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Market Perceptions of US and European Policy Actions Around the Subprime Crisis

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Abstract

This paper explores the impacts of key policy actions by US and European authorities on stock returns of systemically important banks in Europe and US around the subprime crisis. We find that the US policy announcements had a stronger impact on the European and US banking industry than the European policy announcements. In particular, the announcements of monetary policies by the US authorities were accompanied by higher abnormal returns compared to related announcements of European authorities. We also find that the policy announcements, regardless of which side of the Atlantic the news arrived from, has increased the return volatility during the crisis. We further analyze the reactions of implied volatility. The findings suggest that the currency swaps had a non-negligible effect in reducing future uncertainty.

Keywords: Event study; Policy announcement; Subprime crisis
JEL classification: G01, G14, G18, G21, G28

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1 Introduction

Since the onset of the subprime mortgage crisis in 2007 governments and central banks in the US and Europe have taken a number of actions to remedy the situation. Their policy actions include monetary policies (e.g. Fed funds interest rate cut to near zero on 12.16.2008), liquidity supports (e.g. U.S. Term Auction Facility on 12.12.2007 and 12.21.2007; ECB liquidity injection on 08.09.2007) and financial sector policies (e.g. U.S. Troubled Assets Relief Program on 10.03.2008)

In this paper we analyze how the respective stock markets, banking stocks in particular, perceived those policy actions from the two sides of the Atlantic. To that end we use the policy news database constructed by Aït-Sahalia, Andritzky, Jobst, Nowak and Tamirisa (2012) to investigate the immediate reactions of systemically important banking stocks across Europe and US. In particular we analyze the abnormal returns and the induced volatilities corresponding to the several types of key policy announcements by US and European authorities during the crisis. The financial crisis has impaired the whole stock market but has especially destabilized the banking sector. The market reactions to the various policy announcements are of great interest to the scholars and the policy makers seeking the best ways to reverse the negative market sentiment and to halt the economic contagion.

The dynamics of the stock prices during the crisis period indicate strong heteroskedastic volatility and cross-sectionally diverged volatility which would impair the power of the traditional tests of significance of the abnormal returns. Our empirical strategy is based on the exponential general autoregressive conditional heteroskedastic (EGARCH) model with announcement dummies which is a variant of the approach suggested by Savickas (2003). This approach is a natural one given our focus on how policy announcements affect stock returns and volatility under serially heteroskedastic volatility.

Furthermore, the crisis period is dotted with a large number of potentially important announcements from the US and European authorities which refer to different policy types or policy mixes. The announcements exhibit a large degree of clustering overtime which implies that using event windows of a few days around each announcement, as is typically done in event studies, would result in overlapping events rendering the interpretation of the results quite difficult. To reduce the number of overlapping events we thus focus on the immediate stock response on the announcement

day. Hence this study is an investigation of immediate market responses to policy announcements and does not aim to provide an analysis on the long-term effectiveness of policies.

Several studies examine the role of policy actions during the recent subprime mortgage crisis. See for example McAndrews, Sarkar and Wang (2008), Baba and Packer (2009), Panetta, Faeh, Grande, Ho, King, Levy, Signoretti, Taboga and Zaghini (2009) and Taylor and Williams (2009). The paper most closely related to our own is King (2009). King (2009) studies the market reaction around the subprime crisis particularly to bank rescue packages announced in six countries and shows that bank stock prices continued to underperform in all countries except the US. The traditional event study methodology with 100 day event windows used by the author does not consider serial heteroskedasticity, event induced volatility and overlapping events.

Our findings suggest that overall US policy announcements had a stronger impact on the banking industry than European policy announcements. In particular, the announcements of monetary policies and financial sector policies by the US authorities were accompanied by higher abnormal returns compared to related announcements of the European authorities. The findings are in line with the literature documenting that the US news affect the behavior of asset prices around the world but that the opposite is not true (Andersen et al. 2003, Becker et al. 1995, Ehrmann and Fratzscher 2003, Wongswan, 2006). We also find that the policy announcements, regardless of which side of the Atlantic the news arrived from, have increased the return volatility during the crisis. Our results lend additional support to the literature documenting event-induced volatility increases (Savickas 2003, Harrington and Shrider 2007). The robust finding that the policy announcements induce greater volatility motivate us to further analyze the reactions of forward looking implied volatility. The findings suggest that the currency swaps had a non-negligible effect in reducing future uncertainty.

The paper is organized as follows. Section 2 describes the policy announcements and data. Section 3 explains our econometric approach for estimating the impact of policy actions. Section 4 reports our empirical results while Section 5 examines the reactions of implied volatility. Section 6 concludes with a summary of our findings.

2 Policy Announcements and Stock Data

2.1 Policy Announcements

The policy event database we apply is constructed by Aït-Sahalia et al. (2012) and covers major policy announcements from 06.01.2007 to 03.31.2009 by the authorities in the United States, the United Kingdom, and the euro area during the subprime financial crisis.[1] The events sample is subdivided into a Pre-Lehman period (06.01.2007 to 09.12.2008) and a Post-Lehman period (09.15.2008 to 03.31.2009). Policy announcements in the euro area contain those by the European Central Bank (ECB) and country authorities from Austria, Belgium, France, Germany, Ireland, Italy, the Netherlands, and Spain. The policy announcements included are those which are considered as watershed policy events. To identify major policy events the authors search front-page articles where the policy announcement is the main subject. Announcements appearing as front-page news one day before and up to three days after the date of the official announcement are qualified as watershed events.

The policy announcements we employ are classified in three groups: monetary policies; liquidity supports; and financial sector policies.[2] Each group is further subdivided so that the policies are ultimately divided into seven categories. The number of policy event days for each category is reported in Table 1.

[Insert Table 1]

Monetary policies are categorized in two groups, *interest rate cuts* and *quantitative and credit easing*. The latter group includes central bank's purchase of longer-term government bonds (quantitative easing) or private assets such as commercial papers and mortgage backed securities (credit easing).

Two types of liquidity support policies are included, *domestic currency liquidity support* and *foreign currency swaps*. The former group consists of central bank's actions providing liquidity of domestic currency through measures such as discount rate cuts, extending maturity, creating auction facilities and expansion of the auctions, for instance. The latter group mostly consists of

[1] We thank Natalia Tamirisa for graciously sharing the data.

[2] The announcement database has two more policy groups: fiscal policy; ad hoc bailouts and failures. We did not involve these group as fiscal policy would not directly affect the banking industry and ad hoc bailouts and failures are not comprehensive, system-wide measures.

the US dollar liquidity-providing operations which are coordinated actions by the ECB and the FED.

Financial sector policies are classified into three types, *asset purchases*, *liability guarantees* and *recapitalizations*. The first group includes programs purchasing bad loans and risky assets such as mortgage backed securities from troubled financial institutions. The second group consists of policies such as establishing schemes which protect consumer deposits and guarantee debt obligations of financial institutions. The last group includes capital injections to the banks directly or indirectly through recapitalization programs.

Aït-Sahalia et al. (2012) cautions about the overlapping events in the data base which would cause an identification problem contaminating the analysis. In order to reduce the number of overlapping announcements several efforts were undertaken by them.[3] In this paper we employ the main event class of policy announcements (announcements featured as a main event on the frontpage) in the database. Moreover, our main analyses use an one-day event window to further reduce the number of overlapping events.[4]

2.2 Data

The European and US banks included in our study are listed in Annex 1 and 2 respectively.[5] Our criteria for the selection are as follows. First, we rank the European and US banks according to their total assets at the end of 2006.[6] Then we extract the top one hundred banks and we keep those which are publicly traded. We repeat the same selection with end of 2010 data and hold banks which appear in both lists. After this filtering, twenty nine European banks and seventeen American banks remain in the final samples.[7] Daily returns of Euro Stoxx 50 and S&P 500 are used as proxies of the market return for the European and US markets respectively.

The overall test period extends from 01.03.2005 to 10.14.2011. We further define the crisis

[3] For instance they have employed five-day, three-day and one-day event windows showing their results are robust to the potential overlapping events problem.

[4] We have considered to use wider event windows to capture the anticipation and possible lagged effects. However, the number of overlapping announcements triples from 41 to 138 if we extend to a three-day event window (1 day before and 1 day after the announcement) .

[5] Our sample covers all the globally systemically important financial institutions defined by the Basel committee on banking supervision in November 2011 except for Banque Populaire (a French institution not publicly traded) and Bank of New York Mellon.

[6] Bankscope data are used to create the ranking.

[7] Although they survived the selection criteria we also eliminate from the US sample the government-sponsored enterprises such as Fannie Mae, Freddie Mac and Sallie Mae due to their particular quasi-public nature.

period as the period covering the announcement data. We follow Nowak et al. (2011) for the onset of the crisis. Nowak et al. (2011) find a structural break in the bond market data in June 2007. The end of the crisis is identified by the G20 Leaders' Summit held in London on 04.02.2009. Lehman's bankruptcy is widely accepted as perhaps the most dramatic crisis event that changed drastically market expectations. Hence, we use this event to subdivide our data. To summarize, our test period covers the following distinct four subperiods:

- tranquil period (01.03.2005 - 05.31.2007);
- pre-Lehman period (06.01.2007 - 09.12.2008);
- post-Lehman period (09.15.2008 - 03.31.2009);
- recovering period (04.01.2009 - 10.14.2011).

Table 2 presents summary statistics for the log daily returns of three equally weighted portfolios −All banks, European banks only, and US banks only.

[Insert Table 2]

The negative sign and the size of the mean returns (minus16 bps in the pre- and minus 67 bps in the post-Lehman periods) indicate the extent of the loss during the *crisis* period (06.01.2007 - 03.31.2009), while the widened range (1173 bps in the pre- and 3013 bps in the post-Lehman periods) and the enlarged standard deviation of returns (188 bps in the pre- and 544 bps in the post-Lehman periods) demonstrates the volatile state of the financial markets. The standard deviation has surged more than ten-fold for the US banks from the tranquil to the post-Lehman period. Such strongly time-varying volatility would impair the results from a traditional event study approach. In order to overcome this problem we apply a GARCH-based approach suggested in the literature (Corhay and Tourani-Rad 1996, Brockett et al 1999, Savickas 2003, Balaban and Constantinou 2006).

The table also reports the return correlation between the European portfolio and the US portfolio. As it has been observed in preceding crashes the correlation has increased during the crisis period (King and Wadhwani 1990, Lee and Kim 1993, Calvo and Reinhart 1996, Baig and Goldfajn 1999, Forbes and Rigobon 2002).

The data also show a sharp increase in cross-sectional variation of individual stock return volatility during the crisis period consistent with Beltratti and Stulz (2012). The cross-sectional standard deviation of the mean returns has increased from 4 bps in the tranquil period to 10

bps in the pre-Lehman and then to 33 bps in the post-Lehman periods. In order to highlight this variation we compute the 100 days rolling window volatility of daily returns for each stock. Then for each sub-sample, European banks and US banks, and for each day, the cross-sectional standard deviations of the rolling window volatility are computed. Figure 1 plots the time series of the cross-sectional standard deviations of the rolling window volatility.

[Insert Figure 1]

The figure clearly demonstrates the strong surge of the cross-sectional variation of return volatility during the pre-Lehman period which reached a peak during the post-Lehman period. Given the strong cross-sectional variation in return volatility during the crisis period the volatility effect of policy announcement is likely not to be the same across stocks, which could produce event-induced variance increases (Harrington and Shrider 2007). The approach we employ to overcome this problem is outlined in the next section.

3 Methodology

The event study method has been commonly used to analyze market responses to the policy announcements in crisis periods (see for example, Aït-Sahalia et al., 2011, Kho et al.,2000, Miyajima and Yafeh, 2007 and Ongena et al., 2003 for example). However, the presence of heteroskedastic volatility of stock returns observed in the previous section would impair the power of the traditional tests. In order to tackle this problem we implement a variation of the generalized autoregressive conditional heteroskedasticity, GARCH (Bollerslev, 1986) -based approach suggested by Savickas (2003). More specifically, we employ the exponential generalized autoregressive conditional heteroskedasticity (EGARCH) model to allow for asymmetric effects between positive and negative returns (Nelson, 1991).

As in the traditional event study methodology we relate the daily log return of stock i, r_{it}, to the daily log return of the market portfolio, r_{mt}, via the market model. Then our EGARCH-based

approach estimates the following model:

$$\begin{aligned} r_{it} &= \phi_{0,i} + \phi_{1,i} r_{mt} + \phi_{2,i} r_{mt} D_t^* + \lambda_{r,i,j}^k D_{j,t}^k + \varepsilon_{i,t},\ \varepsilon_{it} = \sigma_{i,t} e_{it}, \\ \ln\left(\sigma_{i,t}^2\right) &= \alpha_{0,i} + \alpha_{1,i}\left[\frac{|\varepsilon_{i,t-1}| + \gamma_i \varepsilon_{i,t-1}}{\sigma_{i,t-1}}\right] + \beta_i \ln\left(\sigma_{i,t-1}^2\right) + \lambda_{v,i,j}^k D_{j,t}^k \end{aligned} \tag{1}$$

for $k = E, US$ where policies announced by European (US) authorities are labeled as E (US). $\{e_{it}\}$ is a sequence of independent and identically distributed random variables following the standard normal distribution. $\alpha_{1,i}$ and β_i are the ARCH and GARCH parameters respectively. γ_i captures the asymmetric effects between positive and negative returns. Its sign is expected to be negative so that the positive (negative) shock ε_{it-1} reduces (increases) the log volatility $\ln\left(\sigma_{i,t}^2\right)$.

D_t^* is a dummy variable taking the value of 1 for the crisis period and 0 for the tranquil period. This allows the "market beta" to be dependent on the state of the economy and financial markets (McQueen and Roley 1993, Pettengill, Sundaram and Mathur 1995). In this study the crisis period is defined as 2007.06.01 to 2009.03.31 which contains the above mentioned pre- and post-Lehman periods.[8] Hence, $\phi_{1,i}$ is the market beta during the tranquil period and $\phi_{1,i} + \phi_{2,i}$ is the market beta during the crisis period.

$D_{j,t}^k$ is a dummy variable taking the value of 1 for the type j policy announcement days or 0 otherwise. We use a one day event window [0], i.e., announcement day 0, to minimize the number of overlapping events.[9] The groupings of the policy actions are as specified in the previous section.

Consequently, $\lambda_{r,i,j}^k$ represent the type j policy announcements' average effect on bank i's stock return −the abnormal return− while $\lambda_{v,i,j}^k$ represents the average effect on the volatility −the event induced volatility. Unlike $\lambda_{v,i,j}^k$ which represents the total effect of policy announcements on volatility, since the market return is included in the equation, $\lambda_{r,i,j}^k$ does not represent the total effect on single stock returns. Rather, the parameters capture the part of the effect not absorbed by the market which is specific to each bank.

[8] Table 2 shows that the average return of sample stocks was negative during the pre- and post-Lehman periods while it was positive during the tranquil and recovery periods.

[9] To examine the reactions of European banking stocks to policy actions taken by the US authorities and considering the time difference between the two sides of the Atlantic the one day event window is set to [+1] (i.e., announcement day +1) . Furthermore, when the news is announced in the weekend the event day is postponed to the following Monday for our estimation.

With each daily return series of banking stocks i, model (1) is estimated for each policy type j for $k = E, US$. Then we cross-sectionally test whether the banking industry specific reaction to the type j policies is statistically different from zero. Hence the null hypothesis to be tested is $\lambda^k_{r,i,j} = 0$ for the abnormal return, and $\lambda^k_{v,i,j} = 0$ for the event induced volatility.[10] Having included $D^k_{j,t}$ into the volatility equation in model (1) we are taking account of the event induced volatility (Savickas 2003, Harrington and Shrider 2007).

4 Empirical Results

We first use the overall crisis period (06.01.2007 - 03.31.2009), and then the post-Lehman subperiod (09.15.2008 - 03.31.2009) to examine how the European and the US policy announcements impact stock returns and volatility. A comparison of the impact of policy announcements on the European banks and the US banks follows. Robustness checks are provided at the end of the section.

Table 3 reports the cross-sectional average of the estimated parameters of the model (1), except the abnormal returns $\lambda^k_{r,i,j}$ and induced volatility, $\lambda^k_{v,i,j}$ which will be discussed later.

[Insert Table 3]

ϕ_2 is significantly positive for 36 banks out of 46. In case of European banks, it is 21 out of 29 and for US it is 15 out of 17. The positive and significant ϕ_2 confirms that the banking stock returns were more volatile during the crisis period. European and US banks respectively have been 18.63% and 26.07% more volatile during the crisis period than during the tranquil times.

The significance of ARCH coefficient α_1 and GARCH coefficient β confirms the importance of taking into account both effects in modeling the returns. The coefficient γ are negative significant for 32 out of 46 banks implying the common asymmetric effects of the positive (negative) returns reducing (increasing) the volatility has been present during the sample period.

4.1 European policy vs US policy: Overall crisis period

We start our analysis with the policy announcements during the crisis period (06.01.2007 - 03.31.2009) for all banks. In Table 4, we report the cross-sectional average of the estimated abnormal returns,

[10] The approach implemented for the test is discribed in the appendix.

$\lambda^k_{r,i,j}$, and that of induced volatility, $\lambda^k_{v,i,j}$, from the maximum likelihood estimation of equation (1) for each policy group.

[Insert Table 4]

The numbers reported in Table 4 are the cross sectional means of the policy effect estimates.

4.1.1 Return Effects

In the first and the second column we calculate the average of the estimated abnormal returns observed on the European and the US policy announcement days, respectively.

Overall it appears that US policy announcements had a stronger impact on the banking industry than European policy announcements. US policy announcements were significantly stronger than European ones for four policy types compared to only one policy type. In particular, the announcements of monetary policies and financial sector policies by the US authorities were accompanied by higher abnormal returns. The exceptional case is the announcements by the European authorities concerning asset purchases which outperformed that of the US authorities by 1.76% on average. It seems that the announcements of the US liability guarantees had the most favorable impact on the banking stock returns during the crisis. Turning our attention now to the standalone reactions to the individual policy types the following observations can be made.

Monetary Policy Reductions of the target for the US federal funds rate are accompanied by significant abnormal returns. They exceed 20 basis points on the day of the announcement (the following day for the European banks). On the other hand, the announcements of a decrease in the refinancing rate by the European Central Bank (ECB) or/and a reduction of the official bank rate by the Bank of England (BoE) were not associated with a significant abnormal return. The interest rate cut decisions by the Federal Reserve Board (FRB) had a considerably larger impact on banking stock prices than similar decisions by the European central banks. This difference could be partially attributed to how drastically the central banks reduced the target rate. On one hand, the Federal Open Market Committee has maintained the so-called zero interest rate since December 16th 2008. On the other hand, ECB (BoE) maintained it to 2.5% (2.0%) on December 4th 2008 and since then gradually decreased it toward 1.5% (1.0%).

The quantitative and credit easing policy announcements by the FRB had a weakly significant impact of 38 basis points. The largely negative 5.83% average abnormal return on days which European authorities announced their quantitative and credit easing policies needs a careful interpretation since the effect of the policy announcement was probably distorted by other confounding announcements.[11]

Liquidity Support Neither the domestic channel nor the foreign currency swaps channel are accompanied by significant abnormal returns. Although not statistically significant such policies announced by the US authority had a more favorable impact than the European authorities on average.

Financial Sector Policies The reported significant average abnormal return of -1.32% on the announcement days of US asset purchase programs could be due to the political disagreement and/or uncertainty of how the bill would be implemented and/or a discouraging monthly jobs report released on the same date. The asset purchase programs announced by the European authorities were accompanied by positive abnormal returns on average. The news on European asset purchase programs were absorbed by the market more favorably.

Conversely, the impact of liability guarantee by the US government was significantly larger than the respective impact of European policies. While the European policies were not effective enough to surmount negative news the US policy announcements were accompanied by a 73 basis points abnormal return on average which was the largest favorable effect among all twelve policy classes.

The average abnormal return following the US announcements of recapitalization was positive and larger than the reaction following the European announcements. Such announcements by European authorities were associated with an 80 basis points negative abnormal return, which could be due to the disturbing news on the huge loss faced by RBS.

[11] There are only two policy announcements recorded as quantitative and credit easing in the database. On one of the announcement days,"RBS said it expects to report a 2008 loss of GBP 22 billion to GBP 28 billion (*Wall Street Journal*, 20 January 2009)" and hence the entire banking industry was largely shocked. It seems that the news of setting up an asset purchase programme by the BoE was not strong enough to overcome the discouraging news from RBS.

4.1.2 Volatility Effects

In the third and forth column of Table 4 we report the cross-sectional average of the event induced volatility estimates for the European and the US policy announcements from the maximum likelihood estimation of model (1). The results show that all types of policy announcements −regardless of which side of the Atlantic the news arrived from− increased return volatility. Our results lend additional support to the literature documenting event-induced volatility increases (Savickas 2003, Harrington and Shrider 2007). The clear cut result suggests that it was extremely difficult for policy makers to provide stability in the market during the crisis period.

4.2 European policy vs US policy: Post-Lehman period

Consistent with Aït-Sahalia et al. (2012), we expect market response to policy announcements to depend on the stage of the crisis. Thus we next focus on the impact of policy announcements during the post-Lehman period (09.15.2008 - 03.31.2009). We report the results in Table 5.

[Insert Table 5]

On the whole, the US policy announcements seem to have more positive effects than the European policies which confirms the results presented above.

Turning our attention now to the standalone reactions to the individual policy types, all US policy announcements on monetary policies, liquidity supports, and financial sector policies −except asset purchases− are associated with positive abnormal returns on average. Among them, four cases show a larger reaction −e.g. 126 basis points increase of liability guarantee case− compared to our previous estimation results which may imply that the impact of such policy announcements by the US authorities had strengthened after the bankruptcy of Lehman Brothers.[12] In contrast, we do not find any statistically significantly positive abnormal returns accompanied by such policy announcements by the European authorities; four of them were negative on average (three of them are highly significant at the 1% level). This may imply that the announced contents of the European policies could not positively surprise the market enough and thereby its favorable impact did not exceed the discouraging outlook for the banking industry.

[12] Note that there is no sample policy announcements for three categories −*quantitative and credit easing*, *asset purchases*, and *recapitalization*− during the pre-Lehman period. Hence the estimation results for those three policy types reported in Table 4 are the same as in Table 3.

Although there is one case the average induced volatility shows negative sign (US interest rate cuts), all of the statistically significant ones are positive.

4.3 European banks vs US banks

We next explore the possibly different reactions of the European banking stocks and the US banking stocks to the same type of policy announcements during the post-Lehman period. For each subsample we test the statistical significance of the abnormal returns with the same approach applied in the previous section.

[Insert Table 6]

Table 6 reports the cross-sectional average of the abnormal returns of European banks and those for the US banks separately. For three cases the US policy announcements were perceived more favorably by the European markets and US markets compared to the European policy announcements. On the other hand, there is only one case where the European policy announcements were perceived more favorably by European markets. The results suggest that the US announcements impact the behavior of stock prices of both sides of the Atlantic but not vice versa. The findings are in line with the literature documenting that the US news affect the behavior of asset prices around the world but that the opposite is not true (Andersen et al. 2003, Becker et al. 1995, Ehrmann and Fratzscher 2003, Wongswan, 2006).

Finally we examine the differential reactions of European and US banking stocks to the same policy announcements.

[Insert Table 7]

The differences in reactions are reported in Table 7. The first column in the table subtracts the third column from the first column in the Table 6. It represents the difference in the abnormal returns between European and US banks $\left(\Delta_r^B\right)$ following the European policy announcements. The second column repeats the same for the US policy announcements.[13] We do not find any

[13] Δ_r^B with a positive sign in the first column indicates that the European policy announcements had a stronger effect on the European stock returns; a negative sign indicates the opposite, their impact was stronger on the US stock returns. On the other hand, Δ_r^B with a positive sign in the second column indicates that the US policy announcements had a stronger effect on the European stock returns; a negatives sign indicates the opposite.

significantly negative difference, Δ_r^B, for the European policies even at the 10% level; five cases exhibit a positive sign (two of them are statistically significant at the 5% level). On the other hand, we find a significantly positive difference, Δ_r^B, for the US policies at the 1% level; three cases exhibit a positive sign while four cases exhibit a negative sign (one is significant at the 10% level). Overall, the results imply that the US policy announcements might have stronger effect on either market on average, while the European policy announcements tend to have stronger effects only on the European stock returns which is consistent with the findings in the previous section.

4.4 Robustness checks

In order to check the robustness of our results, we consider a wider event window. We investigate the event window of [-1, +1] and [-2, 0]. Table 8 reports the estimation results with the event window of [-1,+1] and [-2,0], respectively.

[Insert Table 8]

The estimation results suggest that our findings are not sensitive to these alterations.[14]

5 Implied Volatility

The robust finding that the policy announcements induce greater volatility motivate us to further analyze the reactions of implied volatility, which measures the future volatility of stock returns. As such, in contrast to the induced volatility measured in the previous section, the reaction of implied volatility would provide us an insight of how the market perceived the policy announcements in terms of uncertainty.

In order for the analysis, we estimate the following equation:

$$\begin{aligned} \Delta IV_{it} &= \xi_{0,i} + \xi_{1,i}\Delta IV_{mt} + \xi_{2,i}\Delta IV_{mt}D_t^* + Policy + u_{i,t} \qquad (2) \\ Policy &= \sum\nolimits_{k=E,US} \sum\nolimits_j \lambda_{IV,i,j}^k D_{j,t}^k, \end{aligned}$$

[14] For sake of brevity we do not report the results for induced volatility. The results are not sensitve on event window size.

where ΔIV_{it} is the daily log change in put option implied volatility of stock i and ΔIV_{mt} is the daily log change in put option implied volatility of the market index.

We collect the implied volatility data from Thomson Reuters Datastream. The implied volatility series are calculated with the at-the-money American type put option from the nearest expiry month. Due to the data availability the sample is restricted to 19 European banks and 17 US banks. The data restriction also requires us to focus on the post-Lehman period, i.e. 09.15.2008 - 10.14.2011.

Table 9 reports the estimation results of equation (2).

[Insert Table 9]

The results suggest that the announcements do not have banking sector wide significant effect on future uncertainty. However when we explore the effect on individual implied volatility, we find that the foreign currency swaps could significantly lower the future uncertainty for 14 banks out of 36.

5.1 Robustness checks

We further tested the robustness of our finding. We first consider different lag structures (one lag and five lags) of ΔIV_{it} process.

[Insert Table 10]

Panels A and B of Table 10 shows that the findings are robust to the model specifications. Especially the effects of currency swaps are not sensitive to the lag structure.

We also consider longer event window of [-1, +1] and [-2, 0]. Our general finding that none of the policy announcements do not have sector wide significant effect on future uncertainty is robust.

6 Conclusion

The main goal of this paper is to study how the stock markets, banking stocks in particular, perceived the policy actions from the two sides of the Atlantic around the subprime crisis. To that end we use the policy news database constructed by Aït-Sahalia et al. (2012) to investigate the

abnormal returns and the induced volatilities corresponding to key policy announcements by US and European authorities. The sample banks consist of systemically important institutions across Europe and US. The dynamics of the sample stock prices during the crisis period indicate strong heteroskedastic volatility and cross-sectionally diverged volatility, which would impair the power of the traditional event study to test the existence of abnormal returns. We use an EGARCH-model with event induced volatility which allows the test statistic to be correctly adjusted for these problems.

Our estimation results suggest that overall US policy announcements had a stronger impact on the European and US banking industry than European policy announcements. In particular, the announcements of monetary policies and financial sector policies by the US authorities were accompanied by higher abnormal returns compared to related announcements of European authorities while the announcements of the US liability guarantees had the most favorable impact on the banking stock returns during the crisis. The lead role of US policies compared to European policies was strengthened after the collapse of Lehman brothers. Finally, we also find that the policy announcements, regardless of which side of the Atlantic the news arrived from, has increased the return volatility during the crisis. Our findings lend additional support to the literature documenting event-induced volatility increases. The robust finding that the policy announcements induce greater volatility motivate us to further analyze the reactions of forward looking implied volatility. The estimation results suggest that the currency swaps had a non-negligible effect in reducing future uncertainty.

Our findings imply that during the post-Lehman period, when the crisis has been at global phase, currency swaps and US interest rate cuts were welcomed by the market. The policy actions have been followed by a positive significant abnormal returns and do not significantly increase the return volatility. In addition, the currency swaps mitigate future uncertainty to some extent. The present study lends some evidence that the international policy coordination played a no small role during the financial crisis.

Appendix

Similar to the method used by Savickas (2003) the test statistic we implement for the abnormal return is:

$$test_{r,j}^{k} = \frac{\overline{S}_{r,j}^{k}}{se\left(S_{r,i,j}^{k}\right)}, \tag{A.1}$$

where

$$S_{r,i,j}^{k} = \frac{1}{L}\sum_{l=1}^{L}\frac{\widehat{\lambda}_{r,i,j}^{k}}{\widehat{\sigma}_{i,j,l}},\ \overline{S}_{r,j}^{k} = \frac{1}{N}\sum_{i=1}^{N}S_{r,j}^{k},\ \text{and}\ se\left(S_{r,i,j}^{k}\right) = \sqrt{\frac{1}{N\left(N-1\right)}\sum_{i=1}^{N}\left(S_{r,i,j}^{k}-\overline{S}_{r,j}^{k}\right)^{2}} \tag{A.2}$$

for $k = E, US$. L is the number of type j policy announcements, $\widehat{\lambda}_{r,i,j}^{k}$ is the estimate of $\lambda_{r,i,j}^{k}$, and $\widehat{\sigma}_{i,l}$ is the estimated conditional standard deviation of abnormal return on event day l. Similarly, the statistical significance of event induced volatility is tested with a variant of the test statistic introduced by Balaban and Constantinou (2006):

$$test_{v,j}^{k} = \frac{\overline{S}_{v,j}^{k}}{se\left(S_{r,i,j}^{k}\right)}, \tag{A.3}$$

where

$$S_{v,i,j}^{k} = \frac{\widehat{\lambda}_{v,i,j}^{k}}{\widehat{h}_{i,j}},\ \overline{S}_{v,j}^{k} = \frac{1}{N}\sum_{i=1}^{N}S_{v,i,j}^{k},\ \text{and}\ se\left(S_{r,i,j}^{k}\right) = \sqrt{\frac{1}{N\left(N-1\right)}\sum_{i=1}^{N}\left(S_{v,i}^{k}-\overline{S}_{v,j}^{k}\right)^{2}} \tag{A.4}$$

for $k = E, US$. $\widehat{h}_{i}$ is the standard deviation of the estimated conditional standard deviation series for bank i. The test statistics are Student-t distributed with $N-1$ degrees of freedom.

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Annex 1
List of Banks and their Total Assets: Europe

Bank Name	Country code	Total Assets (mil $) 2006	Total Assets (mil $) 2010
BNP Paribas	FR	1,896,935	2,669,907
Deutsche Bank AG	DE	2,070,022	2,546,272
HSBC Holdings Plc	GB	1,860,758	2,454,689
Barclays Plc	GB	1,956,710	2,331,943
Royal Bank of Scotland Group Plc	GB	1,710,636	2,275,479
Crédit Agricole S.A.	FR	1,660,125	2,129,248
ING Groep NV	NL	1,615,049	1,666,368
Banco Santander SA	ES	1,098,212	1,626,805
Lloyds Banking Group Plc	GB	674,489	1,552,245
Société Générale	FR	1,260,162	1,512,656
UBS AG	CH	1,922,775	1,401,923
UniCredit SpA	IT	1,084,267	1,241,966
Credit Suisse Group AG	CH	1,029,219	1,098,345
Commerzbank AG	DE	801,184	1,007,882
Intesa Sanpaolo	IT	759,626	880,221
Nordea Bank AB (publ)	SE	456,855	776,108
Dexia	BE	746,402	757,262
Banco Bilbao Vizcaya Argentaria SA	ES	542,495	738,560
Natixis	FR	604,021	611,984
Danske Bank A/S	DK	483,866	572,548
Standard Chartered Plc	GB	266,047	516,542
KBC Groep NV/ KBC Groupe SA	BE	428,553	428,679
Banca Monte dei Paschi di Siena SpA	IT	208,818	326,402
Skandinaviska Enskilda Banken AB	SE	281,808	324,876
Crédit Industriel et Commercial	FR	282,251	323,405
Svenska Handelsbanken	SE	260,767	320,958
DnB ASA	NO	210,901	316,183
Deutsche Postbank AG	DE	243,497	286,857
Erste Group Bank AG	AT	239,304	275,171

The table reports total assets of the 29 banks at the end of years 2006 and 2010 (in US dollars). Data is collected from Bankscope. The country codes are as follows. AT: Austria; BE: Belgium; CH: Switzerland; DE: Germany; DK: Denmark; ES: Spain; FR: France; GB: United Kingdom; IT: Italy; NL: Netherlands; NO: Norway; SE: Sweden.

Annex 2
List of Banks and their Total Assets: United States

Bank Name	Total Assets (mil $) 2006	Total Assets (mil $) 2010
Bank of America Corporation	1,459,737	2,264,909
JP Morgan Chase & Co.	1,351,520	2,117,605
Citigroup Inc	1,884,318	1,913,902
Wells Fargo & Company	481,996	1,258,128
Goldman Sachs Group, Inc	838,201	911,332
Morgan Stanley	1,120,645	807,698
Prudential Financial Inc	454,266	539,854
US Bancorp	219,232	307,786
PNC Financial Services Group Inc	101,820	264,284
Capital One Financial Corporation	149,739	197,503
SunTrust Banks, Inc.	182,162	172,874
State Street Corporation	107,353	160,505
BB&T Corporation	121,351	157,081
American Express Company	127,853	147,042
Regions Financial Corporation	143,369	132,351
Fifth Third Bancorp	100,669	111,007
KeyCorp	92,337	91,843

The table reports total assets of the 17 banks at the end of years 2006 and 2010 (in US dollars). Data is collected from Bankscope.

Table 1
Number of Policy Announcement Events

	Pre-Lehman		Post-Lehman		Total	
	European Policy	US Policy	European Policy	US Policy	European Policy	US Policy
Monetary Policy						
Interest rate cuts	2	7	7	5	9	12
Quantitative and credit easing	0	0	2	5	2	5
Liquidity Support						
Domestic currency liquidity support	9	10	2	6	11	16
Foreign currency swaps	3		1		4	
Financial Sector Policies						
Asset Purchases	0	0	5	6	5	6
Liability Guarantees	4	1	15	7	19	8
Recapitalizations	0	0	15	15	15	15

The events sample is subdivided into a Pre-Lehman period (06.01.2007 to 09.12.2008) and a Post-Lehman period (09.15.2008 to 03.31.2009).

Table 2
Summary Statistics of Daily Portfolio Returns

	Tranquil	Pre-Lehman	Post-Lehman	Recovery
All Banks				
Mean	0.0006	-0.0016	-0.0067	0.0003
Std.dev.	0.0067	0.0188	0.0544	0.0205
Min.	-0.0322	-0.0456	-0.1599	-0.1065
Max.	0.0283	0.0717	0.1414	0.1084
European Banks				
Mean	0.0007	-0.0017	-0.0064	0.0001
Std.dev.	0.0081	0.0193	0.0506	0.0214
Min.	-0.0384	-0.0723	-0.1189	-0.0772
Max.	0.0305	0.0620	0.1573	0.1340
US Banks				
Mean	0.0003	-0.0014	-0.0072	0.0006
Std.dev.	0.0075	0.0268	0.0797	0.0265
Min.	-0.0360	-0.0735	-0.2586	-0.1729
Max.	0.0246	0.1448	0.1930	0.1931
Correlation	0.3758	0.4413	0.5740	0.5438

The mean, standard deviation, minimum and maximum of the log daily returns of each portfolio during each sub-period are reported. The three equally weighted portfolios consist of: All banks; European banks; US banks, respectively. The observation period is divided into: Tranquil period (01.03.2005 to 05.31.2007); Pre-Lehman period (06.01.2007 to 09.12.2008); Post-Lehman period (09.15.2008 to 03.31.2009); Recovery period (04.01.2009 to 10.14.2011). The correlation is calculated between the European and the US portfolio returns.

Table 3
EGARCH(1,1) Model Estimation Results

	ϕ_0	ϕ_1	ϕ_2	α_0	α_1	β	γ
All Banks							
Mean	0.0001	1.0398***	0.2138	-0.1377	0.2240**	0.9379***	-0.0178
Std.dev	0.0003	0.2217	0.2007	0.2476	0.0900	0.0301	0.0214
European Banks							
Mean	0.0001	0.9704***	0.1863	-0.1709	0.2214**	0.9342***	-0.0169
Std.dev	0.0003	0.2342	0.2110	0.3007	0.1021	0.0365	0.0249
US banks							
Mean	0.0000	1.1580***	0.2607	-0.0811	0.2283***	0.9443***	-0.0193
Std.dev	0.0003	0.1369	0.1779	0.0936	0.0670	0.0126	0.0140
Count of significant parameters							
All Banks							
+	7	46	36	0	46	46	4
−	4	0	2	46	0	0	32
European Banks							
+	4	29	21	0	29	29	3
−	2	0	2	29	0	0	17
US banks							
+	3	17	15	0	17	17	1
−	2	0	0	17	0	0	15

The table reports the cross-sectional average of estimated parameter of the maximum likelihood estimation of equation (1) using the policy announcements during the overall crisis period (06.01.2007 - 03.31.2009).

Table 4
Reactions of Banking Stocks to Policy Announcements: Overall Crisis Period

	Return		Volatility	
	European Policy	US Policy	European Policy	US Policy
Monetary Policy				
Interest rate cuts	-0.0023	0.0022***	0.0265**	0.0247***
Quantitative and credit easing	-0.0583***	0.0038*	0.0067**	0.0090***
Liquidity Support				
Domestic currency liquidity support	-0.0011*	-0.0005	0.0060	0.0190
Foreign currency swaps	0.0006		0.0313	
Financial Sector Policies				
Asset Purchases	0.0044	-0.0132***	0.1147*	0.0100**
Liability Guarantees	-0.0013*	0.0073***	0.0222**	0.0465**
Recapitalization	-0.0080***	0.0017	0.0161**	0.0253***

The table reports the cross-sectional average of estimated abnormal returns, $\widehat{\lambda}^{E}_{r,i,j}$ and $\widehat{\lambda}^{US}_{r,i,j}$, and that of induced volatility, $\widehat{\lambda}^{E}_{v,i,j}$ and $\widehat{\lambda}^{US}_{v,i,j}$, from the maximum likelihood estimation of equation (1) using the policy announcements during the overall crisis period (06.01.2007 - 03.31.2009). For ease of interpretation, while we use $\overline{S}^{E}_{r,i,j}, \overline{S}^{US}_{r,i,j}, \overline{S}^{E}_{v,i,j}$, and $\overline{S}^{US}_{v,i,j}$ of equation (A.2) to construct the significant test the numbers reported in the table are based on the cross sectional mean of policy effect estimates. In the 1st and the 2nd column we calculate the average of the estimated abnormal returns observed on the European and US policy announcement days respectively. In the 3rd and 4th column of the table we report the cross-sectional average of the event induced volatility estimates. The estimates are statistically significant at *10%, **5%, and ***1%, respectively.

Table 5
Reactions of Banking Stocks to Policy Announcements: Post-Lehman Period

	Return		Volatility	
	European Policy	US Policy	European Policy	US Policy
Monetary Policy				
Interest rate cuts	-0.0051*	0.0048**	0.0129**	-0.0022
Quantitative and credit easing	-0.0583***	0.0038*	0.0067**	0.0090***
Liquidity Support				
Domestic currency liquidity support	-0.0021	0.0011	0.0126**	0.0385
Foreign currency swaps	0.0271***		0.0381	
Financial Sector Policies				
Asset Purchases	0.0044	-0.0132***	0.1147*	0.0100**
Liability Guarantees	0.0009	0.0126***	0.0279**	0.0263**
Recapitalization	-0.0080***	0.0017	0.0161**	0.0253***

The table reports the cross-sectional average of estimated abnormal returns, $\widehat{\lambda}^{E}_{r,i,j}$ and $\widehat{\lambda}^{US}_{r,i,j}$, and that of induced volatility, $\widehat{\lambda}^{E}_{v,i,j}$ and $\widehat{\lambda}^{US}_{v,i,j}$, from the maximum likelihood estimation of equation (1) using the policy announcements during the post-Lehman period (09.15.2008 - 03.31.2009). For ease of interpretation, while we use $\overline{S}^{E}_{r,i,j}, \overline{S}^{US}_{r,i,j}, \overline{S}^{E}_{v,i,j}$, and $\overline{S}^{US}_{v,i,j}$ of equation (A.2) to construct the significant test the numbers reported in the table are based on the cross sectional mean of policy effect estimates. In the 1st and the 2nd column we calculate the average of the estimated abnormal returns observed on the European and US policy announcement days respectively. In the 3rd and 4th column of the table we report the cross-sectional average of the event induced volatility estimates. The estimates are statistically significant at *10%, **5%, and ***1%, respectively.

Table 6
Reactions of European Banks and US Banks: Post-Lehman Period

	European Banks		US Banks	
	European Policy	US Policy	European Policy	US Policy
Monetary Policy				
Interest rate cuts	-0.0042*	0.0099***	-0.0065	-0.0038
Quantitative and credit easing	-0.0519***	0.0081***	-0.0692***	-0.0036
Liquidity Support				
Domestic currency liquidity support	0.0037	-0.0017	-0.0120**	0.0057**
Foreign currency swaps	0.0272***		0.0271	
Financial Sector Policies				
Asset Purchases	0.0021	-0.0139***	0.0082	-0.0121
Liability Guarantees	0.0047***	0.0071***	-0.0057	0.0220***
Recapitalization	-0.0070***	-0.0005	-0.0097*	0.0055

The table reports the cross-sectional average of estimated abnormal returns, $\widehat{\lambda}^{E}_{r,i,j}$ and $\widehat{\lambda}^{US}_{r,i,j}$, from the maximum likelihood estimation of equation (1) using the policy announcements during the post-Lehman period (09.15.2008 - 03.31.2009). For ease of interpretation, while we use $\overline{S}^{E}_{r,i,j}, \overline{S}^{US}_{r,i,j}, \overline{S}^{E}_{v,i,j}$, and $\overline{S}^{US}_{v,i,j}$ of equation (A.2) to construct the significant test the numbers reported in the table are based on the cross sectional mean of policy effect estimates. In the 1st and the 2nd column we calculate the average of the estimated abnormal returns of European banking stocks observed on the European and US policy announcement days respectively. The 3rd and 4th column repeats the same for the US banks. The estimates are statistically significant at *10%, **5%, and ***1%, respectively.

Table 7
Reactions of European Banks vs US Banks: Post-Lehman Period

	Δ_r^B	
	European Policy	US Policy
Monetary Policy		
Interest rate cuts	0.0023	0.0137***
Quantitative and credit easing	0.0173	0.0117
Liquidity Support		
Domestic currency liquidity support	0.0158**	-0.0074*
Foreign currency swaps	0.0001	
Financial Sector Policies		
Asset Purchases	-0.0061	-0.0018
Liability Guarantees	0.0104**	-0.0148
Recapitalization	0.0027	-0.0061

The table reports the cross-sectional average of estimated abnormal returns, $\widehat{\lambda}_{IV,i,j}^{E}$ and $\widehat{\lambda}_{IV,i,j}^{US}$, from the OLS estimation of equation (2) using the policy announcements during the post-Lehman period (09.15.2008 - 03.31.2009). For ease of interpretation, while we use $\overline{S}_{r,i,j}^{E}, \overline{S}_{r,i,j}^{US}, \overline{S}_{v,i,j}^{E}$, and $\overline{S}_{v,i,j}^{US}$ of equation (A.2) to construct the significant test, the numbers reported in the table are based on the cross sectional mean of policy effect estimates. The 1st column in the table subtracts the third column from the first column in Table 6. It represents the difference in the abnormal returns (Δ_r^B) following the European policy announcements. The 2nd column repeats the same for the US policy announcements. The estimates are statistically significant at *10%, **5%, and ***1%, respectively.

Table 8
Robustness Check with wider Event Window: Overall Crisis Period

	[-1,+1]		[-2,0]	
	European Policy	US Policy	European Policy	US Policy
Monetary Policy				
Interest rate cuts	-0.0044*	0.0020	-0.0032*	0.0030***
Quantitative and credit easing	-0.0645***	0.0118***	-0.0483***	0.0055***
Liquidity Support				
Domestic currency liquidity support	-0.0015	0.0006	-0.0008	0.0006
Foreign currency swaps	0.0045***		0.0042***	
Financial Sector Policies				
Asset Purchases	-0.0088	-0.0103**	0.0026	-0.0095
Liability Guarantees	0.0001	0.0025	-0.0031***	-0.0005
Recapitalization	-0.0101**	-0.0003	-0.0007	-0.0001

The table reports the cross-sectional average of estimated abnormal returns, $\widehat{\lambda}^{E}_{r,i,j}$ and $\widehat{\lambda}^{US}_{r,i,j}$, and that of induced volatility, $\widehat{\lambda}^{E}_{v,i,j}$ and $\widehat{\lambda}^{US}_{v,i,j}$, from the maximum likelihood estimation of equation (1) using the policy announcements during the overall crisis period (06.01.2007 - 03.31.2009) with event window of [-1,+1]. For ease of interpretation, while we use $\overline{S}^{E}_{r,i,j}, \overline{S}^{US}_{r,i,j}, \overline{S}^{E}_{v,i,j}$, and $\overline{S}^{US}_{v,i,j}$ of equation (A.2) to construct the significant test the numbers reported in the table are based on the cross sectional mean of policy effect estimates. In the 1st and the 2nd column we calculate the average of the estimated abnormal returns observed on the European and US policy announcement days respectively. In the 3rd and 4th column of the table we report the cross-sectional average of the event induced volatility estimates. The estimates are statistically significant at $^{*}10\%$, $^{**}5\%$, and $^{***}1\%$, respectively.

Table 9
Reactions of Banking Implied Volatilities to Policy Announcements: Post-Lehman Period

	European Policy		# of sig.		US Policy		# of sig.	
	Mean	Std.dev.	+	-	Mean	Std.dev.	+	-
Monetary Policy								
Interest rate cuts	-0.0101	0.0711	1	3	-0.0327	0.0563	0	5
Quantitative and credit easing	0.1137	0.1127	8	0	0.0219	0.0696	5	1
Liquidity Support								
Domestic currency liquidity support	-0.0100	0.0957	0	0	-0.0275	0.0581	0	6
Foreign currency swaps†					-0.1735	0.2867	1	14
Financial Sector Policies								
Asset Purchases	-0.0679	0.1052	1	10	0.0225	0.0606	9	0
Liability Guarantees	0.0028	0.0354	1	1	0.0023	0.0512	2	1
Recapitalization	-0.0090	0.0465	1	4	0.0026	0.0506	2	2

The table reports the cross-sectional average of estimated abnormal returns, $\widehat{\lambda}^{E}_{r,i,j}$ and $\widehat{\lambda}^{US}_{r,i,j}$, from the OLS estimation of equation (2) using the policy announcements during the post-Lehman period (09.15.2008 - 03.31.2009) with event window of [0]. In the 1st and 2nd column we report the mean and standard deviation of the abnormal returns on European policy announcements respectively. The 5th and 6th columns repeat for the US policy announcements. The 3rd and 4th columns count the number of individual banks exhibit positive and negative significant abnormal returns respectively. †Although reported at US Policy column, the foreign currency swaps is a joint action by Europe and US.

Table 10
Reactions of Banking Implied Volatilities to Policy Announcements: Robustness checks

Panel A: One lag

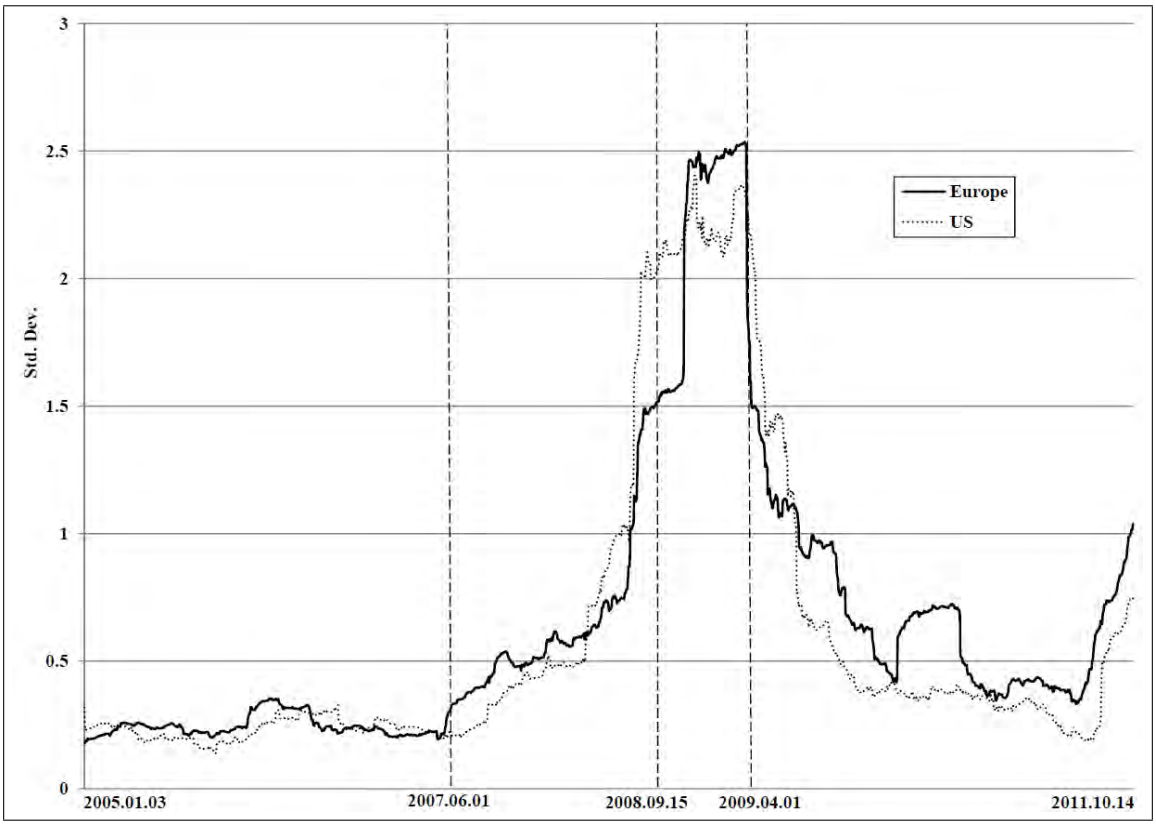
	European Policy		# of sig.		US Policy		# of sig.	
	Mean	Std.dev.	+	-	Mean	Std.dev.	+	-
Monetary Policy								
Interest rate cuts	0.0060	0.0569	3	1	-0.0282	0.0528	0	6
Quantitative and credit easing	0.1097	0.1232	7	0	0.0113	0.0682	4	2
Liquidity Support								
Domestic currency liquidity support	-0.0169	0.0959	0	1	-0.0338	0.0630	0	8
Foreign currency swaps†					-0.1781	0.3167	1	14
Financial Sector Policies								
Asset Purchases	-0.0633	0.1033	1	8	0.0267	0.0561	9	0
Liability Guarantees	0.0103	0.0387	1	1	-0.0127	0.0520	1	2
Recapitalization	-0.0125	0.0479	1	5	0.0052	0.0507	3	2

Panel B: Five lags

	European Policy		# of sig.		US Policy		# of sig.	
	Mean	Std.dev.	+	-	Mean	Std.dev.	+	-
Monetary Policy								
Interest rate cuts	0.0097	0.0529	3	1	-0.0320	0.0567	0	6
Quantitative and credit easing	0.1156	0.1352	9	0	0.0095	0.0714	3	2
Liquidity Support								
Domestic currency liquidity support	-0.0204	0.0984	0	3	-0.0335	0.0630	0	7
Foreign currency swaps†					-0.1700	0.3119	1	14
Financial Sector Policies								
Asset Purchases	-0.0586	0.0968	1	8	0.0303	0.0549	9	0
Liability Guarantees	0.0149	0.0389	1	1	-0.0089	0.0520	2	1
Recapitalization	-0.0111	0.0505	1	6	0.0060	0.0550	3	2

The table reports the cross-sectional average of estimated abnormal returns, $\widehat{\lambda}^{E}_{r,i,j}$ and $\widehat{\lambda}^{US}_{r,i,j}$, from the OLS estimation of equation (2) with one lag (Panel A) and five lags (Panel B) of implied volatility returns ΔIV_{it}. The policy announcements during the post-Lehman period (09.15.2008 - 03.31.2009) are utilized with event window of [0]. For both panels, in the 1st and 2nd column we report the mean and standard deviation of the abnormal returns on European policy announcements respectively. The 5th and 6th columns repeat for the US policy announcements. The 3rd and 4th columns count the number of individual banks exhibit positive and negative significant abnormal returns respectively. †Although reported at US Policy column, the foreign currency swaps is a joint action by Europe and US.

Figure 1
Cross-sectional Standard Deviation of Return Volatility



100 days rolling window volatilities of daily returns for each stock are calculated. Then for each sub-sample, the European banks and the US banks, and for each day, the cross-sectional standard deviation of the rolling window volatilities are computed. The figure plots the time series of the cross-sectional standard deviations of the rolling window volatility.