02	2.14	2.49	0.90	1.58	4.55

Table 4: Predicting Future STOXX 50 returns using VSTOX

Note: This table reports the results for single long-horizon regressions for the monthly continuously compounded returns on Euro Stoxx 50 index at horizons h=1, 3, 6, 9, 12, 24, 36, 48 and 60 months ahead. In Panel A the forecasting variable is the VSTOXX index. In Panels B, C and D, the forecasting variables are mean plus one standard deviation (MP1SD), mean plus two standard deviation (MP2SD) and mean plus three standard deviation (MP3SD) moves in the VSTOXX index respectively. The original sample size is January 1999 – June 2017 and *h* observations are lost in each *h*-horizon regressions of *h*= 1, 3, 6, 9, 12, 24, 36, 48 and 60. For each regression in the Panels A, B, C and D , the slope estimates are reported in row 1, the t-statistics are reported in parentheses in row 2, the R-squared and the F-statistics are reported in rows 3 and 4 respectively. The t-statistics are computed using Newey and West (1987) heteroscedasticity and autocorrelation adjusted standard errors with AIC maximum lags = 6 and pre-whitening with lag = 1. * denotes significant at 10%, ** at 5% and *** at 1% significant levels.

h=	1m	3m	6m	9m	12m	24m	36m	48m	60m
					PANEL A				
VSTOX	0.003	0.01	-0.01	0.01	0.12	0.42	0.74	1.55***	2.17***
	(0.05)	(0.15)	(-0.10)	(0.03)	(0.42)	(0.50)	(0.98)	(2.93)	(4.90)
R-Squared	0.00%	0.02%	0.01%	0.00%	0.26%	1.56%	3.71%	15.75%	37.22%
F-stat	0.004	0.04	0.02	0.00	0.55	3.12	7.12	32.35	95.47
					PANEL B				
MP1SD_EU	-0.04	-0.01	0.04	0.03	0.04	0.23	0.45	0.65*	0.84**
	(-0.73)	(-0.08)	(0.41)	(0.24)	(0.21)	(0.70)	(1.19)	(1.73)	(2.40)
R-Squared	0.50%	0.01%	0.09%	0.02%	0.02%	0.50%	1.47%	3.21%	6.51%
F-stat	1.10	0.02	0.19	0.04	0.05	0.99	2.76	5.73	11.21
					PANEL C				
MP2SD_EU	-0.01	-0.02	0.15	0.21	0.38**	0.60**	0.78*	1.03***	1.22***
	(-0.22)	(-0.27)	(1.10)	(1.12)	(2.47)	(2.10)	(1.80)	(3.15)	(2.57)
R-Squared	0.04%	0.06%	1.26%	1.37%	3.13%	4.07%	5.42%	9.78%	16.85%
F-stat	0.08	0.14	2.73	2.94	6.75	8.36	10.61	18.76	32.63
					PANEL D				
MP3SD_EU	0.01	-0.01	-0.14	0.06	0.23	0.33	0.34	0.57	0.83***
	(0.23)	(-0.17)	(-1.73)	(0.64)	(1.43)	(1.04)	(0.77)	(1.28)	(2.08)
R-Squared	0.03%	0.02%	0.64%	0.06%	0.64%	0.73%	0.62%	1.73%	4.52%
F-stat	0.07	0.04	1.38	0.13	1.35	1.44	1.16	3.04	7.62

Table 5: Generalized Impulse Response of Stock Return Indices to one standard deviation shock in the Fear indices

Note: This table reports the impulse response of monthly returns to one SD innovation in the fear indices for up to next 12 months. Panel A reports the response of returns on S&P 500 index to one SD innovation in VIX, VFTSE and the VSTOXX indices. Panel B and Panel C reports the response of returns on FTSE 100 and STOXX 50 indices respectively. Figures in parentheses are t-statistics. The standard errors used to compute the t-statistics are estimated using Monte Carlo simulation with 5000 repetitions. Model (5) is estimated to generate these responses. Adjusted sample size Adjusted sample size Feb-20001 to May 2017 (Total 196 observations)

	Panel A Response of S&P500 to one SD shock in:			Panel B Response of FTSE100 to one SD shock in:			Panel C Response of STOXX50 to one SD shock in:		
Period	VIX	VFTSE	VSTOX	VIX	VFTSE	VSTOX	VIX	VFTSE	VSTOX
1	-0.07	-0.09	0.35	-0.10	0.02	0.23	-0.01	-0.04	0.62
	(-0.22)	(-0.30)	(1.14)	(-0.36)	(0.09)	(0.79)	(-0.02)	(-0.10)	(1.61)
2	0.42	0.04	0.20	0.48	0.08	0.22	0.63	0.03	0.30
	(1.31)	(0.13)	(0.65)	(1.61)	(0.28)	(0.75)	(1.55)	(0.07)	(0.75)
3	-0.03	0.02	0.15	-0.06	-0.03	0.04	-0.19	0.05	-0.01
	(-0.19)	(0.14)	(0.94)	(-0.38)	(-0.21)	(0.24)	(-0.92)	(0.24)	(-0.07)
4	-0.11	-0.07	0.05	-0.08	-0.06	0.01	-0.19	-0.11	0.01
	(-0.83)	(-0.59)	(0.46)	(-0.65)	(-0.53)	(0.10)	(-1.14)	(-0.77)	(0.10)
5	-0.06	-0.06	0.07	-0.05	-0.06	0.03	-0.12	-0.11	-0.01
	(-0.69)	(-0.70)	(0.91)	(-0.58)	(-0.87)	(0.39)	(-1.07)	(-1.07)	(-0.07)
6	-0.03	-0.03	0.07	-0.02	-0.03	0.03	-0.08	-0.06	0.03
	(-0.42)	(-0.45)	(1.06)	(-0.34)	(-0.54)	(0.52)	(-0.92)	(-0.78)	(0.30)
7	-0.02	-0.02	0.08	-0.02	-0.02	0.03	-0.07	-0.06	0.03
	(-0.37)	(-0.27)	(1.17)	(-0.42)	(-0.45)	(0.65)	(-0.86)	(-0.79)	(0.38)
8	-0.02	-0.01	0.07	-0.02	-0.02	0.03	-0.06	-0.05	0.03
	(-0.32)	(-0.19)	(1.14)	(-0.39)	(-0.38)	(0.63)	(-0.80)	(-0.68)	(0.41)
9	-0.01	-0.01	0.07	-0.02	-0.01	0.03	-0.05	-0.04	0.03
	(-0.25)	(-0.09)	(1.15)	(-0.36)	(-0.30)	(0.66)	(-0.72)	(-0.61)	(0.47)
10	-0.01	0.00	0.06	-0.01	-0.01	0.03	-0.04	-0.03	0.03
	(-0.15)	(0.00)	(1.15)	(-0.29)	(-0.22)	(0.68)	(-0.61)	(-0.51)	(0.52)
11	0.00	0.00	0.06	-0.01	-0.01	0.03	-0.03	-0.02	0.03
	(0.07)	(0.09)	(1.14)	(-0.22)	(-0.14)	(0.69)	(-0.52)	(-0.42)	(0.55)
12	0.00	0.01	0.05	-0.01	0.00	0.03	-0.02	-0.02	0.03
	(0.00)	(0.16)	(1.12)	(-0.16)	(-0.07)	(0.70)	(-0.43)	(-0.34)	(0.58)

Table 6: Response of Valuation metrics to one standard deviation innovations in the fear indices

Note: This table reports the generalised impulse response of the valuation metrics of the market indices to a one standard deviation Shock in the corresponding fear indices. Pane A reports the response of PE ratio, dividend yield (DY), Enterprise value-to-sales ratio (EVS) and Enterprise value –to-earnings before interest and tax (EVEBIT) of the S&P 500 index to one standard shock in the VIX index. Adjusted sample size of the estimated VAR is August 1990 – May 2017 (322 observations). Panel B reports the response of similar valuation metrics of the FTSE 100 to one standard deviation shock in the VFTSE index. Adjusted sample size of the estimated VAR model is April 2000 – May 2017 (206 observations). Finally, Panel C reports the response of similar valuation metrics of the STOXX 50 index to one standard deviation shock in the VSTOXX index. Adjusted sample size of the estimated of the estimated VAR model is January 2003 – May 2005 (159 observations). The standard errors used to compute the t-statistics are estimated using Monte Carlo simulation with 5000 repetitions. * denotes significant at 10%, ** at 5% and *** at 1% significant levels.

	Panel A: One SD shock to VIX				Panel B: One SD shock to VFTSE				Panel C: One SD shock to VSTOXX			
Period	PE_{US}	DY_{US}	EVS_{US}	$EVEBIT_{US}$	PE_{UK}	DY_{UK}	EVS_{UK}	$EVEBIT_{UK}$	PE_{EU}	DY_{EU}	EVS_{EU}	$EVEBIT_{EU}$
1	0.06*	0.00	-0.01***	-0.06**	0.35	-0.02	-0.02	-0.17	-0.16	-0.01	0.00	-0.03
	(1.86)	(0.03)	(-3.22)	(-2.47)	(0.60)	(-1.47)	(-0.98)	(-1.11)	(-1.44)	(-0.99)	(0.30)	(-0.77)
2	-0.01	0.01**	-0.01***	-0.13***	-0.15	0.01	-0.01	-0.08	-0.33*	-0.03	0.00	-0.09
	(-0.16)	(2.56)	(-2.66)	(-2.62)	(-0.17)	(0.25)	(-0.41)	(-0.38)	(-1.79)	(-1.11)	(0.19)	(-1.26)
3	0.08	0.01	-0.01	-0.06	-0.96	-0.01	0.00	0.15	-0.17	-0.03	0.00	-0.07
	(0.98)	(0.94)	(-1.03)	(-0.94)	(-0.88)	(-0.33)	(0.01)	(0.60)	(-0.70)	(-0.72)	(0.28)	(-0.74)
4	0.16*	0.00	0.00	0.01	-0.60	-0.02	0.00	0.12	0.17	-0.03	0.00	-0.05
	(1.75)	(0.05)	(0.20)	(0.09)	(-0.56)	(-0.58)	(-0.07)	(0.54)	(0.63)	(-0.58)	(-0.04)	(-0.42)
5	0.18*	0.00	0.00	0.01	-0.33	-0.02	-0.01	0.11	-0.18	0.00	0.00	-0.09
	(1.76)	(0.18)	(0.59)	(0.16)	(-0.31)	(-0.64)	(-0.53)	(0.49)	(-0.63)	(0.08)	(0.11)	(-0.72)
6	0.20*	0.00	0.00	0.01	0.04	-0.02	-0.01	0.12	-0.28	0.04	0.00	-0.11
	(1.78)	(0.04)	(0.12)	(0.07)	(0.04)	(-0.56)	(-0.42)	(0.56)	(-0.86)	(0.55)	(-0.07)	(-0.76)
7	0.24*	-0.01	0.00	0.04	0.27	-0.01	-0.01	0.14	-0.13	0.02	0.00	-0.07
	(1.94)	(-0.64)	(0.21)	(0.40)	(0.28)	(-0.48)	(-0.28)	(0.68)	(-0.35)	(0.31)	(-0.09)	(-0.48)
8	0.36***	-0.02	0.01	0.12	0.44	-0.01	-0.01	0.13	-0.29	-0.05	0.00	-0.07
	(2.77)	(-1.42)	(0.91)	(1.29)	(0.48)	(-0.34)	(-0.29)	(0.64)	(-0.75)	(-0.55)	(0.05)	(-0.46)
9	0.37***	-0.03	0.01	0.14	0.56	-0.01	-0.01	0.13	-0.23	-0.05	0.00	-0.13
	(2.85)	(-1.60)	(1.00)	(1.49)	(0.64)	(-0.27)	(-0.33)	(0.62)	(-0.50)	(-0.50)	(0.08)	(-0.77)
10	0.38***	-0.03	0.01	0.15	0.63	-0.01	-0.01	0.12	-0.02	-0.04	0.00	-0.11
	(2.83)	(-1.64)	(1.01)	(1.63)	(0.75)	(-0.22)	(-0.32)	(0.61)	(-0.04)	(-0.43)	(0.10)	(-0.59)
11	0.41***	-0.03*	0.01	0.17*	0.66	-0.01	-0.01	0.12	0.15	-0.03	0.00	-0.14
	(2.89)	(-1.69)	(0.95)	(1.71)	(0.83)	(-0.18)	(-0.32)	(0.60)	(0.26)	(-0.31)	(0.08)	(-0.67)
12	0.43***	-0.03*	0.01	0.18	0.68	0.00	-0.01	0.12	-0.33	-0.06	0.00	-0.16
	(2.93)	(-1.69)	(0.85)	(1.80)	(0.88)	(-0.14)	(-0.33)	(0.59)	(-0.54)	(-0.55)	(0.01)	(-0.74)

Table 7: Generalized Impulse Response of Leading Economic Indicator and consumer confidence to one standard deviation shock in the Fear Indices

Note: This table reports the generalised impulse response of conference board leading economic indicator and changes in consumer confidence to one SD innovations is the Fear indices within one country/economic zone for up to next 12 months. Panel A reports the response of US economic leading indicator (CBCLI) and changes in the Consumer confidence (DCCI) to one SD innovations in the VIX index. Adjusted sample size May 1990-May 2017 (325 observations. Panel B reports the response of UK economic leading indicator (CBCLI) and changes in the Consumer confidence (DCCI) to one SD innovations in the VFTSE index. Adjusted sample size April 2000 – May 2017 (206 observations). Panel C reports the response of EMU's economic leading indicator (CBCLI) and changes in the Consumer confidence (DCCI) to one SD innovations in the VSTOXX index. Adjusted sample size April 1999 – May 2017. Figures in parentheses are t-statistics. The standard errors used to compute the t-statistics are estimated using Monte Carlo simulation with 5000 repetitions. Estimated VAR model is. Adjusted sample size Adjusted sample size Feb-20001 to May 2017 (Total 196 observations). The standard errors used to compute the t-statistics are estimated using Monte Carlo simulation with 5000 repetitions. * denotes significant at 10%, ** at 5% and *** at 1% significant levels.

	Panel A Response of US CBLI and DCCI to one SD innovation in the VIX		Panel B Response of UK CBLI and DCCI to one SD innovation in the VFTSE		Panel C Response of EU CBLI and DCCI to one SD innovation in the VSTOX	
Period	CBLI	DCCI	CBLI	DCCI	CBLI	DCCI
1	-0.03	-0.51	0.00	0.07	-0.01	0.05
	(-1.14)	(-1.57)	(-0.01)	(0.30)	(-0.46)	(0.52)
2	-0.04	0.00	0.01	0.06	0.00	0.04
	(-1.57)	(-0.01)	(0.60)	(0.28)	(0.10)	(0.47)
3	-0.03	0.47	0.01	0.00	0.02	0.05
	(-0.84)	(1.33)	(0.65)	(0.01)	(1.09)	(0.85)
4	0.03	0.08	0.01	0.04	0.02	0.06
	(1.15)	(0.37)	(0.55)	(0.49)	(1.04)	(0.99)
5	0.02	0.10	0.01	0.01	0.02	0.04
	(0.81)	(0.57)	(0.46)	(0.13)	(1.01)	(0.90)
6	0.03	0.07	0.01	0.01	0.02	0.04
	(1.08)	(0.55)	(0.40)	(0.20)	(1.04)	(0.97)
7	0.04	0.07	0.00	0.01	0.02	0.04
	(1.64)	(0.69)	(0.33)	(0.25)	(1.07)	(1.02)
8	0.04	0.12	0.00	0.01	0.01	0.04
	(1.68)	(1.24)	(0.29)	(0.21)	(1.02)	(0.99)
9	0.05*	0.10	0.00	0.00	0.01	0.03
	(1.79)	(1.17)	(0.26)	(0.20)	(0.98)	(0.95)
10	0.05*	0.09	0.00	0.00	0.01	0.03
	(1.88)	(1.09)	(0.23)	(0.18)	(0.95)	(0.94)
11	0.05*	0.09	0.00	0.00	0.01	0.03
	(1.90)	(1.22)	(0.21)	(0.17)	(0.93)	(0.92)
12	0.05*	0.09	0.00	0.00	0.01	0.02
	(1.92)	(1.22)	(0.19)	(0.15)	(0.90)	(0.89)

Table 8: Generalised Response of Leading Economic Indicator to one standard Deviation innovation in the Fear indices

Note: This table presents generalised impulse responses of conference board leading economic indicator to one standard deviation innovations in the VIX, VSTOXX, and VFTSE indices up to next 12 months . Panels A, B and C presents the responses of changes in US, UK and EU Leading economic indicator respectively. The VAR model estimated is (9). Figures in parentheses report t-statistics. The t-statistics are computed using standard errors that are estimated using Monte Carlo simulations with 1000 repetitions. Adjusted sample size Feb-20001 to May 2017 (Total 196 observations). * denotes significant at 10%, ** at 5% and *** at 1% significant levels.

	Panel A Response of LI_US to one SD innovation in			Panel B Response of LI_UK to one SD innovation in			Panel C Response of LI_EU to one SD innovation in		
Period	VIX	VSTOX	VFTSE	VIX	VSTOX	VFTSE	VIX	VSTOX	VFTSE
1	-0.03	-0.04	-0.05*	0.00	0.01	0.01	0.01	0.00	0.01
	(-1.02)	(-1.36)	(-1.71)	(-0.03)	(0.97)	(0.72)	(0.54)	(0.20)	(0.49)
2	0.04	0.09	0.09	0.01	0.03	0.02	0.00	0.03	0.03
	(0.77)	(1.46)	(1.54)	(0.39)	(0.96)	(0.60)	(-0.03)	(0.73)	(0.80)
3	-0.03	-0.01	0.00	0.04	0.02	0.01	0.05	0.05	0.04
	(-0.40)	(-0.08)	(0.02)	(1.00)	(0.60)	(0.34)	(0.89)	(0.86)	(0.66)
4	0.09	0.02	0.06	0.06	0.05	0.04	0.12*	0.14**	0.13**
	(0.99)	(0.26)	(0.70)	(1.24)	(1.12)	(0.82)	(1.87)	(2.21)	(2.02)
5	0.14	0.14	0.16	0.06	0.06	0.04	0.11	0.08	0.10
	(1.23)	(1.30)	(1.41)	(1.11)	(1.09)	(0.75)	(1.44)	(1.10)	(1.32)
6	0.12	0.12	0.10	0.04	0.05	0.02	0.05	0.05	0.04
	(0.98)	(0.98)	(0.77)	(0.61)	(0.76)	(0.26)	(0.57)	(0.58)	(0.53)
7	0.15	0.13	0.10	0.06	0.07	0.03	0.08	0.08	0.06
	(1.04)	(0.91)	(0.69)	(0.91)	(1.05)	(0.39)	(0.89)	(0.84)	(0.65)
8	0.10	0.09	0.05	0.05	0.07	0.05	0.04	0.05	0.01
	(0.62)	(0.56)	(0.32)	(0.67)	(0.87)	(0.57)	(0.40)	(0.49)	(0.13)
9	0.10	0.12	0.07	0.01	0.04	-0.01	-0.02	0.01	-0.02
	(0.60)	(0.72)	(0.41)	(0.07)	(0.43)	(-0.13)	(-0.19)	(0.11)	(-0.23)
10	-0.06	-0.08	-0.13	-0.01	0.02	-0.01	-0.03	-0.02	-0.06
	(-0.35)	(-0.41)	(-0.70)	(-0.06)	(0.24)	(-0.13)	(-0.28)	(-0.13)	(-0.53)
11	0.01	0.02	-0.04	0.03	0.05	0.00	-0.03	-0.04	-0.09
	(0.04)	(0.12)	(-0.22)	(0.23)	(0.45)	(0.04)	(-0.26)	(-0.31)	(-0.64)
12	-0.09	-0.03	-0.11	0.00	0.02	-0.01	-0.09	-0.06	-0.10
	(-0.41)	(-0.15)	(-0.52)	(-0.03)	(0.15)	(-0.06)	(-0.65)	(-0.45)	(-0.71)

Table 9: Generalised Response of Consumer Confidence to one standard Deviation innovation in the Fear indices

Note: This table presents generalised impulse responses of changes in consumer confidence (DCCI) to one standard deviation innovations in the VIX, VSTOX, and VFTSE indices, up to next 12 months. Panels A, B and C presents the responses of changes in US, UK and EU consumer confidence respectively. The VAR model estimated is (9). Figures in parentheses report t-statistics. The t-statistics are computed using standard errors that are estimated using Monte Carlo simulations with 1000 repetitions. Adjusted sample size Feb-20001 to May 2017 (Total 196 observations). * denotes significant at 10%, ** at 5% and *** at 1% significant levels.

	Panel A Response of DCCI_US to one SD innovation in			Panel B Response of DCCI_UK to one SD innovations in			Panel C Response of DCCI_EMU to one SD innovations in		
Period	VIX	VSTOX	VFTSE	VIX	VSTOX	VFTSE	VIX	VSTOX	VFTSE
1	-1.74***	-1.15***	-1.76***	0.32	0.54**	0.58***	-0.17*	-0.03	-0.15
	(-4.43)	(-2.80)	(-4.60)	(1.44)	(2.41)	(2.64)	(-1.80)	(-0.36)	(-1.49)
2	0.11	-0.11	-0.61	-0.24	-0.45	-0.66	0.12	-0.08	-0.11
	(0.13)	(-0.13)	(-0.75)	(-0.53)	(-1.01)	(-1.46)	(0.62)	(-0.43)	(-0.59)
3	1.19	0.99	0.83	0.86*	0.69	0.46	0.17	0.23	0.08
	(1.31)	(1.05)	(0.89)	(1.76)	(1.39)	(0.92)	(0.77)	(1.03)	(0.36)
4	0.05	-0.12	-0.21	-0.25	-0.05	0.11	0.36	0.29	0.25
	(0.05)	(-0.12)	(-0.20)	(-0.45)	(-0.09)	(0.19)	(1.41)	(1.17)	(0.99)
5	0.88	0.97	1.15	-0.18	0.19	0.02	0.15	0.10	0.12
	(0.73)	(0.77)	(0.94)	(-0.28)	(0.28)	(0.02)	(0.52)	(0.36)	(0.42)
6	1.11	1.33	1.45	0.46	0.20	0.05	0.42	0.51	0.47
	(0.85)	(1.00)	(1.12)	(0.69)	(0.29)	(0.08)	(1.33)	(1.65)	(1.51)
7	-0.12	-0.24	-0.08	0.33	0.47	0.24	0.22	0.25	0.28
	(-0.08)	(-0.18)	(-0.06)	(0.45)	(0.62)	(0.32)	(0.59)	(0.68)	(0.77)
8	0.41	0.18	-0.80	0.23	0.31	0.05	0.13	0.19	0.07
	(0.27)	(0.12)	(-0.53)	(0.28)	(0.38)	(0.06)	(0.32)	(0.50)	(0.20)
9	0.38	0.27	-0.14	-0.30	-0.11	-0.33	0.21	0.20	0.11
	(0.23)	(0.16)	(-0.08)	(-0.34)	(-0.13)	(-0.37)	(0.49)	(0.49)	(0.27)
10	-0.49	-0.16	-0.63	-0.03	-0.22	-0.08	-0.09	-0.12	-0.15
	(-0.27)	(-0.09)	(-0.34)	(-0.03)	(-0.21)	(-0.08)	(-0.20)	(-0.27)	(-0.34)
11	-0.45	-0.09	-0.16	-0.72	-0.35	-0.45	-0.22	-0.18	-0.21
	(-0.22)	(-0.04)	(-0.08)	(-0.67)	(-0.32)	(-0.41)	(-0.44)	(-0.38)	(-0.43)
12	-2.06	-1.72	-1.91	0.06	0.01	-0.25	-0.32	-0.17	-0.44
	(-0.94)	(-0.80)	(-0.89)	(0.05)	(0.01)	(-0.22)	(-0.59)	(-0.31)	(-0.82)

Table 10: Response of Monetary Policy Indicators to one standard deviation innovations to the fear indices.

Note: This table reports the generalised impulse response of monetary policy-related variables to one SD innovations is the Fear indices within one country/economic zone for up to next 12 months. Panel A reports the response of US monetary policy indicators to one SD innovations in the VIX index.
Δbr_{US}, $\Delta r3m_{US}$, $\Delta r10y_{US}$ and Δx_{US} denotes changes in the FED funds rate, US Dollar 3-month LIBOR, yields on 10-year Generic US Government bond and trade-weighted exchange rate of US dollar respectively. Adjusted sample size May 1990- May 2017 (325 observations. Panel B reports the response of corresponding UK monetary policy indicators to one SD innovations in the VFTSE index. Adjusted sample size April 2000 – May 2017 (206 observations). Panel C reports the response corresponding of EMU's monetary policy indicators to one SD innovations in the VSTOXX index. Adjusted sample size March 1999 – May 2017 (219 observations). Figures in parentheses are t-statistics. The standard errors used to compute the t-statistics are estimated using Monte Carlo simulation with 5000 repetitions. * denotes significant at 10%, ** at 5% and *** at 1% significant levels.

	Panel A: Response to one SD innovation in VIX				Panel B: Response to one SD innovation in VFTSE				Panel C: Response to one SD innovation in VSTOXX			
Period	Δbr_{US}	$\Delta r3m_{US}$	$\Delta r10y_{US}$	Δx_{US}	Δbr_{UK}	$\Delta r3m_{UK}$	$\Delta r10y_{UK}$	Δx_{UK}	Δbr_{EU}	$\Delta r3m_{EU}$	$\Delta r10y_{EU}$	Δx_{EU}
1	-0.02**	-0.01	-0.05***	-0.07	-0.01	-0.01	-0.02	-0.13	-0.01*	-0.01	-0.01	-0.52***
	(-2.33)	(-1.14)	(-3.19)	(-0.89)	(-0.77)	(-0.85)	(-1.42)	(-0.95)	(-1.67)	(-1.39)	(-0.75)	(-4.31)
2	-0.02**	-0.01	0.01	0.06	-0.03***	-0.03**	0.01	-0.13	-0.01	0.00	0.02	-0.10
	(-2.41)	(-0.91)	(0.43)	(0.65)	(-2.78)	(-2.16)	(0.59)	(-0.89)	(-1.29)	(0.25)	(1.30)	(-0.78)
3	-0.02*	-0.04***	-0.01	0.10	-0.05***	-0.07***	-0.01	-0.25	-0.01*	-0.02***	0.00	0.07
	(-1.89)	(-2.98)	(-0.53)	(1.03)	(-4.97)	(-4.69)	(-0.69)	(-1.61)	(-1.73)	(-2.43)	(0.07)	(0.87)
4	-0.02**	-0.02**	0.00	-0.04	-0.02**	-0.03**	0.00	-0.15	-0.01***	-0.02***	0.00	0.08
	(-2.05)	(-2.24)	(-0.24)	(-0.58)	(-2.12)	(-2.22)	(-0.20)	(-1.40)	(-2.53)	(-3.18)	(-0.49)	(1.45)
5	-0.01*	-0.01	0.01	-0.03	-0.01	0.00	0.02*	0.12	-0.01***	-0.02***	0.00	0.03
	(-1.80)	(-1.55)	(1.35)	(-0.64)	(-0.87)	(0.00)	(1.90)	(1.27)	(-2.82)	(-2.58)	(0.32)	(0.92)
6	-0.01	-0.01	0.01	0.01	-0.01	-0.01	0.00	0.10	-0.01**	-0.01**	0.00	0.01
	(-0.80)	(-1.22)	(1.48)	(0.26)	(-1.52)	(-0.71)	(0.47)	(1.27)	(-2.36)	(-2.18)	(0.60)	(0.53)
7	-0.01	-0.01	0.00	-0.02	-0.01	-0.01	0.00	-0.07	-0.01**	-0.01**	0.00	0.02
	(-1.01)	(-1.13)	(0.67)	(-0.43)	(-1.34)	(-1.59)	(-0.36)	(-1.13)	(-2.03)	(-2.12)	(0.04)	(1.16
8	0.00	-0.01	0.00	-0.03	0.00	0.00	0.00	0.03	-0.01*	-0.01*	0.00	0.03
	(-0.75)	(-1.00)	(1.19)	(-1.08)	(-0.10)	(-0.45)	(0.76)	(0.50)	(-1.92)	(-1.95)	(-0.02)	(1.43)
9	0.00	0.00	0.00	-0.02	0.00	0.00	0.00	0.07	-0.01*	-0.01	0.00	0.02
	(-0.27)	(-0.71)	(1.13)	(-0.92)	(0.38)	(0.64)	(0.88)	(1.59)	(-1.72)	(-1.67)	(0.30)	(1.11)
10	0.00	0.00	0.00	-0.02	0.00	0.00	0.00	0.01	-0.01	-0.01	0.00	0.01
	(-0.35)	(-0.51)	(0.89)	(1.00)	(0.05)	(0.31)	(0.06)	(0.33)	(-1.48)	(-1.45)	(0.31)	(0.94)
11	0.00	0.00	0.00	-0.02	0.00	0.00	0.00	-0.01	0.00	-0.01	0.00	0.01
	(0.00)	(0.00)	(0.00)	(-1.13)	(0.10)	(-0.26)	(-0.20)	(-0.34)	(-1.29)	(-1.28)	(0.18)	(1.01)
12	0.00	0.00	0.00	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	(-0.08)	(-0.36)	(1.00)	(-1.05)	(0.37)	(0.11)	(0.17)	(0.11)	(-1.14)	(-1.13)	(0.19)	(0.97)