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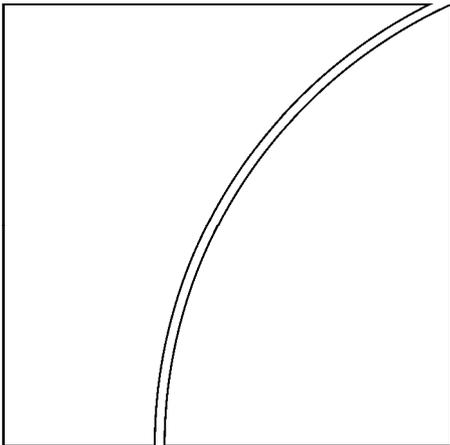
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Time to buy or just buying time? The market reaction to bank rescue packages

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Time to buy or just buying time? The market reaction to bank rescue packages

Michael R King¹

Abstract

This paper reviews the market reaction to bank rescue packages announced in six countries between October 2008 and January 2009. The study distinguishes the impact on creditors as seen in the change of CDS spreads from the impact on shareholders as seen in the movement of bank stock prices. Government interventions benefited creditors at the expense of shareholders, with bank CDS spreads narrowing around the announcements in all cases. Despite a brief positive reaction, bank stock prices continued to underperform in all countries except the United States where the favourable terms of the government support allowed bank stocks to outperform.

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1 Introduction

In October 2008 a number of countries announced *comprehensive* rescue packages to support systemically important banks.² In contrast to ad hoc efforts targeting specific institutions, comprehensive rescue packages offered assistance to all eligible banks within a country and consisted of some combination of government capital injections, debt guarantees, and actions to address impaired assets. These announcements followed earlier exceptional measures to provide banks with short-term funding through central bank facilities, to restrict the short-selling of financial stocks, and to prevent bank-runs by offering or increasing guarantees on bank deposits. This note examines the market reaction to the announcement of comprehensive rescue packages in six countries that accounted for the bulk of policy interventions over this period, namely: the United States, United Kingdom, France, Germany, the Netherlands and Switzerland.

The immediate objective of government interventions was to avoid a repeat of the Lehman bankruptcy of 15 September 2008 with its dramatic and destabilising impact on markets and investor confidence. The medium-term objective was to restore confidence and stability in banks and the financial system in order to restart the supply of credit to households and businesses. While government interventions protected bank depositors and calmed financial markets, these actions were less successful in restoring market confidence in the banking sector. Bank access to private sector capital remained restricted through the end of the year, with little or no access to private borrowing or equity markets. Instead banks remained dependent on government guaranteed debt issuance and capital injections, with some banks being taken into government ownership. Government interventions did avoid further bankruptcies, however, and bought policymakers valuable time to analyse the situation and to formulate a policy response. But the continued weakness in bank stocks and the need for subsequent government interventions suggested that bank shareholders did not view rescue packages as a buying opportunity. The exception is the United States where the favourable terms of the government support were positively received by bank shareholders, allowing US bank stocks to outperform the broader equity market over the period studied.

We measure the market reaction using an event study of the 52 largest banks in these six countries. An event study is a purely statistical exercise that looks narrowly at price movements around an event relative to the market. The study distinguishes the impact on creditors, as seen in the movement of banks' credit default swap (CDS) spreads, from the impact on shareholders, as seen in the reaction of bank stock prices.^{3,4} While rescue

² An earlier version of this study was prepared in March 2009 for the Financial Stability Forum. For an extensive assessment of financial sector rescue packages, see Panetta et al (2009).

³ A credit default swap (CDS) is a contract between a protection buyer who makes periodic payments to the protection seller, and in return receives a payoff if an underlying reference bond undergoes a credit event. CDS contracts are analogous to insurance, because the buyer pays a premium and receives a sum of money if one of the specified credit events occur. The CDS spread represents the total sum of payments per year as a percentage of the swap's notional amount. A spread of 100 basis points (or 1%) on a bond with notional amount of \$1,000,000 equates to an annual payment of \$10,000.

⁴ CDS offer a number of advantages over bond spreads for measuring the response of creditors. CDS are more liquid, require less capital, and are more actively traded than the underlying bonds. Bond spreads are also sensitive to the choice of risk-free benchmark and can reflect other factors that are not related to default risk, such as tax differences between government and corporate bonds (Jorion and Zhang 2007). Das and Hanouna (2006) provide a survey of the early CDS literature, including the seminal study by Longstaff et al. (2005). Recent contributions include Alexander and Kaeck (2008), Chen et al. (2008), and Huang, and Zhou and Zhu (2008).

packages should reduce the probability of a default and push down CDS spreads, the impact on bank stocks is less clear. The benefit of a stronger capital base and the lower probability of financial distress must be weighed against the potential dilution of existing shareholders and any restrictions on the payment of dividends. From a systemic standpoint, bolstering the confidence of creditors was viewed as more important than protecting shareholders whose capital investment is designed to bear losses. More weight is therefore given to the impact on CDS spreads when assessing the effectiveness of government interventions.

This study contributes to a growing literature on the 2007-2009 financial crisis, with existing studies focusing on the causes, the policy response, and the lessons to be drawn from the crisis.⁵ Much of this analysis has been produced as the crisis unfolded, with a focus on the United States where the subprime turmoil originated. This study makes three contributions to this literature. First, it provides an empirical assessment of the market response to the government rescue packages, both at the country-level and the bank-level. Such an assessment is one input when judging whether the interventions were successful. In contrast to most work on the crisis, the current analysis looks beyond the United States to the European response. Such a cross-country comparison highlights how the design of rescue packages conditioned the market response and identifies strategies that were more effective in restoring investor confidence. Second, this study examines the wealth transfer between creditors and shareholders of government rescue packages, similar to studies of other corporate events.⁶ Third, this study contributes to a growing literature on CDS spreads. While a number of researchers have examined CDS spreads as a measure of credit risk, our paper uses movements in CDS spreads to measure the reaction of bank creditors to the announcement of rescue packages. A similar methodology has been used in two papers by Jorion and Zhang (2007, forthcoming) who study the reaction of CDS spreads to US bankruptcy announcements.⁷ Similar to Jorion and Zhang, we focus on jumps in CDS spreads as a negative signal about the financial condition of banks, even though the formal ISDA definition of a credit event is broader than simply default or bankruptcy.⁸ Our paper differs to their study by employing a multi-factor model to measure the creditor reaction, and by applying this approach to the current financial crisis.

Overall, the rescue efforts undertaken between October 2008 and January 2009 benefited creditors at the expense of shareholders. While bank CDS spreads widened relative to the market following Lehman's September 15 bankruptcy, these spreads recovered around the announcement of government rescue packages and continued to narrow over the subsequent weeks in all six countries studied. We find that creditors anticipated the formal

⁵ Baba and Packer (2009), BIS (2008, 2009), Borio and Nelson (2008), Calomiris (2009), Diamond and Rajan (2009), Eichengreen et al. (2009), Gorton (2009), Greenlaw et al. (2008), Hör Dahl and King (2008), and Praet and Nguyen (2008), among others, discuss the origins and propagation of the crisis. Acharya and Richardson (2009), Brunnermeier et al. (2009), Harvey (2008), IMF (2008), Swagel (2009), and Taylor (2009), among others, discuss the policy response and draw lessons from the crisis.

⁶ In terms of the wealth effects of corporate events on creditors and shareholders, Warga and Welch (1993) study leveraged buyouts, Billett, King and Mauer (2004) study mergers and spin-offs, Eberhart and Siddique (2002) study equity offerings and Maxwell and Stephens (2003) study share repurchases.

⁷ Jorion and Zhang (2007) look at the contagion and competition effects of Chapter 7 and Chapter 11 bankruptcies. Jorion and Zhang (forthcoming) empirically measure credit contagion created by counterparty exposures following Chapter 11 bankruptcies. Both studies employ an event study of CDS spreads, while the latter paper also looks at stock price movements.

⁸ Standard ISDA documentation defines six credit events: (1) bankruptcy; (2) failure to pay (the reference entity fails to make interest or principal payments on one of its obligations when due); (3) debt restructuring that adversely affects creditors; (4) obligation default (the reference entity defaults on any of its obligations); (5) obligation acceleration; or (6) repudiation / moratorium. During this period, ISDA would hold an open conference call with market participants to vote and reach consensus on whether a credit event had occurred.

announcement of rescue packages, with bank CDS spreads outperforming the market following the rescue of key banks in late September and prior to the formal announcements in early October. Despite this anticipation, CDS spreads show a large reaction to the announcements. Creditors in banks that did not receive government capital injections or asset support reacted similarly to banks targeted by government actions, suggesting rescue efforts reduced the likelihood of a default across all banks on average. Despite a brief positive reaction when the rescue plans were announced, bank stocks underperformed the market over the subsequent weeks in the six countries studied led by the German, Dutch, and UK banks. The stock prices of banks accepting government support significantly underperformed banks not receiving support, suggesting the receipt of government capital or asset support was viewed as a negative signal of the bank's health. These results are clear at the level of the banking system as a whole, but the results are mixed when looking at banks targeted by specific actions.

This preliminary assessment does not consider the counterfactual case in which governments did not intervene to support systemically important banks. While a market disruption similar to the Lehman Brothers bankruptcy was avoided, a number of banks have been taken into government ownership and further actions may be needed to restore investors' confidence in banks. The recovery in banks stocks in March 2009 and the increased access to private sources of capital following the publication of the US stress tests in May 2009 are positive signs in this direction. At this juncture it is also too early to assess the impact rescue packages have had on restoring the flow of credit to the real economy.

The second section provides an overview of the bank rescue packages. The third section describes the data and the event study methodology. The fourth section employs a top-down analysis of the market reaction to the announcement of rescue packages by examining the average country-level reaction of bank CDS spreads and stock prices. The fifth section takes a bottom up approach and looks at the reaction of banks targeted by a specific action. The sixth section discusses the robustness of these results. The final section concludes.

2 Timeline of announcements

The announcement of comprehensive rescue packages in October 2008 followed earlier measures to provide banks with short-term funding through central bank facilities and to prevent bank-runs by offering or increasing guarantees on bank deposits (Table 1). A timeline of government actions and announcements is available in Appendix A. Pressure on the banks increased dramatically in mid-September after Lehman Brothers filed for bankruptcy, causing a severe and prolonged market dislocation. In this panicked environment, investors, creditors and counterparties questioned the solvency of many systemically-important financial institutions. Bank equity prices turned sharply lower and spreads on CDS swaps widened as the risk of a default increased.

Given their importance for the functioning of the real economy, governments took action to prevent the collapse of major banks and to restore confidence in the financial system. To prevent a run on banks and protect a vital source of bank funding, government introduced or raised coverage under deposit insurance schemes. In the United States, US Secretary Paulson announced plans for the Troubled Asset Relief Program (TARP) in a press conference on 19 September. After being rejected initially by Congress on 29 September, the modified TARP was approved on 3 October. To stem the sell-off following the collapse of Lehman Brothers, many countries imposed bans on the short-selling of designated financial sector stocks, including all the countries studied here. In late September European governments intervened to rescue or nationalise specific institutions, such as Fortis in the Benelux countries (29 September), Bradford & Bingley in the United Kingdom (29 September), Dexia in France and Belgium (30 September), and Hypo Real Estate Bank in Germany (6 October). Despite these efforts, the situation continued to deteriorate with

Table 1
Overview of comprehensive rescue plans
 15 September 2008 to 30 January 2009

Measure	United Kingdom	Netherlands	Germany	France	United States	Switzerland
Capital injections	8 Oct	9 Oct	13 Oct	13 Oct	14 Oct	16 Oct
Debt guarantees	8 Oct	14 Oct	13 Oct	13 Oct ¹	14 Oct	5 Nov
Asset insurance	19 Jan	26 Jan			24 Nov	
Asset purchases			13 Oct		3 Oct ²	16 Oct
Other measures:						
Central bank liquidity operations	Yes	Yes	Yes	Yes	Yes	Yes
Short selling restrictions	18 Sep	21 Sep	21 Sep	21 Sep	18 Sep	21 Sep
Deposit insurance	3 Oct	10 Oct	6 Oct		3 Oct	5 Nov
Ad hoc bank support actions	29 Sep	29 Sep	6 Oct	30 Sep		

¹ Via the Société de financement de l'économie française. ² Plans for the Troubled Asset Relief Program (TARP) were made public on 19 September. The TARP was voted down by Congress on 29 September, but approved in revised form on 3 October.

Sources: BIS (2009); national websites; bank's websites.

interbank markets coming to a virtual stand-still while liquidity in markets evaporated and volatility increased.

The failure of these *ad hoc* actions to restore confidence led to the announcement of *comprehensive* rescue packages, beginning with the United Kingdom on 8 October. Comprehensive rescue packages sought to address various concerns with the funding and capital positions of the banks and consisted of some combination of capital injections, debt guarantees, and actions to address impaired assets through the provision of asset insurance or asset purchases. Within days leading economies issued similar announcements, notably the Netherlands on 9 October, France and Germany on 13 October, and Switzerland on 16 October. In a reversal of its earlier position, the US Treasury announced on 14 October that \$250 billion of TARP funds would be used to recapitalise the banks. These government announcements were accompanied by public statements that, where possible, no systemically-important institutions would be allowed to fail.⁹

Unlike ad hoc actions targeting specific institutions, comprehensive rescue packages were provided to all eligible banks within a country. Governments recapitalised the banks to increase the amount of equity in their capital structures, to reduce their financial leverage and to increase their solvency. Governments in the six countries studied injected capital in the form of common shares, preferred shares, subordinated debt, convertible notes or silent

⁹ See the G-7 Finance Ministers and Central Bank Governors Plan of Action, 10 October 2008.

participations. Under government debt guarantees, the government provides explicit support for creditors purchasing bank debt and other bank liabilities issued by eligible banks in return for an annual fee paid by the issuer. Such guarantees facilitated the refinancing of maturing bank debt. Under asset purchases or insurance, the government assumes part or all of the economic risks of a specific portfolio of assets. This action reduced the regulatory capital a bank must hold by limiting the potential losses from these portfolios thereby reducing the bank's risk-weighted assets and its required capital. These schemes were also designed to improve a bank's ability to raise new private capital. As a last resort, governments took control of a number of insolvent banks to protect depositors and prevent contagion to other financial institutions.¹⁰

The clustering of rescue package announcements in early October, and the likely cross-border effects, make it likely that market participants in neighbouring countries anticipated announcements from their own governments. A second round of announcements took place in late-October and early November as governments modified their plans to avoid competitive distortions across borders. The Dutch and Swiss governments added debt guarantees. The United Kingdom announced an asset insurance scheme in mid-January. Several US and Dutch banks were offered asset insurance in November and January, respectively, while others received more capital injections.

Contrary to what might be expected, broad measures of market uncertainty continued to rise after the announcement of bank rescue packages as market participants sought to digest all the announcements and their implications. US dollar Libor-OIS spreads, which began September around 75 basis points, increased to over 100 basis points on the day following Lehman's bankruptcy. They continued to rise following the announcement of rescue packages, hitting a peak of over 250 basis points by mid-October and only falling to 100 basis points again by January 2009. Similarly the implied volatility on national stock market indices rose from around 20% in August 2008 to above 50% in October and November. The VIX spiked above 80% on 27 October and again on 20 November. Implied volatility of European exchanges exhibited a similar pattern and remained at historically high levels for much of this period. These market indicators suggest that this period was characterised by increased event-induced variance, which presents difficulties for standard statistical tests as discussed below.

3 Data, methodology and hypotheses development

This section provides an overview of the sample and data sources, before describing the event study methodology. It then outlines how CDS spreads and bank stock prices should be expected to respond based on theory and empirical studies of similar corporate events.

3.1 Data

Table 2 provides an overview of the 52 banks in the sample, including the year-over-year change from January 2008 to January 2009 in their average market capitalisation and CDS spreads. These banks represent the largest, publicly-traded banks headquartered in their respective countries as reported in *The Banker* magazine, Bankscope, and national websites. To be included in the sample, a bank had to be in existence as of year-end 2008,

¹⁰ This transfer of control was accomplished directly by supervisors (in the case of the US GSEs and Icelandic banks), or through the courts (Bradford & Bingley, Fortis NV). In some cases governments took control indirectly by acquiring the majority of the voting shares (AIG, Royal Bank of Scotland).

Table 2
Overview of sample

	Bank name	Weight in stock	Average market capitalisation (billions of original currency)			Senior bond CDS spread ¹ (basis points)		
		index Jan 2008	Jan 2008	Jan 2009	% change	Jan 2008	Jan 2009	Change
US	Bank of America ²	1.4%	221,186	60,686	-73%	72	162	90
	Bank of New York Mellon	0.4%	52,651	28,694	-46%			
	BB & T	0.1%	16,651	12,198	-27%			
	Capital One Financial	0.1%	18,839	9,885	-48%	368	290	-78
	Citigroup Inc	1.1%	135,905	26,728	-80%	83	263	180
	Firth Third Bancorp	0.1%	12,917	3,192	-75%			
	Goldman Sachs	0.7%	78,139	35,552	-55%	85	292	207
	JP Morgan Chase & Co.	1.1%	142,654	96,142	-33%	69	136	67
	Keycorp	0.1%	9,081	3,704	-59%			
	Merrill Lynch & Co. ²	0.4%	n.a.	n.a.	n.a.	147	178	31
	Morgan Stanley	0.4%	53,034	19,449	-63%	116	391	275
	Northern Trust	0.1%	15,888	11,768	-26%			
	PNC Financial	0.2%	20,980	16,921	-19%			
	Regions Financial Corp	0.1%	15,014	4,250	-72%			
	State Street and Trust	0.2%	31,013	13,831	-55%			
	SunTrust Banks	0.2%	21,516	7,288	-66%			
	US Bancorp	0.4%	53,827	33,179	-38%	45	140	95
Wachovia Bank ³	0.6%	n.a.	n.a.	n.a.	123	153	30	
Wells Fargo ³	0.8%	163,808	80,855	-51%	43	111	68	
	Total	8.6%						
UK	Barclays Bank	2.2%	31,175	10,316	-67%	64	162	98
	HBOS	1.8%	25,212	9,431	-63%	74	108	34
	HSBC Bank	6.5%	93,264	70,767	-24%	54	105	51
	Lloyds TSB Bank	2.9%	24,287	10,704	-56%	52	107	55
	Royal Bank of Scotland	1.7%	39,966	13,159	-67%	69	122	53
	Standard and Chartered	1.8%	24,042	15,694	-35%	59	176	117
	Total	16.9%						
FR	BNP Paribas	6.2%	63,203	26,989	-57%	42	64	22
	Crédit Agricole	1.9%	35,589	18,902	-47%	55	76	21
	Credit Industriel et Comm.	Na	8,144	3,414	-58%			
	Dexia	1.0%	19,469	5,138	-74%			
	Natixis	na	14,742	3,618	-75%	66	249	183

	Bank name	Weight in stock	Average market capitalisation (billions of original currency)			Senior bond CDS spread 1 (basis points)		
		index Jan 2008	Jan 2008	Jan 2009	% change	Jan 2008	Jan 2009	Change
	Société Générale	4.3%	41,386	19,029	-54%	54	96	42
	Total	13.4%						
DE	Commerzbank	2.0%	14,970	3,095	-79%	59	71	12
	Deutsche Bank	5.6%	42,611	12,723	-70%	55	117	62
	Deutsche Postbank	0.6%	9,664	2,432	-75%			
	DZ Bank	na	Not listed		n.a.	61	125	64
	Hypo Real Estate Holding	0.9%	5,305	457	-91%			
	Total	9.2%						
NL	Fortis	6.4%	35,229	3,102	-91%	72	140	68
	ING Bank	13.4%	53,483	14,296	-73%	64	114	50
	Rabobank	na	Not listed		n.a.	35	135	100
	SNS Reaal	na	3,564	859	-76%			
	Van Lanschot	na	1,318	888	-33%			
	Total	19.8%						
CH	Banque Cantonale Genève	na	988	777	-21%			
	Banque Cantonale Vaudois	na	3,950	2,758	-30%			
	BEKB / BCBE	na	1,993	2,089	5%			
	Credit Suisse	6.8%	71,144	32,222	-55%	59	153	94
	EFG Bank Fin'l Group	na	5,392	2,377	-56%			
	Julius Baer Holding Ltd	2.0%	17,787	8,279	-53%			
	Luzerner Kantonal Bank	na	2,200	2,112	-4%			
	Neue Aargauer Bank	na	2,168	2,079	-4%			
	St. Galler Kantonal Bank	na	2,640	2,115	-20%			
	UBS	10.2%	98,015	42,730	-56%	58	219	161
	Zuger Kantonalbank	na	1,004	1,106	10%			
	Total	19.0%						

¹ Only for liquid CDS contracts included in this study. ² Includes market capitalisation of Merrill Lynch for 2008. Merger closed 30 December 2008. ³ Includes market capitalisation for Wachovia Bank for 2008. Merger closed 31 December 2008.

Sources: Datastream; Markit; author's calculations.

which eliminates a number of institutions that were either acquired (ABN Amro, Bear Stearns, Dresdner Bank, Eurohypo, Washington Mutual), went bankrupt (Lehman Brothers, IndyMac), or were nationalised (Bradford & Bingley).¹¹ The event study of stock returns only considers publicly-listed banks with a free float greater than 20% of the common shares outstanding.¹² This restriction eliminates private cooperative banks (eg Nationwide, Raiffeissen Switzerland), closely-held banks (eg HypoVereinsbank owned 100% by Unicredit Spa, IKB owned 91% by LoneStar), and state-owned banks (German Landesbank). Publicly-traded banks where a government acquired a majority shareholding as part of a rescue plan are included in the sample (eg Fortis, Royal Bank of Scotland). Note that the US sample includes 16 of the 19 bank holding companies subject to the US Treasury's stress tests released in May 2009.¹³ Given rapid consolidation in the banking industry over the previous years and the disappearance of several large players, the sample of banks available for study is small, with the United Kingdom, France, Germany and the Netherlands featuring fewer than six banks each.

Data on national stock market indices, banking sub-indices, and individual stock prices is taken from Datastream. The national stock market indices are the S&P 500, the FTSE 100 (London), the CAC 40 (Paris), the DAX (Frankfurt), the AEX (Amsterdam), and the SMI (Zurich).¹⁴ These indices are market-value weighted, where changes in prices for companies with higher market capitalization have a proportionally larger impact on the index. Panel A of Figure 1 shows movements in national stock market indices and banking sub-indices over the crisis period, with the levels indexed to 100 as of 1 July 2008. The vertical line marks the announcement of each country's rescue package. Note that banking sector stocks significantly outperformed the overall stock market in the two to three years prior to the onset of the financial turmoil in mid-2007, then underperformed dramatically as the crisis unfolded from mid-2007 to year-end 2008.

Table 2 shows the relative weights of the banks included in the sample as a percentage of the national stock market index at end of January 2008. UK banks represented 16.9% of the FTSE 100, with all banks being members of the FTSE 100. While Dutch and Swiss banks as a group represent close to 20% of their respective indices, a number of banks in our sample were not members of these indices. The market weight of banks in the remaining countries is smaller. Note that the average bank saw its market capitalisation shrink by more than 50% over the 12 months to January 2009, reducing the weight of these banks in their respective stock market indices as the crisis progressed. The fact that some of the sample banks are included in national stock market indices should reduce the size of the abnormal returns in the event study below, as it would lead movements of bank stocks and the market to be more closely correlated. This potential bias is addressed in the robustness analysis reported below.

¹¹ Both the Wells Fargo acquisition of Wachovia and the Bank of America acquisition of Merrill Lynch officially closed at year-end 2008.

¹² The sample does not include insurance companies (eg AIG, Aegon), finance companies (eg GMAC, GE Capital), brokerage operations (eg Schroders, Charles Schwab), real-estate companies, building societies (Nationwide, Britannia Building Society), or asset management companies.

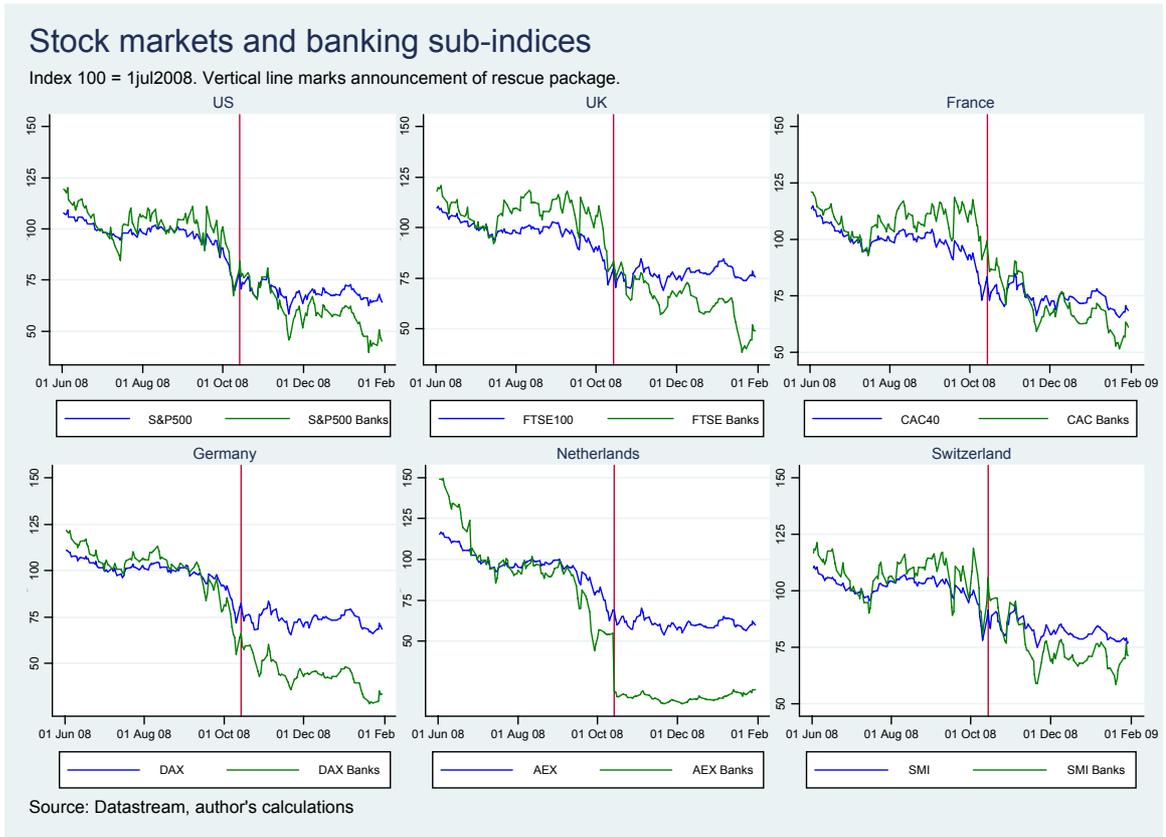
¹³ The three remaining institutions are American Express, GMAC and MetLife.

¹⁴ The results are very similar when using MSCI country-level and regional stock market indices. These results are available upon request.

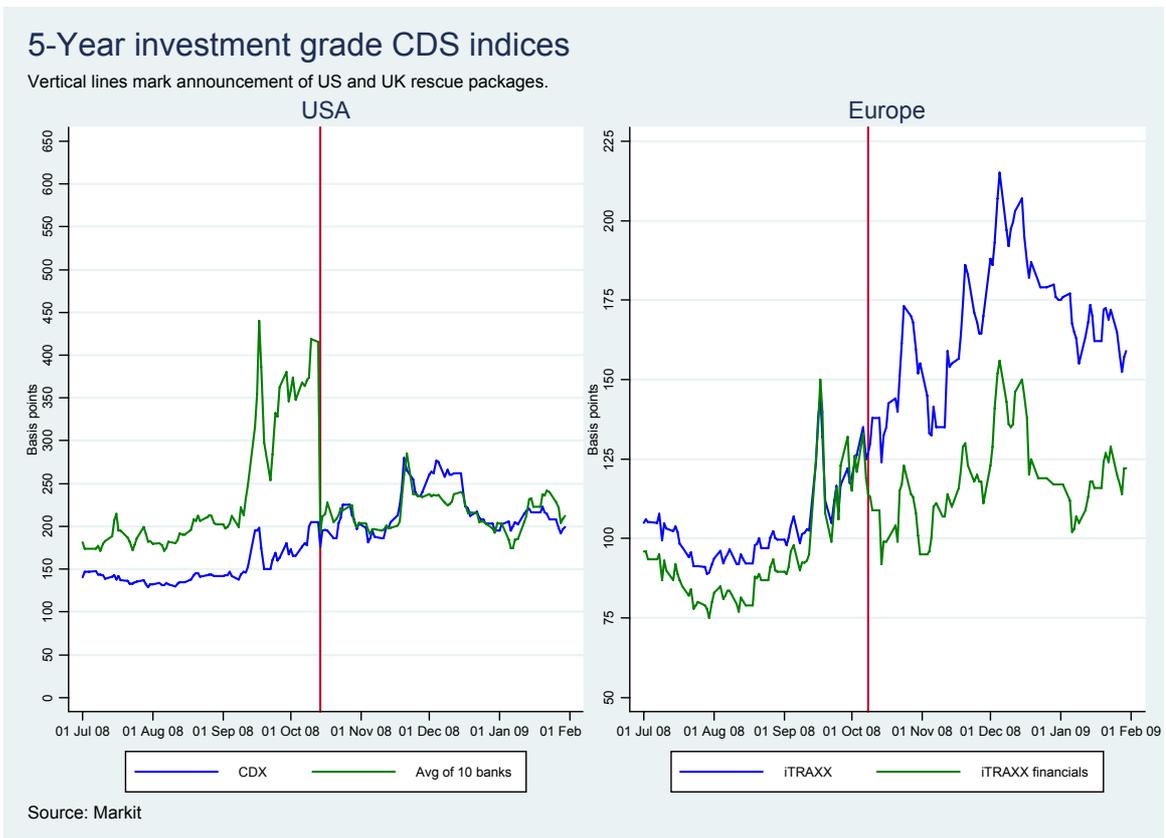
Figure 1

Stock market and CDS indices

Panel A: Stock market and banking sub-indices



Panel B: 5-year investment grade CDS indices and banking sub-indices



Data on CDS indices and individual bank CDS contracts is taken from the Markit Group.¹⁵ The market index for the US is the CDX North America 5-year investment-grade index and for Europe is the iTRAXX European 5-year investment-grade index. These equal-weighted indices are based on the 125 most liquid financial and non-financial CDS contracts. The reference entities in the CDX index are decided by a poll of dealers, who choose to exclude US banks as these banks are prevented from writing protection on themselves. The CDX index therefore excludes US banks. The reference entities in the iTRAXX index are the most liquid European names based on a survey of members. Both indices roll every six months, with a new version of the index created with updated constituents at that time. Panel B of Figure 1 shows the relative movements in these CDS indices over this period. US bank CDS traded at higher levels than the CDX index prior to the crisis then traded in line with the market despite not being part of this index. In Europe, banks were seen as having a lower credit risk than the iTRAXX with the gap widening following the announcement of the rescue packages in mid-October.

Data on individual bank CDS contracts is the spread on the 5-year contract referencing the senior unsecured debt denominated in the reference entity's home currency. The analysis of CDS spreads is restricted to a sample of 28 banks that have a liquid CDS contract. A CDS contract is considered to be liquid if over the period from June 2007 to January 2009 the CDS contract had fewer than 150 missing observations, and no more than 150 days with no change in the spread from the previous trading day.¹⁶ Given the small number of banks in this sample, we include two private banks with a liquid CDS contract, namely Germany's DZ Bank and the Netherland's Rabobank.¹⁷ Note that the average bank saw its CDS spread increase by 80 basis points over the year to January 2009, implying that the cost of insuring a notional amount of \$10 million in bonds increased by \$80,000 per annum.

In the analysis below, we differentiate the reaction across banks that received government support and those that did not. For each bank, we code a dummy variable equal to 1 for banks that received government support as of 20 October, and zero otherwise. This government support may take the form of capital injections, emergency loans, or asset support. We do not consider bonds issued under government debt guarantees when coding this variable. While such a coding scheme is imperfect and time invariant, it allows us to create two groups with a full time series that can be compared.¹⁸ Of the sample of 52 banks in our sample, 19 banks received either capital injections by 20 October while 33 banks did not. This exercise answers the question of how two equal-weighted portfolios constructed based on government support ex-post performed relative to each other.

3.2 Event study methodology

We use an event-study methodology to assess the response of bank CDS spreads and stock prices to the announcement of rescue packages. The choice of securities allows us to distinguish the impact on creditors from the impact on shareholders, similar in spirit to the

¹⁵ Markit receives contributed CDS data from market makers from their official trading records. This data undergoes a rigorous cleaning process to remove stale or inconsistent data and outliers. Markit distributes both contract-specific data and benchmark industry indices (see Jorion and Zhang (2007) for more details).

¹⁶ Different thresholds for missing observations and days with no change generated the same sample of banks.

¹⁷ DZ BANK is the fifth largest commercial bank in Germany and acts as the central administration for more than 1,000 cooperative banks. Rabobank consists of 153 independent local banks, a central organisation, and a large number of specialised international offices that are jointly liable for each other's commitments.

¹⁸ An alternative coding based on when a bank received support would be subject to selection bias, as banks would only enter the sample at the point when the government announced its support. There would be no history to compare prior to the announcements, and the sample size would grow over time.

study by Jorion and Zhang (forthcoming). The event date in our study, $t=0$, is the date of the first public announcement of a *comprehensive* bank rescue package for each country: 8 October for United Kingdom, 9 October for the Netherlands, 13 October for France and Germany, 14 October for the United States, and 16 October for Switzerland (Table 1).¹⁹ We include the trading day after the announcement in our event window, $[0,1]$. While this event window provides a point of reference for evaluating the market reaction, it does not alter the calculation of the market reaction on any given day. It will, however, affect the magnitude of the pre- and post-event reaction when cumulating changes across different windows. Given that market participants in neighbouring countries may have anticipated government announcements, we expect to see movements in CDS spreads and stock prices prior to the first public announcement for each country. The estimation window is from 365 days to 95 days prior to the event date, which corresponds roughly to June 2007 to June 2008. We avoid using the time series of changes immediately prior to the event since they might be partially influenced by the event itself.

Our pre- and post-event window lasts for the 50 trading days prior to and following each country's announcement of a rescue package. This longer window than a typical event study is justified given the objective of restoring stability to the financial sector and restarting the flow of credit to the real economy. The disadvantage of a longer window is that it becomes problematic to disentangle how much of the market reaction post-October is due to the deterioration of the real economy, which accelerated rapidly over the fourth quarter of 2008. On the other hand, this window may still be too short to assess the full impact given the complexity of these programs and the fact that the government support was taken up slowly. We report results over various sub-windows to allow readers to see how movements unfolded over time.

The market reaction is measured in two ways, using abnormal returns (ARs) and market-adjusted returns (MARs). The details on the calculations are discussed below. The two approaches are applied to daily changes in bank CDS spreads and daily total returns in bank stock prices (including the payment of dividends). The use of two approaches allows us to check the sensitivity of the results to the specification, which is important in this setting given the unique features of this event.

An analysis of bank rescue packages presents a number of econometric issues not faced by a typical event study. The events are clustered both within and across countries over a 10-day period, with events overlapping within and across countries. All banks headquartered in a given country are likely to have been affected by the announcements, even if the banks did not receive direct government support. Consistent with the expectation of clustering, we find that the market reactions are correlated across bank securities, whether measured as ARs or MARs. The announcements are also associated with an increase in event-induced variance. These conditions – clustering, overlapping events, increased variance around the event – invalidate traditional test statistics that require ARs to be independent and identically distributed drawings from a distribution with a constant variance. While the reactions of banks' CDS and stock prices are large and economically important, the violation of these assumptions means that we cannot reliably test whether the reactions are statistically different from zero, either using a parametric or a non-parametric test. We therefore remain cautious in the interpretation of our results. Given the large magnitude of the responses – with cumulative responses around the event of up to 40% (4000 basis points) – we feel confident that the reactions are statistically different from zero.

¹⁹ Results are available upon request using either the announcement of the TARP on 18 September or the UK plan on 8 October as common date for all six countries.

3.2.1 Abnormal returns in stock prices

We calculate daily abnormal returns (ARs) for each bank's stock price using a standard event study methodology (MacKinlay 1997). For any bank i the single-factor market model is:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

where R_{it} and R_{mt} are the daily returns of the stock price for bank i and the national stock market index m , respectively, and ε_{it} is a zero-mean error term with constant variance.²⁰ We calculate the ARs for bank i and event date t as the difference between the actual returns and the expected returns over the based on the estimated coefficient from equation (1). We calculate daily ARs for the 50 days prior to and following the event, $[-50,50]$. For each country, we calculate average abnormal returns (AAR) for each day by taking the equal-weighted mean of the ARs for banks headquartered in a given country. The AARs are aggregated over different pre- and post-event windows to calculate cumulative average abnormal returns (CAARs) over the window t to T , $[t, T]$.

3.2.2 Abnormal changes in CDS spreads

We use a similar methodology to study the reaction of bank CDS spreads to the announcements of rescue packages. While researchers have found that a single-factor market model is robust when estimating abnormal stock returns, we find that estimates of abnormal changes in CDS spreads are sensitive to the inclusion of additional factors. We therefore use a multi-factor model to calculate abnormal changes in CDS spreads. Researchers have found that both the levels and changes in CDS spreads are sensitive to the following factors: risk-free rates, equity market volatility (either market-wide or firm-specific), Libor-OIS spreads, and interest-rate swap spreads (Alexander and Kaeck 2008).²¹ We therefore include daily returns on 10-year government bonds and daily changes in implied equity market volatility in our model. We do not include either Libor-OIS spreads or swap spreads as they both contain systemic risk related to the banking sector that we are measuring on the left-hand side of these regressions. For any bank i the multi-factor model is:

$$R_{CDSit} = \alpha_i + \beta_1 R_{mt} + \beta_2 R_{rt} + \beta_3 R_{vt} + \varepsilon_{it} \quad (2)$$

where R_{CDSit} is the period t change in the level of the CDS spread for bank i , R_{mt} is the change in the CDS market index, R_{rt} is the period t return on a country's 10-year government bond, and R_{vt} is the change in implied volatility of a country's national stock market index. The CDS market index for US banks is the CDX index, and for European banks is the iTraxx index. The abnormal change in a bank's CDS is the difference between the actual change and the predicted change based on this multi-factor model. Cumulative average abnormal changes are calculated by summing the average changes over some event window $[t, T]$.

²⁰ An event study is a purely statistical exercise that does not rely on a general theory such as the capital asset pricing model where assumptions must be made about the equity risk premium and the ability of portfolio diversification to remove a stock's idiosyncratic risk. While some authors use a Fama-French three-factor model, these factors are based on non-financial stocks and are only available for US stocks.

²¹ An overnight index swap (OIS) is a swap for a given maturity where the floating rate is equal to the geometric average of an overnight index (i.e. the monetary policy rate) over every day of the payment period

3.2.3 Market-adjusted changes in CDS spreads and stock prices

A second methodology to capture the response of bank CDS spreads and stock prices is to calculate market-adjusted returns (MARs), where the daily change in the relevant market index is deducted from the daily change in a bank's security as follows:²²

$$MAR_{it} = R_{it} - R_{mt} \quad (3)$$

This approach is equivalent to estimating ARs using a market model while constraining the intercept to zero and the beta on the market index to 1. In this case, changes in a bank's securities are assumed to follow the market index one-to-one. The benefit of this approach is its simplicity; we therefore do not try to add other factors other than the market index. We calculate the cumulative average market-adjusted changes for each country by averaging the daily MARs across banks in a given country and summing over some window.

3.3 Hypotheses development

If bank rescue packages contain information that is valuable for investors and creditors, we would expect to see a reaction to the announcements. A failure to find any reaction would suggest that either (i) the markets fully anticipated the rescue packages and the announcement itself contained no new information, or (ii) the programme was not perceived to impact the bank's financial condition, cost of capital, or future cash flows. Assuming the announcements contained valuable information, corporate finance theory and prior empirical evidence provide some expectation of how bank CDS spreads and stock prices may react. We focus on capital injections and asset support (both insurance or purchases), as these events can be clearly identified and the reaction can be measured.

3.3.1 Capital injections

The recapitalisation of banks should be expected to reduce the spread on bank CDS contracts, but may have either a positive or a negative impact on bank stock prices. Capital injections increase a bank's regulatory capital, lower its leverage, and reduce the probability of financial distress.²³ Given that a number of banks and financial institutions had gone bankrupt or been rescued prior to the announcement of rescue packages, the risk of financial distress was real. The recapitalisations together with the public statements that no systematically important bank would be allowed to fail should reduce the probability of a default that would trigger the payout under a standard CDS contract.²⁴ The lower risk of a default would then translate, all else unchanged, into a lower CDS spread, implying that the cost of insurance was lower. A lower risk of financial distress should also reduce the risk premium in the bank's cost of equity and increase the stock price.²⁵ Capital injections may be negative for common shareholders, however, depending on the form of capital injected and

²² Jorion and Zhang (2007, forthcoming) refer to this measure as the cumulative abnormal CDS spread change (CASC). Rather than using a market index, they deduct the change of an equally weighted CDS index with the same rating as the firm. They also use a market index for robustness in unreported results.

²³ An increase in equity capital raises a bank's z-score – a popular measure of bank soundness – implying a lower probability of insolvency risk.

²⁴ The decision to take Icelandic banks into receivership and US agencies into conservatorship was treated as a credit event on the underlying CDS contracts. Government rescues of banks were not, as the support was structured to avoid adversely affecting the bondholders.

²⁵ Almeida and Philippon (2007) estimate that the risk-adjusted cost of financial distress is 4.5% of the pre-distress value for a firm, with other studies that do not account for risk reporting larger values.

the conditions attached to the government investment. If existing common shareholders are diluted (or wiped out) and dividends to common are cut or restricted, then the stock price should fall.

During the fall of 2008, governments recapitalised the banks using a variety of instruments (Table 3, Panel A). While the UK government used common shares, most governments bought hybrid securities – such as preferred shares, subordinated debt or mandatory convertible debt – that combine the stable income stream of bonds with the potential appreciation of common shares. Governments preferred hybrid instruments as they limit the risk of loss to the taxpayer while providing a more attractive dividend stream.²⁶ Preferred shareholders, for example, rank ahead of common shareholders but behind creditors in case of bankruptcy. These benefits come at a cost – preferred shareholders typically cannot vote at shareholder meetings, limiting their ability to influence management. Hybrid securities typically qualify as Tier 2 capital, but they are not viewed with much confidence by market participants due to their limited ability to absorb losses.

Comparing the costs and terms of capital injections across countries is complicated as no two comprehensive rescue plans were alike. For example, the preferred shares and other hybrid securities issued across the six countries featured different coupon rates, redemption rights, and other features. The US preferred shares, for example, had the lowest initial coupon rate of 5%, but included 10-year warrants that provide the government with an option to purchase common stock at a specified price in the future. While France initially bought subordinated debt from the banks, by January it offered preferred shares while leaving open the possibility of buying common shares for troubled institutions. Germany allowed its stabilization fund to take undisclosed ownership stakes in banks, known as silent participations, where the terms were not made public.

Government capital injections came with strings attached. While US and German capital injections mentioned limits on the payment of common dividends, only the United Kingdom explicitly prohibited common dividends whilst the government's preferred shares remain outstanding. Some conditions, however, proved difficult to enforce due to a lack of precision and an unwillingness or inability to interfere in the management of the banks. While many rescue packages outlined restrictions on executive pay, governments lacked the votes, the support of the banks' boards, or the legal basis to block payments.

Prior studies of the wealth effects of security offerings provide guidance on what to expect from the issuance of common equity or hybrid capital. The empirical evidence consistently finds that pure equity offers have a relatively large negative effect, with the announcement of seasoned equity offerings (SEOs) associated with abnormal returns over the first two days of -3%.²⁷ Eberhart and Siddique (2002) argue this decline reflects a reduction in default risk and a transfer of wealth from shareholders to bondholders. The market response to the issuance of hybrid capital depends on the specific features of the security, such as the conversion ratio, the conversion price, the maturity date, and the call period. On average, researchers find that the stock price reaction to the issuance of convertible preferred shares and convertible debt is negative, with 2-day ARs of -1.0% to -1.5% (Lewis et al. 2003). The few studies of non-convertible preferred shares report a negative or insignificant impact on the common stock price (Linn and Pinegar 1988, Howe and Lee 2006).

²⁶ Preferred shares are typically non-voting, have a prior claim on dividends, and take priority over common shares in case of bankruptcy. Subordinated debt has the lowest unsecured claim among creditors in the event of bankruptcy and typically pays the highest rate of interest. Convertible notes are a form of bond that can be exchanged for a specified number of common shares in the future at the option of the investor.

²⁷ Walker and Yost (2008) is a recent paper on seasoned equity offerings that reviews this large literature.

Table 3
Terms of government support

Panel A: Capital injections

Country	Type of security	Dividend / Coupon	Redemption / Convertibility	Other conditions
United States – Capital Purchase Program ¹	Preferred	5% for 5 years, 9% thereafter	Callable at par after 3 years (or earlier using proceeds from qualifying equity offering)	Limits on compensation and common dividends / share repurchases. <i>No common dividends.</i> Limits on compensation.
United Kingdom	Preferred	12% for 5 years, Libor + 700 basis points thereafter	Non-callable 5 years	Board appointments. Lending.
United Kingdom	Common shares			Same as preferred
France	Subordinated debt	8% for 5 years, floating thereafter	Not reported	Limits on compensation. Lending.
Germany	Preferred	Not reported	Not reported	Limits on compensation and dividends. Lending.
Netherlands	Preferred	8.5% minimum, increasing if dividends paid to common	Callable at €15 per share; convertible to ordinary after 3 years	Limits on compensation. Board appointments.
Switzerland	Mandatory convertible notes	12.5% maturing in 30 months	Convertible to common at the issuer's option; converts automatically after 30 months	Limits on compensation.

Panel B: Overview of asset insurance

	Citigroup	Bank of America	ING
Date announced	23 Nov 08	16 Jan 09	26 Jan 09
Currency	USD	USD	EUR
Portfolio value (billions)	301	118	27
Insured portfolio / (trading assets, investments and loans)	23.2%	8.4%	2.3%
Guarantee fee as a percentage of insured portfolio value	2.4%	3.4%	17.5%
Company first-loss tranche as percentage of portfolio value	13.1% 2	8.5%	0.0%
Subsequent company share in losses	10%	10%	20%
Subsequent government share in losses	90%	90%	80%
Maximum downside for government (billions)	228	93	n.a.
Government potential downside as a percentage of insured portfolio value	75.8%	79.0%	80.0%

¹ The preferred shares under the Capital Assistant Program, announced 10 February, have a 9% dividend for 7 years, with the preferred convertible to common at the issuer's option. The preferred converts automatically after 7 years.

Sources: government and company websites; author's calculations.

Another way to benchmark the market reaction to government capital injections is to consider the reaction to capital injections by sovereign wealth funds. Over late 2007 and the first half of 2008 sovereign wealth funds invested more than \$50 billion in western banks in the form of common shares, convertible preferred and convertible debt. We examine the market reaction to eleven of these deals by summing the ARs and MARs over the window [0,5].²⁸ While the earliest transactions for Barclay's, Citigroup and Morgan Stanley were positive for the stock price, the average market reaction for all deals involving common stock was negative with cumulative underperformance of 1.6% to 2.0%. Hybrid deals, however, generated a positive response, outperforming the market by 1.3% to 2.0% on average. These results are in line with the literature cited above.

3.3.2 Asset purchases or insurance

The Dutch, Swiss, and US governments supported specific financial institutions by purchasing impaired assets or providing insurance against losses on specific portfolios.²⁹

In an asset purchase, the government buys impaired securities or loans from the bank, reducing the bank's risk-weighted assets and lowering the amount of capital it must hold against potential losses. While the government bears the risk of losses, it also retains the profits if the assets recover. While the US and Germany announced asset purchase plans, only the Swiss had taken action by the end of January 2009, buying \$39.1 billion of illiquid assets from UBS on 16 October.³⁰ The assets were removed from UBS's balance sheet and placed in a special purpose vehicle, significantly reducing UBS's risk.

Under asset insurance, the government assumes a share of the potential losses on a specified portfolio after a first loss amount (or deductible) is absorbed by the bank. In return, the bank pays the government an insurance premium based on the riskiness of the portfolio. By limiting the bank's potential losses, asset insurance also reduces a bank's risk-weighted assets and lowers the capital it must hold. The government, however, is left with a large potential liability if the assets fall substantially in value. The US and the Netherlands offered asset insurance to three banks (Table 3, Panel B). The US provided protection to Citigroup and Bank of America against the possibility of unusually large losses on asset pools of \$301 billion and \$118 billion, respectively. In both cases, the US government bears 80% of the losses after the deduction of a first loss tranche paid by the bank but does not share in any profits. The Dutch authorities created an illiquid asset backup facility to insure most of the risk from \$35.1 billion of Alt-A securities owned by ING. The Dutch government shares in 80% of the downside and the upside.

Asset purchases or asset insurance should be positive for both the stock price and the CDS spread, as both interventions lower the potential losses faced by common shareholders and reduce the risk of default. As a result, the share price should rise and CDS spreads should narrow. In three out of four cases the government's actions coincided with the injection of

²⁸ These results are available upon request.

²⁹ Royal Bank of Scotland and Lloyds TSB received support under the UK asset protection scheme on 26 February 2009 and 7 March 2009, respectively. These operations are not considered in this study.

³⁰ By August 2009, Germany's proposed bad bank scheme had not yet received government approval.

capital (in the form of preferred shares). In the case of Citigroup and Bank of America, the insurance and capital injection followed earlier support efforts and the offer of government insurance may have signalled a deterioration in the quality of the bank's assets which may be a negative signal for the bank's health.

While asset purchases have been used during past banking crises with some success, this type of government intervention is associated with the creation of bad banks. In the case of the 1990s Nordic crisis and the 1980s Savings and Loans crisis, the bad bank was only created following the bankruptcy or nationalisation of the distressed bank. Elliott (2009) describes how Mellon Bank and CIGNA used this strategy successfully in 1988 and 1996, respectively, leading to a rise in the stock price and narrowing of credit spreads. Packer (2000) describes the Japanese experience with a bad bank, while Calomiris et al (2004) provide an overview of various country experiences. In terms of the response to asset insurance (or guarantees of toxic assets), there appear to be few historical precedents that can be used to anticipate the market reaction.

3.3.3 Summary

In summary, the discussion above suggests the following three hypotheses:

H1: The announcement of government rescue packages will be associated with a narrowing of bank CDS spreads relative to the market.

H2: Capital injections will be associated with a rise in bank stock prices relative to the market if the benefits of lower leverage and a lower probability of financial distress outweigh the potential dilution of existing shareholders or restrictions on payment of common dividends.

H3: Asset purchases and asset insurance will be associated with a narrowing of bank CDS spreads and a rise in the stock price relative to the market.

4 Market-wide reaction to comprehensive rescue packages

This section reviews the country-level reaction of bank CDS spreads and stocks prices to the announcement of bank rescue packages. The two event-study measures are calculated as described in section 3. We check the robustness of these results in section 6.

4.1 Response of bank CDS spreads

An analysis of CDS spreads highlights creditors' reaction to the announcement of bank rescue packages. Table 4 provides the abnormal spread changes and market-adjusted spread changes for banks headquartered in a given country. A positive sign represents a widening (or worsening) of the CDS spread relative to the market, while a negative sign represents a narrowing (or improvement).

Panel A of Table 4 shows the cumulative average abnormal changes in CDS spreads calculated using the multi-factor model in equation (2). Bank CDS spreads narrowed relative to the market across all countries over the window [-50,-26], with the biggest improvement for Swiss and Dutch banks. The next window [-25,-1] covers the month preceding the announcements when Lehman Brothers declared bankruptcy. Bank CDS spreads widened by more than 20% relative to the market over this period in the United States, United Kingdom and the Netherlands, consistent with the increase in the perceived risk of default. By contrast, the average CDS spreads for French and Swiss banks outperformed the iTRAXX over this period. The announcement of rescue packages over the window [0,1] is associated with a spread narrowing in five out of six countries, with the average bank CDS in this sample declining by 11.8% relative to the market. Though the rescue announcements

Table 4

Reaction of bank CDS spreads around announcement of rescue packages

Country	[-50,-26]	[-25,-1]	[0,1]	[2,25]	[26,50]	[-50,-1]	[0,50]
Panel A: Cumulative abnormal changes in CDS spreads based on multi-factor model							
United States	-0.7%	23.6%	-6.1%	-14.6%	-9.0%	22.9%	-29.7%
United Kingdom	-1.7%	27.9%	-25.4%	-10.4%	-9.8%	26.3%	-45.6%
France	-1.7%	-28.3%	-19.3%	2.4%	-10.1%	-30.0%	-27.0%
Germany	-1.4%	-6.1%	-12.2%	-6.9%	-1.1%	-7.5%	-20.2%
Netherlands	-4.6%	32.0%	4.1%	-43.5%	1.0%	27.4%	-38.4%
Switzerland	-10.9%	-16.4%	-8.1%	-16.8%	8.9%	-27.3%	-16.0%
Average across all banks	-2.3%	12.2%	-11.8%	-13.8%	-6.1%	9.9%	-31.7%
Banks receiving support	0.4%	10.9%	-12.9%	-10.7%	-8.9%	11.3%	-32.5%
Banks not receiving support	-5.8%	14.2%	-10.4%	-17.6%	-2.4%	8.5%	-30.5%
Difference	6.1%	-3.3%	-2.4%	6.9%	-6.5%	2.8%	-2.0%
Panel B: Cumulative market-adjusted changes in CDS spreads							
United States	12.7%	20.9%	-3.1%	-6.4%	10.5%	33.6%	1.0%
United Kingdom	5.2%	33.7%	-25.3%	-5.8%	-2.1%	38.9%	-33.2%
France	7.8%	-18.2%	-17.3%	8.0%	-5.1%	-10.4%	-14.4%
Germany	3.7%	-4.7%	-9.9%	-5.5%	3.7%	-1.0%	-11.7%
Netherlands	6.0%	37.2%	0.5%	-34.9%	9.3%	43.1%	-25.2%
Switzerland	6.2%	-8.1%	-7.6%	-0.5%	25.1%	-1.9%	17.0%
Average across all banks	8.2%	15.3%	-10.6%	-6.9%	5.8%	23.5%	-11.6%
Banks receiving support	13.0%	17.0%	-11.9%	-1.5%	5.8%	30.0%	-7.7%
Banks not receiving support	1.9%	13.3%	-8.8%	-13.8%	5.8%	15.2%	-16.8%
Difference	11.1%	3.7%	-3.2%	12.3%	0.0%	14.8%	9.1%

were partially anticipated, this movement suggests that the announcements were still important for bank creditors. Given an average CDS spread on day 0 of 156 basis points across the 28 banks in this sample, this movement implies an average narrowing of 18 basis points relative to the market. To put this movement in perspective, this magnitude is roughly ten times larger than the reaction that Jorion and Zhang (2007, forthcoming) report around US bankruptcy filings.

Following the announcements of rescue packages, bank CDS spreads continued to outperform the market with a narrowing on average of 13.8% over [2,25] and 6.1% over [25,50]. The pattern varies by country, with US, UK and German banks showing a tightening over both periods. In the case of the Netherlands and Switzerland, spreads narrowed over the first period but then stabilized or reversed over the second period. The final two columns of Panel A show the cumulative performance for the 50 trading days before and after the announcements. The average bank CDS widened by close to 10% prior to the event, and narrowed by 32% afterwards. Creditors took comfort from the government interventions, with

spreads narrowing relative to the market in all six countries. The biggest beneficiaries were banks in the UK (-45.6%), followed by the Netherlands (-38.4%), the United States (-29.7%), and France (-27.0%).

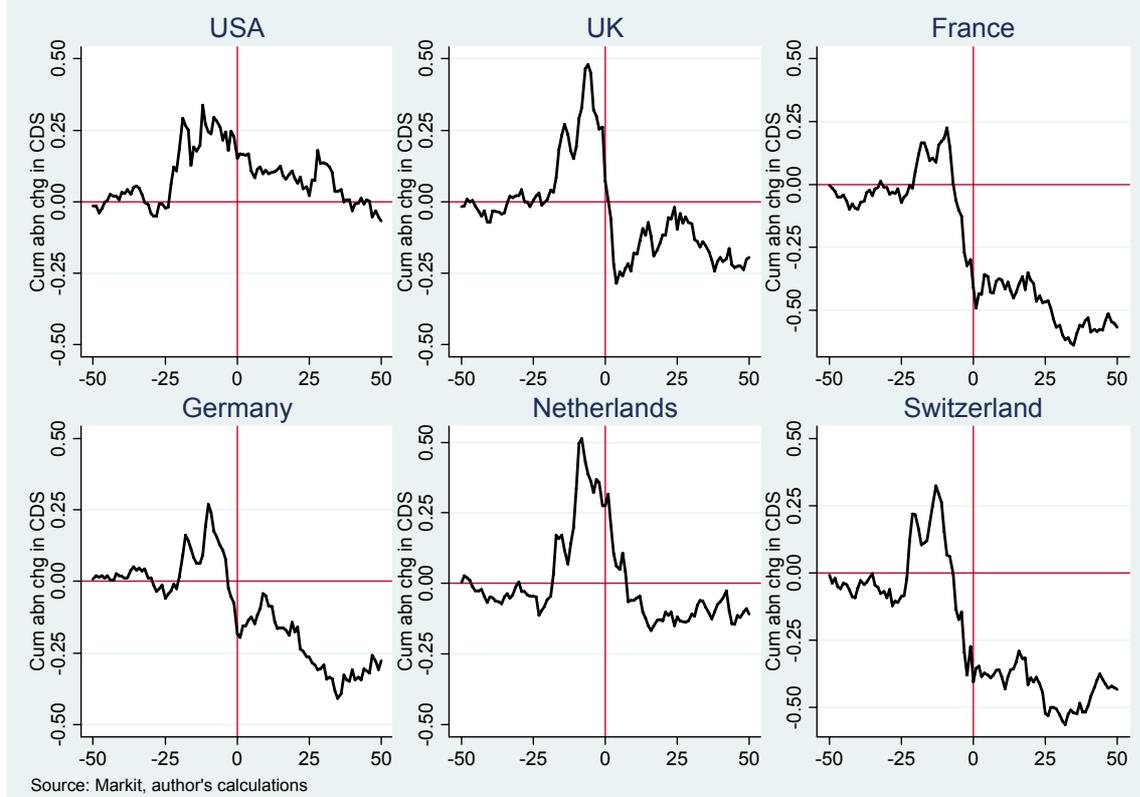
The country-level response of bank CDS spreads to the announcement of rescue packages is best seen by graphing the cumulative average abnormal changes for each country (Figure 2). The vertical line at day 0 marks the announcement of each country's rescue package. The pattern of spread widening prior to the announcement followed by spread narrowing is clear for each country. The spread widening is particularly large for UK, Dutch and Swiss banks. Note that the average US bank only saw its CDS spread return to the market level by the end of the period, while the average European bank outperformed over this window.

Figure 2 also shows that creditors anticipated the government support, as the peak in cumulative average abnormal spread changes occurs roughly a week prior to the announcements. In the case of the US, there is a noticeable narrowing around the announcement of the TARP on 19 September, followed by a widening as the details and fate of the TARP became less certain around 26 September. In the case of the European countries, bank CDS spreads begin to narrow in late September following the capital injections for Fortis and Dexia and the nationalisation of Bradford & Bingley. In all cases, the narrowing trend begins prior to the 3 October vote on the TARP and the announcement of comprehensive rescue packages. Creditors clearly viewed the support for key institutions as reducing the risk of default for all banks, with the accompanying public statements that no systemically important banks would be allowed to fail reinforcing this trend.

The country-wide results average the performance of banks that received government support with others that did not. The final row of Panel A therefore compares the market reaction of banks receiving explicit government support in the form of capital injections or asset protection with banks that received only implicit support. Debt guarantees are not considered in this classification. This distinction is only possible ex-post, as banks are assigned to one of two categories based on whether they received government support by 20 October. Both groups of banks saw their CDS spreads widen relative to the market prior to the announcement with most of this spread widening occurring in the month of September. The announcements were followed by spread narrowing for both categories of banks over the remaining period. Overall, CDS spreads for both groups widen by around 10% prior to the announcements, but then recover by around 30% following the event. Figure 3 graphs the reaction for both categories of banks over the 50 trading days prior to and following the announcement. The pattern is similar, with banks receiving government support widening more but then recovering by more; by the end of the period the cumulative movement over the entire window [-50,50] is the same for both groups. From the point of creditors, therefore, there does not appear to be an economically important distinction between banks receiving support and those that did not. Creditors from both groups of banks appear to have taken comfort from the government interventions.

Figure 2

Cumulative average abnormal changes in CDS spreads by country

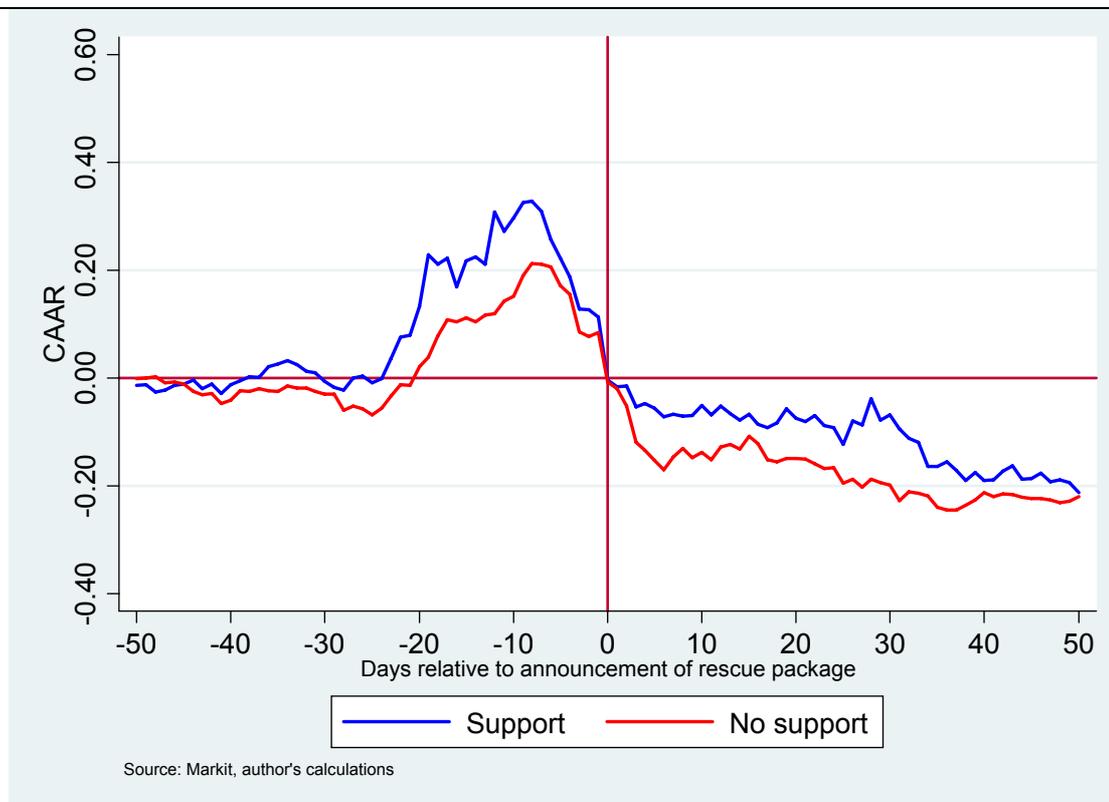


Panel B of Table 4 presents the event-study results based on market-adjusted changes in CDS spreads based on equation (3). The magnitude and direction of the reaction are similar to the results calculated using the multi-factor method, confirming that the results are robust to the methodology used. The only periods where the results are noticeably different are over the windows [-50,-26] and [26,50]. Using cumulative MARs, the widening of average bank CDS spreads relative to the market prior to the announcements is greater, while the narrowing following the announcements is smaller. Using this methodology US bank CDS stabilise but do not outperform the market following the announcement, while Swiss banks underperform. When comparing the results based on the degree of government support, banks not receiving support see less of a widening and a greater narrowing of their CDS spreads relative to the market. The banks receiving government support benefit substantially less, suggesting that the provision of government support provides a negative signal about the prospects of these banks.

In summary, the overall widening of CDS spreads prior to the announcement of bank rescue packages followed by a narrowing around the event supports our first hypothesis (H1) that creditors took comfort from the government interventions. These results are robust to the methodology employed for the measurement of the market reaction, and are consistent across countries.

Figure 3

Cumulative average abnormal changes in CDS spreads by level of government support



4.2 Response of bank stocks

We now examine the reaction of common shareholders as seen in the response of bank stock prices. Table 5 presents the ARs and MARs. In this case, a positive value represents a rise (outperformance) in the average bank stock relative to the national stock market index, while a negative value represents a fall (or underperformance) relative to the market. Note from Figure 1 that stock markets fell sharply over this period, so outperforming the market does not imply a positive total return on bank stocks.

The average bank stock outperformed its national stock market index by 7.3% over the window [-50,-26]. Bank stocks in all countries outperformed over this period, except Germany where the banks tracked the overall market closely. While the average bank continued to outperform the market by 8.0% over the window [-25,-1], the performance across countries was mixed with bank stock prices underperforming in the UK, Germany and the Netherlands. In contrast, US bank stocks outperformed the market by 23.5%, likely in response to discussions about the TARP that began on 18 September, possibly supported by the introduction of short-sale constraints on the same day. French stocks also outperformed by 14.4% over this period. Given that the French announcement lagged the UK announcement by a week, the positive response for French banks over [-25,-1] may reflect the market's expectation of government support.

Table 5

Reaction of bank stocks around announcement of rescue packages

Country	[-50,-26]	[-25,-1]	[0,1]	[2,25]	[26,50]	[-50,-1]	[0,50]
Panel A. Cumulative average abnormal stock returns based on market model							
United States	12.4%	23.5%	21.1%	-15.7%	2.0%	35.9%	7.4%
United Kingdom	5.3%	-5.9%	13.1%	-24.0%	-6.9%	-0.5%	-17.8%
France	9.3%	14.4%	-14.5%	-5.7%	-20.2%	23.6%	-40.3%
Germany	-0.6%	-13.1%	6.8%	-27.7%	-7.4%	-13.7%	-28.3%
Netherlands	1.5%	-12.2%	4.4%	-28.7%	3.5%	-10.6%	-20.9%
Switzerland	3.6%	0.5%	-2.6%	-7.5%	6.8%	4.1%	-3.2%
Average across all banks	7.3%	8.0%	8.2%	-15.7%	-1.3%	15.4%	-8.8%
Banks receiving support	7.8%	10.5%	9.4%	-24.3%	0.9%	18.3%	-14.0%
Not receiving support	7.0%	6.5%	7.4%	-10.4%	-2.7%	13.6%	-5.6%
Difference	0.8%	4.0%	2.0%	-13.9%	3.5%	4.8%	-8.4%
Panel B: Cumulative market-adjusted stock returns							
United States	11.8%	9.8%	15.5%	-19.2%	1.7%	21.6%	-2.1%
United Kingdom	5.5%	-14.7%	10.5%	-26.1%	-7.2%	-9.3%	-22.8%
France	6.6%	7.6%	-12.2%	-9.8%	-22.3%	14.2%	-44.3%
Germany	-4.5%	-26.6%	12.1%	-34.2%	-8.4%	-31.1%	-30.5%
Netherlands	0.6%	-10.1%	5.2%	-29.5%	2.5%	-9.5%	-21.9%
Switzerland	3.4%	5.3%	-3.7%	-3.8%	5.5%	8.7%	-2.0%
Average across all banks	6.4%	1.1%	6.2%	-17.5%	-2.2%	7.5%	-13.5%
Banks receiving support	6.5%	-2.8%	6.4%	-28.6%	0.0%	3.8%	-22.1%
Not receiving support	6.3%	3.5%	6.1%	-10.8%	-3.5%	9.7%	-8.2%
Difference	0.3%	-6.3%	0.3%	-17.8%	3.6%	-6.0%	-14.0%

The announcement of bank rescue packages was received positively in four out of six countries, with the average bank stock rising by 8.2% relative to the market over the window [0,1]. US and UK bank stocks saw the biggest gains, outperforming by 21.1% and 13.1%, respectively. While the US response may be linked to the favourable terms of the US Treasury's non-convertible preferred shares (and debt guarantee scheme), the rationale for the UK reaction requires some explanation. While the UK government announced a comprehensive rescue plan on 8 October, the terms of the capital injections (including the restrictions on payment of dividends) and the names of the banks receiving capital were not disclosed until the following week. The positive UK reaction, therefore, likely reflects the impact of public statements that the banks would not be allowed to fail. French banks, by contrast, fell by 14.5% following their country's announcement on 13 October, likely reflecting the relatively high cost and limited support of their country's rescue packages. The French government only offered subordinated debt, which provides no protection to common shareholders, and this capital came at a high cost – close to double the cost of US preferred stock. The package also did not include any government debt guarantees or other forms of asset support.

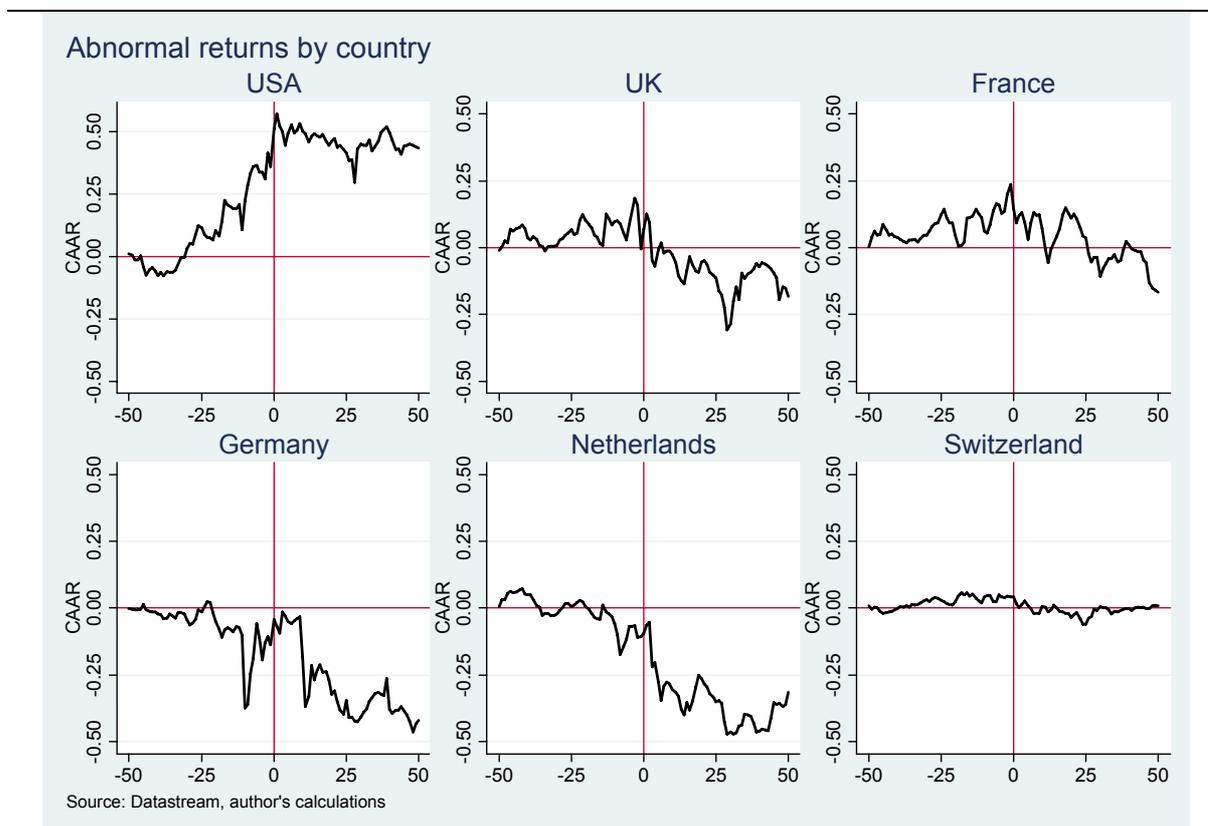
The disclosure of the details of the UK capital injections on 13 October contributed to the sharp fall in UK bank stocks, which underperformed the market by 24.0% on average. Bank stocks underperformed in all countries over the window [2,25], led by Dutch (-28.7%) and German banks (-27.7%). On average the 50 bank stocks in this sample fell by 15.7% relative to the market over this period. Clearly bank shareholders were not convinced that the rescue packages represented a buying opportunity. Instead, the large underperformance suggests that investors feared more write-downs, further losses and possible nationalisation. While stock prices continued to fall relative to the market in France, Germany and the UK over the window [26,50], they stabilised in the remaining countries. Overall, the final two columns of Panel A of Table 5 show that bank stock prices outperformed the market by 15.4% on average over [-50,1], then fell by 8.8% as the details became known over [0,50]. US banks outperformed the S&P500 both pre- and post-announcement, while bank stocks in the UK, Germany and the Netherlands fell relative to the market over both periods.

Figure 4 graphs the average bank response for each country. US banks exhibit positive CAARs over the window [-50,50], with a run-up beginning more than a month prior to the 14 October announcement. Swiss banks follow their market closely over this period, while banks in the remaining countries underperformed with the worst cumulative performance seen in Germany (-42.0%) and the Netherlands (-31.5%). By contrast, US banks show an average cumulative performance of 43.3%, with the economically important outperformance reflecting the favourable terms of the US rescue package for common shareholders.

This cross-country comparison provides the market's assessment of the relative merits of each country's rescue package. The US rescue package was the most favourable for bank shareholders. The preferred shares issued under the US's Capital Purchase Program had a relatively low annual dividend of 5% for five years, were callable at par after only three years, had no material restrictions on common dividends and imposed few constraints on bank

Figure 4

Cumulative average abnormal bank stock returns by country



management. By comparison, the capital injected in the Netherlands and France had a cost of 8.5% per annum with a more expensive call price. In the United Kingdom, the common shares issued by the government diluted existing shareholders, while the preferred shares were the most expensive with a 12% coupon, no option for redemption within five years, and a ban on payment of common dividends whilst the preferred shares remained outstanding. Based on estimates from Goldman Sachs, the average dilution of common shareholders from the US capital injection was 9%, while the UK's combination of preferred and common shares diluted existing shareholders by up to 60%. In Switzerland, the rescue package held little information for bank shareholders. The package appears to have been tailored to the needs of UBS, with no other banks receiving capital and no debt guarantees being offered.

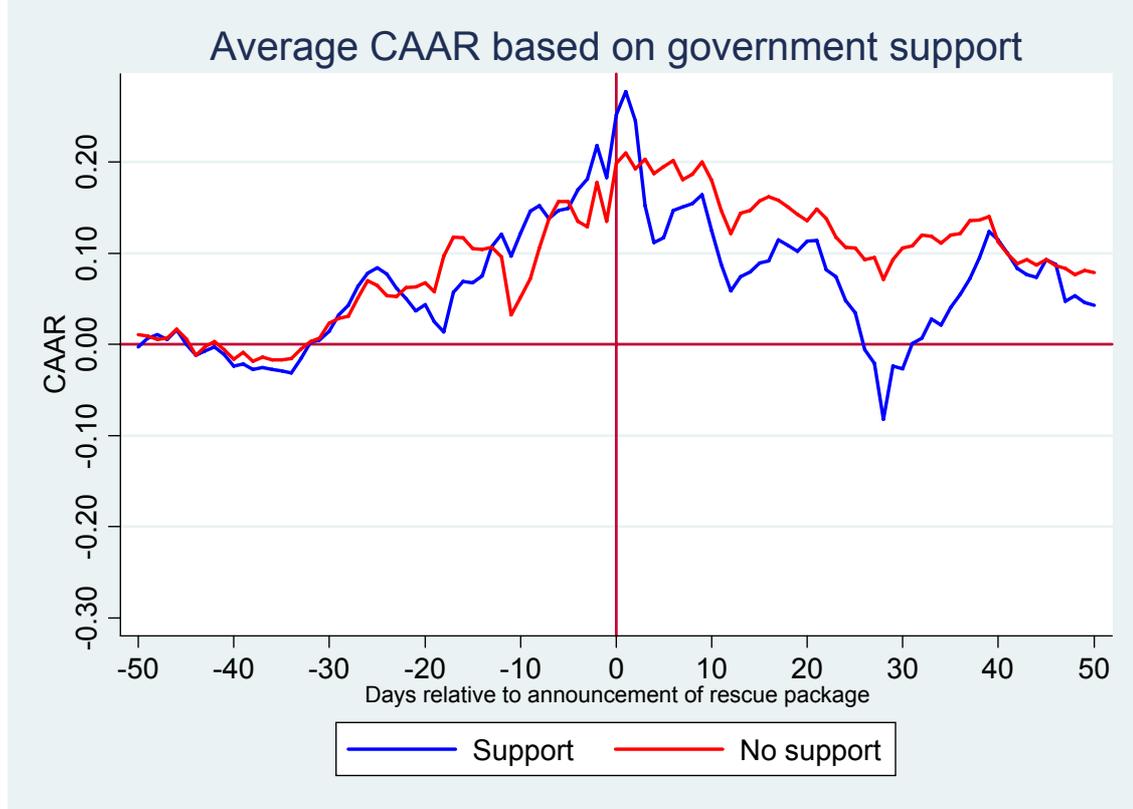
The final row of Panel A of Table 5 again compares the reaction of banks receiving direct support in October with those that did not. The banks receiving government support outperform the other banks prior to the announcements and in response to the announcement itself. They then exhibit a much greater underperformance following the country-specific announcements. On average, banks receiving support outperform banks not receiving support by 4.8% over the window [-50,-1] but then underperform this peer group by -8.4%. This result suggests that the receipt of government support was viewed as a negative signal by shareholders, as it may have revealed information about the financial condition of the banks that was not known to the public. Figure 5 graphs the response for both categories, and shows the greater volatility of AARs for the banks receiving government support, with a greater run-up prior to the announcements followed by a greater underperformance for much of the period following the announcements. The recovery around day 30 for banks receiving support coincides with the decision by the US Treasury to provide asset insurance and a second capital injection to Citigroup on 24 November, which boosted the stock prices for all US banks in our sample.

We check the robustness of these results in Panel B of Table 5 where we present the reactions based on market-adjusted stock returns from equation (3). The trends are similar using this methodology but the magnitude of the CAARs is lower. The performance relative to the market is less positive for outperformance and more negative for underperformance. As a result, US banks now show an average underperformance relative to the market of -2.1% over the window [0,50]. Based on market-adjusted returns, banks receiving support underperform their peers both prior to and following the announcements with a cumulative underperformance of -20.% over [-50,50]. The different magnitude of the results using market-adjusted returns suggests that the levels calculated using a traditional event study methodology should be viewed with caution. The market-adjusted returns may be a better indication of the returns an investor would have received from buying an equally-weighted portfolio of bank stocks and shorting the market index.

In summary, the performance of bank stock prices following the announcement of bank rescue packages confirms our second hypothesis (H2). In the United States, bank stock prices outperformed reflecting the decline in the probability of financial distress and the favourable terms of the capital injections. The risk of US bank failures was high following the failure of Lehman Brothers and IndyMac, and the government take-over of AIG, Fannie Mae, and Freddie Mac. While the US Treasury's preferred shares included warrants with the potential to dilute shareholders, the favourable terms of the capital allowed the average US bank share to outperform the market following the announcement of government support. In other countries, the risks of financial distress were also high as seen in the capital injections for Fortis and Dexia and the nationalisation of Bradford & Bingley. While banks were recapitalised, the cost and conditions of European rescue plans were punitive for existing common shareholders leading to an underperformance of bank stocks in most countries. The UK package appears to have been the most costly for existing shareholders, which explains the fall in stock prices when the terms were disclosed. Given that only three out of six banks accepted the capital, the fall for banks receiving capital was offset by the positive response of

Figure 5

Cumulative average abnormal bank stock returns by level of government support



banks that did not. Swiss banks were the exception as the average Swiss bank was relatively unaffected.

5 Market reaction to bank-specific actions

The results presented in the previous section have focused on the country-level response to the announcement of comprehensive rescue packages. The impact of measures targeting specific banks may be lost in this analysis due to the averaging across banks in a given country receiving different degrees of support. In some countries, banks were offered government capital but declined (eg Barclays, Credit Suisse, Deutsche Bank). In other cases, banks received multiple capital injections (eg Commerzbank, Royal Bank of Scotland) or benefited from asset purchases (UBS) or asset insurance (Bank of America, Citigroup, ING). The impact of such targeted actions on a bank's creditors and shareholders cannot be identified in the analysis above. More importantly, the choice of banks receiving capital or asset support is not exogenous, as the need for government intervention was likely a result of a bank's business strategy, asset mix, risk management practices, or other unobservable firm characteristics.

Given the limited sample size, we cannot easily overcome this endogeneity problem. We therefore adopt a simple strategy and show the abnormal movements of a bank's securities

relative to its peers.³¹ We identify the date when a bank received targeted support, and focus on the days immediately around this bank-specific event, [-1,1]. This narrow window minimizes the overlap between events, as well as movements that may be due to other bank-specific news. In the analysis of abnormal stock returns, we modify the single-factor market model to include the return on the relevant banking sub-index, which proxies for a bank's peers. In the analysis of abnormal changes in CDS spreads, we include the daily change of (i) a CDS banking sub-index, and (ii) an index of Libor-OIS spreads. In the case of European banks, we add Markit's iTRAXX Financials index for European banks. For US banks, the CDX Financials index is not appropriate as it does not contain banks. We therefore construct a US banking sub-index as the simple average of CDS spreads for the US banks in our sample excluding the bank that is being targeted by the action. The daily change in Libor-OIS spreads in each country is included as a proxy of bank counterparty credit risk during the crisis. While there are potential issues with the clustering of events and the sample size, we calculate statistical tests based on the standard deviation of daily abnormal movements over the estimation window [-365,-70].

5.1 Response of CDS spreads to bank-specific actions

Table 6 shows the results of estimating the abnormal changes in a bank's CDS spreads and the abnormal stock returns for 35 bank-specific events. The table shows the abnormal response on the day prior, the day of the announcement and the day following. The events are presented chronologically from September 2008 to end of January 2009, with the type of support shown in the second column.

On the day prior to the capital injections, CDS spreads showed considerable volatility but no clear pattern with both positive (widening) and negative (narrowing) movements. On the day when a bank received targeted support, CDS spreads react although the direction varies by countries. CDS spreads narrowed relative to the market for most European banks, consistent with our first hypothesis (H1). In the case of the UK banks, for example, the average spread narrowed by around 15% on 13 October, which is both statistically significant and economically important. The exception are the US banks where the capital injections on 14 October were associated with an average widening of around 25% relative to what might have been expected based on the multi-factor regressions. This response is contrary to our first hypothesis, and suggests that the government support provided a negative signal to creditors for these banks. By contrast, the US capital injections announced on 27 October generate the expected narrowing of CDS spreads. On the day following the events, CDS spreads were again mixed with narrowing in some cases and widening in others. In 15 out of 24 cases, the movements are not statistically different from zero.

Turning to the four cases involving asset purchases or asset insurance, this intervention was associated with a statistically significant narrowing for UBS (-23.2%) and ING (-16.8%), but no significant change for Citigroup or Bank of America. None of the reactions on the day following are significantly different from zero. This market reaction provides only partial support for the third hypothesis (H3) that creditors took comfort from the reduction in potential losses and the decline in risk-weighted assets.

³¹ One-to-one matching (eg UBS versus Credit Suisse) may be preferable but is not possible for banks in three out of six countries as all banks received capital.

Table 6

Market reaction to bank-specific actions relative to market and peers

Date	Type of support	Bank (nationality) ¹	Abnormal change in CDS			Abnormal stock returns		
			[-1]	[0]	[1]	[-1]	[0]	[1]
29 Sep	capital	Fortis (NL)	0.183***	-0.212***	-0.126***	-0.014	-0.009	-0.022
30 Sep	capital	Dexia (FR)	-	-	-	-0.234***	0.037***	0.074***
6 Oct	loan	Hypo Real Estate (DE)	-	-	-	0.390***	-0.189***	-0.005
9 Oct	guarantee	Dexia (FR)	-	-	-	-0.099***	0.138***	0.133***
13 Oct	capital	HBOS (UK)	-0.075	-0.142***	-0.078	-0.047***	-0.320***	-0.085***
13 Oct	capital	Lloyds TSB (UK)	-0.006	-0.157***	-0.059	0.011	-0.183***	-0.094***
13 Oct	capital	RBS (UK)	-0.043	-0.147***	-0.034	-0.102***	-0.120***	-0.043***
14 Oct	capital	Bank of America (US)	-0.174***	0.219***	-0.027	0.018	0.089***	-0.032**
14 Oct	capital	BoNY Mellon (US)	-	-	-	0.038***	0.084***	-0.059***
14 Oct	capital	Citigroup (US)	-0.009	0.218***	0.072	0.001	0.101***	-0.022
14 Oct	capital	Goldman Sachs (US)	0.007	0.252***	0.091*	0.124***	0.044***	0.029**
14 Oct	capital	JPMorgan (US)	-0.004	0.257***	-0.068	-0.079***	-0.112***	0.025*
14 Oct	capital	Merrill Lynch (US)	0.008	0.249***	-0.082*	-0.019	0.122***	-0.022
14 Oct	capital	Morgan Stanley (US)	0.030	0.169***	0.085*	0.753***	0.117***	-0.055***
14 Oct	capital	State Street (US)	-	-	-	-0.017	0.139***	-0.064***
14 Oct	capital	Wells Fargo (US)	-0.009	0.138***	0.163***	-0.008	0.014	0.072***
16 Oct	capital, purchase	UBS (CH)	0.032	-0.232***	0.053	0.019	-0.018	-0.041***
20 Oct	capital	BNP Paribas (FR)	0.207***	-0.052	-0.122**	0.002	-0.019	0.014
20 Oct	capital	Crédit Agricole (FR)	0.116**	-0.017	-0.042	0.019	0.010	0.085***
20 Oct	capital	Société Générale (FR)	0.092*	0.001	-0.031	0.034**	0.000	0.015
20 Oct	capital	ING (NL)	0.206***	-0.168***	-0.157***	-0.297***	0.203***	-0.023*
27 Oct	capital	BB & T (US)	-	-	-	0.100***	0.035***	0.005
27 Oct	capital	Capital One Fin'l (US)	-0.008	-0.178***	-0.083*	0.035***	0.024*	0.010
27 Oct	capital	Keycorp (US)	-	-	-	0.037***	0.018	0.086***
27 Oct	capital	Northern Trust (US)	-	-	-	0.018	0.042***	-0.027**
27 Oct	capital	Regions Fin'l (US)	-	-	-	-0.053***	0.152***	0.054***
27 Oct	capital	State Street (US)	-	-	-	-0.001	0.041***	0.032**
27 Oct	capital	US Bancorp (US)	-0.054	-0.100**	-0.035	0.055***	0.008	-0.027**
3 Nov	capital	Commerzbank (DE)	0.005	-0.030	0.020	-0.063***	-0.016	-0.022
13 Nov	capital	SNS Reaal (NL)	-	-	-	-0.027**	-0.050***	0.005
24 Nov	capital, insurance	Citigroup (US)	0.123**	-0.042	-0.005	-0.234***	0.348***	-0.008
8 Jan	capital	Commerzbank (DE)	-0.041	0.038	0.029	-0.007	-0.064***	0.003
16 Jan	capital, insurance	Bank of America (US)	0.070	-0.009	-0.007	-0.127***	-0.107***	0.000
19 Jan	capital	RBS (UK)	0.028	0.170***	0.186***	-0.048***	-0.399***	0.002
26 Jan	insurance	ING (NL)	0.006	-0.094**	-0.057	-0.033**	0.188***	-0.061***
		<i>Average</i>	0.028	0.005	-0.013	0.004	0.009	-0.001

¹ CH=Switzerland, DE = Germany, FR=France, NL=Netherlands, UK=United Kingdom, US = United States

Overall, the response of CDS spreads to bank-specific actions are mixed. Capital injections and other forms of support benefited creditors of European banks but initially not US banks. The US Treasury's support on 14 October appears to have sent a negative signal, although similar support on 27 October was viewed positively. The failure to find a significant impact on the day following the event suggests that bank creditors reacted quickly to the news.

5.2 Response of stock prices to bank-specific actions

The response of bank stocks to capital injections varies by country in line with the conditions imposed on banks that received government capital. While capital injections and debt guarantees for Dexia was positive for shareholders, the provision of an emergency loan for Hypo Real Estate Bank was viewed negatively. The response to capital injections in the United Kingdom was universally poor, likely due to the dilution of existing shareholders and the prohibition against the payment of common dividends that accompanied the government's investment. The three UK banks receiving government capital underperformed the market and their peers with cumulative abnormal returns of 26% to 45% over this three day period.

In the case of US capital injections, seven of the nine banks receiving preferred shares on 14 October outperformed the market and their peers by around 10%, suggesting that existing shareholders and market participants viewed the capital injections positively. Only JP Morgan underperformed, falling 11.2% relative to the market and its peers as shareholders reacted negatively to this news. The second group to receive capital on 27 October also responded positively in five out of seven cases.

Capital injections for UBS, the French banks and Commerzbank had no noticeable effect on the stock price. While ING showed an outperformance of 20.3% on the day of the Dutch recapitalisation, this outperformance did not fully reverse the underperformance on the prior day of -29.7%. A capital injection for SNS Reaal was viewed negatively. Subsequent capital injections for Commerzbank in January and the conversion of the UK government's preferred shares for common for Royal Bank of Scotland were both negative for shareholders.

The stock price reaction for the banks receiving asset insurance are mixed. While the provision of asset insurance together with a second capital injection for Citigroup in November was positive for shareholders, a similar action for Bank of America in January was accompanied by a negative reaction. The announcement of asset insurance for ING was initially positive to the stock, with some of the gains reversed the next day. This mixed reaction leads us to reject the third hypothesis (H3) that asset purchases or insurance should be positive for shareholders.

Overall it is hard to draw clear conclusions from these bank-specific results. The mixed market reactions show that the response must be conditioned on the situation of each bank. A capital injection that is not dilutive may be viewed as a negative signal for the firm's health (JPMorgan, Bank of America) while a dilutive capital injection may be viewed positively if it reduces the probability of bankruptcy (ING, Citigroup). The only clear conclusions are that the capital injections for US banks were generally positive for shareholders, while capital injections for UK banks were clearly negative. These bank-level results confirm the country-level findings about the relative attractiveness of the rescue packages in these two countries.

6 Robustness

Event studies suffer from a number of well-documented shortcomings. In particular the results can be sensitive to how the study is specified. We therefore examine the robustness of the results to the following assumptions: (i) the choice of market benchmark for calculating

ARs and MARs; (ii) the number of factors used for measuring ARs, and (iii) the choice of the estimation window over which the parameters of the market model are calibrated.

First, we check the robustness of our results to the choice of market benchmark, which is national stock market indices for bank stocks and the CDX and iTRAXX indices for bank CDS spreads. The national stock market indices are closely correlated with each other, with pairwise correlations of 60-96% prior to June 2008; these correlations rise to 95-98% over July 2008 to January 2009. Such high correlations suggest that national stock markets are driven by a common factor that becomes more important during the crisis period. As a robustness check, we extract the first principal component across national stock market indices, which explains 93.6% of the variation, and construct a global stock market index based on this common factor. We then calculate the abnormal stock returns using market-model regressions on this global index. The results using this common benchmark are very similar to those reported in Table 5. We conduct a similar exercise for CDS spreads, where the first principal component explains 99.5% of the variation. Again the results in Table 4 are robust.

Second, we check the robustness of ARs to the inclusion of other factors. For the country-level analysis, we include the relevant banking sub-index as a second factor when calculating abnormal returns. The addition of this second factor increases the average fit of the regressions on stock returns, with the mean R-squared increasing from 46.9% to 61.3%. The results are similar for four out of six countries, although the absolute size of the CAARs is reduced. French banks no longer exhibit a pre-event run-up and underperform over September and early October based on this specification. The German banks included in the study exhibit a much larger reaction to the announcement of the rescue packages on 13 October, and exhibit less underperformance thereafter. The other results are broadly unchanged.

Third, we check the robustness of our results to the choice of estimation window used to measure the sensitivity to the overall market in equations (1) and (2). In specifying the estimation window, we consider the timing of the crisis, which began in mid-June 2007 following the disclosure of problems with two Bear Stearns hedge funds. The crisis then advanced in several stages with a sharp rise in volatility following Lehman's bankruptcy on 15 September 2008. Over this period, the banking system experienced considerable stress and the relatively stable relationship between bank stocks and national stock market indices became less stable reflecting the rise in idiosyncratic risk for banks. One way to view this changing relationship is to look at the rolling one-year correlations between market indices and banking sub-indices for stocks and CDS spreads (which proxy for individual banks), respectively. The correlations are high early in the period, but then trend downwards as the crisis unfolds before falling sharply around the announcement of the rescue packages. This changing correlation has implications for the choice of estimation window, as a traditional event study calculates abnormal movements assuming the relationship between a security and the market index is stable. For this reason, we chose an estimation window from June 2007 to June 2008 that includes the first year of market turmoil. If an estimation window is used prior to the crisis (eg June 2006 to June 2007), the average R-squared of the regressions in equations (1) and (2) are much lower and the expected movements are noisier. While changing the estimation window has little effect for the study of stock returns, the results for CDS spreads are sensitive to this specification. Using the earlier estimation window leads to a greater abnormal widening of bank CDS spreads prior to the announcements, and less of a recovery afterwards. These results would suggest creditors saw less benefit from government support.

Finally, the sensitivity of the results was also checked to the sample size and the dating of the announcement of comprehensive rescue plans. These changes do not alter the overall results materially.

7 Conclusion

This paper assesses the market response to bank rescue packages announced in October 2008 in six countries. We measure the market reaction of bank CDS spreads and stock prices for 52 banks using an event study methodology, which provides a measure of the wealth transfer between shareholders and creditors. The event study methodology has clear limitations; it is a statistical exercise based on a number of qualifying assumptions. With these caveats in mind, we examine both the average response across banks headquartered in a given country and the reaction of banks targeted by specific actions. The rescue packages were designed to avoid the default of systemically important banks while restoring confidence in the financial system and ultimately restarting the flow of credit to support the real economy. With these objectives in mind, we focus on the 50 trading days before and after the announcement in each country.

Government interventions benefited creditors at the expense of shareholders, with the average bank CDS spreads for each country narrowing around the announcements in all cases. Despite a brief positive reaction, bank stock prices continued to underperform in all countries except the United States where the generous terms of the government support allowed bank stocks to outperform the market. Stock prices of banks receiving direct government support do worse than banks not receiving government capital, suggesting this support provided a negative signal to shareholders. The response to bank-specific actions are mixed. In general capital injections were positive for creditors but negative for common shareholders, although there is considerable variation depending on a bank's specific circumstances and the type of support provided.

The cross-country response of stock prices highlights the relative attractiveness of the government support. In particular the stock market response reflected the type of capital injected, the conditions attached to this capital and the protection offered to common shareholders. In contrast to the European experience, the US rescue packages were well received by both creditors and shareholders. The non-convertible preferred shares issued under the Capital Purchase Program were favourably priced, offered little dilution of existing shareholders, and did not impose material constraints on bank management. By contrast, bank shareholders in the UK saw their equity diluted and their future income stream reduced due to the government's restriction on the payment of dividends. Shareholders in other countries did not receive much benefit from the injection of hybrid capital. Not only was this capital expensive, it did not offer shareholders any protection from future losses. Asset purchases or insurance were used in only four cases with mixed results.

Overall bank stocks underperformed the market on average following the government interventions, suggesting government capital injections did not restore market confidence in the banks. This response is not unexpected as the rescue packages were not designed to protect shareholders whose capital is designed to bear losses. The more negative response in some countries such as the United Kingdom reflected the greater dilution of existing shareholders and the binding restrictions on the payment of dividends. The positive response of creditors suggests that government intervention reduced the risk of a default across all banks. Judged from this perspective, the fact that only a few institutions were nationalised suggests government interventions were successful. The October rescue packages provided governments with time to assess the situation and formulate their policy responses. At the same time, these policy interventions did not represent a buying opportunity as seen in the underperformance of bank stocks in most countries studied.

This assessment does not consider the counterfactual case in which governments did not intervene to support systemically important banks. While a market disruption similar to the Lehman Brothers bankruptcy was avoided, a number of banks were taken into government ownership and further actions were needed to restore investors' confidence in the institutions concerned. It is also too early to assess the impact of rescue plans on restoring the flow of credit to businesses and households. Given the weakness in bank stocks through January

2009 and the limited access to bond markets without a government guarantee, it is not obvious that banks were in a position to extend more loans. Future research may usefully monitor the deleveraging and repair of bank balance sheets, and assess the extent to which government support has restored the flow of credit to the real economy.

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Appendix A

Timeline of key rescue efforts

19 September	US Treasury makes public plans to purchase illiquid assets from banks under Troubled Asset Relief Program (TARP).
29 September	Fortis receives a \$16 billion in capital from the Dutch, Belgian and Luxembourg governments, representing 49% of capital. Bradford & Bingley is nationalised by the UK government. US Congress votes down the TARP.
30 September	France and Luxembourg inject € 6 billion of capital into Dexia.
3 October	US Congress approves the revised \$700 billion TARP. Dutch assets of Fortis are nationalised.
6 October	German government provides € 50 billion emergency credit facility to Hypo Real Estate Group
8 October	UK government announces recapitalisations and debt guarantees for banks.
9 October	Dutch government announces plan to recapitalise banks. Dexia receives debt guarantees totalling € 150 billion from Belgium, France and Luxembourg.
13 October	French and German governments announce system-wide bank recapitalisations and guarantees for new bank debt. Germany also announces fund to purchase bank assets. UK announces capital injections in three banks.
14 October	US government announces that up to \$250 billion of previously approved TARP funds are to be used to recapitalise banks. US also announces program to offer guarantees on new debt (Temporary Liquidity Guarantee Program). US Treasury purchases preferred shares in nine banks. Dutch government announces debt guarantee scheme.
16 October	Swiss government announces bank recapitalisation and asset purchase plan. UBS transfers \$31 billion of illiquid assets and receives CHF 6 billion in equity.
20 October	Dutch government buys € 10 billion in preferred shares in ING. French government announces plans to buy subordinated debt of six banks, including BNP Paribas, Crédit Agricole, and Société Générale.
3 November	Germany government buys € 8.2 billion of preferred shares in Commerzbank.
5 November	Swiss government announces debt guarantee scheme.
13 November	Dutch government buys € 750 million in preferred shares in SNS Reaal.
24 November	US Treasury provides Citigroup protection against losses on an asset pool of USD 306 billion, and buys another USD 20 billion in preferred shares.
8 January	Germany government buys another € 10 billion of preferred shares in Commerzbank.
16 January	US Treasury provides Bank of America protection against losses on asset pool of USD 118 billion, and buys another USD 20 billion in preferred shares.
19 January	UK announces asset protection plan and converts its preferred shares in RBS into ordinary.
26 January	Dutch government creates € 35.1 billion back-up facility for ING's Alt-A mortgage securities.

Sources: national websites; bank's websites.
