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Market response to policy initiatives during the global financial crisis

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ABSTRACT

This paper examines the impact of macroeconomic and financial sector policy announcements in the United States, the United Kingdom, the euro area, and Japan on interbank credit and liquidity risk premia during the recent crisis. Overall, policy interventions were associated with a reduction in interbank risk premia, most significantly for recapitalization programs. By contrast, decisions to bail out individual banks in an ad hoc manner or let them fail were accompanied by a significant rise in interbank risk premia. Most policy announcements had international spillovers. These results are broadly robust to using alternative measures of financial distress and varying the size of the event window.

1. Introduction

When the subprime crisis struck in the United States and especially when it spread to other advanced economies and pushed the global economy into recession, designing an effective policy response to the crisis became the number one priority for policymakers around the globe. The ultimate goal of wide-ranging central bank and government interventions was to address the fragility of banking systems and restore confidence in the financial markets. Achieving these goals required a delicate consideration of the sources of stress and the availability of suitable remedies—all against heightened uncertainty about financial and macroeconomic prospects. Reaching consensus on how quick and aggressive policy actions should be, how much weight should be put on macroeconomic and financial sector policies, and what specific form they should take, particularly given various legal, political, and other constraints, has been a challenge both at the national and global levels (Swagel, 2009).

The debate on what policy response would be most effective unfolded in real time, and the first econometric analyses also appeared. They largely focused on the effectiveness of the Federal Reserve's Term Auction Facility (TAF), with conflicting results (Taylor and Williams, 2009; McAndrews et al., 2008). Some studies underscored the importance of the U.S. Federal Reserve's commitment to provide unlimited U.S. dollar swap lines to other central banks in alleviating dislocations in the dollar swap markets (Baba and Packer, 2009; McAndrews, 2009), although the events are difficult to disentangle from other measures of liquidity support. Announcements of financial restructuring measures were found to have reduced bank credit default swap (CDS) spreads, including for foreign banks, with the magnitude of the impact correlated with the magnitude of resources pledged (Panetta et al., 2009).[1] The literature on the effectiveness of crisis policy response has been growing rapidly, with most analyses focusing on individual countries or specific policy measures.

The contribution of this paper is twofold. First, we construct a detailed database of macroeconomic and financial sector policy initiatives announced during the crisis by four systemically important

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[1] Other studies assessing the impact of policy interventions during the current crisis include Artuç and Demiralp (2010), Gagnon et al. (2010), Joyce et al. (2010), Meier (2009), Neely (2010), and International Monetary Fund (IMF, 2009a and b).

advanced economies – the United States, the United Kingdom, the euro area, and Japan – between June 1, 2007 and March 31, 2009. The database covers announcements in the area of fiscal policy, monetary policy (interest rate decisions, and quantitative and credit easing), liquidity support (in domestic and foreign currency), as well as financial sector policy (system-wide recapitalization, asset purchases, liability guarantees, and deposit insurance). It also contains information about ad hoc bailouts of individual banks and decisions not to take specific policy actions (for example, allowing banks to fail or not passing a given piece of legislation through a legislative body).

Second, using a methodology common in the finance literature – an event study – we assess how successful macroeconomic and financial sector policy initiatives were in addressing the financial sector distress. Our main indicator of financial distress is a widely monitored measure of credit and liquidity risk premia in the global interbank markets—the change in the spread between London Interbank Offered Rates (Libor) and Overnight Index Swaps (OIS) for the U.S. dollar, and we also examine the robustness of results to an array of alternative measures, such as the recently introduced transaction-based New York Funding Rate (NYFR)–OIS spread, the spread between the Libor rate and the risk-free rate (the TED spread), the expected Libor–OIS spread, and the spread of repo transactions to the risk-free rate. We also consider a composite measure of bank-specific default risk (credit default swap (CDS) spread), and measures of market perceptions of macroeconomic prospects and financial market volatility (equity price and volatility indices (VIX), respectively). We employ parametric and nonparametric means tests to evaluate whether policy announcements had an economically and statistically significant impact on interbank risk premia.

The event study methodology has a number of advantages. The most important are its simplicity, parsimony, and focus on the immediate market response to an event, a policy announcement in this case. Compared to alternative methodologies (for example, the regression analysis used, among others, by Taylor and Williams, 2009), event studies are better designed to work with the limited sample size and avoid specification issues of the underlying spread model. Although the basis of policy evaluation is narrow in an event study, it may be suggestive of policies' long-term effectiveness as a positive immediate market reaction may be self-fulfilling, laying ground for a sustained policy success.

Nonetheless, an event study has limitations. It does not lend itself to the analysis of causality. Neither can it provide a comprehensive evaluation of policy effectiveness. Such an assessment requires correlating measures of policy intensity and objectives over the entire policy horizon, while controlling for the effects of other policies and changes in market conditions. A comprehensive assessment of policies may reach different conclusions from an event study. For example, some policies which markets initially receive negatively (such as allowing a bank to fail) may ultimately be welfare-enhancing (for example, by avoiding moral hazard stemming from a perception that some banks are “too-big-to fail”) (Klingebiel et al., 2001).

Several issues need to be addressed when applying the event study methodology to our research questions. The first challenge is to create multiple draws of announcements, which we achieve by classifying announcements by type and pooling them across countries.[2] To minimize the endogeneity problem and ensure that results are not contaminated by the effects of multiple announcements, we focus on major non-overlapping policy announcements. When setting the length of the event window, we strive to strike a balance between the risk of assuming insufficient time for the absorption of complex policy news during unprecedented crisis times and the risk of contaminating the measured market response with the effects of other announcements. Our baseline analysis is based on a five-day window, and we confirm the validity of results for alternative, smaller windows up to a minimum length of one day. We also consider alternative reference time as an imperfect substitute for increasing the frequency of the study.[3]

Consistent with McQueen and Roley (1993), we expect market response to announcements to be state contingent, i.e., depend not only on the surprise content of announcements but also on the state of the economy and financial markets in which investors interpret them. Although an event study cannot fully control for the multitude of macroeconomic and structural factors that may affect market response to news, we use sparse conditioning on the state of the economy by splitting the sample period into two. By dividing the sample into a pre- and post-Lehman period we draw a distinction between what was perceived at the time to be a contained crisis (with a fallout limited mainly to the United States), and a global financial crisis accompanied by a global recession. We examine robustness to controlling for expectations about the Libor–OIS spread and content of monetary and fiscal policy announcements (expectations data for other types of policies were not available).

Based on the literature on past crises, both macroeconomic and financial sector policy announcements are expected to have a significant calming impact on interbank credit and liquidity risk premia (see Reinhart and Rogoff, 2008; Calomiris et al., 2005; Claessens et al., 2005; Furfine, 2002). Financial sector policies aim to restore financial stability, while macroeconomic policies help to avoid the vicious feedback between the financial sector and the broader economy. Owing to a high degree of integration of the global financial system, we expect to find evidence of international spillovers from policy announcements by systemically important countries.

The announcement's effects are likely to vary across types of policies. For example, although both monetary and fiscal easing aim to support activity, the impact of monetary easing on credit and liquidity risk premia is likely to be stronger as it directly relieves funding pressures and reduces counterparty risk. Unconventional policies are likely to show little impact on the spreads themselves, as their system-wide impact is more difficult to assess, although some institutions are likely to benefit significantly. Announcements of liquidity support reduce liquidity premia (Michaud and Upper, 2008) but may not alleviate counterparty risk concerns (Heider et al., 2009).

The introduction of government guarantees may have a larger immediate effect on interbank risk premia than asset purchases, because guarantees instantaneously transfer risks from banks' balance sheets to the sovereign. Principle-based bank recapitalization programs are likely to be welcomed by markets, while decisions to bailout financial institutions in an ad hoc manner may have ambiguous effects. Although intended to allay markets' fears about the stability of individual institutions, they may increase their concerns about the soundness of the overall financial system, as markets may consider that announcements about ad hoc bank bailouts reveal bad news that financial institutions are in trouble and country authorities are privy. Such announcements may raise uncertainty and information asymmetry about counterparty risk.

The findings of this paper suggest that the policy response did not entail one particular silver bullet for containing the crisis. Both macroeconomic and financial sector policy announcements were associated with reductions in the Libor–OIS spreads, with market responses to announcements depending on the broader context in which market participants were interpreting the news. Several specific results emerge, which are broadly robust to the changes in specification discussed above:

[2] We undertake country-specific analyses, using the Libor–OIS spreads in respective currencies, to gauge the extent to which pooled results are driven by specific country announcements and to examine the cross-country spillovers of policy announcements.

[3] Using intraday frequency is not feasible because of the once-daily fixing of the Libor rate and the lack of information of the hour and minute of crisis policy announcements.

- Announcements of interest rate cuts were followed by a reduction in interbank risk premia, particularly during the global phase of the crisis, while market response to fiscal policy announcements was negligible. Response to announcements of liquidity support is hard to ascertain: announcements of domestic currency liquidity support were associated with a decline in the Libor–OIS spread, but the statistical significance of this result diminishes when the event window is narrowed. Announcements of forex swaps were consistently followed by a decline in the spread; yet it is difficult to disentangle these announcements from those of domestic currency liquidity support.
- In the financial sector area, announcements of ad hoc bailouts of individual banks were followed by a sharp widening of spreads, aggravating distress in interbank markets during the global phase of the crisis. These effects were not limited to domestic markets but were visible throughout the global financial system.
- By contrast, systematic financial restructuring measures tended to be associated with a reduction in interbank risk premia. Recapitalization announcements, in particular, were followed by a reduction in interbank risk premia during the global crisis. Recapitalization – the main financial sector measure that markets apparently deemed effective in the heat of the crisis – indeed turned out to be the main focus of post-sample policy actions, including the Federal Reserve's stress test results leading to demands to raise additional bank capital, as well as the actions proposed by the G20.
- Results for liability guarantee announcements are more mixed. Such announcements were associated with a decline in interbank risk premia only during the subprime crisis (when they largely reflected the U.K. government's measures in response to the revelation of Northern Rock's problems). During the global crisis the response to announcements of liability guarantees (mostly triggered by the announcement of the Irish blanket guarantees on all deposits, which raised concerns about possible regulatory arbitrage and disruptive cross-border flows, amid growing concerns about banks' solvency) was negative, albeit statistically insignificant, accompanied by a widening of interbank risk premia. The same result holds for asset purchases.

The rest of the paper is organized as follows. Section 2 discusses the Libor–OIS spread as a measure of credit and liquidity risks premia in interbank markets and describes the specially created database on policy announcements. Section 3 provides a brief overview of the event study methodology and describes how the event study was designed. Section 4 discusses graphical evidence and statistical tests of policy announcement's effects for the pooled and country-specific samples as well as confirms the robustness of results to alternative specifications. Section 5 concludes.

2. Measuring financial sector distress and policy initiatives

The analysis of interbank market responses to policy announcements requires daily data on a measure of financial distress in interbank markets and on policy announcements. Such measures are discussed below. The section also describes how the time period is split to control for differences in macroeconomic and financial conditions before and after the collapse of Lehman Brothers.

2.1. Measures of financial distress

We measure the effect of policy announcements on the day-to-day changes in the 3-month Libor–OIS spread—a proxy for the liquidity and counterparty risk premia in the global interbank markets and a commonly used indicator of funding in the unsecured segment of the money market during the financial crisis. The Libor rate comprises the expected risk-free interest rate over a specific term, the term premium, the credit risk premium of unsecured trading with another bank, and the liquidity risk premium of term in lieu of overnight (McAndrews et al., 2008). The overnight index swap (OIS) rate is the weighted average rate at which borrowers can roll over overnight funding. The OIS rate is therefore a measure of investor expectations of the fed funds rate over the term of the swap and contains hardly any counterparty credit risk, given that these contracts do not involve initial cash flows (Sengupta and Man Tam, 2008). Thus, the spread between the Libor and OIS rates over the same term reflects both the counterparty credit risk and term premia.

In times of sufficient liquidity and in the absence of market dislocations, the Libor–OIS spread is close to zero. However, when markets are under stress, uncertainty about credit and liquidity risk creates an opportunity cost of term funding, resulting in a positive spread between the Libor and OIS rates. With credit and liquidity risks becoming the major drivers of the increase in the interbank interest rates since the summer of 2007, the Libor–OIS spread turned into a widely monitored indicator of financial distress (Taylor, 2009) and a useful measure of the effectiveness of policy interventions (McCormick, 2007).

Although the Libor–OIS spread was widely used as a key indicator of financial distress, its reliability can be contested, for example, owing to major dislocations in money markets during the crisis and the role of central banks in displacing financial intermediation in wholesale term markets (Mollenkamp, 2008). Another concern is that the Libor rate tends to be calculated based on banks' quotes rather than rates used in actual lending transactions. Also, major dislocations in money markets during the crisis and the displacement of private sector unsecured funding by central bank support measures have reduced the reliability of Libor.[4]

To confirm that using the Libor rates does not bias the results, we examine robustness to using alternative measures of financial distress (Section 4). Instead of the U.S. dollar Libor rate, we consider the recently introduced three-month New York Funding Rate (NYFR), a more broadly defined analog to the London fixing of the unsecured money market in U.S. dollars.[5] (Similar data were not easily available for other countries in the sample.) We also consider several alternative system-wide measures of credit and liquidity risks – the spread between the Libor rate and the risk-free rate (the TED spread), the forward-looking Libor–OIS spread using futures contracts at one-year maturity, and the spread between government bond repo rates and the corresponding risk-free rate – as well as bank-specific measures of default risks (composite bank CDS spreads, IMF, 2009b) and measures of market expectations of macroeconomic prospects and financial stability, such as equity price and volatility indices (VIX). All market data were obtained from Bloomberg, except the NYFR, which was from the interbroker-dealer ICAP.

Price dynamics are measured using daily financial market data at market opening. In the baseline analysis for the Libor–OIS spread, Libor refers to 11 am London time (the only fixing per day). To ensure consistency, we use the New York-open time for the OIS rate. Although the focus on the spot Libor–OIS spread rules out a higher-than-daily frequency of the event study (and moreover, information on the hour or minute of policy announcements is not available), futures prices offer some insight into the potential sensitivity of results of the Libor–OIS spread to the choice of pricing times. We consider alternative (opening and closing) reference times for the expected Libor–OIS spread based on futures prices as a robustness check.

[4] At the onset of the crisis, some Libor panel banks were allegedly underquoting to protect their reputation. Although outlier contributions (25% of the highest and lowest quotes) to the daily Libor survey ("fixing") are eliminated from the sample, one needs to acknowledge that unsecured markets may not function well during times of stress.

[5] In contrast to Libor, which represents a surveyed quote of the benchmark rate of interest at which banks can expect to lend funds to each other in the London interbank market, the NYFR is the representative transaction rate at which an institution would be likely to obtain funding in the market. The NYFR was launched by the interbroker-dealer ICAP on June 8, 2008.

2.2. Crisis timeline

To account for differences in the macroeconomic and financial environment before and after the collapse of Lehman Brothers, we split the crisis period into two sub-periods: (i) the *subprime crisis* from June 1, 2007 to September 14, 2008, which was characterized by a series of predominantly central bank policy measures with a relatively narrow focus on arresting the downward spiral of counterparty confidence; and (ii) the *global crisis* from September 15, 2008 to March 31, 2009, which witnessed frequent and diverse policy interventions motivated by a sense of heightened urgency about the need to restore financial stability and avoid a global economic depression.

The onset of the crisis is identified as June 1, 2007 based on a Markov-switching vector autoregression of bond market data (Nowak et al., 2011). The end of the period coincides with the G20 Leaders' Summit on Financial Markets and the World Economy, held in London on April 2, 2009, when the leaders pledged more than 1 trillion dollars to tackle the global financial crisis by improving international finance and trade and fostering an economic recovery. The collapse of Lehman Brothers on September 14, 2008 marks the end of the subprime phase and the beginning of the global phase of the crisis.

The break around the time of Lehman collapse is visible both in the data on the Libor–OIS spread and other measures of financial distress as well as in the cumulative number of policy announcements discussed below. Spreads increased sharply in August 2007 (the "black swan" event of Taylor, 2009), remained persistently high through the rest of 2007 and the first half of 2008, and then shot up further in September 2008 after Lehman Brothers' collapse. The collapse of this systemic institution aggravated distrust in wholesale funding markets, and banks became increasingly reluctant to lend to each other over longer terms.

Policy responses to the crisis before and after Lehman collapse differed. During the subprime phase, country authorities and markets perceived the crisis as largely limited to the fallout from the collapse of the U.S. subprime mortgage market and its implications for mortgage-backed securities' markets. Policy priorities largely focused on the unfreezing of credit markets and dealing with weak financial institutions. Interest rate cuts and aggressive provision of liquidity support were seen as ways to address these policy objectives. The collapse of Lehman Brothers demonstrated the systemic nature of the crisis, at the same time as a sharp deterioration of incoming macroeconomic data pointed to global recession. Aggressive use of monetary and fiscal easing, while appropriate, gradually eroded policy room available to country authorities. Policy priorities during the global phase of the crisis increasingly shifted to restoring market confidence, preventing further systemic bank collapses, and stimulating domestic demand. During that phase of the crisis, interest rates declined sharply, and many central banks shifted to using unconventional monetary policy measures.

2.3. Policy announcements

We compile data on major policy initiatives announced by country authorities in the United States, the United Kingdom, the euro area, and Japan in response to the financial crisis.[6] Data for the euro area include policy announcements by the European Central Bank (ECB) and national authorities from Austria, Belgium, France, Germany, Ireland, Italy, the Netherlands, and Spain. Dates of policy announcements are identified based on official press releases, major newspapers and news search engines, and are double-checked against similar compilations of crisis events by central banks, investment banks, international organizations, and individual researchers (for example, Federal Reserve Bank of New York, 2009[7]; Federal Reserve Bank of St. Louis, 2009; Furceri and Mourougane, 2009; Global Financial Association, 2009; Guillén, 2009; IMF, 2009a and b). We confirmed our database with IMF country desks and the authorities, wherever possible. Unfortunately, only information on the day (and not the hour or minute) of policy announcements is available for the country sample used in this paper, which restricted the event study to daily frequency.

We focus on watershed policy events, distinguished by the prominence of media coverage, to minimize noise and the number of overlapping events that may bias results. Although traders use news tickers and other market information systems to monitor news during the day, we believe the financial press is a better gauge for selecting watershed policy events because it interprets complex policy announcements and analyzes their impact on financial risks, both of which are critical for investors to position themselves appropriately in response to the announcements.

We search front-page articles where the policy announcement is the main subject (rather than articles describing the extreme market moves), which helps mitigate potential endogeneity problems. For the United States and the United Kingdom, we identify major policy events by their appearance as front-page news in the *Financial Times* and/or the *Wall Street Journal* ("front page criterion") one day before and up to three days after the date of the official announcement. Given the greater diversity of the economic and financial press in the euro area and Japan, for these economies, we identify watershed events using additional news sources, such as Bloomberg and Associated Press, and the coverage in Federal Reserve Bank of New York (2009).

Policy initiatives are dated as of their official announcement. For a few measures that involved a multi-stage decision-making process (for example, the adoption of a fiscal stimulus package), the consecutive stages of the process are recorded to the degree the authorities made public announcements at each stage. We classify announcements into the following categories: (i) fiscal policy; (ii) monetary policy; (iii) liquidity support; (iv) financial sector policy; and (v) ad hoc bank bailouts and failures (Table 1).

Fiscal measures include all policy actions that aim at stimulating domestic demand, through increases in expenditures or reductions in taxes, unless classified in other categories. Since fiscal measures typically require legislative approval, the political decision process is usually protracted with a series of announcements making headlines.

Monetary policy measures include interest rate decisions and quantitative and credit easing. *Quantitative easing* involves the central bank's purchasing government securities, while *credit easing* consists of purchases of private sector debt in primary or secondary markets, including mortgage-backed securities.

Liquidity support is the provision of domestic currency liquidity through broadened access to central bank refinancing, extended collateral framework, more frequent auctions, or longer maturities, as well as the provision of foreign currency liquidity through swap agreements between central banks and central bank funding facilities for foreign currency liquidity.

Financial sector policies include the tools commonly utilized to resolve systemic banking crises, and are further broken down according to their implications for bank balance sheets:

- *Asset purchase* programs use public funds to buy risky assets from banks to shield them from losses. Banks profit from asset purchase programs to the extent that credit risk is removed from their balance sheets, and also because the purchases may put a floor on market prices in banks' trading books. The category also includes ring-fencing of bad assets, which may be conducted either off-balance

[6] The database is available from the authors upon request.

[7] For an introduction to the New York Fed crisis timelines, see Hellerstein et al. (2009).

Table 1
Classification of policy measures.
Source: Authors.

Type	Measures	Examples
Fiscal policy	Fiscal stimulus packages	German Pact for Employment and Stability (1/14/09), Stimulus plan announced by President Sarkozy (12/4/08), U.K. stimulus package (11/24/08), U.S. Economic Stimulus Act (1/18/08, 1/24/08, 1/29/08)
Monetary policy		
Interest rate cuts		Coordinated rate cut by six central banks (10/8/2008)
Interest rate increases and decisions to maintain interest rates unchanged		Policy rates maintained (e.g., ECB 10/2/2008, BoE 11/8/2007, FOMC 9/16/2008) or increased (e.g., ECB 7/3/2008)
Quantitative and credit easing		Gilt purchases (3/5/09), BoJ outright JGB purchases (1/22/09, 3/19/09), Federal Reserve buys long-term Treasuries (3/18/09) BoE asset purchase facility (1/19/09), U.K. Corporate Bond Secondary Market Purchase Scheme and CP Facility (3/5/09), BoJ purchase of corporate financing instruments (1/22/09, 2/19/09), Fed purchases agency debt and MBS (3/18/09), ECB purchase of covered bonds (5/7/09)
Liquidity support		
Domestic currency liquidity support	Relaxation of collateral framework; change in funding terms or auction schedule	U.S. Term Auction Facility (12/12/07, 12/21/07), launch of the Term Asset-Backed Securities Loan Facility (TALF, 3/3/09), ECB's expansion of the collateral framework (10/15/08), lengthening of the terms (8/22/07) and introduction of additional auctions (12/17/07), U.K. Special Liquidity Scheme (4/21/2008, extended 9/17/2008), U.K. long-term repo with expanded collateral (10/3/08)
	Support of money markets	Asset-Backed Commercial Paper (ABCP) Money Market Fund Liquidity Facility (9/19/08)
Foreign currency swaps	FX swaps and FX funding	ECB offers dollar funding (12/12/07)
Financial sector policies		
Asset purchases	Asset purchases	Troubled Assets Relief Program (10/3/08), Spain's fund to buy impaired assets (10/7/08)
	Ring-fencing of bad assets and asset guarantees	Maiden Lane SPVs for buying impaired assets (Bear Stearns, 3/14/08; AIG, 11/10/08), SPV WestLB (2/6/08), French loan guarantees (10/13/08), asset guarantees to Citi (11/23/08) and BofA (1/16/09), UK Asset Protection Scheme (1/19/09)
Liability guarantees	Guarantees for old or new liabilities	Irish Government Guarantee Scheme (9/30/08), U.K. Credit Guarantee Scheme (10/8/08), U.S. Temporary Liquidity Guarantee Program (10/14/08)
	Enhancement of depositor protection	Ireland (9/20/2008), U.K. (10/3/08), Germany (10/5/08), U.S. extension to credit unions (1/28/09)
	Provision of lender of last resort facilities to individual banks	Northern Rock liquidity support facility (9/14/07), Hypo Real Estate rescue (9/29/08), Federal Reserve Board's acceptance of applications to be chartered as bank holding companies (e.g., Goldman Sachs and Morgan Stanley, 9/21/08)
Recapitalization	Capital injection and nationalization	TARP capitalization of nine U.S. banks (10/28/08), subordinated debt for six French banks (10/20/08), U.K. Bank Recapitalization Fund (10/8/08 and subsequent capital injections in October 2008 and February/March 2009)
Ad hoc bank bailouts and failures		
Ad hoc bank bailouts		IKB (8/2/07, 2/13/08), SachsenLB (8/26/07), Northern Rock (11/19/07, 2/17/08), Bear Stearns (3/14/08), Fannie Mae and Freddie Mac (9/7/08), Merrill Lynch (9/15/08, 11/26/08), WaMu (9/25/08), Bradford and Bingley (9/29/08), Fortis (9/29/08), Dexia (9/30/08), Wachovia (10/12/08)
Bank failures		NetBank (9/30/07), IndyMac (7/11/08), Lehman Brothers (9/15/08)

sheet through a special purpose vehicle absorbing assets, or on the balance sheet through asset guarantees. Asset purchases usually involve signing a loss-sharing agreement between a public institution providing funds and the bank receiving them. The measure can either be adopted for a single institution or as a system-wide facility for a given asset class.

- *Liability guarantees* are system-wide guarantees for newly issued or existing wholesale financing, and the enhancement of deposit protection schemes. It also embraces the lender-of-last resort funding to individual banks and other ways to grant financial institutions access to alternative funding sources, such as the chartering of U.S. investment banks as bank holding companies to allow them to tap retail funds.
- Finally, *recapitalization* includes the direct injection of capital partially or fully originating from public funds, including the announcement of system-wide recapitalization programs, like the U.K. Bank Recapitalization Fund, and nationalization, which includes the assumption of a controlling stake in a bank.

Among the above policies, asset purchases and recapitalization could be interpreted as measures aimed to restore solvency (while having positive effect on the liquidity position of financial institutions). Liability guarantees are mainly liquidity-enhancing measures.

A special category – ad hoc *bailouts, and failures* – comprises the gamut of decisions that did not involve enacting comprehensive, system-wide and/or principle-based measures to contain the financial crisis. These were mostly actions aimed at rescuing distressed financial institutions outside orderly resolution regimes or financial sector support packages. The category also covers decisions to allow banks to fail – Lehman Brothers, IndyMac, and NetBank – and decisions to bail out individual troubled institutions – Bear Stearns, Washington Mutual and the Fannie Mae and Freddie Mac conservatorship, to name a few prominent examples in the United States.

For packages of measures, we identify the main measure based on the degree of prominence of front-page coverage for the measures included in the package, which also helps to reduce the number of overlapping announcements. For example, the FOMC's vote to maintain the interest rate corridor on March 18, 2009, is considered less significant than the same day's release that the Fed would purchase agency debt and treasury securities for more than one trillion U.S. dollars. In a few cases where several equally important policy initiatives were announced on the same day, they are included as separate entries in the database.

All in all, the database includes 234 front-page announcements (Table 2). Financial sector initiatives accounted for the largest share of front-page announcements (37%), followed by monetary policy and liquidity support announcements (25% and 23%, respectively), and ad hoc bailouts and failures (11%). The largest number of front-page announcements covered the policy measures taken by the United States (46%) and the ECB and the euro area governments (33%).

Table 2
Number of front-page policy announcements, June 1, 2007–March 31, 2009.
Source: Authors.

	United States	United Kingdom	Euro area	Japan	Total	As a percentage of all front-page announcements
Fiscal policy	6	1	2	1	10	4
Monetary policy	21	15	18	5	59	25
Interest rate cuts	12	8	5	1	26	11
Higher/stable interest rates	4	3	13	2	22	9
Quantitative and credit easing	5	4	0	2	11	5
Liquidity support	33	5	14	1	53	23
Domestic currency liquidity support	28	4	9	1	42	18
Foreign currency swaps	5	1	5	0	11	5
Financial sector policies	33	18	35	1	87	37
Asset purchases	7	4	2	0	13	6
Liability guarantees	9	8	19	0	36	15
Recapitalization	17	6	14	1	38	16
Ad hoc bailouts, and failures	14	3	8	0	25	11
Ad hoc bank bailouts	11	3	8	0	22	9
Bank failures	3	0	0	0	3	1
Total number of front-page events	107	42	77	8	234	100
As a percentage of total number of front-page announcements	46	18	33	3	100	

Although countries' approaches to stabilize the financial sector and support domestic growth were broadly similar, the exact timing and characteristics of measures varied depending on authorities' perceptions of the extent and timing of crisis impact, as well as local institutional, structural, and political factors. With the onset of the subprime crisis, most countries stepped up the provision of liquidity support to financial institutions, but only the United States (and to a lesser degree the United Kingdom) aggressively cut interest rates during that period. The United States also initiated the first fiscal stimulus early on, in January 2008, long before the crisis took on its global dimension, while other countries announced fiscal stimulus packages much later, in the last quarter of 2008.

Several countries resorted to ad hoc interventions to bail out troubled financial institutions during the subprime crisis, such as the bailout of Bear Stearns in the United States, guarantees to Northern Rock in the United Kingdom, and the rescue of IKB and two *Landesbanken* (state banks) in Germany. The United States was the only country that employed a diverse set of financial sector measures early on, ranging from asset purchases to liability guarantees and recapitalization. The U.K. early response to the crisis concentrated on the provision of liability guarantees and changes in deposit insurance schemes, motivated by the need to address shortcomings in the latter. The euro area responded with a large number of recapitalization and liability guarantee measures only after the collapse of Lehman Brothers. In Japan, major financial sector policy announcements focused on recapitalizations.

In addition to dates and types of policy announcements, we record information about the expected and officially announced intensity of some announcements. Data on officially announced intensity are available for fiscal, monetary, and financial sector interventions in the United States and the United Kingdom. For fiscal stimulus packages or asset purchases that imply (quasi-) fiscal outlays, we record the officially announced size of the package or special-purpose budget allocation. Expectations data are available only for fiscal and monetary interventions in these two countries. For fiscal stimuli, market expectations of the magnitude of intervention are determined using news searches in the *Financial Times* and the *Wall Street Journal* within one week prior to the official release, and checked against the IMF's internal data. For policy rate decisions, we use median expectations from *Bloomberg*'s surveys of market analysts.

3. Event study methodology

We evaluate the real-time response of interbank credit and liquidity risk premia to policy announcements using the event study methodology. The methodology is well established, especially in the finance literature (see Campbell et al., 1997; Kothari and Warner, 2007). The event study methodology is generally well suited to assessing the short-run response to policy announcements. Its main strengths are simplicity and parsimony, allowing us to work with the limited sample of announcements we have.

An event study needs to be designed carefully to address several issues. To create multiple draws of similar events, we classify announcements into several policy event types (as discussed in Section 1) and pool them within each sample country and across countries. (We examine consistency of country-specific analyses with those based on the pooled sample.) It is also important to ensure that the results for a given type of policy announcement are not influenced by other events. Applying the front-page and main-event criteria for classifying announcements (see Section 2) helps reduce the number of overlapping events. Furthermore, when undertaking the analysis on country-specific news, we exclude domestic announcements that fall within five days from each other, except for multiple announcements associated with different policy measures under support packages and concurrent announcements on the same day for which identifying the main event was difficult.[8] For the pooled sample underlying tests of total spillovers, we adopt the same screening of overlapping event days ("contamination") but also exclude announcements made by different countries if they occurred on the same day and covered the same broad policy type category (fiscal, monetary, liquidity, financial sector, failure/bailout, and other). For coincidental but different policy measures, the announcement of the economically more significant one is chosen.

Limiting the size of the event window helps to avoid contaminating the analysis of given announcement's effects with those of preceding and subsequent announcements in an environment where such announcements were made in relatively short succession. We use a narrow five-day event window—one day before and three days after an announcement. A three-day post-announcement window allows for a more protracted-than-usual absorption of news, which appears appropriate as many crisis policy initiatives were unprecedented and/or complex, without any apparent benchmarks for evaluating their effects. We examine the robustness of results to using symmetric three- and one-day windows, with a corresponding relaxation of the contamination screen. We find that the results are largely unchanged.

Another aspect of the identification problem is that policy announcements may affect markets before the event window because they were anticipated. In this case, the policy measures would be priced out before the announcement, reducing the significance of the announcement's effects. To account for such a possibility, we collect measures of the surprise component of interest rate cuts and fiscal stimulus packages in the United States and the United Kingdom (see Section 1 for details) and examine the robustness of results to using only the surprise content of announcements. Expectations

[8] They include 9 events in the United States (on 12/12/2007, 7/30/2008, 9/15/2008, 10/14/2008, 10/12/2008, 10/14/2008, 10/21/2008, 11/21/2008, and 2/06/2009), 3 events in the United Kingdom (on 7/05/2007, 8/07/2008, and 3/07/2009), 4 events in the euro area (on 5/08/2008, 10/13/2008, 10/24/2008, 11/03/2008, and 1/09/2009), and 3 events in Japan (on 9/18/2008, 10/07/2008 and 12/12/2008).

data for other countries or types of announcements were not easily available.

The last challenge, which event studies cannot address directly (and it is by design), is controlling for the multitude of factors that may have bearing on market response to announcements. Market perceptions of policy announcements are likely to be state-contingent, depending on how markets perceive the underlying problem that needs to be addressed through policy measures and whether the announced policy measure is timely, appropriate, sufficient, and credible to address this problem. These considerations are likely to have differed considerably before and after the collapse of Lehman Brothers. Aside from alternative specification of the dependent variable, the splitting of the crisis period into the two sub-periods (see Section 2 for details) helps to control for differences in the macroeconomic and financial conditions to some extent.

Tests of the robustness of results to using alternative measures of financial distress also help to confirm that the main results are not biased. We consider alternative system-wide measures of interbank risk premia, such as the transaction-based NYFR–OIS rate, expectations about the Libor–OIS spread, the spread of repo transactions to the risk-free rate, and the TED spread. We also consider composite measures of bank-specific default risk (credit default swap spreads), and measures of market perceptions of macroeconomic prospects and financial market volatility, such as equity price and volatility indices (VIX), respectively.

We analyze the impact of policy announcements on changes in the Libor–OIS spread, and capture the cumulative impact of policy announcements over a few days. The event study methodology requires aggregating the abnormal differences in the market indicator of interest within each event window to construct cumulative abnormal differences, under an assumption that no other factors moved the stress indicators during the event window. These differences are then averaged across types of policy to calculate average cumulative abnormal differences (ACAD). Focusing the analysis on short-term changes in the Libor–OIS spread avoids the need to model the time-varying properties of its level, including trends, structural breaks, nonlinearities, and nonstationarity.

We define abnormal differences as actual daily changes in the Libor–OIS spread at market opening during the event window as the baseline specification. During both phases of the crises, day-to-day changes of the Libor–OIS spread were not statistically different from zero, which justifies the measurement choice of abnormal differences reflecting the nonstationary dynamics of changes in Libor–OIS spreads. Statistical tests based on an alternative definition of abnormal differences – the difference between the actual daily change on each day of the event window and the expected daily change measured as the average daily change over the previous 20 working days – point to the same conclusions as the baseline specification. This is not surprising as the two measures of abnormal differences are highly correlated with each other.

For other financial market indicators, which we consider as part of robustness analysis, the assumption of zero mean reversion is not valid. Abnormal differences are computed as a difference between the expected daily change of the market indicator and its actual daily change. The expected daily change of the market indicator is estimated as the average daily change over the previous 20 working days and is subtracted from the actual daily change on each day of the event window to obtain abnormal differences.

Although, as explained above, increasing the frequency of data is not feasible, we consider an alternative reference time to gauge if our definition of abnormal differences at daily frequency is a limitation.[9] For the expected Libor–OIS spread based on futures prices, data are available for both open and close prices. In the baseline specification, we measure changes between the opening prices on each day in the event window and then check robustness to using changes between the opening and closing prices on the same day and between the closing prices on subsequent days. The results are generally robust.

We apply parametric and nonparametric tests of means before and after announcements to abnormal differences to ascertain whether the announcement is associated with a statistically significant effect on interbank risk premia. Parametric tests attribute an equal chance to both positive and negative deviations from expectations (in addition to allowing for tail behavior of abnormal changes if a more stringent test statistic based on extreme value theory is chosen), while nonparametric tests do so without distributional assumptions. A small number of observations weaken the power of statistical tests, pointing to the need to consider both the economic and statistical significance of results. Statistical tests are specified in line with the literature, for example, Patell (1976), Brown and Warner (1985), Boehmer et al. (1991), Campbell et al. (1997), and McKinlay (1997).[10]

4. Impact of policy announcements on interbank credit and liquidity risk

To gauge the response of the Libor–OIS spreads to announcements of policy interventions, we first plot changes in the Libor–OIS spreads during the event window and then test the statistical significance of differences in the behavior of the Libor–OIS spreads prior to and after announcements. We start with the graphical analysis and statistical tests on a pooled sample of announcements and the U.S. dollar Libor–OIS spread, and then proceed to the robustness analysis and analysis of international spillovers from policy announcements.

4.1. Graphical analysis

Using the global event sample where more stringent filtering applies to avoid the overlap of event windows, announcements of policy interventions during the subprime period were similarly associated with slightly lower spreads, and this effect became more pronounced during the global phase (Fig. 1, top panels). During the global crisis period, ad hoc bank bailouts and failures were associated with a dramatic increase of the financial market stress.

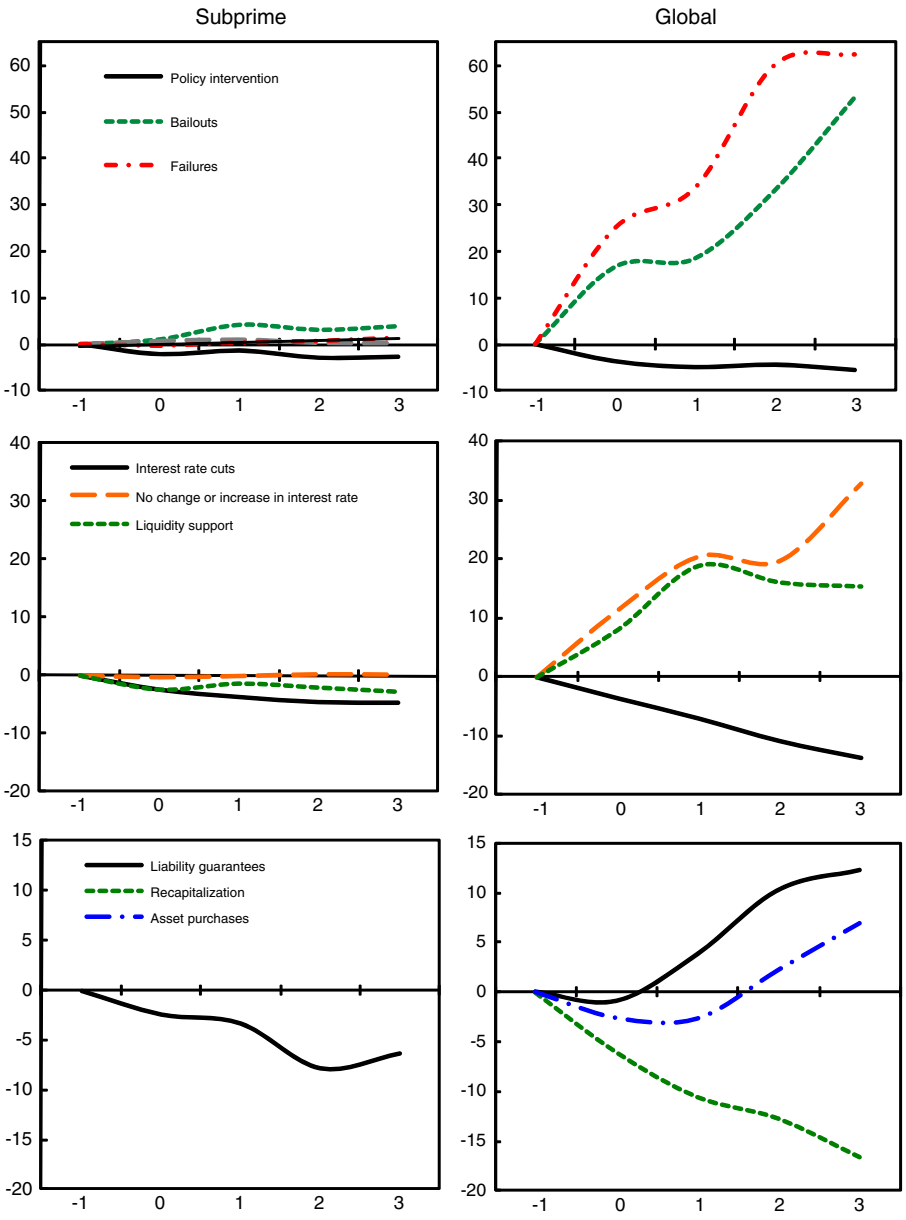
This finding carries through to monetary and financial sector policy measures. The middle panels of Fig. 1 show that announcements of interest rate cuts were associated with a decline of the Libor–OIS spread, which was particularly pronounced during the global crisis phase. The event study seems to point to an adverse effect of maintaining or increasing policy rates during the global phase when the Libor–OIS spreads widened by about 30 basis points on average over the event window. Somewhat surprisingly, announcements of liquidity support were not followed by lower interbank market spreads in the global phase, when market concerns shifted from liquidity to solvency issues.

Among measures targeted directly at banks, announcements concerning recapitalization were associated with reductions in the Libor–OIS spread during the global phase (by about 15 basis points on average over the event window). On the opposite, liability guarantee announcements were even followed by wider spreads during the global phase, as were asset purchases (after an initial drop in interbank spreads).

Policy interventions led to a reduction of the Libor–OIS spread more often on average than did ad hoc bank bailouts or failures (Fig. 2). The frequency plot for policy actions is centered at zero

[9] We are grateful to the editor for this suggestion.

[10] A detailed description of the test statistics is available upon request.



Source: Authors' estimates.
Note: The variable plotted on the vertical axis shows the average cumulative abnormal differences (ACADs) in basis points within the event window of one day before the event and three days after the event, scaled to zero on the first day of the event window using the average abnormal difference on the first event day. This effectively introduces a one-day lag and reduces the event window to four days. The horizontal axis shows days within the event window, with "0" corresponding to the day of the announcement.

Fig. 1. Impact of policy announcements on the Libor–OIS spread, June 1, 2007–March 31, 2009 (in basis points).

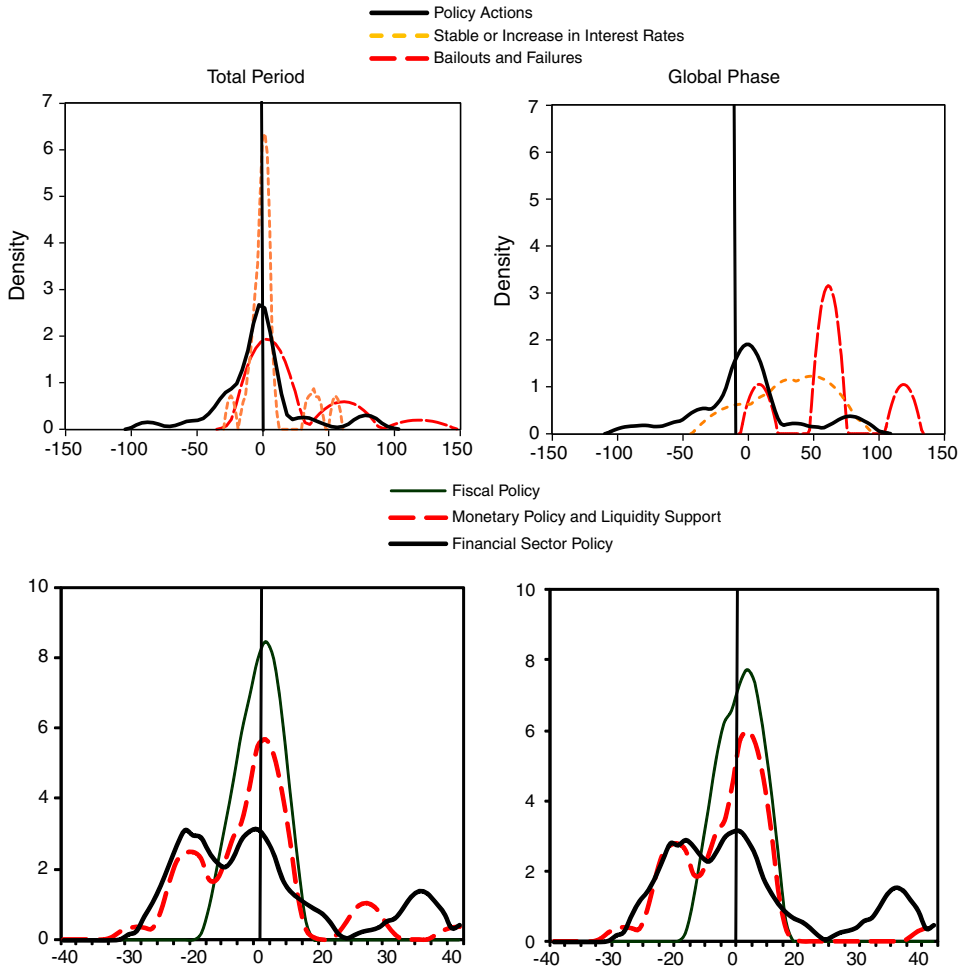
(i.e., announcements of policy actions on average had a negligible impact on the Libor–OIS spreads), while the frequency distribution of ad hoc bailouts is skewed to the right, for the global phase of the crisis. This implies that announcements of policy actions were accompanied by a decline of the Libor–OIS spreads more often on average than ad hoc bank bailouts and failures did. Announcements of monetary policy actions and financial sector policy initiatives were associated on average with reductions in interbank risk premia. The frequency plots for these types of announcements have long left-hand-side tails, containing a larger mass of observations than the right-hand-side tails, suggesting that the average probability of spread declines was higher than that of increases.

4.2. Statistical analysis

Statistical tests confirm that while both macroeconomic and financial sector announcements were associated with a significant favorable impact on interbank credit and liquidity risk premia, the effects of announcements varied considerably across different types of policies and phases of the crisis.

4.2.1. Monetary policy

Interest rate cuts were associated with significant declines in the Libor–OIS spreads, with larger declines during the global phase of the crisis (Fig. 2 and Table 3). More countries implemented interest



Source: Authors.
Note: The variable plotted on the horizontal axis shows the average cumulative abnormal differences (ACAD), in basis points, over the window of one day before the event and three days after the event. The vertical axis shows density, in percent. The kernel density is estimated using Epanechnikov kernel and linear binning. The bandwidth is set to minimize the asymptotic mean integrated squared error compared to the reference (Epanechnikov) distribution. The category "policy actions" includes all types of policy announcements, except interest rate policy inaction and ad hoc bank bailouts and failures, which are plotted separately.

Fig. 2. Frequency distribution of changes in the Libor–OIS spread in response to policy announcements (in percent).

rate cuts during that phase of the crisis than during the early stage, the magnitude of the cuts was larger, and on one occasion interest rate cuts were coordinated by major central banks. The decline in the Libor–OIS spreads following interest rate cuts may have reflected markets' expectation that lower interest rates would increase liquidity in the financial system, thereby reducing liquidity risk in interbank markets. The result also confirms that interest rate policy remained a key policy tool throughout the crisis, given the markets' familiarity with conventional monetary policy and the credibility of interest rate actions. By contrast, increases in (or stability of) interest rates were associated with wider Libor–OIS spreads, and the statistical significance of this result increases if the event window is narrowed.

Announcements concerning unconventional monetary policy were followed by declines in interbank credit and liquidity risk premia, albeit without statistical significance, possibly because the likely effects of these policies were more difficult to discern than those of interest rate decisions. Although some institutions may have been expected to benefit significantly from unconventional policies, the system-wide impact of these measures was uncertain and difficult to assess.

4.2.2. Liquidity support

Announcements of liquidity support were not associated with clear-cut reductions in interbank risk premia during either phase of the crisis. Early in the crisis, announcements about the provision of U.S. dollar liquidity through swap agreements between the Federal Reserve and other major central banks (which often coincided with announcements about the provision of domestic currency liquidity support) were accompanied by statistically significant but small reductions in the Libor–OIS spreads (Table 3). Although the finding of strong announcement's effects for forex swaps is consistent with other studies (for example, Baba and Packer, 2009; McAndrews, 2009), it is possible that the results partly reflect the effects of domestic currency liquidity support, as the respective announcements often took place together (for example, the Federal Reserve's announcements on December 12, 2007).

During the global crisis, while the slight decline of the Libor–OIS spread was statistically significant, forex swaps were not any longer (Table 3). This result does not lend much support to the hypothesis that the provision of liquidity support helped reduce interbank spread through relieving funding pressures from those institutions that had access to liquidity facilities (Artuç and Demiralp, 2010;

Table 3
Statistical tests for alternative event windows.
Source: Authors' estimates.

	Parametric test	Non-parametric test	Stat. sign.	Obs.	Parametric test	Non-parametric test	Stat. sign.	Obs.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Five-day event window (1 day before and 3 days after announcement)							
	Subprime phase				Global phase			
Fiscal policy	8.9	−0.5	–	*1*	0.8	−0.3	–	*6*
Monetary policy								
Interest rate cuts	−7.1	1.4	*	*8*	−17.9	1.4	*	*7*
Higher/stable interest rates	0.1	−0.2	–	*17*	31.3	−0.8	–	*3*
Quantitative and credit easing	–	–	–	*0*	−14.7	0.5	–	*5*
Liquidity support								
Domestic currency	3.5	−0.5	–	*12*	−5.7	0.4	*	*2*
Forex swaps	−17.0	3.0	***	*4*	78.6	−0.5	–	*1*
Financial sector policy								
Recapitalization	–	–	–	*0*	−15.4	1.6	**	*18*
Asset purchases	–	–	–	*0*	11.9	−0.9	–	*5*
Liability guarantees	−11.3	1.6	**	*4*	18.4	−0.8	–	*10*
Bailouts and failures								
Ad hoc bailouts	2.6	−0.9	–	*7*	62.3	−1.0	*	*4*
Bank failures	3.3	−0.7	–	*2*	61.8	−0.5	*	*1*
Surprises								
Fiscal policy	–	–	–	*0*	−0.8	0.4	–	*3*
Monetary policy	−2.0	0.6	–	*4*	−2.1	0.1	–	*4*
	Three-day event window (1 day before and 1 day after announcement)							
	Subprime phase				Global phase			
Fiscal policy	2.0	−0.7	–	*2*	0.5	−0.4	–	*7*
Monetary policy								
Interest rate cuts	−4.6	0.7	*	*8*	−9.1	1.1	*	*8*
Higher/stable interest rates	−0.2	−0.8	–	*17*	22.9	−0.8	*	*3*
Quantitative and credit easing	–	–	–	*0*	−15.3	−0.2	–	*5*
Liquidity support								
Domestic currency	1.7	−0.3	–	*16*	−4.4	0.2	–	*3*
Forex swaps	−12.3	3.0	***	*4*	18.9	−0.5	–	*1*
Financial sector policy								
Recapitalization	–	–	–	*0*	−7.9	1.7	**	*25*
Asset purchases	–	–	–	*0*	6.3	−1.0	–	*7*
Liability guarantees	−5.8	2.0	**	*4*	6.1	−0.7	–	*12*
Bailouts and failures								
Ad hoc bailouts	0.5	−0.3	–	*7*	46.4	−1.1	**	*5*
Bank failures	2.2	−0.7	–	*2*	26.7	−0.5	*	*1*
Surprises								
Fiscal policy	2.0	−0.7	–	*1*	1.1	−0.5	–	*3*
Monetary policy	−1.4	0.3	–	*4*	−1.8	−0.1	–	*5*
	One-day event window (only announcement day)							
	Subprime phase				Global phase			
Fiscal policy	0.5	−0.1	–	*2*	0.1	−0.3	–	*8*
Monetary policy								
Interest rate cuts	−0.6	−0.7	–	*9*	−2.6	1.7	–	*10*
Higher/stable interest rates	−0.1	−0.1	–	*17*	13.1	−0.8	*	*3*
Quantitative and credit easing	–	–	–	*0*	−2.8	0.6	–	*6*
Liquidity support								
Domestic currency	0.4	−0.2	–	*17*	−0.5	0.1	–	*3*
Forex swaps	−2.8	1.9	**	*4*	0.1	−0.5	–	*1*
Financial sector policy								
Recapitalization	–	–	–	*0*	−2.8	1.3	*	*26*
Asset purchases	–	–	–	*0*	4.2	−0.9	–	*7*
Liability guarantees	1.5	−0.9	–	*4*	1.8	−0.4	–	*15*
Bailouts and failures								
Ad hoc bailouts	0.8	−0.6	–	*7*	18.7	−1.1	**	*5*
Bank failures	0.7	−0.5	–	*2*	2.3	−0.5	*	*1*
Surprises								
Fiscal policy	0.5	−0.1	–	*2*	0.8	−0.7	–	*3*
Monetary policy	−0.2	0.0	–	*4*	−0.2	0.1	–	*5*

Note: The table reports test statistics for the parametric test based on the Average Cumulative Abnormal Differences (ACAD) and the nonparametric sign-size test respectively (for more details on the test statistics, see Appendix I). All tests are performed on a pooled sample of policy announcements and the U.S. dollar 3-month Libor–OIS spread. A negative (positive) value of ACAD (sign-size) test statistic means that the pertinent policy measure reduced the Libor–OIS spread. Asterisks ***, **, and * indicate statistical significance (two-tailed, standard normal distribution or generalized extreme value (GEV) distribution, whichever is more restrictive) at the 1, 5 and 10% level, respectively. Statistical significance is assigned if all parametric and non-parametric tests are consonant with each other at the significance level of at least 10%; the lowest value of the test statistics is used. The peak-to-trough change in the Libor–OIS spread was 79.2 basis points during the subprime phase (with a daily average change of 0.2 basis points and a standard deviation of 1.0 basis points) and 141.2 basis points during the global phase of the financial crisis (with daily average change of 0.15 basis points and a standard deviation of 2.8 basis points).

McAndrews et al., 2008; Deutsche Bank Securities Inc. (Deutsche Bank), 2009; Christensen, 2009).

4.2.3. Fiscal easing

Announcements concerning fiscal stimulus packages were not associated with significant reductions in interbank credit and liquidity risk premia, possibly because fiscal policy measures were seen as mainly targeting other objectives, for example, increasing domestic demand, and as likely to have uncertain and delayed effects on interbank risks.

4.2.4. Financial restructuring

Announcements of recapitalization were associated with favorable developments in interbank markets during the global phase of the crisis (Fig. 1 and Table 3), and this effect was statistically significant. This result may reflect the perception that an urgently implemented, globally coordinated recapitalization was the key policy action needed to stabilize the banking system at that time (Eichengreen and Baldwin, 2008).

By contrast, reaction to announcements of liability guarantees was mixed. During the subprime crisis, such announcements were followed by large and statistically significant reductions in interbank credit and liquidity risk premia. This response likely reflected the large guarantees extended by the U.K. government to depositors of a mortgage lender Northern Rock. The authorities provided stronger support for depositors than the latter anticipated (as manifested by the run on the bank) and also guaranteed wholesale creditors. Other countries used few liability guarantee measures during the subprime period, and these measures were smaller in magnitude. During the global phase, announcements about liability guarantees were not followed by lower liquidity and credit risk premia in interbank markets. In fact, spreads widened after such announcements, possibly owing to the fact that many announcements were implemented in response to the Irish government's decision to introduce a blanket guarantee and concerns that such decisions would result in regulatory arbitrage and outflows of deposits to countries with more generous guarantees and deposit protection.

News about asset purchase programs was followed by an initial decline and a subsequent increase in credit and liquidity risk premia, although these effects were statistically insignificant. One possible reason for the more volatile impact of announcements about asset purchases than those about liability guarantees and recapitalization is markets' concern about the potential ineffectiveness of asset purchases—owing to banks' unwillingness to realize implicit losses out of fear that participation in asset purchase programs would be interpreted as a negative signal about their soundness. Hoshi and Kashyap (2008) point to banks' stigma derived from participating in the asset purchase program and their reluctance to sell the distressed assets at current market prices (below their fundamental value).

4.2.5. Ad hoc bank bailouts and failures

The impact of ad hoc bank bailouts of individual institutions by far outsized the impact of other policy interventions during the global phase. Bailouts were accompanied by a greater than 60 basis point increase in the Libor–OIS spread on average in that period (Fig. 1).[11] Announcements of bailouts tended to send shockwaves through markets as they suggested the possibility of failure of a systemic institution. In most cases, bailouts were carried out with constructive ambiguity about the government's willingness to provide further support to banks—an intentional difference compared to system-wide recapitalization and liability guarantee programs. While we acknowledge the possible endogeneity of policy actions in these particular instances, banks may have interpreted bailout announcements as evidence of forthcoming bad news about the soundness of other financial institutions amid increased uncertainty about the government's intentions of supporting them. As a result, bailouts may have not been able to mitigate asymmetric information and uncertainty about counterparty risk—the main causes of stress in interbank markets (Heider et al., 2009). Market response to ad hoc bailouts was similar to that of bank failures, both in sign and magnitude.

4.3. Robustness checks

4.3.1. Event window

To evaluate the robustness of results, we first consider a narrower event window (three days and one day instead of five). We make commensurate adjustments to the sample of non-contaminated global watershed events as fewer event windows of policy announcements overlap. The narrowing of the event window does not affect the main conclusions, with the results showing a small variation typical of event studies (Table 3).

4.3.2. Policy expectations

Controlling for the surprise content of monetary announcements confirms the earlier results, but at a lower level of statistical significance. Standardized surprises of interest rate changes were not associated with significant declines of the interbank risk premia during the global crisis (Table 3). One possible explanation why the results for measures of surprises are not statistically significant is that during a crisis both the expected and unexpected components of policy announcements may have material effects owing to high uncertainty surrounding expectations and rapidly changing policy environment. As McQueen and Roley (1993) show, the effect of macroeconomic releases depends not only on their new informational content but also the state of the economy and financial markets in which investors interpret them. In normal times, policy announcements, for example, interest rate decisions, may be better anticipated than during crises (Bernanke and Kuttner, 2005). Fiscal policy surprises also do not render statistically significant results, in part owing to an insufficient precision of the underlying measure of surprises.

4.3.3. Alternative measures of financial distress

Lastly, we confirm that the main results hold across alternative measures of financial distress. During the global phase of the crisis, all system-wide measures of interbank risk premia – the NYFR-OIS rate, the TED spread, the expected Libor–OIS spread, and the spread of repo transactions to the risk-free rate – registered an improvement after announcements of interest rate cuts, quantitative and credit easing, domestic liquidity support, and recapitalization programs (Figs. 3 and 4, Table 4). Surprises about fiscal and monetary policy easing were also consistently associated with a decline in interbank risk premia. By contrast, announcements of ad hoc bank bailouts and failures as well as decisions to keep interest rates stable or increase them were associated with a widening of all measures of interbank risk premia. Announcements' effects on other measures – of macroeconomic prospects and financial volatility (the equity price index and VIX) and bank-specific default risks (CDS spreads) – were similar.

4.3.4. Alternative reference time for the financial market series

Although the daily frequency of the study is constrained by the unavailability of information on the hour of policy announcements and the absence of intraday quotations of the Libor rate, we check the sensitivity of results to using price changes between alternative times of day for the expected Libor–OIS spread implied by futures prices at one-year maturity. We consider price changes between the closing times as well as between the opening and closing of markets on each day during the event

[11] During the subprime phase of the crisis, market response to ad hoc bank bailouts was smaller and statistically insignificant, possibly because concerns about counterparty risk were less acute and related more to idiosyncratic reasons, such as weak bank management, than to the overall strength of bank balance sheets.

Table 4
Robustness to using alternative measures of financial risk.

		3-month LIB OR-OIS spread	3-month NYFR-OIS spread[a]	3-month LIB OR-OIS future spread[b]	Repo-risk free spread[c,d]	TED spread[c,e]	VIX[c,f]	CDS composite index[c]	Equity composite index[c]
Subprime phase									
Fiscal policy		↑	–	–	↑	↑	↑	↑	↑
	Interest rate cuts	↓*	–	–	↑	↑	↓	↓	↑
Monetary policy	Stable/increase of interest rates	↑	↑	↑	↓	↓	↑	↑*	↓
	Quantitative and credit easing	–	–	–	–	–	–	–	–
Liquidity support	Domestic currency support	↑	↑	↓	↓	↑	↑	↑*	↑
	Forex swaps	↓***	–	–	↑	↓*	↑	↑*	↓**
Financial sector policy	Recapitalization	–	–	–	–	–	–	–	–
	Assets purchases	–	–	–	–	–	–	–	–
	Liability guarantees	↓**	–	↑	↓	↓	↓	↑	↑
Bailouts		↑	↑	↓	↑	↑	↑	↑	↓
Failures		↑	↑	↑	↑	↑	↑	↑*	↑
Surprises	Fiscal policy	–	–	–	–	–	–	–	–
	Monetary policy	↓	↓	↑	↑	↓*	↓*	↓*	↑*
Global phase									
Fiscal policy		↓	↓	↑	↑	↑*	↓	↑	↓
Monetary policy	Interest rate cuts	↓*	↓**	↓	↓	↓*	↓	↓	↓
	Stable/increase of interest rates	↑	↑	↓	↑	↑	↑	↑	↓
	Quantitative and credit easing	↓	↓	↑	↓	↓	↓	↑	↓
Liquidity support	Domestic currency support	↓*	↓	↑	↓	↓	↓*	↓*	↑
	Forex swaps	↑	↑	↓*	↓	↑	↑	↑	↑
Financial sector polcy	Recapitalization	↓**	↓**	↑	↓	↓*	↓	↑	↓
	Asset purchase	↑	↑	↓	↓	↑	↑	↓	↓
	Liability guarantees	↑	↑	↓	↓*	↑	↑	↓	↓
Bailouts		↑*	↑	↑	↓	↑	↑	↑	↑
Failures		↑*	↑**	↑	↑**	↑**	↑*	↑*	↓
Surprises	Fiscal policy	↓	↓	↑	↑	↑*	↓	↓	↑
	Monetary policy	↓	↓	↑	↓	↓*	↓	↓*	↓*

Note: An arrow"↑" ("↓") indicates an increase (decrease) of the corresponding market indicator. "–"denotes that no observations were available due to the absence of such policy measure or the late sample starting date (in the case of the New York Funding Rate and the Libor–OIS futures rates). Asterisk***, **, and * indicate statistical significance (two-tailed, standard normal distribution or the generalized extreme value (GEV) distribution, whichever is more stringent) at the 1, 5 and 10% level based on the parametric and nonparametric tests. Statistical significance is assigned if all parametric and non-parametric tests are consonant with each other at the significance level of at least 10%; the lowest value of the test statistics is used.

[a] In contrast to LIBOR, which represents a quote of the benchmark rate of interest at which banks can expected to lend funds to each other in the London interbank market, the New York Funding Rate (NYFR) is the representative transaction rate at which an institution would be likely to obtain funding in the market. The NYFR was launched on June 2, 2008 by the inter-dealer brokerage ICAP in response to market concerns about the accuracy of the LIBOR fixing and the panel composition of contributing banks.

[b] The future contract on the 3-month Libor–OIS spread. A positive value indicates elevated liquidity and credit risks in the future compared to the present. The Libor–OIS contract is taken at one-year maturity.

[c] Controlling for expectations over the 20-day pre-event window.

[d] Based on the 3-month government bond yield.

[e] The TED spread is defined as the difference between the LIBOR rate at a maturity term of 3 months.

[f] VIX is the Volatility Index, created by the Chicago Board Options Exchange as a measure of equity market volatility. The computation of VIX is based on the implied volatility of eight option series on the S&P 100 index, or OEX. VIX is quoted in percent per annum.

window. The results are largely unchanged, with the switch in the reference time hardly affecting economic and statistical significance.

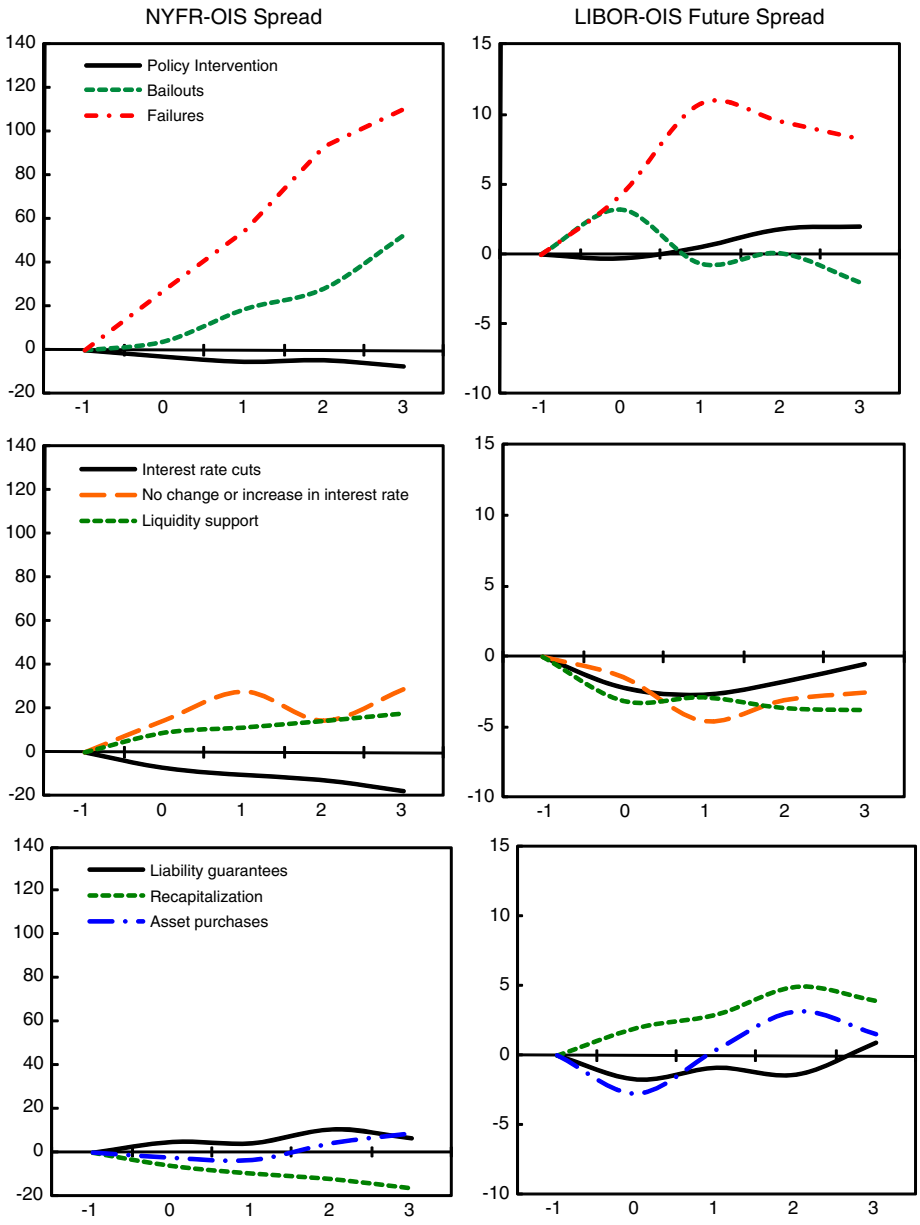
4.4. Analysis of policy spillovers

In the global financial system, crisis policy initiatives taken by systemically important countries are likely to have bearing on market conditions in other countries. An analysis of market responses to country-specific announcements confirms that they indeed had statistically significant effects beyond national borders and that these effects intensified as the crisis deepened. Table 5 reports the main findings of statistical tests of domestic and foreign policy announcements on the Libor–OIS spreads for the respective currencies.

4.4.1. Monetary policy

International spillovers from interest rate cuts were significant during the global phase, with all countries benefiting from the interest rate reductions undertaken by their peers. The United States implemented aggressive interest rate cuts during the subprime crisis and so did the United Kingdom during the global phase. Other countries either did not cut interest rates (the euro area and Japan during the subprime crisis) or did so much more gradually, possibly owing to concerns about reaching the zero-interest-rate floor (for example, the United States and Japan during the global crisis) and concerns about price stability and the functioning of the money market (for example, the ECB during the global phase). However, our results show that even gradual and moderate monetary easing had significant positive international spillovers.

The U.S. and U.K. announcements about the use of unconventional monetary policy were accompanied by reductions in interbank credit and liquidity risk premia domestically and had positive international spillovers for Japan and the euro area. These results may reflect the large scale of unconventional monetary operations pursued by the Bank of England and the Federal Reserve. The main difference in their approaches was the Bank of England's narrow focus on purchases of



Source: Authors' estimates.
Note: The variable plotted on the vertical axis shows the average cumulative abnormal differences (ACADs) in basis points within the event window of one day before the event and three days after the event, scaled to zero on the first day of the event window using the average abnormal difference on the first event day. This effectively introduces a one-day lag and reduces the event window to four days. The horizontal axis shows days within the event window, with "0" corresponding to the day of the announcement.

Fig. 3. Impact of policy announcements on the NYFR–OIS spread and the Libor–OIS spread during the global crisis phase, September 16, 2008–March 31, 2009.

government paper and the Federal Reserve's coverage of a broad range of instruments, in part to support asset prices, particularly those of mortgage-backed securities. The Bank of Japan announced limited purchases of equities from banks, which had positive spillovers for the euro area. The ECB's small program to buy covered bonds apparently did not give rise to spillovers.

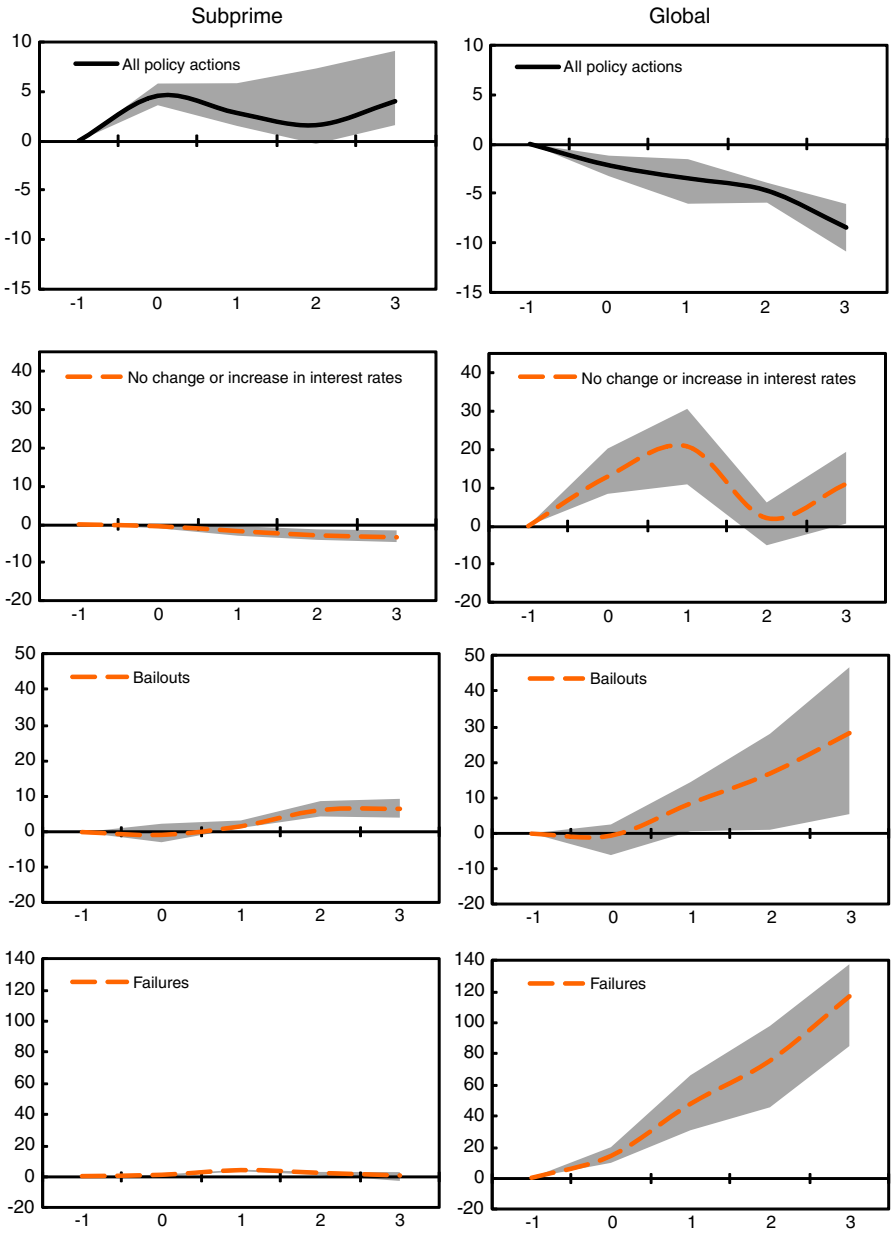
4.4.2. Liquidity support

Announcements of domestic currency liquidity support do not appear to have resulted in significant international spillovers, consistent with the weak results for this type of announcements reported in Table 3. Even if the provision of liquidity support may have helped to reduce funding pressures for those institutions that had access to liquidity facilities, which included the large global financial institutions, this effect did not translate to a reduction in interbank risk premia in foreign markets.

By contrast, announcements of forex swaps by the euro area's and the U.K. authorities had significant positive spillovers in the U.S. (and global) interbank markets. This finding is consistent with the strong results for forex swaps in Table 3. They suggest that funding pressures were seen by markets as an important channel for propagation of the crisis, and the introduction of forex swaps helped allay concerns about such funding pressures, with positive effects on counterparty risks.

4.4.3. Fiscal easing

Fiscal policy announcements generally had positive, although not always statistically significant spillovers. U.S. announcements of fiscal



Source: Authors' estimates.
Note: The variable plotted on the vertical axis is the median value of the average cumulative abnormal differences (ACADs) in basis points within the event window of one day before the event and three days after the event, scaled to zero on the first day of the event window using the average abnormal difference on the first event day, across five alternative measures of market response (TED spread, NYFR-OIS spread, repo-riskfree rate spread, and the LIBOR-OIS futures spread of sample countries. This effectively introduces a one-day lag and reduces the event window to four days. The grey shaded area shows the inter-quartile range (IQR) of values between the 25th and 75th percentile. The horizontal axis shows the days within the event window, with "0" corresponding to the day of the announcement.

Fig. 4. Impact of policy announcements on alternative measures of financial distress, June 1, 2007–March 31, 2009 (in basis points).

stimulus stand out in this regard, as they clearly had strong positive international spillovers during the subprime crisis. During the global phase, when other countries have also embarked on fiscal easing, policy spillovers were more multi-directional, albeit less statistically significant. An interesting aspect of the results concerning fiscal policy announcements is that they show that even if a policy measure did not aim to alleviate stress in a particular market (interbank market in our case) and was not followed by any improvements in this market, it may still have international spillovers, possibly reflecting asymmetric information and the resulting differences in perceptions of how this measure would affect risk premia.

4.4.4. Financial restructuring

The results for liability guarantees are similar to those for fiscal policy, with clear evidence of international spillovers from a single measure, in this case, announcement of U.K. liability guarantees

Table 5
Bilateral and global spillovers from crisis policy announcements.
Source: Authors' estimates.

		Subprime phase				Global phase			
		United States	United Kingdom	Euro area	Japan	United States	United Kingdom	Euro area	Japan
Fiscal policy		–	US	US	US	JP	EU	UK, JP	EU
Monetary policy	Interest rate cuts	o	o	o	US	JP	EU, JP	US, JP	EU
	Higher/stable interest rates	o	o	o	US, EU	o	o	o	o
	Quant./credit easing	–	–	–	–	o	o	US, UK, JP	US, UK
Liquidity support	Domestic currency	o	o	o	o	o	o	o	US
	Forex swap lines	EU, UK	o	o	o	o	–	–	–
Financial sector policy	Recapitalization	–	–	–	–	EU	US, JP	US	o
	Asset purchases	–	–	–	–	o	EU	o	EU
	Liability guarantees	UK	US	UK	o	JP	US	US	EU
Failures and bailouts		o	*JP*	*UK*	*US, EU*	*EU*	*US*	o	*US*

Note: Abbreviated country names ("US" for the United States, "UK" for the United Kingdom, "EU" for the euro area, and "JP" for Japan) indicate statistically significant spillover effects of domestic policies on the corresponding country, based on bilateral country analyses. The column headers are the countries which received spillovers. The country abbreviations in cells indicate the countries where spillovers originated ("bilateral spillover"). Italics indicate an increase in the Libor–OIS spread due to bilateral spillovers, while the regular font means a decrease. "o" indicates that spillovers (whether positive or negative) were statistically insignificant. "–" means that spillovers were not feasible, i.e., foreign announcements in the respective policy category did not occur or did not qualify as a front-page event.

during the subprime crisis. This finding is consistent with the results in Table 3 for liability guarantees. During the global phase, spillovers from liability guarantees were positive but statistically insignificant. Likewise, spillovers from announcements of recapitalization programs (by the United States, euro area, and Japan) were positive during the global stage of the crisis but statistically insignificant. Announcements of asset purchase programs were not associated with significant international spillovers, consistent with results in Table 3. There is some evidence that announcements of asset purchases by the eurozone authorities were accompanied by a reduction in interbank risk premia in foreign markets.

4.4.5. Ad hoc bank bailouts and failures

Announcements of ad hoc bank bailouts and failures had pervasive international spillovers, particularly between the United States and the euro area during the global stage of the crisis. This finding may reflect market's awareness of large cross-border exposures of banking institutions and the risk of bank contagion.

5. Conclusion

An immediate positive market response to announcements of policy initiatives during a financial crisis may be self-fulfilling and indicative of whether these initiatives would help to restore confidence. This paper constructs a unique database of policy announcements and uses it to provide a broad-based assessment of the immediate market responses to a wide array of policy measures introduced by systemically important advanced economies during the recent crisis between June 1, 2007 and March 31, 2009. Results are derived using a parsimonious event study methodology, which is well designed to deal with the limited sample size of policy announcements. The validity of findings is evaluated using the gamut of alternative specifications. The main focus is on risk premia in interbank markets, and various other measures of financial distress are considered as part of robustness checks. Several policy implications emerge from the study:

First, market moves surrounding policy announcements suggest that markets saw interest rate cuts and bank recapitalization as the most promising policy steps to resolve the crisis. The result concerning recapitalization lends support to the views expressed by prominent academics in real time (for example, Eichengreen and Baldwin, 2008), as well as the importance given to recapitalization in the post-sample policy actions, particularly stress tests in the United States. No strong evidence that domestic liquidity support helped relieve pressures in the interbank markets was found (consistent with Taylor and Williams, 2009), while announcements of forex swaps were associated with significant declines in interbank risk premia (similarly to Baba and Packer, 2009).

Second, the paper finds that domestic policy initiatives often had significant bearing on credit and liquidity risk premia in foreign interbank markets. International spillovers of policy announcements increased as the crisis deepened and policymakers intensified their efforts to restore financial stability. All in all, markets' response to announcements appears consistent with a view that an internationally coordinated policy response was best suited to restore market confidence when the crisis became global. But even in the absence of explicit policy coordination, "natural" international policy spillovers appear to have played an important role by helping calm investors' concerns.

Third, some policy decisions, for example, decisions to bail out banks in an ad hoc bank manner, on a case-by-case rather than systematic basis, were associated with significant increases of credit and liquidity risk premia in the interbank market. Ad hoc bailouts targeted at individual systemic institutions were accompanied by a worsening of market fears, possibly because they were perceived as a signal that problems in the financial sector were worse than originally assumed by markets and/or that the authorities chose not to follow a systematic, principle-based response to a crisis. Market response to ad hoc bailouts was similar to that of bank failures. By contrast, systematic, principle-based efforts to restore the health of the financial sector through recapitalization programs were found to have elicited a consistently positive market response.

Notwithstanding the robustness of the results, they need to be taken with a caveat of possible endogeneity problems, challenges of evaluating counterfactuals, and the fact that at some stages of the crisis, there might have been no good alternatives to a given policy response, for example, an ad hoc bailout of a large financial institution. Also, the analysis does not provide a comprehensive causal assessment of policy effectiveness during a financial crisis; it focuses on an immediate market response to policy announcements, which tends to have a bearing on but may not always be indicative of the long-term effectiveness of policies. Nonetheless, the study has an important merit: it points to the types of policy announcements that were associated with a reversal of market sentiment during the financial crisis, and such a reversal was, without a doubt, a key goal of crisis containment.

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